

Wood Procurement and Harvesting Trends in North Carolina

by

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Introduction

The forest products industry is a major sector of North Carolina's economy contributing \$4.6 billion in annual gross domestic product and employing over 65,000 individuals. Among the 65,000 forest products jobs, approximately 2,900 are logging and forestry jobs (Mitchell 2013). Because of its importance to the overall economy of North Carolina, timber supply chain research is very beneficial to the health of the industry. However, limited research is available regarding wood procurement and harvesting characteristics, with most industry research focusing on market analysis and price trends (Land & Mendell 2012). The objective of this study is three pronged: (1)-describe wood procurement trends in North Carolina, (2)-assess the future supply of timber and market forces that will influence the supply, and (3)-characterize the loggers in North Carolina based on experience, equipment spread, and willingness to expand operations.

Methods

Face to face interviews were conducted between May and August 2014 with 27 subjects. Potential subjects' contact information was obtained from the North Carolina Forest Service website which contained a list of timber buyers, loggers and mills in North Carolina. Subjects were contacted by telephone and notified of the scope and purpose of the interview. Of the 27 subjects, 13 were procurement foresters, 6 were wood dealers and 8 were loggers. The subjects represented 23 different counties, with 21 in North Carolina, 1 in Virginia and 1 in South Carolina. (Figure 1). Two separate questionnaires were used, one for procurement foresters and wood dealers, and another for loggers; both are attached as appendices. The geographic center of the state located in Star, North Carolina was used to delineate regional results and trends.

Wood Procurement and Harvesting Trends Study Area

Map By: George Hahn
Data from: U.S. Census Bureau
2/20/2015

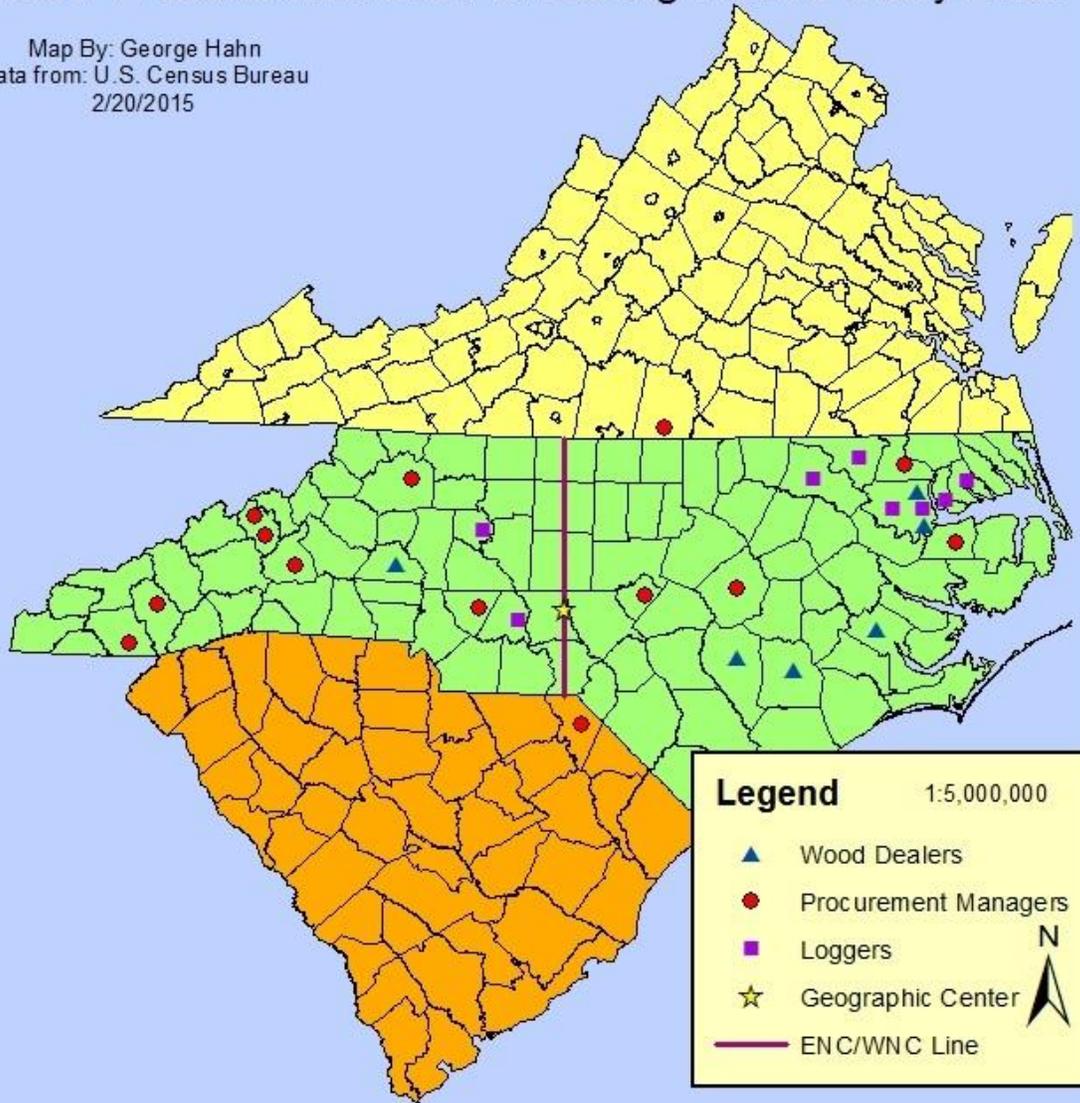


Figure 1. Wood procurement and harvesting trends study area.

Procurement questionnaire

Procurement foresters were first asked to describe their wood procurement system. They were also asked to quantify how many employees worked at the site by category (managers, timber buyers, and staff). Next, the region of operation and average amount of hardwood and pine wood purchased in tons was requested. Subjects were then inquired regarding the product mix (a percentage of total wood purchased) and type of supplier (percentage divided among forest landowners, loggers, wood dealers, sawmills/other residues and other). The ensuing question asked how much wood was purchased through supply agreements and how long those agreements typically lasted.

A summary of total delivered wood costs by category was requested along with a summary of where the wood was sold. Wood delivered costs categories consisted of stumpage, logging, hauling, and wood dealer fee and were recorded as a percentage of total wood cost. Locations of wood sales were subdivided into six categories: pulp mills, sawmills, panel mills, pellet mills, bioenergy plants and other. Locations were also recorded on a percentage scale. Qualitative questions were asked about the effects of biomass markets on operations, future supply of wood, and market influences on future supply.

Logging questionnaire

Loggers were first asked how long they had been logging and, if applicable, how long they had owned their own business. Next they were asked their region of operations and their type of business (contract logger for a wood dealer, contract logging for a forest products mill, independent logging, or other). Next, loggers were asked if they currently or historically have purchased standing timber. Average production in tons per week for both pine and hardwood

was recorded along with the percentage of products harvested (sawtimber, chip-n-saw, pulpwood, and biomass/energy wood). The typical number of hours per week and weeks per year worked was recorded along with number of employees, employee wages. workman's compensation rate.

Logging rates were recorded based on three categories: cut and load rate per ton, haul rate per ton and average haul distance. The logger was asked whether trucking was handled by the company or by contract. The effects of biomass markets on operations was asked, as well as whether the logger provided biomass to mills; if so, how much and in what form (hardwood/pine, chips/pellets/roundwood). Finally, loggers were asked about their equipment, specifically the make and model, purchase cost, and life span.

Results

Procurement Questionnaire Results

Landowner-based procurement was the most common type of system utilized by 8 of the 19 procurement subjects (42%) (Table 1). The second most utilized system was the dealer-based system with 6 of 19 (32%). Logger-based was the least common system in use with only 5 of 19 subjects (26%).

Table 1. Wood supply systems for North Carolina, eastern North Carolina, and western North Carolina.

System	North Carolina	Western NC	Eastern NC
dealer-based	32%	13%	36%
landowner-based	42%	38%	55%
logger-based	26%	50%	9%

The average purchase radius was 112 miles and the subjects employed an average of 5 employees. The average amount of pine and hardwood wood purchased weekly was 6,734 tons and 5,134 tons respectively. The most common pine product purchased was pulpwood at 43% followed by sawtimber at 41%, biomass at 8%, and chip-n-saw 7%. For hardwood products, sawtimber was the predominant product purchased at 56%, followed by pulp at 34%, biomass at 7% and chip-n-saw at 3% (Figure 2).

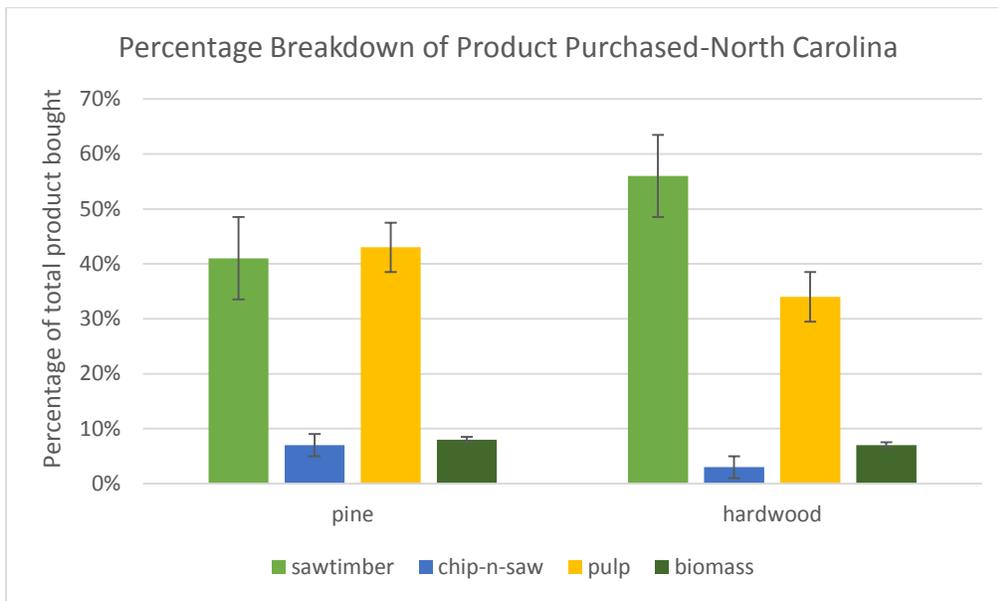


Figure 2. Percentage breakdown of product purchased-North Carolina, with standard deviation.

When subjects were asked to indicate the source of their wood on a percentage scale, the most common source was landowners at 50%, followed by loggers at 22%, wood dealers at 20%, other sawmills at 5%, and woodyards and fee lands at 3% (categorized as “other”). On average 16% of wood was purchased through supply agreements with the mean length of time for the agreement being half a year.

Mills most often sold their pine to pulp mills (40%), followed by sawmills (20%), bioenergy plants (12%), panel mills (5%), pellet mills (2%). Retailers and woodyards comprised 17% of

pine sales and were categorized as “other”. For wood costs, stumpage was the largest cost at 39% logging costs were second at 35%, followed by hauling and wood dealer fees at 18% and 8% respectively (Table 2).

Table 2. Average total delivered wood costs by category for North Carolina, eastern North Carolina, and western North Carolina.

Category	North Carolina	Western NC	Eastern NC
Stumpage	39%	40%	39%
Logging	35%	41%	30%
Hauling	18%	19%	16%
wood Dealer	8%	0%	15%

When asked the effects of biomass on wood procurement, based on a 1 to 4 scale, with 1 being no effect and 4 being a large effect, the average response was a 2 (little effect). Private landowners were the number one projected suppliers of wood in the next 5-10 years with 8 of 19 procurement foresters and wood dealers (42%) ranking it first followed by wood dealers (26%), loggers (11%), other (16%) and sawmills (5%) (Figure 3).

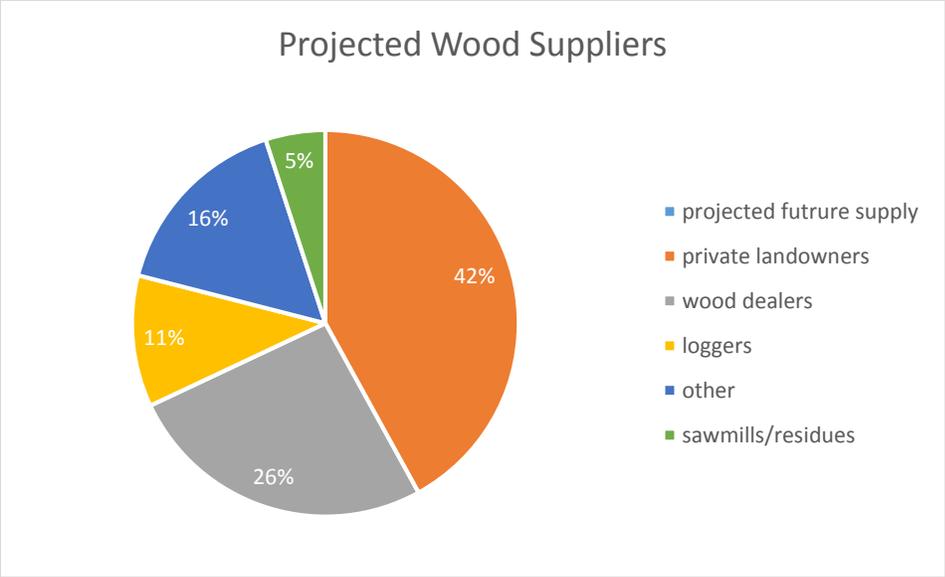


Figure 3. Projected wood suppliers.

Logging capacity was chosen as the number one market force on wood supply by 9 of the 19 subjects (47%), followed by supply (32%), highway regulations (11%), environmental regulations and social pressures (both at 5%) (Figure 4).

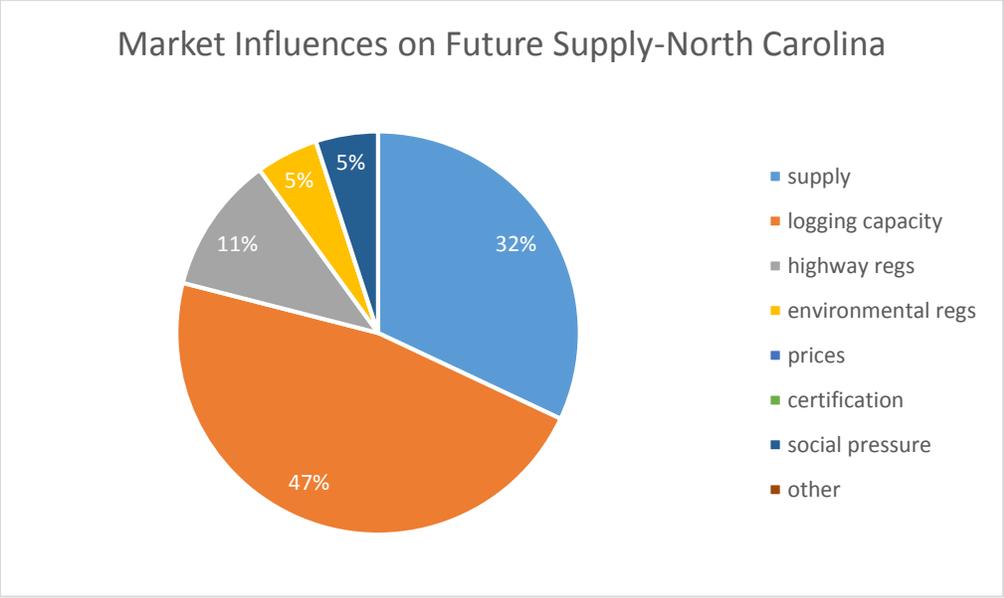


Figure 4. Influencing factors on future supply-North Carolina.

Regional Procurement Trends

Certain trends were noticed when comparing the data from subjects in the western part of the state versus the eastern part of the state. The most obvious trends were main suppliers and products purchased. In eastern North Carolina, the most common supply of wood was from landowners (55%) while in the western part of the state, the most common supplier was loggers (50%) (Table 1). Another trend was the amount of hardwood purchased in the western part of the state was more than double the amount of hardwood wood purchased in the eastern part of the state.

Products purchased were also vastly different in the two regions as indicated by Figures 5 and 6. Pulpwood was by far the most common product purchased in the eastern part of the state which accounted for an average of 52% of all purchased wood. Sawtimber was the most common product purchased in the western region with an average of 84%.

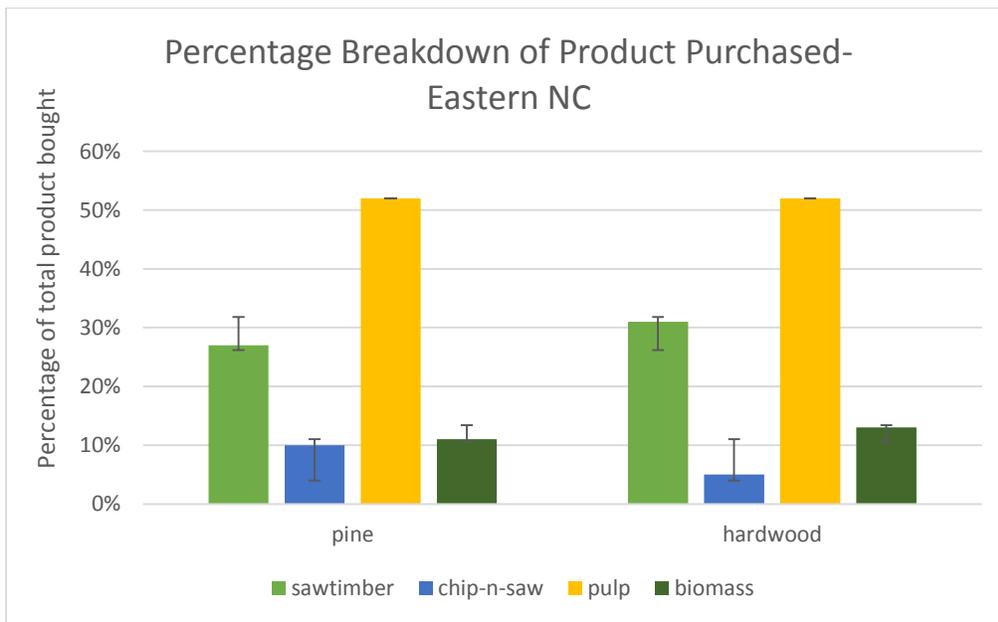


Figure 5. Percentage breakdown of product purchased-Eastern NC, with standard deviation.

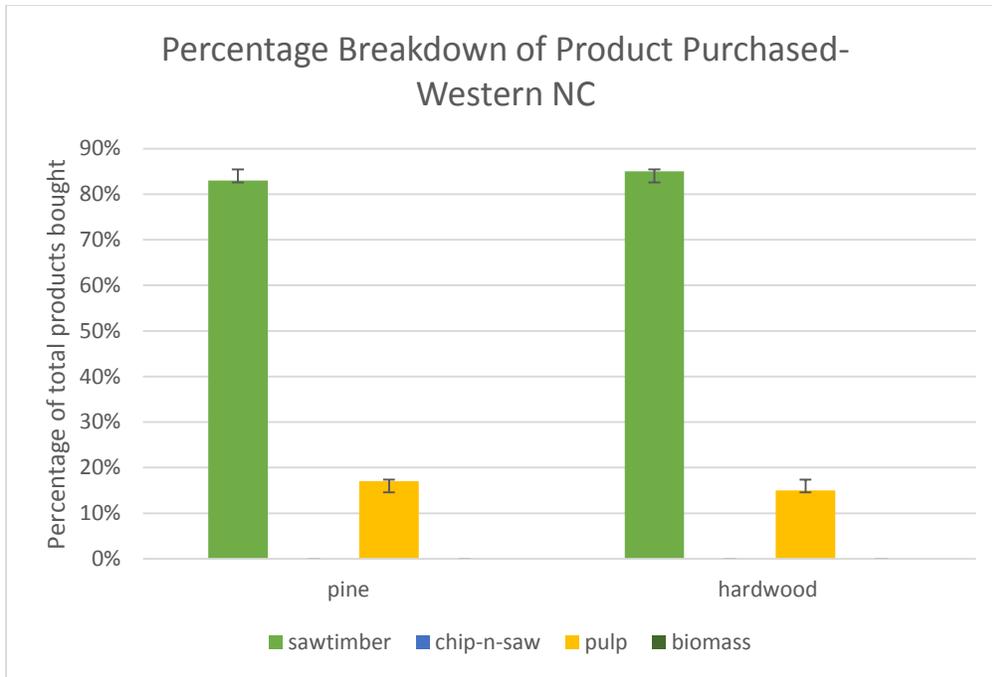


Figure 6. Percentage breakdown of product purchased-Western NC.

An average of 28% of wood is purchased through supply agreements in the western part of the state versus 7% in the eastern region. Biomass had more effects on wood purchasing operations in the eastern part of the state with the average effect being 3 on a 1 to 4 scale, while in the western part of the state the average score was 1 on the same scale.

Projected future suppliers of wood varied between the regions with wood dealers being the most common in the eastern region and landowners being the most common in the western region. In terms of market factors, subjects listed logging capacity as the number one factor in the eastern region (Figure 7), followed by standing timber availability and highway regulations. In the western region, logging capacity and supply tied for first, followed by environmental regulations and social pressures (Figure 8).

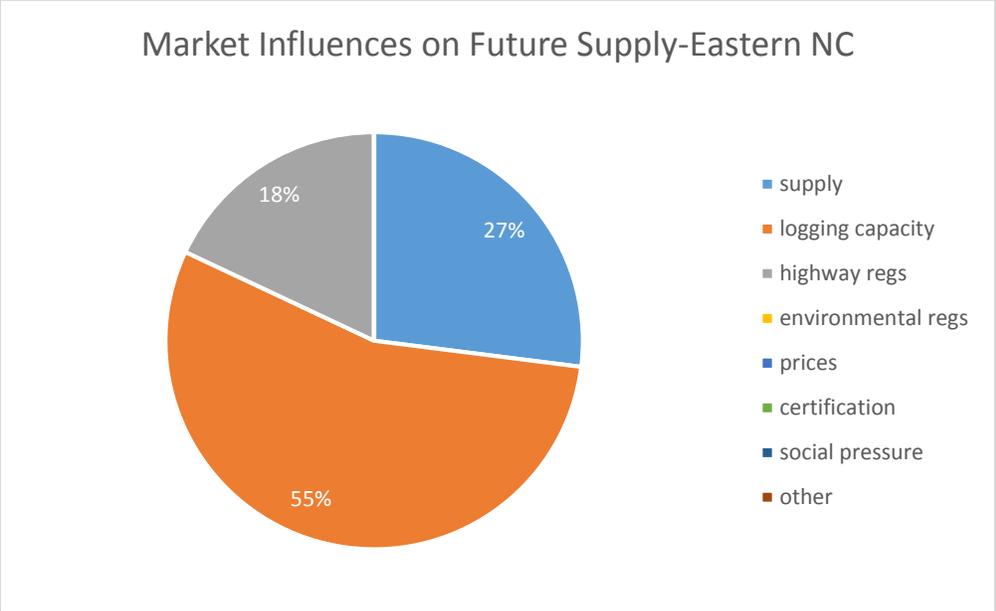


Figure 7. Market influences on future supply-Eastern NC.

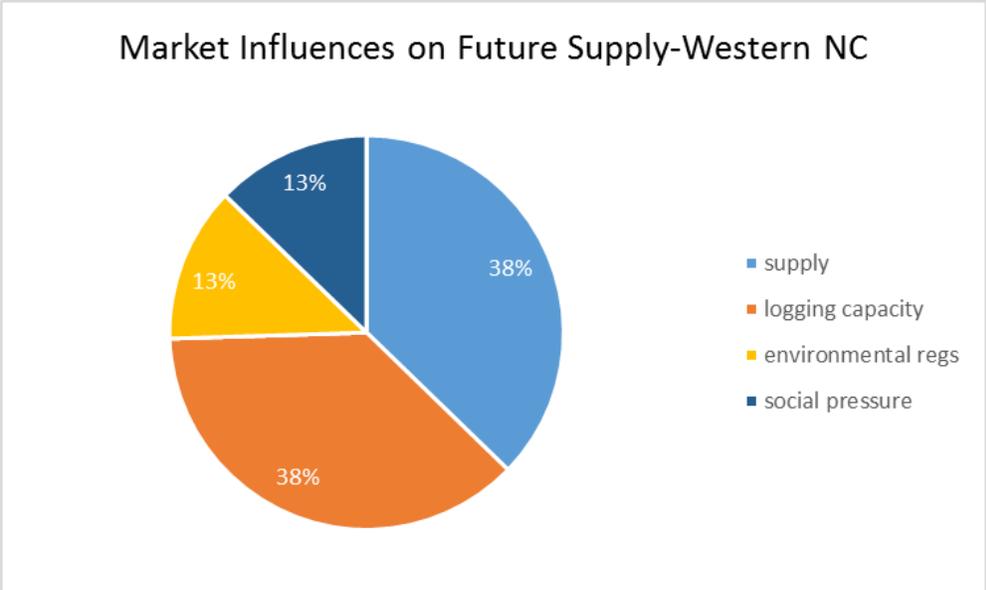


Figure 8. Market influences on future supply-Western NC.

Logging Questionnaire Results

When asked how long they had been logging, the average reply was 36 years with a minimum of 10 years and a maximum of 60 years. Average years that subjects had owned their business was 33 years with a minimum of 10 years and maximum of 60 years. Average weeks worked per year

was 50 with a minimum of 47 and maximum of 52. Average hours worked per week was 51 with a minimum of 40 hours and maximum of 75 hours per week (Table 3).

Table. 3. Business characteristics of loggers surveyed.

Business Characteristic	Average	Minimum	Max
years spent logging	36	10	60
years owned own business	33	10	60
weeks worked/year	50	47	52
hours worked/week	51	40	75
number of employees	16	2	30
employee wage (\$/hour)	\$13.75	\$11.00	\$15.50

When asked to describe the type of operation, 62% subjects described their operation as an independent logging company. The remaining 37% were classified as contract loggers for wood dealers (Table 4).

Table 4. Type of logging business.

Type	North Carolina	Western NC	Eastern NC
independent	62%	100%	50%
contract for dealer	38%	0%	50%

Six of the eight loggers interviewed (75%) bought stumpage, while only two of the eight loggers (25%) did not buy stumpage (Table 5).

Table 5. Percentage of loggers who buy stumpage.

Do You Buy Stumpage?	North Carolina	Western NC	Eastern NC
yes	75%	100%	67%
no	25%	0%	33%

Average weekly production was 1,554 tons in pine and 1,279 tons in hardwood. In terms of product mix, the average breakdown was 47% pine pulpwood followed by 32% pine sawtimber, 12% pine chip-n-saw, and 9% pine biomass (Table 6). Regarding hardwood products, pulpwood was the most common product harvested at 44%, followed by sawtimber (32%), biomass (19%), and chip-n-saw (5%) respectively.

Table 6. Product class harvested-North Carolina.

Product Class Harvested	Pine	Hardwood
sawtimber	32%	32%
chip-n-saw	12%	5%
pulp	47%	44%
biomass	9%	19%

In terms of operations, the average number of employees for each subject was 16, with a minimum of 2 and maximum of 30. Employee wages averaged at \$13.75/hour, with the minimum being \$11.00/hour and maximum of \$15.50/hour.

The average equipment spread was 3 feller-bunchers, 3 skidders, 3 loaders, 1 bulldozer, 2 chippers, 7 chip vans, 4 trucks, 5 log trailers, and 2 processors. Feller-bunchers had an average purchase price of \$226,867, and ranged from \$45,000- \$385,000; average life span was 10 years, and ranged from 5 to 20 years. The average model year of feller bunchers was a 2008 model with the oldest being a 2000 model and the newest being 2013. When comparing skidders, the average price was \$166,650, with a range of \$10,000-\$320,000. Average model was a 2007 model with the oldest model being a 1984 model and the newest model being a 2014 model. Average life span was 8 years, ranging from 5 to 10 years. Loaders cost an average of \$204,133 and had an average economic life of 10 years. The average model year was a 2006 model. Chippers cost an average of \$326,000, had an average economic life of 14 years, and the average

model year was a 2003. When comparing the price of trucks, the average price was \$81,000, with an average economic life of 11 years and the average model was 2003, with the oldest model being a 1991 and newest being a 2012. Processor purchase prices ranged from \$18,000 to \$280,000 with an average of \$120,000. The average economic life was 13 years and average model year was 2004. Van purchase prices averaged \$23,167 and ranged from \$4,500-\$35,000. Average economic life was 13 years and ranged from 10 to 20 years. The average van model year was a 1996 model. The average purchase cost of bulldozers was \$256,250, and ranged from \$120,000-\$600,000. The average economic life was 14 years, and the average model year was a 2001 model (Table 7).

Table 7. Logging equipment spread-NC.

Machine	Avg Price	Stand. Dev	Min Price	Max Price	Avg Model	Min Model	Max Model	Avg Life	Min Life	Max Life
feller buncher	\$ 226,866.67	\$103,396.51	\$ 45,000.00	\$385,000.00	2008	2000	2013	10	5	20
skidder	\$ 166,650.00	\$100,289.20	\$ 10,000.00	\$320,000.00	2007	1984	2014	8	5	10
loader	\$ 204,133.33	\$ 74,869.28	\$ 38,000.00	\$300,000.00	2006	1990	2014	10	7	12
chipper	\$ 326,000.00	\$166,165.58	\$ 40,000.00	\$600,000.00	2006	1984	2013	14	6	20
truck	\$ 81,687.50	\$ 43,645.11	\$ 20,000.00	\$130,000.00	2002	1991	2012	11	9	20
trailer	\$ 28,666.67	\$ 20,451.57	\$ 5,000.00	\$ 52,000.00	1998	1975	2011	18	10	20
processor	\$ 120,166.67	\$114,288.09	\$ 18,000.00	\$280,000.00	2004	1981	2014	13	7	20
van	\$ 23,166.67	\$ 16,357.97	\$ 4,500.00	\$ 35,000.00	1996	1980	2012	13	10	20
dozer	\$ 256,250.00	\$229,687.29	\$120,000.00	\$600,000.00	2001	1994	2006	14	10	20

Cut and load rates averaged \$13.74/ton and ranged from \$12.00/ton-\$17.00/ton. The average haul rate was \$4.22/ton with a minimum of \$3.35/ton and \$5.50/ton. The average haul distance one way was 47 miles and ranged from 35 miles to 60 miles (Table 8).

Table 8. Logging rates in North Carolina.

Logging Rates	North Carolina	Stand. Dev	Western NC	Stand. Dev	Eastern NC	Stand. Dev
cut & load (\$/ton)	13.74	1.65	15	2.83	13.33	1.18
haul to mill (\$/ton)	4.22	0.92	3.5	0.21	4.46	0.95
average haul distance (miles)	47	11	38	4	50	11

When asked about the effects of biomass markets, the average effect on a 1 to 4 scale was 3. Of the loggers surveyed, 75% supplied biomass to energy companies and 83% of the biomass supplied was hardwood chips, followed by 17% being hardwood roundwood. Fifty percent of the loggers surveyed indicated they planned to expand operations if there was an increase in demand.

Regional trends in logging survey

Due to the small sample size of loggers from the western part of the state (2 loggers), it was difficult to detect empirical trends in the data. However, there were anecdotal trends in the operations of logging crews. Eastern logging crews were larger with an average of 18 employees, while western logging crews had an average of 3 employees. While there was no significant difference in the length of time each subject had been logging, there was a difference in the percentage that bought stumpage. In the western part of the state 100% of the subjects bought stumpage compared to 67% of subjects in the eastern region of the state. Likewise, 100% of western loggers were independent operations compared to 50% of eastern loggers. In terms of products, in the western part of the state, an average of 85% of wood harvested was sawtimber and only 10% pulpwood (Table 9).

Table 9. Product class harvested-western North Carolina.

Product Class Harvested	Pine	Hardwood
sawtimber	85%	85%
chip-n-saw	0%	0%
pulp	10%	10%
biomass	5%	5%

Eastern loggers however harvested 59% pulp and only 13% harvested was sawtimber (Table 10). However, 17% of harvested wood was biomass. The average price of feller bunchers purchased in the western part of the state was \$60,000 compared to \$226,867 in the eastern region. The trend of more expensive equipment continued for skidders (\$28,250 western NC compared to \$201,250 in the east), loaders (\$81,500 western NC compared to \$223,000 eastern NC), chippers (\$40,000 western NC compared to \$326,000 eastern NC), trucks (\$21,667 western NC compared to \$101,167), and vans (\$4,500 western NC compared to \$32,500 in eastern NC).

Table 10. Product class harvested-eastern North Carolina.

Product Class Harvested	Pine	Hardwood
sawtimber	15%	11%
chip-n-saw	16%	7%
pulp	59%	58%
biomass	10%	24%

When asked about plans for expansion, 67% of eastern loggers indicated they planned to expand with more demand while 100% of western loggers indicated they did not plan to expand operations with more demand. Only 50% of western loggers supplied biomass compared to 83% of eastern loggers. In both regions, the most common form of biomass supplied was hardwood chips. Logging rates were somewhat higher in western North Carolina with the cut and load rate being an average of \$15.00/ton compared to \$13.33/ton. However, the haul rate was cheaper in western North Carolina (\$3.50/ton), compared to eastern North Carolina (\$4.46/ton). The average haul distance was significantly higher in eastern North Carolina (50 miles round trip) as compared to western North Carolina (38 miles round trip).

Discussion

The most common wood supply system utilized was the landowner-based system. This is in part due to the fact that wood dealers and procurement foresters were interviewed for the procurement questionnaire; wood dealers most often buy wood from landowners thereby skewing the averages. When looking solely at procurement foresters who worked at mills, 67% of the subjects described their supply system as dealer-based. The dealer-based system is a well ingrained system in wood procurement in eastern North Carolina. A common theme when interviewing procurement foresters was that of the need to maintain a good reputation. The dealer-procurement forester relationship takes years and in some cases decades to develop and maintain. Procurement foresters in the eastern region of the state see buying stumpage as a bad business practice for two main reasons: (1)-it would destroy the dealer-mill relationship that takes years to develop, and (2)-mills see buying stumpage as an added constraint on time and resources. For similar reasons, the logger-based supply system is utilized in the western region of North Carolina where the logger takes the place of the wood dealer (Figures 8 and 9).

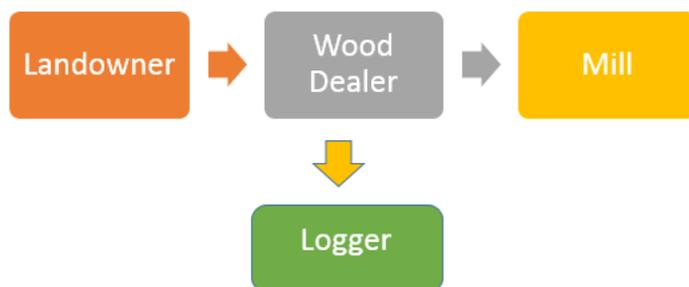


Figure 8. Flow chart showing wood supply chain in eastern North Carolina.



Figure 9. Flow chart showing wood supply chain in western North Carolina.

The species composition of western North Carolina varies greatly from eastern North Carolina and has a direct effect on products harvested and purchased by mills. More valuable hardwoods in the western region cause the demand for sawtimber to be the main product, while more abundant softwoods and domination of yellow pine species create the demand for pulpwood as the main product in eastern North Carolina (Frederick & Sink 2010). International markets for wood pellets as fuel have driven biomass markets in eastern North Carolina because of the availability of raw materials, cheap logging rates and less regulation. The proximity to eastern seaboard ports also makes eastern North Carolina an ideal supplier for this international market. Sustainability requirements for biomass markets abroad are often more stringent than in the United States. Certification is an important market influence because of the social pressure for the growing biomass markets to prove their sustainability.

Logging supply is a major concern in the forest products industry because of the average age of the logging force, strenuous and hazardous level of the work, and uncertainty of where the next generation of loggers will come from. Financial pressures also play a factor as it is not uncommon for loggers to have well over one million dollars in financed equipment invested in a single crew. This financial pressure alone is often enough to discourage people from entering the logging force.

Logging forces in the western region of North Carolina utilize less equipment and often times still hand-fell trees. The low purchase prices of equipment is a reflection of the common saying among North Carolina loggers and foresters, “logging equipment goes west to die.” Meaning, loggers in the western region of the state buy more used equipment than their eastern counterparts.

Social pressures in western North Carolina are prevalent because of the increasing number of seasonal residents. These residents place aesthetic value high on their priority list and are often discouraged when they see an active logging job. This displeasure is often felt by the logging and forest products community on a daily basis.

Future research could explore why mills do not offer incentives to loggers to prove their sustainability through certification while at the same time facing criticism from the general public. Also, research could explore areas where the forest products industry could have a more positive public perception through educational outreach.

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Appendix: Related Documents

NC State University – Forestry

Wood Procurement Systems and Capacity Questionnaire

Survey number: _____

- 1) Describe your company’s wood procurement system, e.g., direct purchase from landowners, purchase from wood procurement organizations, loggers.
- 2) How many employees do you have by category (e.g. managers, timber buyers, staff)?
- 3) What counties or region to you do business in?
- 4) What is your average amount of wood purchased per week (tons (or other unit -specify))?

	Average	Range
Pine (tons)		
Hardwood (tons)		

- 5) What is your average product mix purchased by percentages?

Product / Species	Pine	Hardwood
Sawtimber	%	%
Chip-n-saw	%	%
Pulpwood	%	%
Biomass / energy wood	%	%
Total	100%	100%

- 6) Who do you buy wood from, as applicable?

Forest Landowners	%
Loggers	%
Wood Dealers	%
Sawmill / other residues	%
Other (specify)	%

- 7)
 - a) What percentage of wood is purchased through supply agreements? _____%
 - b) How long do the supply agreements last? Average: _____yrs Range: _____yrs
- 8) Where you sell wood to, if applicable?

	Pine	Hardwood
Pulp Mills	%	%

Sawmills	%	%
Panel Mills	%	%
Pellet Mills	%	%
Bioenergy	%	%
Other (specify)	%	%

9) What are your approximate percentages of total delivered wood costs by category?

Function:	Stumpage	Logging	Hauling	Wood Dealer
Average	%	%	%	%
Range	%	%	%	%

10) What effect have biomass markets (chips/pellets for energy) had on your operations?

11) Where do you foresee most of your wood supply coming from or how will it change in the next 5 to 10 years, e.g., direct purchase from landowners, purchase from wood procurement organizations, loggers?

12) Discuss the market influences do you see as a driving force for this supply, such as:

- Supply / availability, logging capacity, prices, highway regulations
- Environmental regulations, social pressures, forest certification/buyer sustainability requirements, other

NC State University – Forestry
Logging Systems, Capacity, and Costs Questionnaire

Survey number: _____

Production Type and Amounts

- 1) How long have you been logging?
- 2) How long have you owned your own logging business?
- 3) What counties do you operate in?
- 4) Do you buy / have you bought standing timber?
- 5) How does your business operate?
 _____ Contract logging for a wood dealer
 _____ Contract logging for a forest products mill
 _____ Independent logging (buying your own timber and delivering under your own company to mills)
 _____ Other (Describe) _____

- 6) What is your average production per week (tons)?

	Average	Range
Pine (tons)		
Hardwood (tons)		

- 7) How many weeks do you work per year? _____
- 8) How many hours per week? _____
- 9) What is your average product mix by percentages?

Product / Species	Pine	Hardwood
Sawtimber	%	%

Chip-n-saw	%	%
Pulpwood	%	%
Biomass / energy wood	%	%
Total	100%	100%

10) What effect have biomass markets (chips/pellets for energy) had on your operations?

11) Do you supply biomass to energy plants, such as Craven Wood Energy or Enviva? What form of biomass (roundwood or chips?)

	Average	Range
Pine (tons)		
Hardwood (tons)		

12) What is your average and range of logging contract rates / costs / distance (circle which one)?

	Average	Range
Cut & Load on Truck (\$/ton)		
Haul to Mill (\$/ton or \$/loaded mile)		
Average Haul Distance (miles)		

13) Do you plan to expand operations or your crew size / could you do so with more demand?

Logging System

14) How many employees do you have?

15) What are their wage rates?

16) What is the social insurance & workers comp (percentage or \$ per unit (specify))?

17) What is your equipment spread and costs, including support vehicles?

