

5-4-2016

Can Portable Band Sawmill Operators Help Address Connecticut's Small Scale Forest Management Needs?

Frances E. P. Champagne

University of Connecticut - Storrs, frances.champagne@uconn.edu

Recommended Citation

Champagne, Frances E. P., "Can Portable Band Sawmill Operators Help Address Connecticut's Small Scale Forest Management Needs?" (2016). *Master's Theses*. 914.
https://opencommons.uconn.edu/gs_theses/914

This work is brought to you for free and open access by the University of Connecticut Graduate School at OpenCommons@UConn. It has been accepted for inclusion in Master's Theses by an authorized administrator of OpenCommons@UConn. For more information, please contact opencommons@uconn.edu.

Can Portable Band Sawmill Operators Help Address Connecticut's Small Scale
Forest Management Needs?

Frances E. P. Champagne, B.S.

B.S., University of Connecticut, 2008 & 2011

A Thesis

Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Science

At the

University of Connecticut

2016

APPROVAL PAGE

Masters of Science Thesis

Can Portable Band Sawmill Operators Help Address Connecticut's Small Scale Forest Management Needs?

Presented by

Frances E. P. Champagne, B.S.

Major Advisor _____

John C. Volin

Associate Advisor _____

Thomas E. Worthley

Associate Advisor _____

Benjamin Campbell

University of Connecticut

2016

ACKNOWLEDGEMENTS

I would like to thank the many people who have helped and encouraged me with my research, including members of my advisory committee for their patience, as well as my family and friends. Special thanks to the participants in this study, who devoted their time and information to promote research in small scale forest production in Connecticut. It is my hope that through this work, some truly useful information about this topic will be made available to them.

TABLE OF CONTENTS

1. INTRODUCTION	
1.1 Current Natural Resource Management	1
1.2 Connecticut's Roadside Trees	3
1.3 Small Scale Forestry Alternatives to Traditional Harvesting & Processing	4
1.4 Advantages of PBSOs in Small Scale Forest Management	6
1.5 Niche Markets	8
1.6 Research Questions	10
2. METHODS AND STUDY DESIGN/ANALYSIS	
2.1 Instrument	11
2.2 Goals of Instrument	11
2.3 Statistical Analyses	12
2.4 Examining Startup Costs	17
3. RESULTS	
3.1 Demographics and Projected Interest	17
3.2 Current Sawyers	20
3.3 Interest in Workshops	26
3.4 Comparison of Startup Costs	26
4. DISCUSSION	
4.1 Research Question Considerations	
4.1.1 <i>Characteristics of Interested Individuals</i>	27
4.1.2 <i>Current Sawyer Operations</i>	28
4.1.3 <i>What does the PBSO Community Need?</i>	30
4.2 Recommendations and Suggestions	33
5. APPENDIX A	36
6. LITERATURE CITED	46

ABSTRACT

The shrinking average size of Connecticut forested land parcels, as well as increased interest in roadside forest management activities and small-acreage treatments for wildlife habitats, all necessitate scale-appropriate management methodologies for tree harvesting and vegetation management. Corresponding value-added processing for wood products, such as with portable band sawmills, has the potential to foster local markets and utilization of wood products in the small quantities produced. A survey of portable band saw mill operators (PBSOs) in Connecticut was conducted to help determine the capacity for PBSOs to assist in addressing the state's small-scale forest management needs. Results of the survey revealed that the majority of sawmill owners are over the age of 60; age and annual income had significant effects on interest in operating a PBSO business, whereas sawmill ownership and income effected possible interest in becoming part of a niche market. Current sawyers indicated a need for education in harvesting and operational practices, value-added techniques, and marketing, with an additional interest in obtaining logs from roadsides. PBSOs can be of assistance in addressing small scale forest management needs.

1. INTRODUCTION

1.1 Current Natural Resource Management

A decline in the average size of forested Connecticut properties, a high level of interest in small-area wildlife habitat enhancements among Connecticut woodland owners, and increased interest in roadside forest management activities are all examples of current forest management scenarios that call for small-volume, low impact methodologies for tree harvesting and vegetation management in the state. Management projects generating low volumes of wood are often of little or no economic interest to the traditional high-volume timber industry. On the other hand, value-added activities, such as the use of portable band sawmill operations (PBSOs) to produce local lumber can be part of an array of small-scale technologies that might be used in various combinations to address small-scale management needs.

Research on harvesting and processing timber at the small-scale level is lacking in the United States (Lupo, 2010). This is true in Connecticut where very little research has been performed on the initial production of local wood products, including use of portable band sawmills, and virtually none has been executed on their use at locations along Connecticut roadsides. The addition of value-added options such as PBSOs in combination with available low-impact harvesting methods potentially increases the economic viability of small scale management. A better understanding of the opinions, attitudes and motivations of members of the PBSO community will provide insight as to the capacity for this technology to contribute to small-scale forest management solutions.

Outsourcing and increased worldwide trade within timber markets have contributed to a decline in domestic forestry production in the United States. While U.S. forest product exports have increased (Foreign Agricultural Service, 2015), the U.S. still depends on wood product

resources of developing countries that are harvested and exported to the U.S. (Berlik et al., 2002), thereby decreasing the sales of American wood products. One reason given for the lack of harvesting enough home-grown resources is a perceived desire to promote resource conservation. However, the conservation of natural resources in developed countries like the U.S. has had a counter-effect on less-industrialized countries (Berlik, et al., 2002), in which over-harvesting of resources has been observed.

With increased awareness of these circumstances, sustainability has become a major focus of many natural resource management issues in the U.S. and in other developed nations (Chapin et al., 2009), though numerous obstacles to true sustainability remain. For example, continued shrinking land parcel size (United States Forest Service Northern Research Station, 2011) and corresponding limited management options in developed settings such as the state of Connecticut (Tyrrell, 2015), contribute to difficulties faced by both conservation and sustainability efforts. In locations where there is a substantial number of people living on small parcels of land within surrounding forested areas of a nearby city, it is not possible for municipalities to provide comprehensive sustainable forest management operations or guidance (Chapin et al., 2009). According to Barlow et al. (1998), the likelihood of harvesting decreases as population density grows; this is a major issue in areas such as Connecticut, where population density is already estimated to be approximately 738 people per square mile (United States Census Bureau, 2010) and where the existing timber industry is equipped to operate efficiently only on larger parcels (De Lasaux et al., 2009).

To begin exploring these issues, the attitudes of stakeholders, namely private landowners, have recently been analyzed. Survey research in Connecticut found that more than 75% of woodland owners have strong ethics regarding appropriate land stewardship and place a high

value on land attributes such as wildlife habitat, but do not actively manage their properties (Tyrrell, 2015). The study suggests that more diverse management options need to be made available to Connecticut woodland owners, addressing their diverse priorities and interests.

According to the United States Forest Service (2014), as of 2012, 81% of the forested land in the Eastern U.S. is privately owned, which is similar to that found in Connecticut at 83% (Wharton et al., 2004). The small average parcel-size, however, leads to a pointedly high number of woodland parcels and potential stakeholders. This issue has become a concern regarding management of wildlife in the area, where even seemingly insignificant parcels can make a difference for survival rates of local wildlife, such as the American woodcock, which benefits from structural landscape diversity due to its varied habitat requirements (see: www.audubon.org). Wildlife management tactics involving tree harvesting have been used to support such habitat needs. The Connecticut Young Forest and Shrubland Initiative (Connecticut Department of Energy and Environmental Protection, 2016), has helped address the issue of the New England cottontail and habitat fragmentation due to lack of appropriate forest management. Larger tracts of forest must be adequately maintained in order to support these and other wildlife populations while adhering to sustainable harvesting practices.

1.2 Connecticut's Roadside Trees

Recent increase in branch and tree removal along Connecticut's roadsides due to greater frequency of severe weather events affecting utility lines (State of Connecticut Public Utilities Regulatory Authority, 2014) is producing a large amount of potentially saleable local wood products that are currently under-utilized or discarded as waste. According to one Connecticut tree warden, roadside trees are similar to urban trees—once cut down, they are viewed as nothing more than an expense (Donnelly & Doria, 2014). At the beginning of the 21st century, it became clear

that value-added utilization of urban wood waste is needed (Lyon & Bond, 2014). This need is now arising for roadside trees. In the past, logs from roadside trees have often been avoided by the sawmill industry due to possible processing problems, such as nails or other sawblade-damaging fragments. However, with scientific advancements such as metal detection technology, it is now possible to scan logs for potentially damaging materials, even at the small scale, making roadside trees more appealing to wood processors.

In Connecticut, utility companies are currently implementing a pruning method referred to as enhanced tree trimming (ETT) near utility lines. The potential exists, however, to decrease the frequency of tree trimming along roadsides if a broader strip of forest vegetation is more precisely managed for an appropriate structure at any given location (see: www.stormwise.uconn.edu). Such an approach would involve removing trees that pose a serious threat to the utility lines or safety within one tree height of the road, and leaving those that are healthy and able to withstand extreme weather events at a desirable spacing. Under this scenario, some trees to be removed will potentially contain high-quality wood. A complementary solution for the utilization of this timber is needed. In these situations, because the areas and wood volumes are likely to be small, privately owned forested land management needs, in cooperation with the need for roadside vegetation management, could be facilitated by small scale forestry entrepreneurs, including the PBSO community.

1.3 Small Scale Forestry Alternatives to Traditional Harvesting & Processing

Largely because of perceived ecological consequences there is regular public concern about how timber harvesting is practiced (Bradley & Kearney, 2007). However, using portable sawmills as part of harvesting and processing methods may show that responsible harvesting can be low-impact and not necessarily detrimental to the environment and at the same time

contribute to reductions in transportation and labor costs (Mullins, 2007). Research performed on the use of portable sawmills in Papua New Guinea (Fox et al., 2011) showed that implementation of community-based portable band sawmills may help to reduce dependence on heavy labor and increase more sustainable harvesting and management practices. While the concept of a fully community-based sawmilling operation may not be applicable with Connecticut stakeholders, there are some characteristics of such an operation that could prove useful, such as improved close relationships between entrepreneurs and customers in the proposed specialty market of PBSOs.

In Connecticut's forestry and timber harvesting commerce, the current high production commodity timber industry does not fully satisfy current management needs. According to the United States Census Bureau (2013), Connecticut saw a 26% decline in operational sawmills between the years 2002-2012, with current primary production operations dropping from 19 to 14 active sawmills. Of those that remain, most are conducted in a manner that addresses high timber volume per acre, rather than lesser amounts from very small properties. This is in part due to logistical complications; using a log skidder on small land parcels or along roadsides is not practical, nor is transporting a handful of logs from a small site to a fixed-site sawmill, located far away. In addition a persistent negative view of logging in southern New England affects tree harvesting that results from aesthetic perspectives associated with large-scale timber harvesting equipment and the dramatic changes that it can produce in a forested landscape. There is also an apparent detachment between logging work and the resulting forest products that are consumed by the public (Egan, 2011). An important characteristic of Connecticut landowners regarding tree harvesting is the very low priority most landowners place on management for timber products compared to other activities and uses they associate with their land (Tyrrell, 2015). Even

landowners that might consider some degree of harvesting are hesitant because of the degree of disturbance involved with traditional high-volume logging practices. The ability of portable sawmills to provide a value-added operation using small volumes of wood can contribute to scale appropriate management options that are potentially more acceptable for woodland owners.

Opportunities and incentives already exist for the engagement of PBSOs, because they can be used to mill logs at the site from which they were harvested, particularly in locations where the land area does not allow for traditional, large-scale logging methods. For example, availability of financial and technical assistance programs for certain conservation practices through the Natural Resources Conservation Services Environmental Quality Incentives Program (NRCS EQIP) fosters a demand for small-scale management options (see:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/>). Wood harvested from roadsides, including recovery of products from urban trees (Lyon & Bond, 2014) could be milled into marketable products with the attribute of having been grown and processed locally by PBSOs within the state.

1.4 Advantages of PBSOs in Small Scale Forest Management

Numerous pros and cons have been identified for portable sawmills (Smorfitt et al., 2003a). Drawbacks include that the use of a portable mill may require daily travelling to and from a site and storage when not in use; however, many benefits balance and might even outweigh the inconveniences. According to Kowero et al. and the Queensland Department of Primary Industries–Forestry (as cited in Smorfitt et al., 2001), they are fairly inexpensive to obtain, they can handle smaller diameter logs, and reduced transport of logs on public roads (Smorfitt et al., 2001) for primary processing. In reference specifically to band sawmills, there are also the added benefits of cheaper blade replacement and reduced kerf, which is the portion

of the log being physically cut as the blade moves through a log, becoming an empty path behind the blade, which produces sawdust, and is not a part of the end product (Bratkovich, n.d.). While some proponents of circular mills might argue that the band blade can lead to a wave effect on the product due to wandering of the blade (Smorfitt et al., 2001), this can be controlled by proper maintenance of guides, tensioning of the blade and experience in milling (Smorfitt et al., 2001). Processing lumber at the harvest site rather than at a distant mill also leaves unused organic matter behind, including sawdust and slabs, which can be beneficial to the ecosystem from which the timber is harvested (Briedis et al., 2011), and does not become a waste product (Smorfitt et al., 2001).

Individuals who run these operations have a variety of equipment to choose from, some of which have a lesser impact on the surrounding ecosystems. There also exist a variety of portable mill types, including band saw, chain saw, and circular saw mills, with band saws gaining popularity since their introduction in the 1980s (Smorfitt et al., 2003b). Woodmizer, the largest portable band sawmill manufacturer, has sold approximately 200 mills to Connecticut residents in the last 20 years (A. Shearer, personal communication, April 22, 2016), and it is estimated that the next four to five smaller manufacturers might have sold 20 to 30 mills each.

Since there are current management needs, as well as available technology to address these needs, and approximately 300 PBSOs in Connecticut (T. Worthley, personal communication, March 14, 2014), information about what people are doing with said equipment and how/if they are addressing these needs is an appropriate line of inquiry. This includes how they are currently operating as a business, if at all. The informational needs of this cohort should also be addressed in an effort to ensure that they are operating safely and that their practices have little negative, or perhaps even a positive impact, on surrounding ecosystems and neighborhoods.

In light of these matters, small scale management approaches by PBSO owners have the potential to be of assistance by allowing for a way to process the timber on-site, with property owners having some oversight on the progression from harvesting through processing. PBSOs, with the assistance of other equipment such as fetching arches and winches, can be used on small parcels without having to transport logs to a mill, or products to buyers, thus decreasing the need for high fuel consumption machinery and environmentally damaging harvesting methods. Use of tractors/ATV-type equipment, instead of skidders, combined with winches and logging arches greatly reduces soil compaction and root damage as opposed to dragging with chains (Boyt, 2013) or a large skidder, as is done in conventional logging, which can cause substantial disturbance of the soil (Rogers, 2010). These methods also reduce likelihood of rolling over a tractor or ATV (Boyt, 2013), thereby increasing safety.

According to Cassens (2011), the general benefits of running a PBSO include overall low costs, single-person operation, and inexpensive blade replacement; these features are desirable if milling along roadsides in a suburban or urban setting, where there is likely not enough room for multiple workers or extra equipment.

1.5 Niche Markets

Current research indicates that U.S. wood product consumers show preference for wood products that were manufactured domestically (Cai & Aguilar, 2012). A notable change in product-type demand has also occurred, with consumers increasingly requesting custom work (Espinoza et al., 2011). With continued newspaper articles regarding local goods production, there is speculation that the lumber produced by PBSOs could be used in the expanding locally-made niche market. With websites, such as www.visitconnecticut.com, promoting local consumerism through programs such as Farm to Table, the possibility exists that this type of

campaign could include Connecticut-milled lumber and wood products (see Rand 2011). One example is that of a modern establishment located in Connecticut which creates hand-crafted furniture from urban trees. A similar niche could be created, founded entirely on the concept of lumber from customers' local vicinity instead of metropolitan trees. Entrepreneurs in this type of market would face less competition from international producers (Buehlmann et al., 2010).

According to Nardi-Cyrus et al. (2016) and Rand (2011), there could be an increased demand for locally grown wood among secondary wood producers (SWPs), such as carpenters and furniture makers, if consumers were more aware of its availability. However, the need to address quality and reliability in local value-added wood product operations, such as grading, planing, and kiln-drying lumber, must also be addressed so as to increase SWPs' interests in purchasing and working with Connecticut timber products from primary wood producers (Nardi-Cyrus et al. 2016). PBSOs can be a viable option in resolving this incongruity. Portable band mills are different from conventional fixed-site circular sawmills in that they function similarly to a typical band saw used in woodworking. They also allow for more custom cuts because the customer is often nearby and therefore able to better describe what s/he is looking for in a final product. Other small scale tools and techniques that could be used to address this portion of the issue include cooperative use of portable/solar kilns and other moveable equipment needed to add value to rough-cut lumber.

Numerous reasons, opportunities, and incentives exist to promote a role for the PBSO community in Connecticut in the management of local woodlands and in producing local wood products, but little is known about the characteristics of the PBSO community. Who are these operators, what do they know, what are their interests, and are they up to the challenge of the management needs? With a better understanding of how these operations currently function, as

well as what the owners feel they need to know more about, it is possible to change the apparent detachment between logging work and the resulting forest products that are consumed by the public (Egan, 2011). If harvesting and processing of local timber is viewed well by the surrounding community, it may be possible to market a high-quality, locally grown and processed forest product. Therefore, research concerning Connecticut sawyers' attitudes regarding these topics is necessary with the aim of determining if they can help to address the state's forest management needs.

1.6 Research Questions

This study is focused on individuals who are currently a part of the Connecticut sawmill community or who are interested in becoming involved in it. More comprehensive consideration is given to current sawyers.

Main research questions:

1. What are the defining demographic characteristics of current sawmill owners and individuals interested in becoming part of the sawmill market?
 - a. Are these individuals interested in operating a PBSO business in a niche market?
2. How do current sawyers operate in the industry?
3. What information about being a part of the lumber manufacturing industry is needed in the Connecticut portable sawmill community?

2. METHODS AND STUDY DESIGN/ANALYSIS

2.1 Instrument

A survey (Appendix A) was created and distributed to individuals in Connecticut who are associated with or interested in the primary processing of wood. The Dillman method (Dillman et al., 2009) was used in part of the distribution of the survey. A paper version was mailed to individuals who have previously expressed interest in milling operations in Connecticut, or who were known to own or operate a sawmill in the state. An online version was created and emailed to the University of Connecticut's Forestry e-mail listserv as well as to subscribers of the *Independent Sawmill and Woodlot Management* magazine, and was also placed in an advertisement in *Go Local* magazine that included the online link to the survey. Paper versions and informational handouts about the online survey were made available to individuals at local lumber stores and logging events.

2.2 Goals of Instrument

The survey instrument was used to ascertain the characteristics of current sawmill owners, as well as those who are interested in operating a portable sawmill business and/or becoming part of a niche market. In addition to demographic data of those interested in running an entrepreneurial PBSO, operational information was sought from current owners of sawmills in an effort to gain some insight into how these operations are presently functioning. Data were also collected regarding what types of information these individuals feel they need to know more about, including mill operation, sawing for particular products, creating business plans, and being able to sell their final products. Additional data regarding operations and outlooks of current sawyers was also collected, but was not analyzed in this study; it will be of use in future research.

2.3 Statistical Analyses

Initial visual analysis of the raw demographic data from the PBSO survey indicated that age and income appear to have an impact on sawmill ownership. These results indicate that the majority of current sawmill owners are over age 51, with an annual income greater than \$50,000.00 (Figures 1A and 1B). Since the dependent variable, ownership, is binary, effects of age and annual income were obtained from the following binary logit model [1] in Stata:

$$[1] \quad P(Y = 1|X) = \frac{e^{\beta'x}}{1+e^{\beta'x}}$$

where P_i is the probability the i^{th} respondent's ownership status did not change and x_i represents age and income associated with the i^{th} respondent (Bartholomew, et al., 2015). Since the logit model produces log odds estimates, there is no upfront explanation. Therefore, marginal effects were calculated to describe the increased/decreased probability of sawmill ownership when there is a change in one of the independent variables.

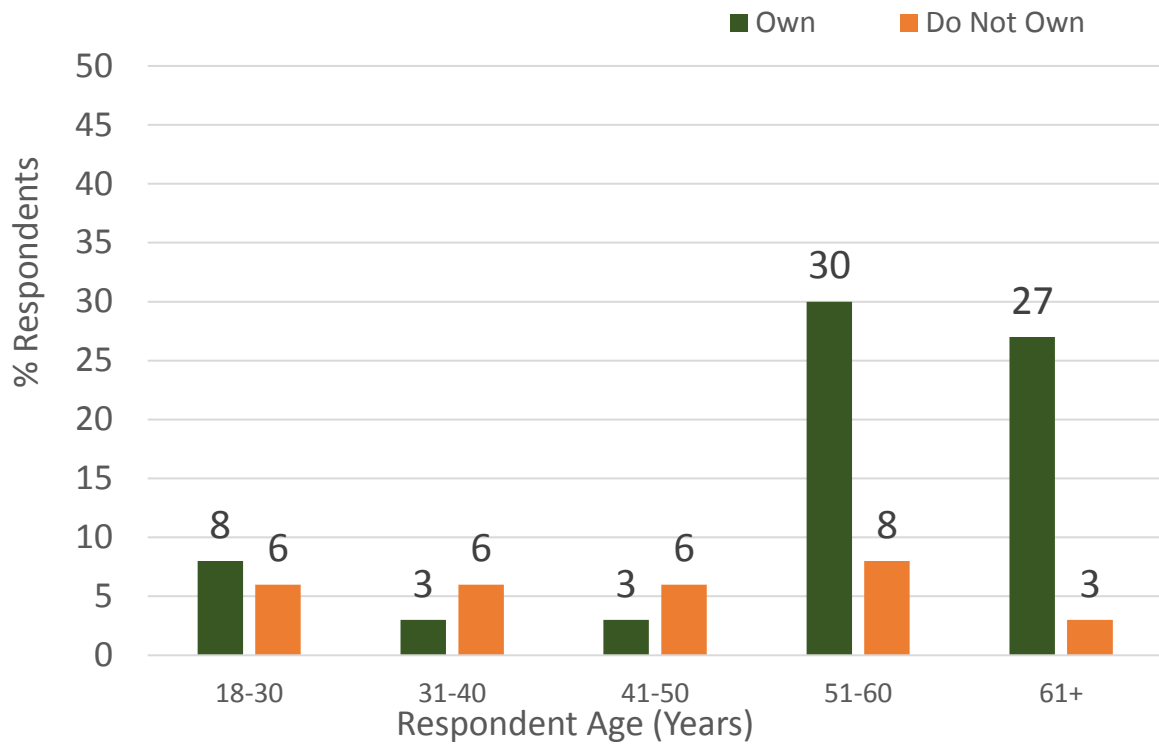


Figure 1A. Portable Band Sawmill Survey Respondent Ages (n=37)

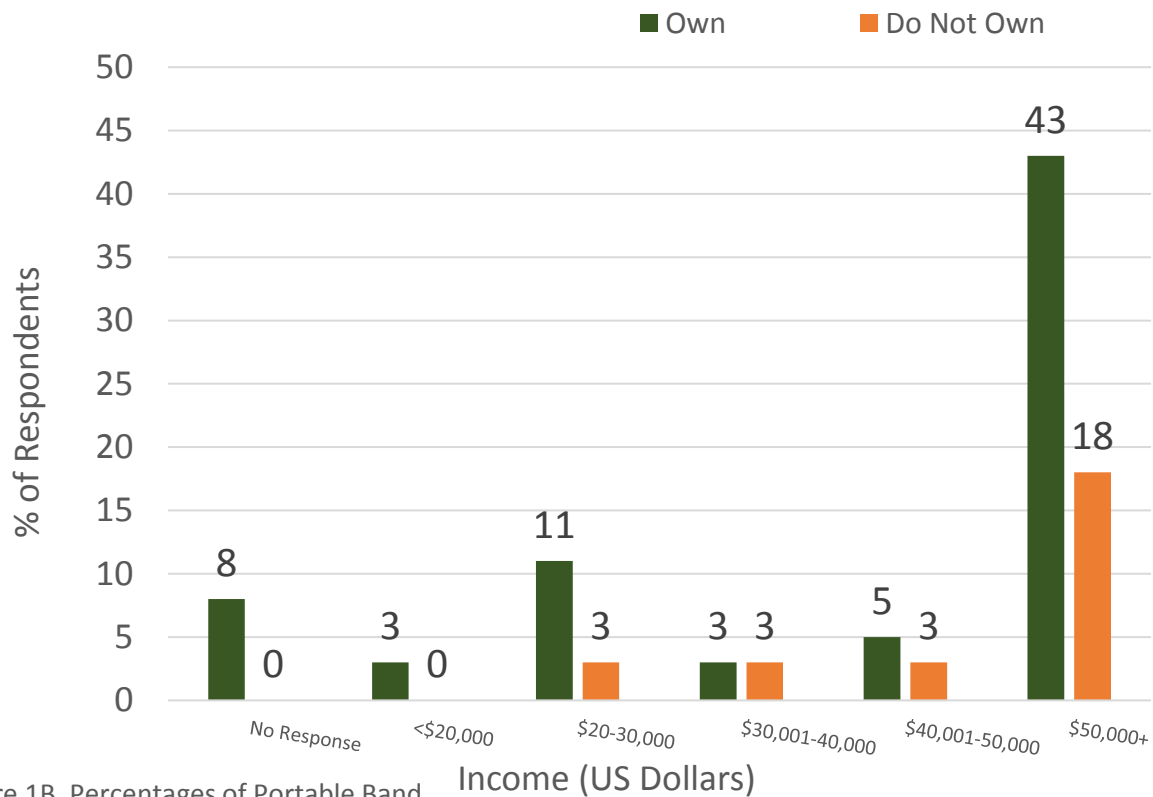
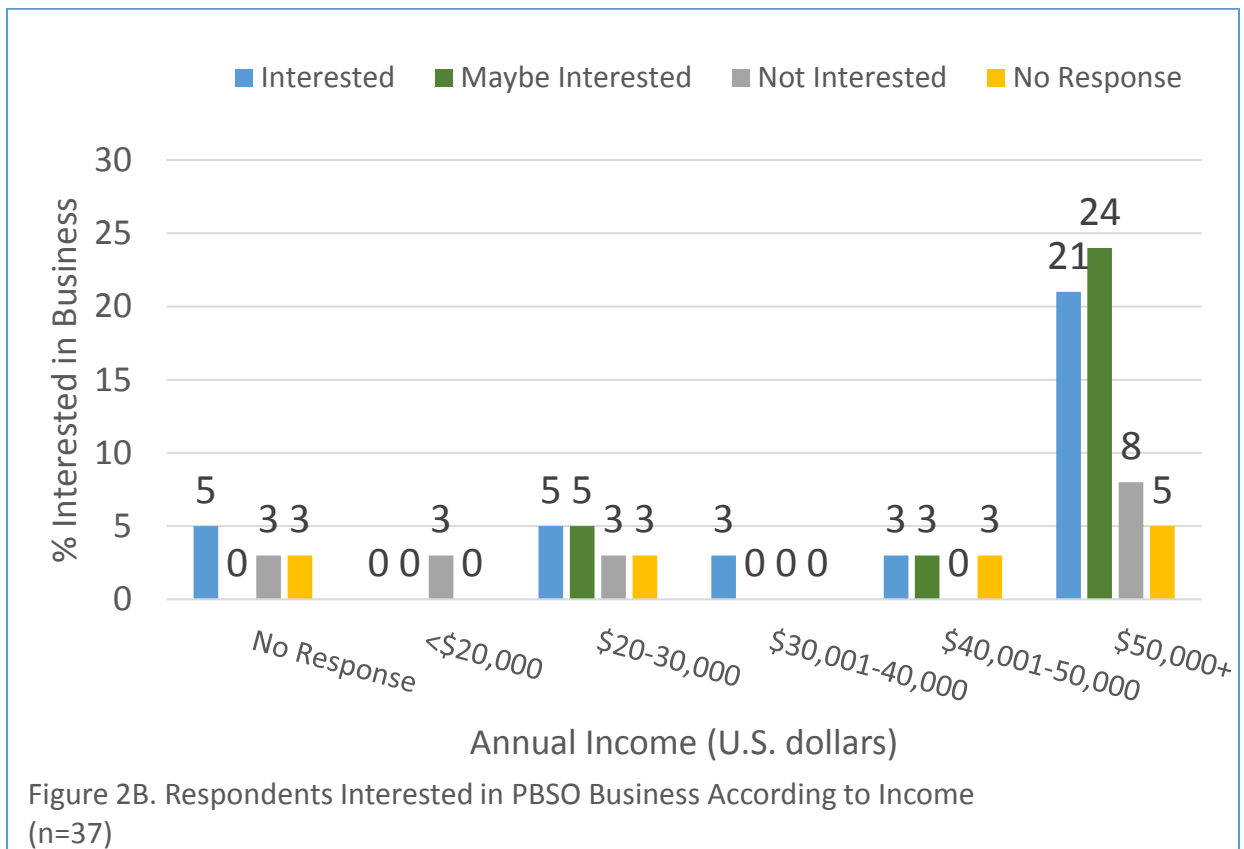
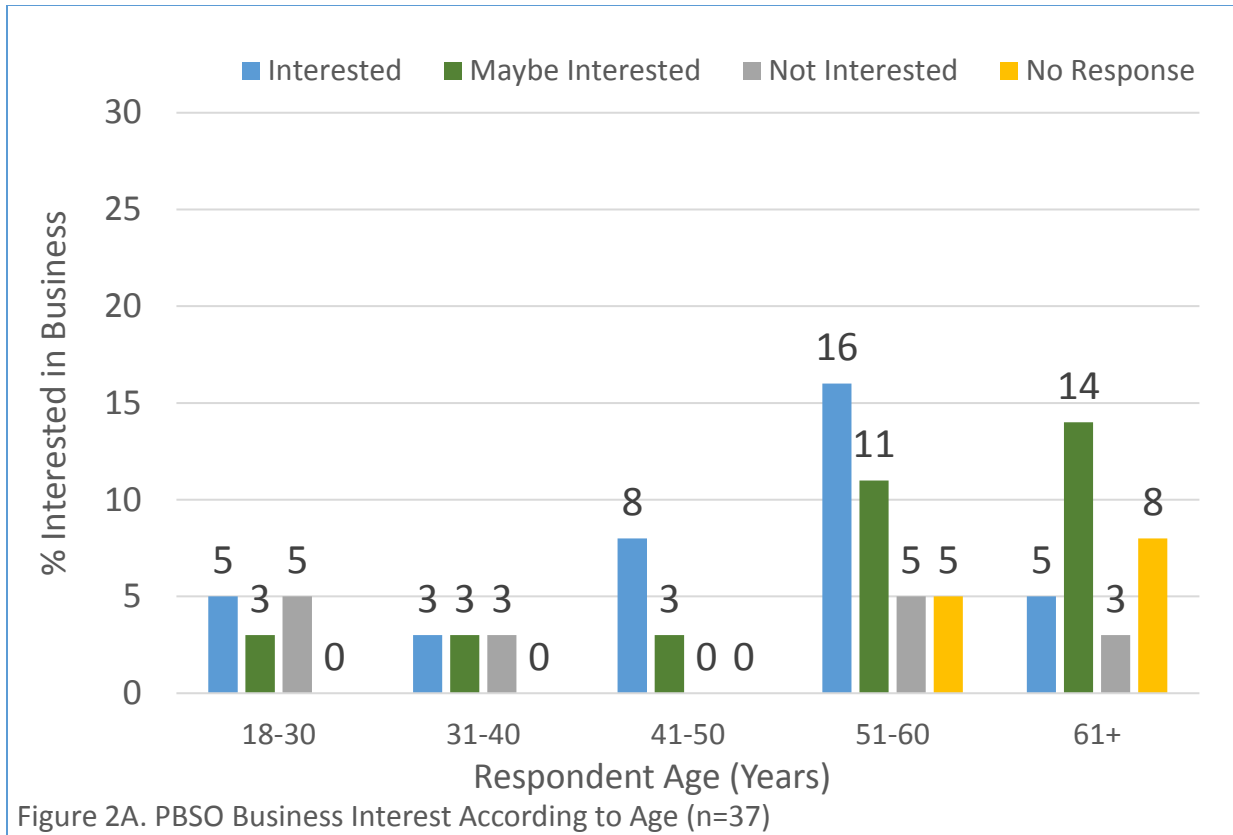


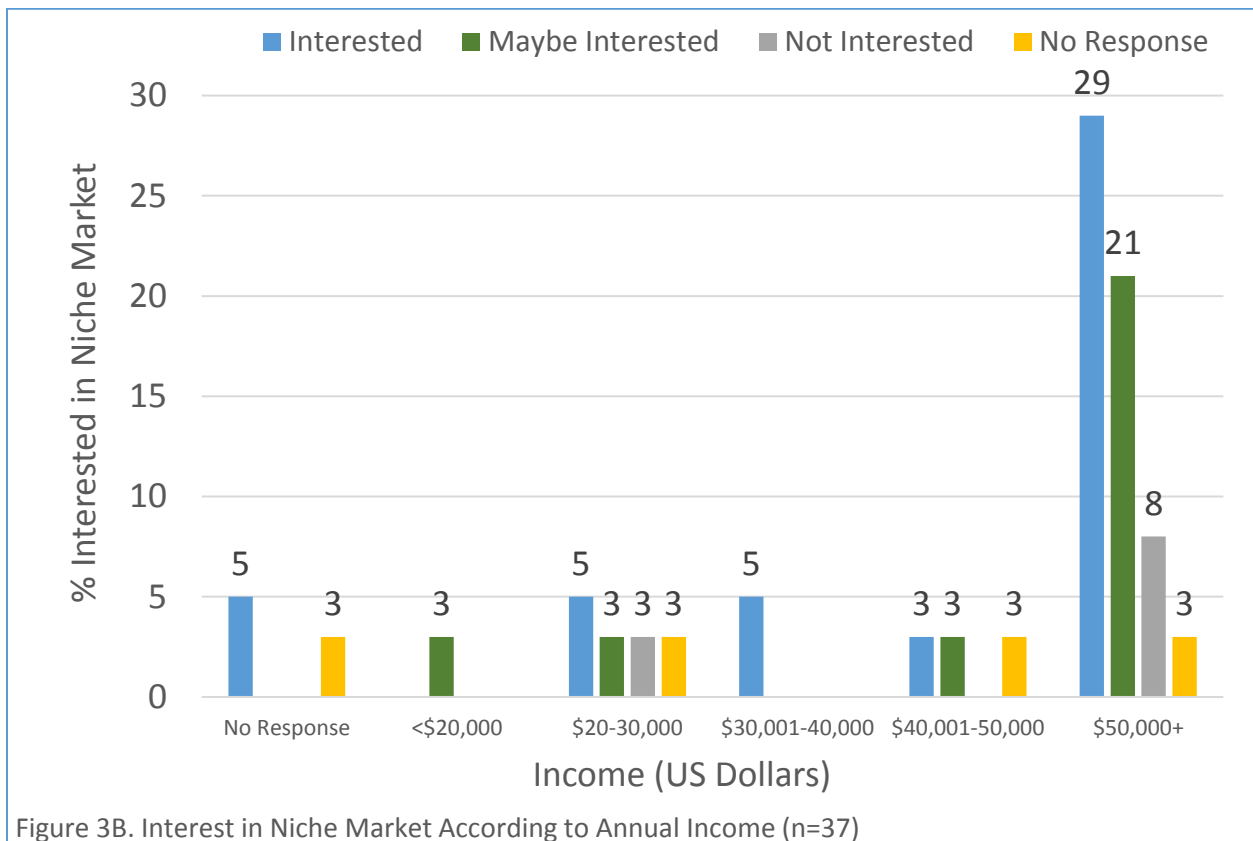
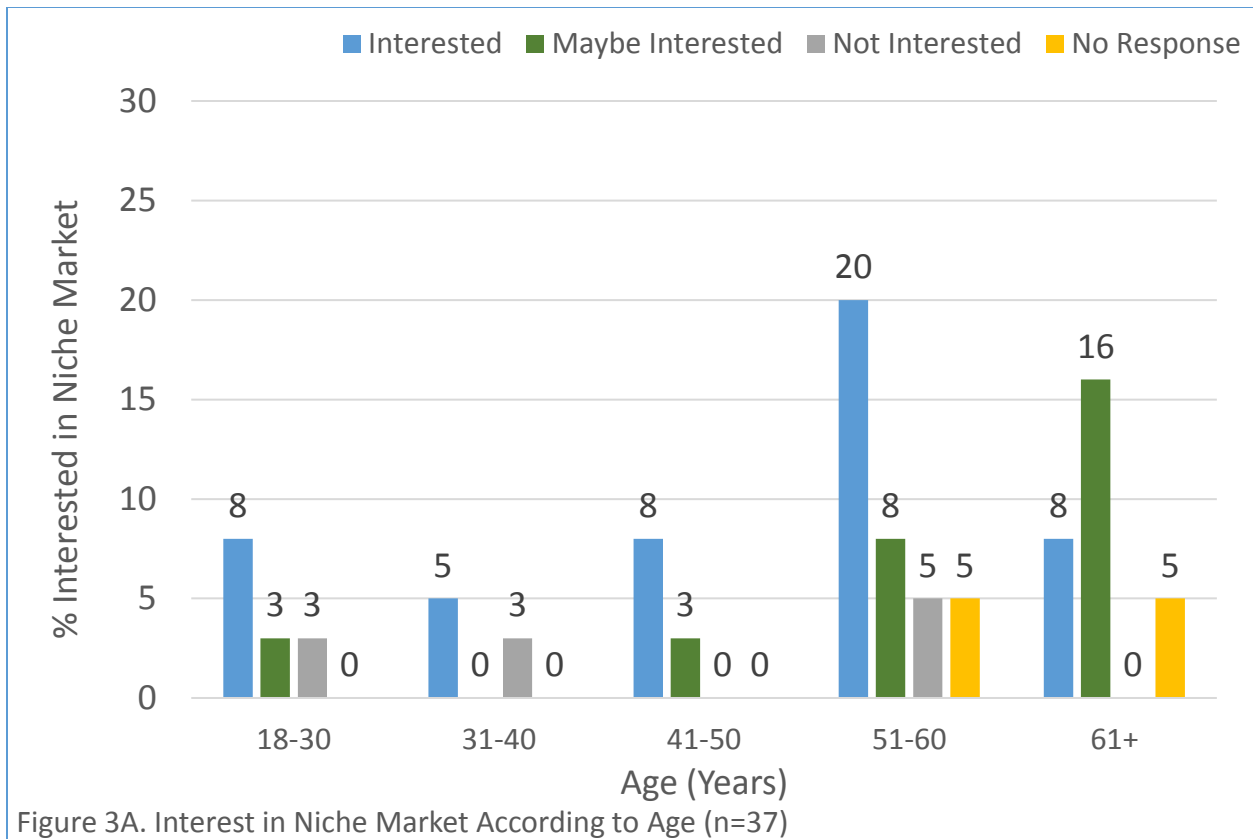
Figure 1B. Percentages of Portable Band Sawmill Survey Respondent Annual Income (n=37)

Age and income were also used to visually examine potential interest in operating a PBSO business (Figures 2A and 2B), as well as interest in becoming a part of a niche market (Figures 3A and 3B.). Respondents aged 51 and older or who currently earn more than \$50,000 annually visibly stood out in both the business interest and the niche market graphics. Marginal effects were obtained from a multinomial logit model [2] in Stata using changes in age, income, and sawmill ownership, to describe PBSO business interest and niche market interest:

$$[2] \quad \text{Log}(P_{ij}/P_{i1}) = \beta_{0j} + \beta_{1j}x_i + \beta_{2j}x_{i2} + \beta_{3j}x_{i3}$$

where i is the i th individual and j is the j th category of the dependent variable, which would be interest in business or niche market.





2.4 Examining Startup Costs

Estimates for sawmill prices were obtained from a range of listings at <http://www.sawmilltrader.com/> as well as the Woodmizer website, <http://woodmizer.com/us/>. Dry kiln pricing was also obtained from Woodmizer. New arch equipment pricing was obtained from Logrite, located in Vernon, Connecticut (<http://logrite.com/>). A range of prices for tractors, ATVs, and skidders was obtained from Craigslist (<https://geo.craigslist.org/iso/us/ct>). Since many fixed-site sawmill owners construct their own buildings to shelter the mill, pricing was approximated according to required materials, including metal roofing (<https://geo.craigslist.org/iso/us/ct>) and the pouring of footings for the structure, which can vary greatly, depending on the size of the structure and the location in the state.

3. RESULTS

3.1 Demographics and Projected Interest

A total of 37 responses were obtained, of which 27 respondents were current sawmill owners. This is approximately a 9% representation of the sawmill owners in Connecticut. Individuals aged 61 years or greater are 27% more likely to own a sawmill than those aged 60 or less at $\alpha = 0.05$ (Table 1). Annual income did not have a significant effect on sawmill ownership.

Table 1. Marginal effects from a binary logit model using age in years and annual income in US dollars to explain sawmill ownership probability (standard error), significant results at $\alpha = 0.05$ (n=37)

Variable	Ownership Prediction	<i>p</i> -value
Age 51-60	21% (0.15) more likely	0.15
Age 61+	27% (0.13) more likely	0.04
Annual Income >\$50,000	-8% (0.15) less likely	0.60

It is less likely (35%) that current sawmill owners would not have an interest in running a

PBSO business (Table 2) than non-owners. Individuals whose income is greater than \$50,000/year are 34% more likely to maybe be interested in running a PBSO business. Those aged 61+ that were maybe interested, as well as those owning a sawmill with definite interest, tended ($\alpha=0.08$ and 0.09 , respectively) to show an increased likelihood in business interest (Table 2).

Table 2. Marginal effects from a multinomial logit model using age in years, annual income in U.S. dollars, and sawmill ownership to explain PBSO business interest (standard error) at $\alpha=0.05$ (n=37)

Interest	Variable	Marginal Effects (SE)	<i>p</i> -value
Not Interested	Age 51-60	-0.026 (0.17)	0.99
	Age 61+	-12 (0.16)	0.44
	Income \$50,000+	-11 (0.16)	0.50
	Own Sawmill	-35 (0.16)	0.03
Maybe Interested	Age 51-60	10 (0.21)	0.65
	Age 61+	38 (0.22)	0.08
	Income \$50,000+	34 (0.15)	0.02
	Own Sawmill	6 (0.16)	0.70
Interested	Age 51-60	-9 (0.21)	0.65
	Age 61+	-26 (0.2)	0.20
	Income \$50,000+	-24 (0.18)	0.19
	Own Sawmill	29 (0.17)	0.09

As can be found in Table 3, sawmill owners are less likely (54%) to not be interested in

becoming a part of a niche market than non-owners. Individuals with an income of \$50,000/year or greater are 26% more likely to maybe be interested in becoming a part of a niche market. Sawmill owners are 31% more likely to maybe be interested in becoming part of a niche market than non-owners (Table 3). At $\alpha=0.18$, the analysis definitely does not suggest that sawmill owners are any more likely to have definite interest in becoming part of a niche market than non-owners.

Table 3. Marginal effects from a multinomial logit model using age in years, income in U.S. dollars, and sawmill ownership to explain niche market interest probability (standard error) at $\alpha=0.05$ (n=37)

Interest	Variable	Prediction (%)	<i>p</i> -value
Not Interested	Age 51-60	29 (0.23)	0.2
	Age 61+	23 (0.26)	0.38
	Income \$50,000+	-10 (0.15)	0.48
	Own Sawmill	-54 (0.15)	<0.0001
Maybe Interested	Age 51-60	-16 (0.14)	0.24
	Age 61+	-0 (0.17)	0.99
	Income \$50,000+	26 (0.13)	0.04
	Own Sawmill	31 (0.11)	0.01
Interested	Age 51-60	-13 (0.22)	0.56
	Age 61+	-22 (0.23)	0.33
	Income \$50,000+	-16 (0.17)	0.36
	Own Sawmill	23 (0.17)	0.18

3.2 Current Sawyers

Seventy-eight percent of sawyers surveyed consider harvesting trees to be beneficial to regeneration of native species and wildlife habitat (11% non-response) and 48% are willing to perform some type of additional management activity (22% non-response), such as timber stand improvement or tree thinning, if they are harvesting logs themselves. More specifically, of the 74% who are currently harvesting, 22% indicated that they perform an extensive inventory of the property to obtain a complete account of all potentially usable trees, 14% perform a moderate stand inventory, 8% perform minimal inventory, and 11% perform no inventory; 45% declined to respond (Figure 4). Forty-eight percent of respondents indicated that they would be willing to perform some sort of additional management activity, while 30% would not and the remaining 22% did not provide a response. Of the 48% that would provide additional management; 37% expressed interest in tree thinning, 26% in providing timber stand improvement, 19% were willing to perform a forest inventory for a property owner, 11% were willing to provide mechanical invasive species management/removal, and 4% in chemical invasive species management/removal (Figure 5).

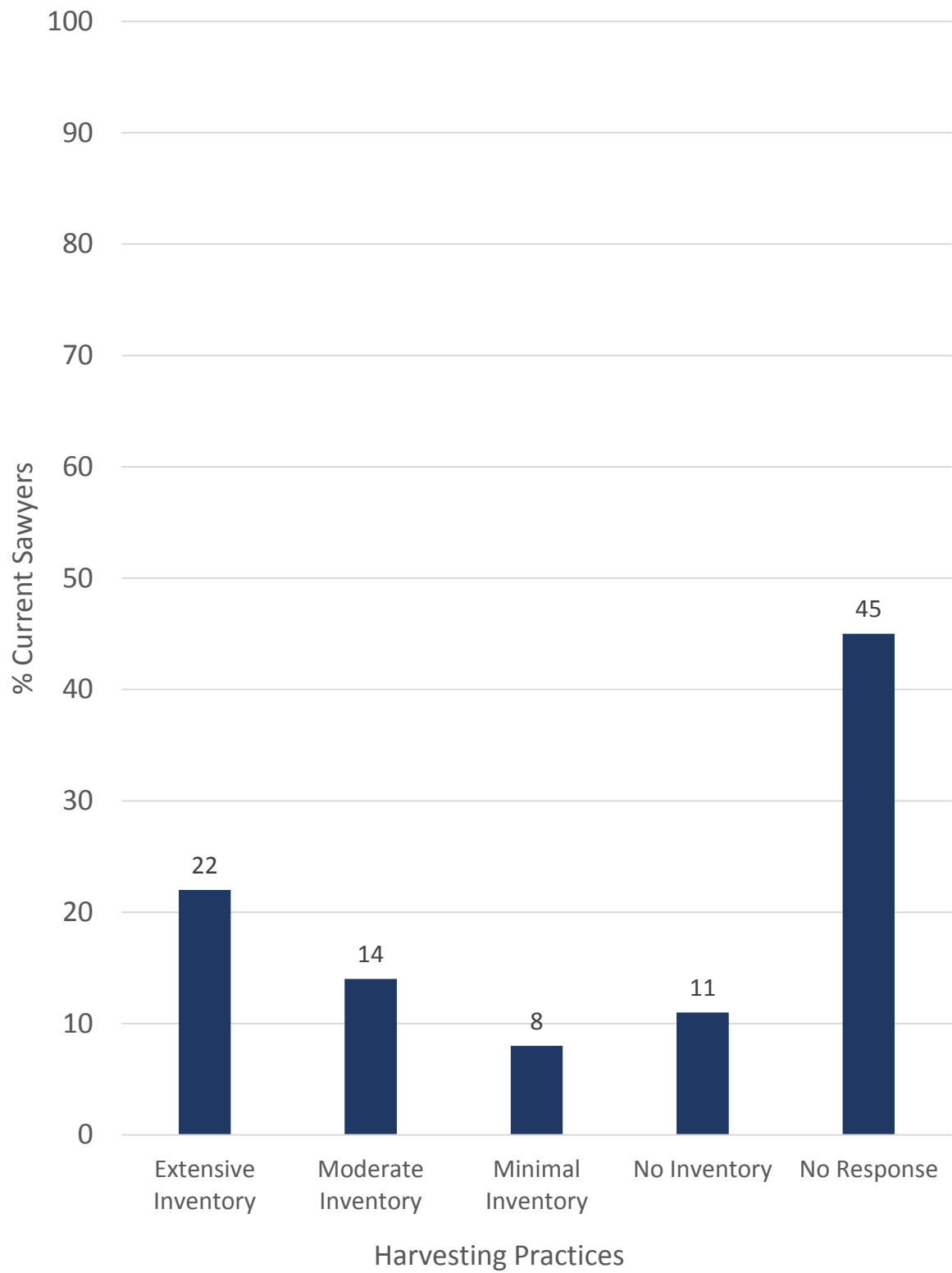


Figure 4. Harvesting Practices of Current Sawyers in CT (n=27)

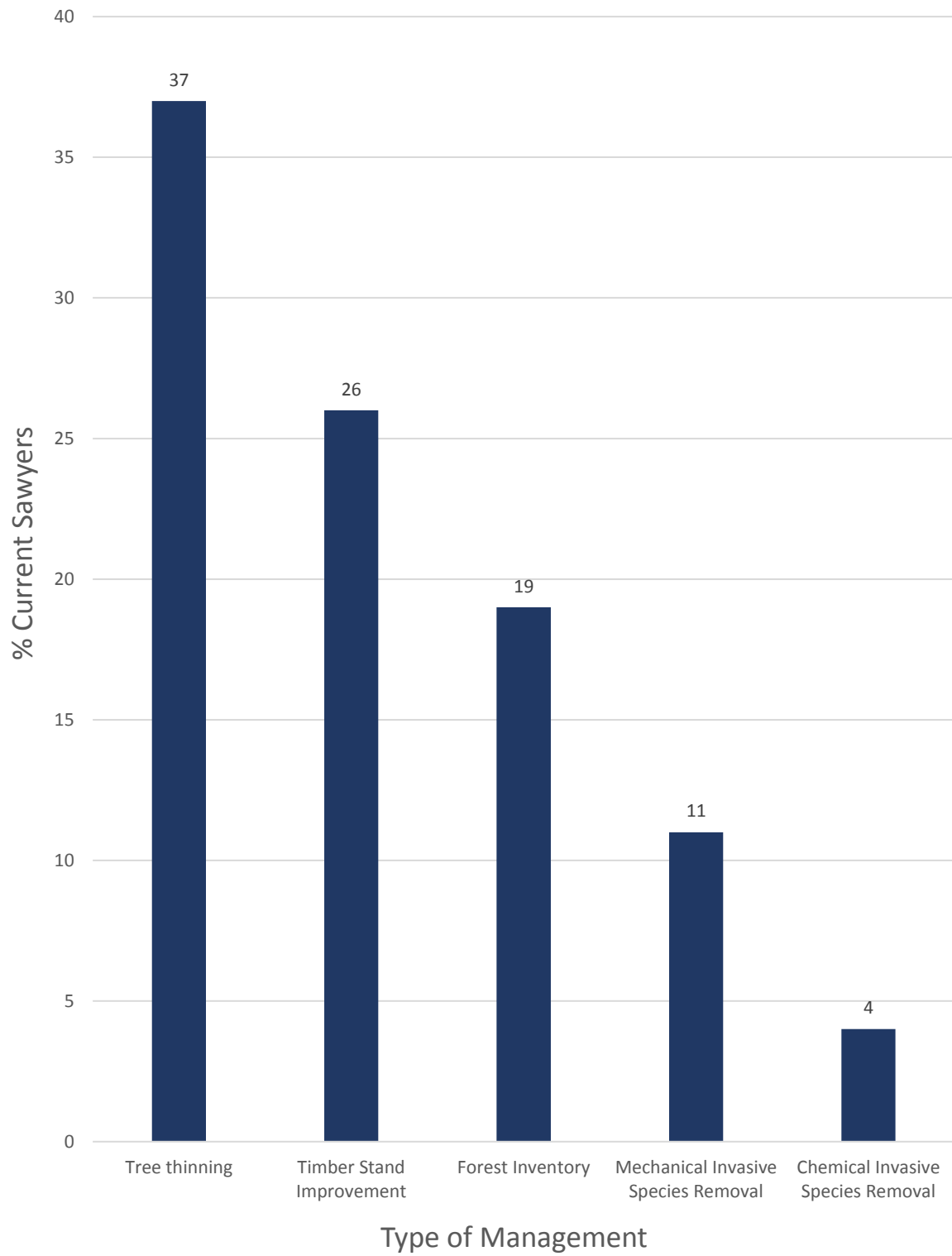


Figure 5. Percentages of Types of Additional Management Current Sawyers are Willing to Perform (n=27)

Eighty-one percent of current sawyers indicated that they would be willing to obtain roadside logs from tree crews, with these possible stipulations: 58% if delivered, 37% if low-cost, and 33% if they would be able to mill the logs on-site, where the tree was harvested (Figure 6). (Note that respondents were allowed to select more than one stipulation.) Some of these responses may be a consequence that only 37% of current sawmill owners indicated ability to transport logs on public roads (4% non-response) (data not shown).

In the survey, current value-added operations implemented by sawyers included 78% that air dry their lumber, 15% kiln dry, 48% provide planing, and 44% provide species sorting (Figure 7). Of those that responded, 74% expressed potential interest in a kiln-drying cooperative (4% non-response).

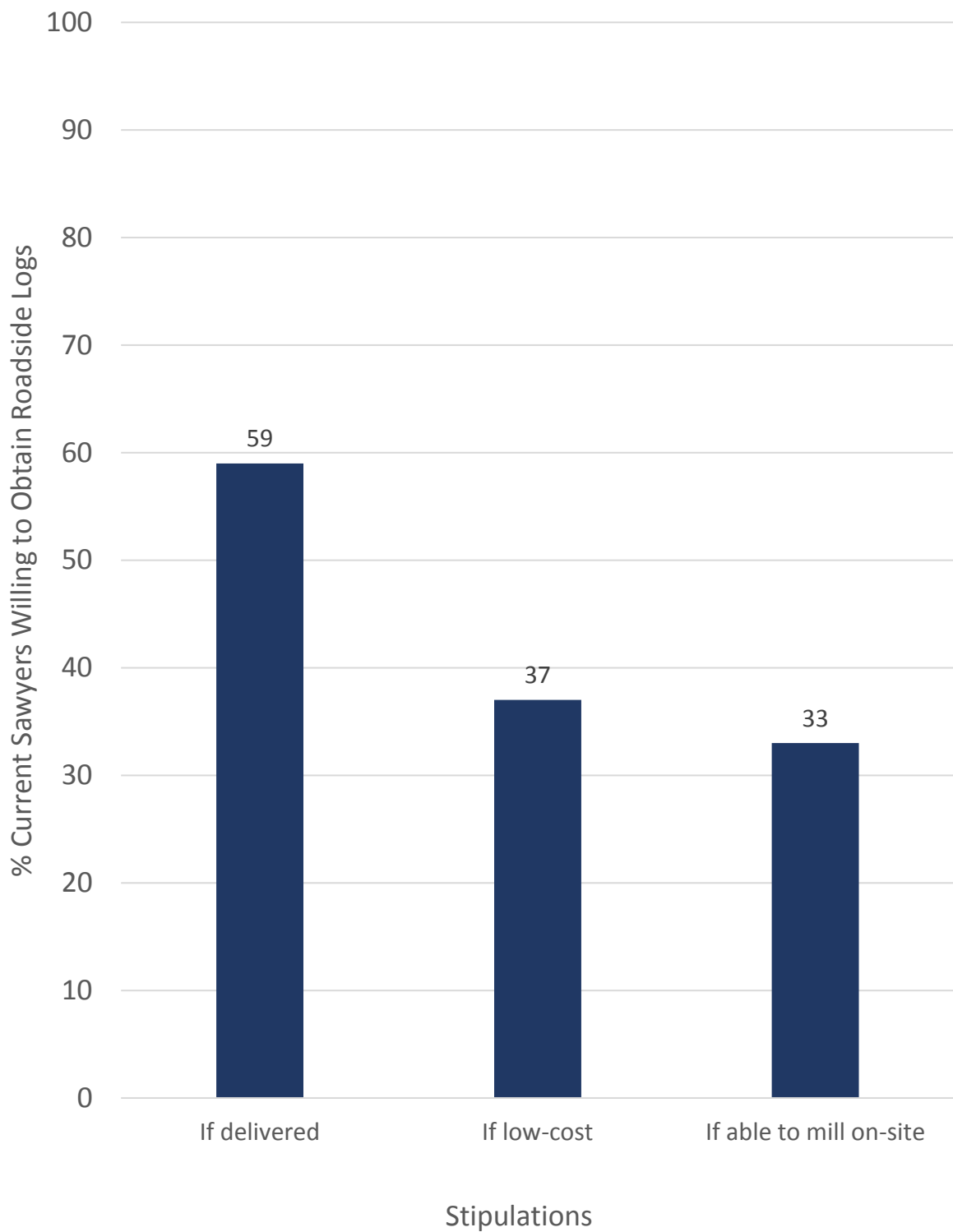


Figure 6. Stipulations of Current Sawyers Willing to Obtain Roadside Logs from Tree Crews (n=27)

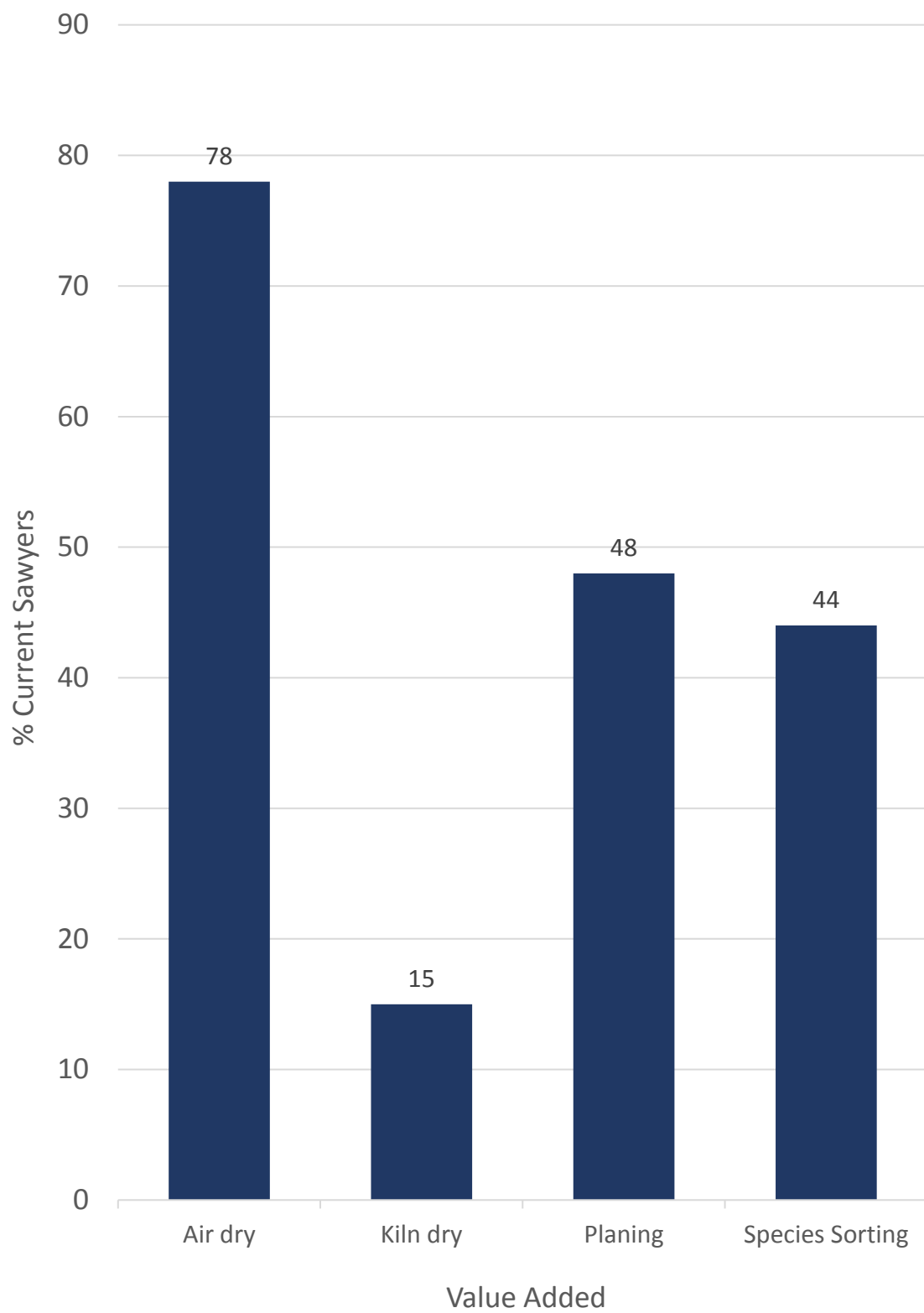


Figure 7. Current Value-Added Operations Applied by Sawyers (n=27)

3.3 Interest in Workshops

Respondents indicated interest in all suggested possible future workshops (Table 4). Over half indicated that they would attend a workshop on how to saw for a particular product and nearly one third indicated interest in help with developing markets and drawing customers. Over one quarter of respondents indicated interest in a workshop on basic mill operation, and nearly one quarter were interested in attending a workshop on how to create a business plan.

Table 4. Interest In Possible Future Workshops (n=37)

Workshop	Interest
How to saw for a particular product	51%
Help in drawing markets/customers	30%
Basic Mill Operation	27%
Help in creating a business plan	24%

3.4 Comparison of Startup Costs

An approximation of basic equipment costs to start a PBSO business is presented below in Table 5 to display the investment required as opposed to that needed for large-scale logging equipment. A fixed-site operation would likely be required to meet local zoning specifications due to the need for a structure to accommodate the sawmill setup. This is in addition to location preparation, such as removal of vegetation, and excavation of the site in preparation for concrete to be poured, all of which could potentially be done by the owner, but at the cost of many hours of labor. As can be seen in Table 5, the start-up approximations for a fixed-site mill are typically much higher than those for a PBSO.

Table 5. A comparison of equipment start-up costs for a portable band sawmill vs. fixed-site sawmill.

PBSO		Fixed-Site Mill	
Equipment	Price	Equipment	Price
Logging Arch	\$500-2,000	Skidder	~\$18-50,000+
ATV or 4X4 tractor	\$550-30,000	Structure for shelter	~\$5-20,000+
Portable band sawmill	\$13-30,000	Circular sawmill	\$10-60,000+
Total	Dry kiln	Total	
	\$1,500-10,000+		
\$15,550-70,000		\$33,500-150,000+	

4. DISCUSSION

4.1 Research Question Considerations

4.1.1 Characteristics of Interested Individuals

It is not entirely surprising that individuals who were likely to own a sawmill were over 61 years of age and earning \$50,000.00 or more annually, as similar demographics have been described for U.S. farmers, of which 33% are aged 65 and over and 61% work in an additional occupation (USDA Census of Agriculture, 2014). In fact, some portable sawmills may be purchased for on-farm use (Smorfitt et al., 1999). Woodland owners in Connecticut are also an aging demographic, with 85% aged 50 or older. These individuals are harvesting their woodlands for more than firewood; 19% of owners have cut logs for personal use and 21% have cut trees for sale (Tyrrell, 2015) . The PBSO survey results indicate that individuals likely to be

interested in operating a PBSO business are current sawmill owners whose annual income currently exceeds \$50,000.00; the same holds true for those who are likely to be interested in becoming a part of a niche market. While age significantly affects ownership, it does not directly affect interest in PBSO business or niche market. Since the results of this survey indicate an interest in PBSO entrepreneurship, it is possible that these individuals would be able to assist in better managing small forested parcels of land.

With the increase in demand for domestic wood products as indicated by Cai and Aguilar (2012) and the desire to conserve resources, there is the additional possibility that this niche market will gain popularity among consumers who own smaller properties and/or are interested in local products. Nardi-Cyrus et al. (2016) and Rand (2011) found that there could be an increased demand for locally grown wood among secondary producers; in this study, it was found that PBSO operators could provide a source for locally grown and processed wood.

4.1.2 Current Sawyer Operations

Current sawyers are willing to perform some type of additional forest management for a landowner and are also interested in accepting roadside trees for milling. Since these individuals are willing to perform these services, implementation of these types of operations would prove useful on small parcels of forested private lands. In light of apparent willingness to mill logs obtained from roadsides (Figure 6), incorporating PBSOs into roadside vegetation management can also help to address the issue of transporting logs as noted by Smorfitt et al. (2001), an issue and highlighted in this survey by current sawyers, of which 59% were only willing to do so if the logs are delivered (Figure 6). In cases where the customer is keeping the final wood product, goods transportation would not be necessary. Indicated difficulties with transporting logs also justifies the notion that sawing on-site is appropriate in urban and exurban areas. This might

reduce operational costs for the sawyer, since s/he would not have to operate, hire or purchase a log truck to haul their timber to his/her sawmill. Such cost reductions could contribute to the economic viability of these management operations.

Many current sawyers are already harvesting their own logs, and while 45% did not indicate whether or not they perform a forest inventory prior to harvesting, nearly half are carrying out some type of inventory, indicating that there is somewhat of an awareness of the option to evaluate a work site for potential profits prior to harvest. Numerous possibilities exist as to why a lack of response occurred. It may be that current PBSO owners do not always have control over the harvesting process. Of those surveyed, various sources are used to obtain logs, including their own property, municipalities, donations, and sometimes scavenging of roadside trees—it is difficult to discern how these logs were harvested and what, if any, inventories or precautions were taken to minimize impact on the surrounding ecosystems. Other sources of logs for current sawyers included yard trees and trees felled by arborists, which again, might not trigger a need for a customary forest inventory as part of the harvesting process.

However, there is also the possibility that harvesters do not want to disclose this information or provide property owners with these figures, for fear that it could decrease their profits. This is a problem because when uninformed landowners learn that their forests were cut in an unsustainable manner, or that there was more value in their forest than they were led to believe, they might become turned off from harvesting in the future, thus extending the public notion indicated by Egan (2011) that logging is not a respected profession.

As described by Costello et al. (2000), negative public perceptions of the aesthetic impact of traditional clearcutting as a harvesting method to maintain a variety of wildlife habitats may result in increased application of uneven-aged forest management techniques, such as group

selection, where the stand is harvested more slowly, over the course of 40 to 50 years. This approach, however has not been found to be as successful in maintaining habitats for species requiring more open space (Costello et al., 2000). These fallouts further elucidate the idea that there is a need for the public to be better informed about harvesting practices so that they will be more accepting of the need to use harvesting as a part of forest management. Increased reforestation (Foster et al., 1998) is causing a decrease in habitat diversity, which is negatively affecting native wildlife species, such as shrubland birds (Dettmers, 2003). It is therefore important for forested areas to be maintained in a manner that mimics natural disturbances in order to sustain diverse wildlife populations (Litvaitis, 2003). Since many sawyers indicated that they believe harvesting of trees may be beneficial to regeneration of native species and wildlife habitat, it is possible that through some training, these individuals could be better able to harvest trees in a sustainable, community- and ecosystem-friendly manner, thereby further assisting in the management of small pieces of forested land through removal of potentially hazardous trees, as well as undesirable growing stock from roadsides. This study shows that sequentially processing these trees into lumber and locally-made wood products could change what has long been thought of as objectionable harvesting and resultant waste products into a desirable commodity.

4.1.3 What Does the PBSO Community Need?

Better guidelines and educational opportunities, such as workshops, would greatly benefit this community, and should be geared toward a variety of age cohorts to keep this option available to property owners for years to come. Current sawyers indicated that they are in need of guidance regarding sawing for particular products and developing a customer base, as well as basic mill operation and business planning in order to ensure success in this business. It has been

previously concluded that with the appropriate training, PBSO owners are capable of successfully implementing such small scale operation; lack of knowledge regarding business practices has also been noted as a concern with regards to entrepreneurs (Holzknecht & Kanowski, 2012). This PBSO survey confirmed that these issues exist among sawyers in Connecticut.

Some members of the Connecticut PBSO community are interested in learning more about how to operate as a successful business. One respondent stated,

“I would need to know more about the specific things wood workers think are most valuable.”

There is a need for education regarding these types of concerns. While there may be academic information available to the public, it has been determined that educational efforts, such as through the Cooperative Extension System, including workshops, demonstrations, and newsletters, could be more helpful in satisfying such a demand, so as to make the information easier to obtain and apply (Kelsey, 2002). Respondents indicated that some of the information they need to go into business includes an understanding of marketing and business plans, including startup information; what they would need for supplies; how to estimate the yield of a log; and the average amount of time it takes to harvest and process a tree into a saleable secondary wood product. This might also include information on how to apply value-added attributes, such as planning or kiln drying, which could be customizable for each client.

There are circumstances under various scenarios where a third party might invest in forest management. The Natural Resources Conservation Service (NRCS) and U.S. Forest Service have in the past provided assistance to locations in need with the NRCS Healthy Forests Reserve Program, such as with the American Recovery & Reinvestment Act, to implement the St. Croix

Hurricane & Hazardous Fuel Mitigation Project (NRCS, V.I. RC&D, n.d.). This type of assistance for those affected by roadside vegetation management, including homeowners, municipalities, and private companies, such as utilities, may lower the costs and increase outcomes. Since some sawmill owners are already obtaining logs from tree companies, there is potential for further cooperation between sawyers and arborists to process removed trees into saleable lumber if both parties are provided with the necessary information. Efforts to promote linkages between small scale entrepreneurs and larger businesses that might have mutual interests could be beneficial to both parties (Alvarez & Barney, 2001), e.g. sawyers and tree trimming companies, but will require adequately educating all stakeholders to ensure effective collaboration (United States Environmental Protection Agency, 2013).

Venn et al. (2004) found that the amount of time it takes for each portion of the process of creating lumber, from harvesting to finished products, such as kiln-dried, planed lumber is important information for small-scale timber operations. It is apparent from the results of this study that sawyers would benefit from being aware of the time commitment required for each component of the process because they would better be able to plan out the extent to which they would like to take their business practices, as well as how they would like to operate. However, a time study of the duration of harvesting a tree, processing it into useable logs, sawing the logs into lumber, and any additional value-added options, which would be useful, was beyond the scope of this study. Further considerations include creating satellite landing areas or yards in areas where there are very few logs to be milled, so as to cut down on the time it takes to set up and disassemble the mill (De Lasaux et al., 2009).

Survey respondents also showed concern over appealing to customers this type of niche market.

“I am most concerned about market demand. There doesn't seem to be a lot of interest in native products anymore.”

However, as Cai and Aguilar (2012) indicate, there is an increasing demand for domestic wood products; therefore, this concern may no longer be a major issue. This is further supported by Buehlmann et al.'s (2010) claim that such customized manufacturers would face less competition from foreign markets. Part of drawing markets at the local level and securing a nearby customer base could include marketing to landowners seeking proper management of their forests. Broadened utilization of currently operating buy-local initiatives would also be beneficial to this market, perhaps through advertisement and selling of pre-made products at local lumber yards or farmers' markets (*see* Nardi-Cyrus et al., 2016 and Rand, 2011), where potential customers could see examples of what a PBSO has to offer.

4.2 Recommendations and Suggestions

Further research is needed to define a variety of aspects within this entrepreneurial concept. The potential business viability of whether or not PBSOs can compete with fixed-site sawmills needs to be examined, along with whether or not tree trimming/removal companies are willing to work with PBSOs both monetarily and with Stormwise recommendations. Another point of insight might be the possibility that landowners may be more willing to part with trees, even in urban settings, if there is value added to the timber and the community will somehow benefit. Prior research has shown that a public participation planning approach for managing conflicts among stakeholders (Paletto et al., 2015), such as landowners, municipalities, and utilities, can be eventually solved within a group effort framework (Kangas et al., 2008) and this approach may facilitate the multitude of discrepancies that can exist in the management of roadside forests, such as in Connecticut. This approach may also prove useful in addressing the

respondents' expressed interest use of a cooperative kiln

This study has indicated that there is an interest in operating PBSO businesses and becoming involved in a niche market, as well as in gaining knowledge on this subject; an additional question that is yet to be answered is whether there are individuals who are interested in becoming a part of a niche secondary wood product market; if there is such an interest, a way in which to promote this endeavor must also be generated. There is some speculation that a tiered business setup might be of use in this type of market, where the enterprise is vertically integrated (Cubbage et al., 2015). In this scenario, the company would have control over the entire process, from harvesting raw material to completing a finished product, such as a dining room table. While this is not an approach used by most comprehensive manufacturers or retailers that rely upon suppliers and contractors, it seems to work for niche businesses, and has been shown to be useful in timber harvesting profit (Cubbage et al., 2015).

All things considered, further, more specific research on this topic is justified, with the purpose of determining if in fact each of the described particulars of such an operation might have an impact on its long-term feasibility. This research might include increasing public awareness of potential PBSO utilization, as well as interest in their products.

Sustainable forestry practices incorporate ecological, economic, ethical, and social factors (Jacobson, 2009). Since contemporary international trade has become routine, assurance of sustainably harvested timber products has become a challenge (Smith, 2004); it is therefore justifiable to actively source goods from trustworthy entities, such as local sources, where producer reputation is paramount, and the consumer can more easily inquire about the harvesting process, including whether or not it was performed sustainably. The results of this study indicated that PBSOs could be of assistance in this matter. Sustainability is defined as meeting

present needs by using environmental resources in a manner which will not jeopardize future generations' ability to meet theirs (Chapin et al., 2009). Concerning timber products, the impact of harvesting is often viewed as undesirable due to visual effects (Bradley & Kearney, 2007), as well as fluctuations in soil and water quality (Shepard, 2006), but can be an exceptional instrument in achieving small scale forest management goals. While not specifically examined in this study, it begs the question if responsible harvesting and forest management, including the use of PBSOs to process harvested timber locally, could supplement the shaping of more sustainable communities.

5. APPENDIX A

PBSO SURVEY INSTRUMENT

Information Sheet for Local Small Scale Forest Products Survey

Principal Investigator: Thomas E. Worthley

Title of Study: Potential Use of Portable Band Sawmills in Connecticut

You are invited to participate in this survey of forest product producers and consumers. We are interested in finding out your views about the local small scale production of forest products.

Your participation in this study will require completion of a survey. This should take approximately ten to fifteen minutes of your time. Your participation will be anonymous and confidential, and you will not be contacted again in the future. You will not be paid for being in this study. There are only minimal risks to this project. These risks are similar to those that might occur to looking at a computer screen or using a computer mouse for a short period of time. The only inconvenience would be the actual taking of the survey. However, the benefits of your participation may impact society by contributing knowledge to the field of local economies and rural enterprise.

You do not have to be in this study if you do not want to be. You do not have to answer any question that you do not want to answer for any reason. We will be happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact the PI of the project, Thomas Worthley, at Thomas.worthley@uconn.edu or 860-345-5232. If you have any questions about your rights as a research participant you may contact the University of Connecticut Institutional Review Board (IRB) at 860-486-8802. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

Thank you.

Section I

Basic Information

1. Please indicate the following by circling the most applicable option:

Age: 18-30 31-40 41-50 51-60 61+

Gender: Male Female Prefer not to respond

Annual Income: <20,000 20,000-30,000 30,001-40,000 40,001-50,000 50,000+

2. Do you currently own a sawmill?

☐ Yes

☐ No (Please proceed to Section VII.)

3. What kind of sawmill do you own?

☐ Band sawmill

☐ Circular Sawmill

☐ Chain Sawmill

4. Does it have hydraulics?

☐ Yes

☐ No

5. What originally inspired you to purchase a sawmill?

☐ Spur of the moment

☐ It seemed like a useful tool

☐ It sounded cool

☐ Intended to use it to make money

☐ Other _____

6. Do/would you move the mill from site to site?

☐ Yes

☐ No

☐ Maybe

If no/maybe, please explain why:

7. Do you process wood for others with your sawmill?

☐ Yes

☐ No

Approximately what percent of your work does this comprise?

_____ %

8. Do you currently operate a sawmill business?

☐ Yes

☐ No

About how long have you been in business?

Section II

Production

1. Are you currently operating in urban/suburban areas?

☐ Yes ☐ No

If no, would you be willing to do so if there was a market for it?

☐ Yes ☐ No ☐ Maybe

2. Are you working with municipalities?

☐ Yes ☐ No ☐ No, but interested ☐ No, not interested

3. Have you ever worked in an area that enforces a noise ordinance?

☐ Yes ☐ No ☐ Not sure

4. What is the minimum Board Foot quantity you would require to move the mill to a site/job?

☐ No minimum ☐ <1000 ☐ 1000-2000 ☐ 2000-5000 ☐ 5000+

5. What is the maximum distance in miles would you be willing to travel for a job that has only your minimum BF requirement?

☐ 10 ☐ 25 ☐ 50 ☐ 50+

6. What is the maximum time you would be willing to spend travelling to a site with high potential?

☐ 30 minutes ☐ 1 hour ☐ 1.5 hours ☐ 2+ hours

7. What is the maximum amount of time you would spend at one site?

☐ 1 day ☐ 2 days ☐ 3 days ☐ 4 days ☐ 5+ days

8. How do you currently dry your lumber?

☐ Air-dry ☐ Kiln-dry ☐ Do not dry

9. Would you be interested participating in a kiln-drying cooperative?

☐ Yes ☐ No ☐ Maybe

10. What species do you work with most of the time?

11. What species do you prefer to work with?

12. What is done with low-grade pieces?

- ☐ Firewood ☐ Pallets ☐ Railroad ties ☐ Other

13. What is done with by-products and wood waste?

- ☐ Donated to local farms ☐ Sold to others
☐ Used otherwise, such as in gardening ☐ Discarded/Not used

14. Check any of the following value-added operations that you currently implement:

- ☐ Air Drying ☐ Kiln Drying ☐ Planing ☐ Grading ☐ Sorting species

15. Do you expect to be in production 10 years from now?

- ☐ Yes ☐ No ☐ Unsure

Section III

Operations

1. How/where do you store your equipment?

- ☐ At home/on my own property ☐ Rented storage facility
☐ I move it from job-site to job-site

2. What is your estimated volume output in board feet per year?

_____ BF

3. Do you use all of the products you generate or do you sell to someone else? (Please explain.)

4. Where do you obtain most of your wood at this time?

5. How many days out of the year are you/would you want to be operational?

6. If certifications/permits are required, would it turn you away from running a sawmilling business?

- ☐ Yes ☐ No ☐ Maybe

Would your decision depend on their cost?

- ☐ Yes ☐ No ☐ Maybe

7. Are you willing to obtain logs from companies/tree crews cutting roadside trees? Check all that apply.

☐Yes ☐No ☐Maybe, if delivered ☐Maybe, if low cost ☐Maybe, if able to
mill on-site

If yes or maybe, what would your stipulations be?

If yes or maybe, how would you negotiate for them?

If no, what is holding you back?

8. Do you have the ability to transport logs on public roads? ☐Yes ☐No

What do you feel would be the biggest drawback to milling at roadside locations (up to 100 feet in off the road)? (Check all that apply.)

- ☐Potential for glass, metal, other blade-damaging fragments in the trees
 - ☐Possible passers-by stopping to inquire about what you're doing
 - ☐Working with small land parcels
 - ☐Members of the public who are not 100% agreeable to tree harvesting
 - ☐Other (Please explain.) _____
-

9. Do you currently have employees?

☐Yes ☐No

10. Would you be interested in hiring workers? (If you already employ individuals, would you hire more if financially able?)

☐Yes ☐No ☐Maybe

11. Do you currently have insurance for your operation?

☐Yes ☐No ☐Prefer not to answer

Section IV
Products

1. Why is your final product of superior quality compared to that of a lumber yard or big box store?

2. Once you have the logs, how long does it take you to produce an acceptable amount of BF for a day's work?

☐ 2 hours ☐ 4 hours ☐ 6 hours ☐ 8+ hours ☐ I do not currently measure this

3. What products do you produce the most? (Check all that apply.)

☐ Rough-sawn lumber ☐ Planed lumber ☐ Air-dried lumber ☐ Kiln-dried lumber

☐ FAS and FAS One Face (Selects) ☐ No. 1 Common and No. 2A Common

4. Do you use your sawmill to address your own material needs as opposed to an income tool?
Please explain.

5. What is your main form of compensation for your work?

☐ Bartering
☐ Cash/check
☐ Other

Section V
Customers

1. How do/would you obtain customers for the lumber you produce if you do not use it all yourself? (check all that apply)

- ☐Online ☐Fliers
☐Newspapers ☐Other
☐Word of mouth

2. When processing lumber for a customer to use, how do they typically use it?

- ☐Barns/Outbuildings ☐Furniture ☐Flooring/Trim ☐Cabinetry ☐Unknown

3. Are you interested in selling or donating wood to local schools for use in woodshop education?

- ☐Yes ☐No ☐Maybe

If yes, up to how many BF/year?

_____ BF

4. What is your main customer type for the lumber you produce? (Select One)

- ☐Wholesale ☐Secondary wood producers ☐Specialty markets
☐Custom clients ☐The general public (retail)

5. Have you accumulated a large amount of lumber and are unsure what to do with it in terms of customers?

- ☐Yes ☐No

6. Does unsold lumber become a waste product? For example, what do you do with it after a year?

7. How do/would you advertise your sawmilling services? (Check all that apply.)

- ☐Flyers at local businesses ☐Journals
☐Online ☐Word of mouth
☐Newspapers ☐Radio
☐Magazines ☐Television

Section VI

Harvesting

1. Do you currently harvest trees yourself?

☐ Yes ☐ No

If yes, what do you use for harvesting equipment?

2. Would you buy standing timber to harvest yourself?

☐ Yes ☐ No ☐ Maybe

If yes or maybe, what would your stipulations be?

If no, what is holding you back?

3. Which of the following would most likely hold you back from regularly harvesting and milling trees from small parcels of land? (Check all that apply.)

☐ Finding enough work ☐ Difficulties of working with owners ☐ Finding a buyer for my product

4. Do you enter into formal written contract with the property owner?

☐ Yes ☐ No ☐ No, but interested in doing so

5. If a piece of equipment is damaged on a job-site, who pays for repairs?

☐ Customer/Property owner ☐ Myself
☐ Combination ☐ Depends on the degree of damage

6. How do you work this type of issue into a contract with your customer?

☐ Formally written in a contract ☐ Discussed verbally ☐ Not addressed ahead of time

7. If harvesting trees from private property, how extensive of an inventory do/would you perform beforehand?

☐ None
☐ Minimal—just a quick overview of the property
☐ Moderate—an overview of the property and partial stand inventory
☐ Extensive—a complete inventory of all potentially usable trees

8. Do you ever consider the harvesting of trees to be beneficial to such things as regeneration of native species and wildlife habitat?

☐ Yes ☐ No ☐ Maybe

9. Place a checkmark next to any management activities you would be willing to perform on the property for additional compensation:

- ☐ Forest inventory for the property owner
- ☐ Timber stand improvement
- ☐ Tree thinning
- ☐ Mechanical invasive species management/removal, such as barberry
- ☐ Chemical invasive species management/removal
- ☐ None

Please proceed to VIII on the back of this booklet

Section VII

Potential Sawmill Ownership

1. Are you interested in owning a sawmill?

- ☐ Yes
- ☐ No (please proceed to section VIII, on the back of this booklet)
- ☐ Maybe

2. If you were to purchase a sawmill, what type would you buy?

- ☐ Portable band saw ☐ Portable circular saw ☐ Fixed-site circular saw
- ☐ Chainsaw mill ☐ Other

3. Would it have hydraulics?

- ☐ Yes ☐ No ☐ Not sure

Please proceed to Section VIII on the back of this booklet.

Section VIII
Concluding Questions/Comments

1. Are you interested in operating a portable band sawmill for business purposes?
☐Yes ☐No ☐Maybe
2. Are you interested in becoming part of a niche/custom market?
☐Yes ☐No ☐Maybe
3. Do you know others who own or are interested in operating a portable band sawmill?
☐Yes ☐No ☐Not Sure

If yes, would you be willing to provide their contact information or share ours with them?
☐Yes* ☐No ☐Maybe

4. If offered, I would attend a workshop on the following topics:
☐Basic mill layout/production line
☐How to saw for a particular product, such as flat/plain sawn, quarter sawn, and rift sawn
☐Help in developing a business plan
☐Help in developing markets
5. Are you willing to partake other activities to further explore this topic?
☐Yes—an in-person interview*
☐Yes—a phone interview*
☐Yes—a focus group*
☐Not at this time

6. What do you feel you need to know more about in order to go into and/or efficiently operate this type of business?

Comments

*Please contact us at:

Department of Natural Resources and the Environment
University of Connecticut
1376 Storrs Road, Unit 4087
Storrs, CT 06269-4087

Thomas Worthley:
Thomas.Worthley@uconn.edu or
860-345-4511
Frances Champagne:
Frances.Champagne@uconn.edu

6. LITERATURE CITED

- Alvarez, S.A., & Barney, J.B. (2001). How entrepreneurial firms can benefit from alliances with large partners. *The Academy of Management Executive* 15(1): 139-148. Retrieved from http://www.jstor.org/stable/pdf/4165716.pdf?_seq=1461758522192
- Barlow, S. A., Munn, I. A., Cleaves, D. A., & Evans, D. L. (1998). The effect of urban sprawl on timber harvesting: A look at two southern states. *Journal of Forestry*, 96(12), 10-14. Retrieved from <http://uconn.library.ingentaconnect.com/content/saf/jof/1998/00000096/00000012/art00006>
- Bartholomew, C., Campbell, B. L., & Wallace, V. (2015). Factors affecting school grounds and athletic field quality after pesticide bans: The case of Connecticut. *HortScience*, 50 (1), 99-103.
- Berlik, M. M., Kittredge, D. B., & Foster, D. R. (2002). The illusion of preservation: A global environmental argument for the local production of natural resources. *Journal of Biogeography*, 29 (10-11): 1557-1568. Retrieved from http://harvardforest.fas.harvard.edu/sites/harvardforest.fas.harvard.edu/files/publications/pdf/s/Berlik_JBiogeography_2002.pdf
- Bradley, G. A., & Kearney, A. R. (2007). Public and professional responses to the visual effects of timber harvesting: Different ways of seeing. *Western Journal of Applied Forestry* 22(1), 42-54.
- Bratkovich, S. M. (n.d.) Thin kerf sawing: A technology worth adopting. *United States Department of Agriculture Forest Service*. [cited 11/20 2015]. Retrieved from <http://na.fs.fed.us/spfo/pubs/forestprod/thinkerf/kerf.htm>
- Briedis, J. I., Wilson, J. S., Benjamin, J. G. & Wagner, R. G. (2011). Logging residue volumes and characteristics following integrated roundwood and energy-wood whole-tree harvesting in central Maine. *Northern Journal of Applied Forestry* 28(2) 66-71.
- Buehlmann, U., Espinoza, O., Bumgardner, M., & Smith, B. (2010) Trends in the US hardwood lumber distribution industry: Changing products, customers, and services. *Forest Products Journal* 6 (6), 547-553. <http://dx.doi.org/10.13073/0015-7473-60.6.547>
- Boyt, D. (2013). The proper equipment for low-impact logging. *Green Horizons* 17(1). Retrieved from <http://agebb.missouri.edu/agforest/archives/v17n1/gh8.htm>
- Cai, Z. & Aguilar, F. (2012). Consumer stated purchasing preferences and corporate social responsibility in the wood products industry: A conjoint analysis in the U.S. and China. *Ecological Economics* 95(11) 118-127. <http://dx.doi.org/10.1016/j.ecolecon.2013.08.017>
- Cassens, D. L. (2011). *Manufacturing and marketing eastern hardwood lumber produced by thin kerf band mills*. West Lafayette, IN: Purdue Extension.

- Chapin, F. S., Kofinas, G. P., and Folk, C. (2009). *Principles of ecosystem stewardship: resilience-based natural resource management in a changing world*. New York, NY: Springer.
- Connecticut Department of Energy and Environmental Protection. (2016). Connecticut's Young Forest and Shrubland Initiative. Retrieved from http://www.ct.gov/deep/cwp/view.asp?a=2723&q=514596&deepNav_GID=1655 Updated 20 January, 2016.
- Costello, C.A., Yamasaki, M., Pekins, P.J., Leak, W.B., & Neefus, C.D. (2000). Songbird response to group selection harvests and clearcuts in a New Hampshire northern hardwood forest. *Forest Ecology and Management*, 127(1-3) 41-54. doi:10.1016/S0378-1127(99)00131-0
- Craigslist. Connecticut. Retrieved from <https://geo.craigslist.org/iso/us/ct>.
- Cubbage, F.W., Davis, R. R., Rodríguez Paredes, D., Mollenhauer, R., Elsin, Y. K., Frey, G. E., ... & Chemor Salas, D.N. (2015). Community forestry enterprises in Mexico: Sustainability and competitiveness. *Journal of Sustainable Forestry*, 34(6-7), 623-650. <http://dx.doi.org/10.1080/10549811.2015.1040514>
- De Lasaux, M. J., Spinelli, R., Hartsough, B. R., and Magagnotti, N., (2009) Using a small-log mobile sawmill system to contain fuel reduction treatment cost on small parcels. *Small Scale Forestry* 8(3) 367-379. doi:10.1007/s11842-009-9089-z
- Dettmers, R. (2003). Status and conservation of shrubland birds in the northeastern US. *Forest Ecology and Management* 185(1-2). 81-93. doi:10.1016/S0378-1127(03)00248-2
- Dillman, D. A., Smyth, J. D. & Christian, L. M. (2009) *Internet, mail, and mixed-mode surveys: the tailored design method*. (3rd ed.). Hoboken, NJ: Wiley.
- Donnelly, C. & Doria, G. (2014). The use of wood from urban and municipal trees. *Connecticut Department of Environmental Protection Division of Forestry*.
- Egan, A. (2011). Characteristics of and challenges faced by logging business owners in southern New England. *Northern Journal of Applied Forestry* 28(4). 180-185.
- Espinoza, O., Buehlmann, U., Bumgardner, M., & Smith, B. (2011) Assessing changes in the U.S. hardwood sawmill industry with a focus on markets and distribution. *BioResources* 6(3) 2676-2689. Retrieved from http://ojs.cnr.ncsu.edu/index.php/BioRes/article/view/BioRes_06_3_2676_Espinoza_BBS_US_HW_Sawmill_Industry_Market
- Foreign Agricultural Service, United States Department of Agriculture. (2015) Money does grow on trees as U.S. forest product exports set record. *International Agricultural Trade Report*.

- Retrieved from <http://www.fas.usda.gov/data/money-does-grow-trees-us-forest-product-exports-set-record>
- Foster, D.R., Motzkin, G., & Slater, B. (1998). Land-use history as long-term broad-scale disturbance: Regional forest dynamics in central New England. *Ecosystems* 1(1) 96-119. doi:10.1007/s100219900008
- Fox, J. C., Keenan, R. J., Brack, C. L., & Saulei, S. (2011) Native forest management in Papua New Guinea: advances in assessment, modelling and decision-making: production and supply options for community forest enterprises in Papua New Guinea. *Australian Centre for International Agricultural Research*. Retrieved from http://aci-ar.gov.au/files/node/14125/native_forest_management_in_papua_new_guinea_adv_a_17895.pdf
- Holzknicht, H., James, R., & Kanowski, P. (2012). A review of the use of portable sawmills in Papua New Guinea and Solomon Islands. *Australian Centre for International Agricultural Research*. Retrieved from http://aci-ar.gov.au/files/node/14448/fr2012_07_a_review_of_the_use_of_portable_sawmill_17205.pdf
- Jacobson, M. (2009). Sustainable forest harvesting: An economic perspective. *Forest Finance Series Publications, 1*. Retrieved from http://extension.psu.edu/natural-resources/forests/finance/forest-tax-info/publications/forest-finance-1-sustainable-forest-harvesting-an-economic-perspective/extension_publication_file
- Kangas, A., Kangas, J., & Kurttila, M. (2008). Group decision making and participatory planning. *Decision Support for Forest Management: Managing Forest Ecosystems, 16*. doi:10.1007/978-1-4020-6787-7
- Kelsey, K.D. (2002). A case study of stakeholder needs for Extension Education. *Journal of Extension* 40(2). Retrieved from <http://www.joe.org/joe/2002april/rb2.php>
- Litvaitis, J.A. (2003). Are pre-Columbian conditions relevant baselines for managed forests in the northeastern United States? *Forest Ecology and Management* 185(1-2) 113-126. [http://dx.doi.org/10.1016/S0378-1127\(03\)00250-0](http://dx.doi.org/10.1016/S0378-1127(03)00250-0)
- Logrite. Log arches. Retrieved from <http://www.logrite.com/store/Category/log-arches>.
- Lupo, C. V. (2010). The role of portable sawmill microenterprise adoption in promoting rural community development and its application in small-scale forest management. (Doctoral Dissertation). [Cited 09/15 2015]. Retrieved from <https://etd.auburn.edu/bitstream/handle/10415/2322/Complete%20dissertation%20FINAL.pdf?sequence=2&ts=1456249196192>
- Lyon, S. & Bond, B. (2014). What is “Urban wood waste”? *Forest Products Journal* 64(5-6) 166-170. <http://dx.doi.org/10.13073/FPJ-D-14-00023>

- Mullins, Jeff. (2007). Portable sawmills—a valuable asset for small woodland owners. *Utah Forest News* 11(2), 4-6. Retrieved from <https://forestry.usu.edu/files/uploads/UFN1102.pdf>
- Nardi-Cyrus, N., Worthley, T. E., & Ricard, R. M. (2016). Understanding the barriers to using locally grown wood in the forest products industry. *Journal of Extension*, 54(1). Retrieved from <http://www.joe.org/joe/2016february/rb6.php>
- NRCS. (n.d.) V.I. RC&D Awarded \$2.7 Million NOAA Habitat Restoration Economic Stimulus Grant. [Cited 09/14 2015]. Retrieved from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/pr/people/partners/?cid=nrcs141p2_037299
- Paletto, A., Cantiani, M. G., & De Meo, I. (2015). Public participation in forest landscape management planning (FLMP) in Italy. *Journal of Sustainable Forestry* 34(5) 465-482. doi:10.1080/10549811.2015.1026447
- Rand, C. C. (2011). "Buy local" consumer behavior and wood products: A case study. Master's Thesis, University of Connecticut. Retrieved from http://digitalcommons.uconn.edu/cgi/viewcontent.cgi?article=1184&context=gs_theses
- Rogers, H. M. (2010) Impacts of Portable-Sawmill Logging on Stand Structure and Regeneration. *Australian Forestry* 73(1) 12-23. <http://dx.doi.org/10.1080/00049158.2010.10676305>
- Sawmill Trader. Retrieved from <http://www.sawmilltrader.com/>.
- Shepard, J. P. (2006). Water quality protection in bioenergy production: the US system of forestry best management practices. *Biomass and Bioenergy* 30(4) 378-384. <http://dx.doi.org/10.1016/j.biombioe.2005.07.018>
- Smith, W. (2004). Undercutting sustainability: The global problem of illegal logging and trade. *Journal of Sustainable Forestry*, 19(1-3), 7-30. http://dx.doi.org/10.1300/J091v19n01_02
- Smorfitt, D. B., Harrison, S. R., and Herbohn, J. L. (1999). Factors in the acquisition and utilisation of portable sawmills in Queensland. *Australian Forestry* 62(1) 45-50, doi:10.1080/00049158.1999.10674762.
- Smorfitt, D. B., Harrison, S. R., and Herbohn, J. L. (2001). The role of portable sawmills and chainsaw milling in tropical small-scale forestry. In S. R. Harrison & J. L. Herbohn (Eds.) *Sustainable Farm Forestry in the Tropics: Social and Economic Analysis and Policy* (77-82). Northampton, MA: Edward Elgar Publishing, Inc.
- Smorfitt, D. B., Harrison, S. R., and Herbohn, J. L. (2003a) Portable sawmills in a high-value rainforest cabinet timber industry in North Queensland. *Small-scale Forest Economics, Management and Policy* 2(1) 21-36. doi:10.1007/s11842-003-003-9

- Smorfitt, D. B., Harrison, S. R., and Herbohn, J. L. (2003b). Portable sawmills: The current and potential future role in the timber supply chain. In J. Suh, D. B. Smorfitt, S R. Harrison, & J. L. Herbohn (Eds.) *Marketing of Farm-grown Timber in Tropical North Queensland*. (49-64). Cooperative Research Center for Tropical Rainforest Ecology and Management, Cairns.
- State of Connecticut Public Utilities Regulatory Authority. (2014). PURA investigation into the tree trimming practices of Connecticut's utility companies. Docket No. 12-01-10. Retrieved from <http://environment.yale.edu/uri/files/FINAL120110PURA.pdf>
- Tyrrell, M. L. (March 2015). Understanding Connecticut woodland owners: A report on the attitudes, values and challenges of Connecticut's family woodland owners. Connecticut Department of Energy and Environmental Protection. [cited 09/23 2015]. Retrieved from http://www.ct.gov/deep/lib/deep/forestry/ct_woodland_owners_report.pdf
- United States Census Bureau. 2013 County Business Patterns (NAICS) in US Census [database online]. 2013 [cited 11/15 2015]. Retrieved from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=BP_2011_00A1&prodType=table
- United States Census Bureau. (2010). Resident population data. [database online]. Retrieved from <http://www.census.gov/2010census/data/apportionment-dens-text.php>
- United States Environmental Protection Agency. (2013). Getting in step: Engaging stakeholders in your watershed. [Cited 04/27/2016]. Retrieved from <https://cfpub.epa.gov/npstbx/files/stakeholderguide.pdf>
- United States Forest Service (2014). S. N. Oswalt & W. B. Smith (Eds.) U.S. forest resource facts and historical trends. Retrieved from http://www.fia.fs.fed.us/library/brochures/docs/2012/ForestFacts_1952-2012_English.pdf
- United States Forest Service Northern Research Station. (2011). U.S. Forest Service Inventory Shows Overall Health, Future Challenges for Southern New England Forests. NRS News Release. [Cited 11/22 2015]. Retrieved from <http://www.nrs.fs.fed.us/news/release/southern-new-england-forests>
- USDA Census of Agriculture. (2014). Farm demographics-U.S. farmers by gender, age, race, ethnicity, and more. *Census of Agriculture 2012 Census Highlights*. Retrieved from https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Highlights/Farm_Demographics/connecticut
- Venn, T. J., McGavin, R. L., & Leggate, W. W. (2004). Costs of Portable Sawmilling Timbers from the Acacia Woodlands of Western Queensland, Australia. *Small-Scale Forest Economics, Management and Policy* 3(2), 161-175. doi:10.1007/s11842-004-0012-3
- Wharton, E. H., Widmann, R. H., Alerich, C. L., Barnett, C. J., Lister, A. J., Lister, T.

W.,...Borman, F. (2004). *The forests of Connecticut*. Retrieved from http://www.fs.fed.us/ne/newtown_square/publications/resource_bulletins/pdfs/2004/ne_rb160.pdf

Woodmizer (2016). Kilns. Retrieved from <http://woodmizer.com/us/Products/Secondary-Processing/Kilnsf>.

Woodmizer. (2016). Portable sawmills. Retrieved from <http://woodmizer.com/us/Products/Portable-Sawmills>.