

**WASTE WOOD UTILIZATION IN VIRGINIA'S
INTERFACE AND URBAN FORESTS**

***A Baseline Study of Industry Practices and
Perceptions***

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ABOUT THIS REPORT

Summarized in this report are the findings of baseline surveys conducted in 2014 for the Virginia Department of Forestry by faculty and staff in the Virginia Tech College of Natural Resources and Environment. This study has not been peer-reviewed and should not be quoted or cited without permission of the report authors.

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EXECUTIVE SUMMARY

Urban/interface forestlands (UIF) include areas where urban areas meet and interact with rural lands, the edges of large cities and small communities, areas where homes and other structures are intermixed with forests and other land uses, and islands of undeveloped lands within urban areas. The rapid growth of urban areas over the last few decades has resulted in an increased amount of wood that is produced from harvesting/clearing of trees in transition areas between urban and interface forests. An abundant wood supply is generated by these activities; however, it is perceived that most wood processing operations do not use such material or if it is used, it is underutilized.

Researchers at Virginia Tech investigated current waste wood utilization and management practices in urban/interface areas of Virginia with the goal of characterizing key stakeholders that are currently involved in the management, harvesting, and processing of UIF wood and identifying barriers and potential uses for wood utilization. They also investigated how certain stakeholders have been successful in waste wood utilization and how others view their future needs for success in terms of technical assistance and market infrastructure. The information from this project will be used to develop an assortment of education, outreach, and technical assistance products for the stakeholders identified.

The research determined that the most common uses of UIF wood was for firewood, lumber, and chipped products. There were clear differences in the perception of barriers and incentives to the utilization of UIF wood between those who produced the materials and who used the materials. Highly ranked barriers for utilizers were contamination, lack of infrastructure to handle materials, variable supply of wood material and lack of quality material. Highly ranked barriers of municipal governments and private tree care contractors were lack of in-house equipment for processing waste wood, lack of in-house space for stockpiling waste wood, and lack of local processors to utilize waste wood. While those utilizing UIF cited additional revenue as the lead incentive and avoidance of tipping fees as one of the lowest, municipal and private contractors indicated the opposite, where avoidance of tipping fees was the greatest incentive and additional revenue was only an incentive by one third of respondents.

A list of business strategies was developed based on the response of successful UIF wood products businesses. These included: not pricing their products lower than competitors, employing consultants or professionals in areas that the owner is not an expert, acquiring knowledge about their competitor's activities, emphasizing product quality and cost reduction, focusing on unique products and not competing with commodity products, and involving employees in decision-making.

The results of this work clearly indicate the need for outreach and technical assistance. Based on the barriers identified by these groups, outreach and technical assistance efforts should focus on liability, contamination, and utilization. Although incentives for further UIF utilization were generally agreed upon by municipal employees and private tree care contractors, their differing opinions on barriers should be taken into account when developing future educational or technical programs aimed at increasing UIF utilization.

INTRODUCTION

BACKGROUND AND JUSTIFICATION

Urban/interface forestlands (UIF) can be defined as the area where urban areas meet and interact with rural lands. Alavalapati (2005), Monroe et al. (2003), and Communities Committee et al. (2004) define UIF as the edges of large cities and small communities, areas where homes and other structures are intermixed with forests and other land uses, and islands of undeveloped lands within urban areas. Urban areas in the Southern U.S. have rapidly expanded over the last few decades, creating large interface areas between urban and rural/ex-urban forests. This area will continue to grow as the U.S. population increases and becomes increasingly urban. Currently, 78% of the U.S. population lives in urban areas (Zhang et al. 2008; Seto et al. 2012). Virginia is no exception to this trend. Between 2000 and 2010, Virginia's population grew by about 1 million (US Census Bureau 2010a), and is expected to grow by another 1.6 million between 2010 and 2030 (Weldon Cooper Center for Public Service 2012). In addition, 75% of all Virginians reside in urban areas (US Census Bureau 2010b), placing strain on both city infrastructure and natural resources. Through tree plantings and canopy restoration projects, there are also a substantial number of trees growing in Virginia's urban areas. Recent studies estimate tree cover in urban and community areas of Virginia at 401,000 hectares (Nowak and Greenfield 2012) or approximately 166 million trees (Nowak and Greenfield 2009).

Urbanization increases the amount of wood waste that is produced from disposal of unwanted wood items, construction and demolition projects, and harvesting/clearing of trees in transition areas between urban and traditional forests (i.e. forest interface areas). An abundant wood supply is generated by these activities (Bratkovich et al. 2007; Dovetail 2008; Nzokou et al. 2011; Little et al. 2011; Roush and Royer 2003; Brashaw et al. 2012). However, most wood processing operations do not use such material. Research suggests UIF wood has value and can be utilized for high-value forest products. Some parts of the U.S. have adopted forest management and harvesting techniques to be successful in procuring wood resources from this area (Jensen and Visser 2004), and there is likely a greater opportunity for increasing the utilization of UIF material in Virginia. There is a wide variety of utilization efforts across the country aimed at intercepting UFW before it ends up at an MSW facility. Not only do these efforts result in disposal cost avoidances, but they provide economic opportunities as well. A key to cost-effective UFW utilization is to find the highest and best use for a given material. According to a working draft of the ANSI A300 Part 11 Standard for Urban Forest Harvesting, "wood should be used at the highest possible value that is appropriate given the quality, quantity, and marketability of the available resource" (Tree Care Industry Association, Inc. 2013). Interviews conducted by Dovetail Partners, Inc. (Howe et al. 2013) indicate that producers of UFW believe further utilization can provide beneficial opportunities. Perceived opportunities include the avoidance of tipping fees, environmental stewardship, community engagement, and the creation of additional markets by involving the traditional forest products industry. Another commonly reported theme was the opportunity to provide more consistent production through best management practices, educational campaigns, and legislative mandates.

STUDY GOALS AND OBJECTIVES

The scope of this study was to investigate current waste wood utilization and management practices of industry and municipal governments in urban/interface areas of Virginia. The study was conceived as the first phase of a three-phase initiative by Virginia Dept. of Forestry (VDof) and its partners to understand waste wood utilization in the state and identify strategies to increase utilization for the benefit of forest resources and associated industries.

In phase one (the study described here), our aim was to characterize key stakeholders that are currently involved in the management, harvesting, and processing of UIF wood and identify barriers and potential uses for wood utilization. Our approach to understanding these stakeholders, their practices, and their perceptions was to conduct a series of surveys with industry professionals and municipal governments around the state. From these surveys, we were able to glean information about how certain stakeholders have been successful in waste wood utilization and how others view their future needs for success in terms of technical assistance and market infrastructure.

In phases two and three of the waste wood initiative, baseline information from the phase one study will be used to craft an assortment of education, outreach, and technical assistance products for stakeholders. Phase two is anticipated to entail the formation of an urban wood working group that will direct the development of case studies, business models, and educational materials. Phase three would focus on outreach and implementation through activities such as pilot projects, demonstration areas, and continuing education workshops around the state.

STUDY METHODS

At the outset of this study, we recognized that there are two distinct arenas of practice in UIF waste wood utilization in Virginia: interface forestlands and urban forests. Interface forestlands were considered those areas in pre-urban and ex-urban areas around the state where traditional forest management and harvesting operations are undertaken. Urban forests were considered those areas within highly urbanized jurisdictions where landscape tree maintenance and land clearing operations are the primary source of waste wood. Although there are many commonalities and overlap of stakeholders and geographic footprint between these two UIF arenas, we surmised that the two should be separated for purposes of study administration. As a result, we broke the study into multiple step and tasks. They are outlined with specific methodology as follows:

1. Virginia Tech Researchers, in collaboration with VDof personnel, identified key stakeholders and target audiences thought to be involved in the management, harvesting, and processing of UIF wood material. Once these individuals and organizations were identified, contact information was collected for the administration of separate surveys. A mail survey was administered to interface forestland stakeholders while urban forest stakeholders participated in a web-based survey.

In interface forestlands, stakeholders included primary wood products manufacturers, biomass users, firewood producers, mulch producers, consulting foresters, loggers and those involved in land clearing. VDOF supplied information on portable and small-scale wood products producers, firewood processors, mulch processors, consulting foresters and loggers. Virginia Tech researchers identified processors, loggers, foresters by contacting trade associations; searching online mailing lists, current mailing lists, industry directories, and contacting municipalities, etc.

In urban forests, stakeholders comprised two primary groups: municipal government employees and private-sector arborists. Virginia Tech Researchers worked with VDOF to identify 91 urban municipalities and the individuals working for those governments who were most knowledgeable of waste wood generation and utilization within the jurisdiction. Municipal government workers comprised urban foresters, solid waste managers, engineers, and planners. A single person was solicited for the survey in each locality. Of the 91 solicited municipalities, 56 responded to the survey for a response rate of 61%. Private-sector arborists were identified through cooperation with the Mid-Atlantic Chapter of the International Society of Arboriculture. Specifically, contact information was obtained for individuals who were Certified Arborists, a professional credential held by an assortment of tree care service proprietors and consultants. Of the 774 arborists solicited for the survey, 239 responses were received, providing a response rate of 31%.

2. For each arena, Virginia Tech Researchers designed, tested, and administered a survey of the stakeholders/audiences identified in Task 1 with the purpose of (1) determining the current and potential uses of wood material produced from UIF areas and (2) determining the current barriers and incentives to utilization. The surveys also characterized organizations and individuals currently involved in the management, processing, marketing, and utilization of wood material produced from UIF areas. For the interface forestland arena, the survey was administered to loggers separately from other stakeholders to maximize response rate.
3. Virginia Tech Researchers conducted a search of trade publications related to forestry, arboriculture, forest products, and municipal governments to identify potentially successful models/entrepreneurs/case studies for interface forest management and urban “waste wood” utilization. Respondents to the interface forestland survey conducted in Task 2 who indicated participation with successful utilization of wood materials were also contacted to determine the current state of their involvement with this material. Virginia Tech Researchers then designed, tested, and administered a survey to successful businesses of waste wood utilization identified in Task 3 to determine the attributes that have contributed to their success. A list of key attributes required for the development of a successful waste wood utilization business was determined. Educational materials, including publications were developed from this data with the goal of being used in training in phase two of the larger VDOF initiative.

STUDY FINDINGS

WHO IS GENERATING AND UTILIZING WASTE WOOD?

Interface Forestlands

When determining who is involved with interface waste wood (IWW), it is important to separate those who generate it from those who utilize it. To complicate matters, it is likely that many smaller companies both generate and utilize the material. Therefore, survey respondents were asked if they (i) generate, (ii) utilize, (iii) generate and utilize, or (iv) neither generate nor utilize IWW. The majority (38%) does not generate or utilize, 32% utilize only, 14% both utilize and generate, and 10% generate only. Six percent of the respondents did not answer the question.

To analyze the current users of this material in greater detail, the results for those who only utilize IWW were combined with those who both generate and utilize IWW. Ninety-five percent of the respondents who were current users of IWW were primary manufacturers, indicating that the largest current use of this material is for primary products. Of those primary products, 56% were lumber or lumber products producers and 44% produced a ground or chipped product (compost, mulch or boiler fuel). Given the large value difference between a chipped or ground product and a lumber product, these results indicate a potential for significant value gain by better utilization of IWW. However, to fully understand the potential value increase, information about the form and quality must first be determined. When the data for respondents who indicated that they both generate and utilize IWW were combined with those who generate only, 59% of those who generate IWW do so in log, chipped, or ground wood form and 41% were lumber or pallet producers.

When all SHARP loggers whose primary activity was logging were asked if they harvest trees from UIF, the majority (56% did not harvest trees from UIF), while 40% did conduct these harvests, and 4% did not answer this question. For respondents whose primary activity was not logging, the majority (58% also did not harvest trees from UIF), whereas 36% did conduct these harvests. Six percent did not answer the question. Loggers were clearly the primary group that interacted with UIF wood material.

Urban Forests

As is the case with interface waste wood, it is also important to distinguish between those who generate and utilize urban forest waste (UFW). An additional dynamic at play in the urban forests is the differences in these practices between municipalities and private tree care contractors. On the municipal side, 87% of respondents indicated that their locality generates UFW. The bulk of this material is generated from either maintenance of public greenspaces and rights-of-way (71%) or collection of citizen yard debris (21%). Municipal UFW is generated in nearly identical proportions from tree pruning (31%), tree removal (32%), and curbside pickup (32%). Municipal respondents were very evenly distributed across Virginia's five physiographic provinces; together, the Southern Mountains and Southern Piedmont represented only about 27% of respondents due to fewer urban localities.

Two-thirds of private tree care contractors who responded to the survey indicated that they generate UFW. Their UFW originates primarily on residential properties (46%), commercial properties (17%), and public greenspaces (14%). Most of this UFW comes from either tree pruning (45%) or tree removal (43%). In contrast to the equitable geographic distribution of municipal respondents, private tree care contractors were predominantly located in the Northern Piedmont (44%) and Coastal Plain (21%). More specifically, 46% of private respondents were located in the Washington, DC Metropolitan Statistical Area. Though geographically skewed, this distribution accurately reflects the concentration of tree care contractors in urban centers where there is an abundance of landscape trees and a wealthy clientele willing to spend money on those trees.

WHAT ARE THEY DOING WITH UTILIZED WASTE WOOD?

Interface Forestlands

Companies that work with IWW are predominantly primary manufacturers (95%) who produce a lumber or lumber product (56%) or a chipped or ground product (44%). Sawmills made up the largest user group (49%), followed by compost producers (16%) and mulch producers (13%). Other users included biomass producers, cabinet manufacturers, wood boiler users, and land clearers. While questions were asked to each user group regarding the type of material and volume used, the useable response rate for these questions was too low to make reasonable comparisons.

Urban Forests

Of those localities generating UFW, an average of 41% of logs, 52% of chips and 46% of brush is being directly utilized by the municipality. The majority of directly utilized logs are processed into firewood (42%), lumber (18%), or mulch (8%). Nearly all directly utilized chips are processed into mulch (75%) or compost (21%). Directly utilized brush likewise ends up being processed into mulch (76%) or compost (21%). Municipalities rarely utilize logs in-house for high-value products such as furniture (6%), cabinetry (6%), or veneer (5%), but this is not surprising given the lack of specialized equipment and personnel to do so. Likewise, biomass fuel is rarely produced from chips (4%) or brush (4%). An appreciable amount of municipal UFW is being transferred to a third party: 26% of logs, 29% of chips, and 28% of brush. While the fate of these materials cannot be tracked, presumably a large proportion of this material is also being processed into products.

Private contractors reported similar rates of direct utilization for logs (29% utilized), chips (31%), and brush (35%). Overall utilization is probably much higher given that these materials are frequently transferred to third parties (42% of logs, 53% of chips, and 32% of brush), presumably for processing into some type of product. Like municipalities, private contractors who directly utilize UFW tend to process logs into firewood (52%), mulch (17%), or lumber (17%); process chips into mulch (63%) or compost (20%); and process brush into mulch (52%) or compost (28%). Private contractors also rarely produce high-value products such as furniture, cabinetry, or flooring (6% total).

WHAT ARE THEIR PERCEPTIONS OF BARRIERS AND INCENTIVES TO UTILIZATION?

Barriers to Utilization

When companies that work with UIF wood material were asked, “What barriers do you believe a business may encounter when working with urban/interface wood?”, the three most common barriers were: contamination (e.g. metal, cement) (16%), lack of infrastructure to handle materials (e.g. log trucks, sorting yard, and distance to mill) (15%), followed by variable supply of wood material from urban/interface forestlands (15%). The least commonly mentioned barriers were quality of wood material (10%), liability (9%), lack of local processors (9%), lack of education on utilization of urban wood material (9%), and on-site processing time (6%). Five percent of the respondents answered that no barrier was encountered while working with IWW. Interestingly, lack of market demand was not listed by any respondent as a barrier to the use of IWW.

In the case of logging businesses that harvest trees from UIF, the top three barriers to utilization were liability (31%), contamination (22%), and quality of wood material (18%). Other barriers included variable supply of wood material (10%), lack of education on utilization of urban wood material (5%), and lack of market demand (5%), respectively. Seven percent of the logger respondents answered that no barriers have been encountered while working with IWW. Two percent of the respondents answered that they have found other barriers affecting their business. The most commonly mentioned were:

1. Access, lack of education to the neighbors around the area
2. Small parcels
3. Other landowners
4. People upset about cutting trees next to their homes

For logging businesses that do not harvest trees from UIF, the top three barriers to utilization were liability (31%), contamination (17%), and quality of wood material (16%). Other barriers were lack of market demand (9%), lack of education on utilization of urban wood material (9%), and variable supply of wood material (8%). Seven percent of the logger respondents answered that no barriers have been encountered, and 2% percent answered “other” barriers. Interestingly, the top three barriers were almost the same for those who work with UIF wood materials and those who do not, which indicates, these are the top problems that need to be overcome to increase UIF wood utilization.

When companies that do not work with UIF wood material were asked, “Why hasn’t your company worked with wood material from urban/interface forestlands?”, the major reasons were not enough volume and only purchase gate wood (wood delivered directly to a mill) (20%) followed by too small volume to make profit and only use contract logging (14%). The least mentioned reasons were species that are available are not desirable (5%) and lack of knowledge on utilizing urban/interface wood. However, 25% of the respondents answered that there were other reasons like the following:

1. Too much damage to the mill with potential of metal in logs
2. Customers bring logs to us
3. Not need all time

4. We boil and bend some posts and backs and the best wood to choose from is the trees that are cut in the winter time December, January and February.
5. Normally mulching stumps, tops logging debris so landowner can manage property with tractor and brush hog
6. I only cut my own timber

When loggers not working with UIF wood were asked, “Why hasn’t your company worked with wood material from urban/interface forestlands?”, 40% of the respondents indicated that volume was too small to make a profit, followed by not enough wood volume available (27%) and lack of knowledge on utilizing urban/interface wood (20%).

In urban forests, municipal government workers and private contractors face a unique set of barriers to utilization compared to their professional counterparts in the interface forestlands. Because of methodological differences between surveys in the urban forests and interface forestlands, reporting on barriers is slightly different. The urban forests survey asked respondents to rank nine potential barriers to UFW utilization. There was no clear consensus either within or between groups on the major barriers, which reflects not only the diversity of perspectives, but also the multitude of challenges. Lack of local processors was the most frequently cited barrier, identified as a top-three barrier by 42% of municipal respondents and 48% of private contractor respondents.

Other frequently-cited barriers in urban forests were lack of in-house space for stockpiling (52% municipal and 41% private), lack of in-house equipment for processing (56% municipal and 30% private), and logistical difficulties of transporting to local processors (29% municipal and 40% private). The biggest point of departure between municipal and private respondents was their perception of on-site logistical difficulties in handling waste wood. Because private contractors are predominantly working on residential parcels, space for felling and maneuvering saw timber is limited and requires additional time and equipment to extract intact. About 37% of private contractors ranked these logistical difficulties as a major barrier compared to 23% of municipal employees. Concern about a viable market for waste wood products was also expressed: 34% of private contractors and 27% of municipal employees cited lack of local consumers as a major barrier.

Incentives for Utilization

When companies that work with UIF wood material were asked, “Where does urban/interface forestland wood material have the greatest potential?”, respondents answered that the greatest potential was for lumber (24%), biomass (14%), and mulch (12%). Other potential products were pulp and compost (both 9%), railroad ties 8%, flooring and pallets (both 7%). The categories with the lowest potential use for urban/interface wood were: cabinets (3%), veneer (1%), composite and craft wood products (1%), furniture (1%), and doors (1%).

The potential uses identified by respondents were different than the current uses of UIW, where 56% is used for lumber products and only 24% is used for mulch and biomass, with the remainder used for other products. This result indicates that there is a perceived greater potential for the use of this material in higher value products (lumber) over chipped and ground products.

When companies that work with UIF wood material were asked, “Why does your company work with wood material from urban/interface forestlands?”, the main response was access to customers (30%), followed by additional revenue (24%) and value added products (18%). The least mentioned reasons were avoidance of transportation and shipping fees (both 8%), unique species (6%), potential for environmental certification (4%) and to enter to new markets (2%).

When asked why a company that does not work with UIF wood material would like to work with this type of material, 24% of the survey’s respondents agreed that additional revenue can be one of the major reasons to work with waste wood, followed by accesses to customers with 16%. Twelve percent affirmed that avoidance of disposal fee and entering a new market can be some of the reasons to work with this type of material. Four percent of the companies answered that avoidance of transportation or shipping costs, potential for environmental certification incentive, unique species and wood characteristics, and value added products could be some of the possibilities for a company to be interested to work with urban/interface wood.

Municipal and private contractor respondents to the urban forests survey were asked to rate their level of agreement with various statements about UFW utilization. For both groups, the most commonly agreed-upon reason for increasing UFW utilization was “environmental concerns”, which rated slightly below “somewhat agree”. This finding suggests that respondents, on average, view under-utilization of UFW as deleterious to the environment. The lowest ranked reason for UFW utilization by both groups was “regulatory concerns”, which rated slightly above “neither agree nor disagree”, suggesting that respondents are not experiencing much legal pressure to increase UFW utilization. Interestingly, private contractors also ranked “financial concerns” (could be interpreted as opportunity to decrease operational costs or increase profits) fairly low, only slightly agreeing with this statement on average. Although both respondent groups somewhat viewed UFW utilization as a major current issue, they both tended to agree that it will be a more important issue in the future.

The urban forests survey also asked respondents to rank seven potential incentives for UFW utilization. In contrast to earlier perceptions of barriers, there seemed to be greater consensus among respondents about the key incentives. “Avoidance of disposal fees” was the most frequently cited incentive, identified as a top-three incentive by 79% of municipal respondents and 69% of private contractor respondents. Over two-thirds of respondents in both groups also cited “environmental sustainability” as an important incentive to increase UFW utilization. About half of respondents cited “avoidance of transportation costs” as an important incentive. Less than one-third of respondents in both groups viewed “additional revenue” as an important incentive, suggesting there is either lack of interest or confidence in the marketability of UFW products.

ATTRIBUTES OF SUCCESSFUL URBAN/INTERFACE WOOD BUSINESSES

Virginia Tech Researchers conducted a search of trade publications related to forestry, arboriculture, forest products, and municipal governments to identify successful models/entrepreneurs/case studies, both in state and nationwide, for interface forest management and urban “waste wood” utilization. A total of eighty companies were identified and contacted to participate in a survey aimed at understanding the attributes of their businesses. Eighteen companies answered the survey. Thirty-eight businesses didn’t want to participate, twenty were out of business, and ten didn’t answer the phone. Sixty one percent of respondents were primary manufacturers, 33% secondary, and 6% other.

What Successful Urban/Interface Wood Business Look Like

- The majority of companies had 1–5 employees (56%), while 22% had 6–11, 11% had none, 6% had 12–17, and 6% had 18–20, demonstrating that most successful companies working with urban wood are small (less than 12 employees). Sixty-one percent of the companies used both hardwood and softwoods, where 39% used only hardwoods. The predominant species utilized were walnut, oak, ash, cherry, and maple.
- Most of the companies were run by people of older age (56% were over 50 years old) with 22% aged 40–49 and 17% aged 30–39. Eighty-eight percent of the owners held a university diploma.
- It is clear that most successful urban/interface businesses acquire their raw material without cost. Thirty-three percent of respondents acquired their material from municipalities or local governments and another 24% acquired their material free. Only 24% purchased their raw material.
- The majority (89%) of businesses did not receive any financial assistance from federal, state or local governments. This result agrees with Gadenne (1998), who concluded that firms that rely on larger amounts of external financing perform worse in the short term than businesses that rely less on external sources of financing. Also, Lussier (1995) found that small businesses that have started undercapitalized tend to be less successful in comparison with those who have started with and maintained adequate capital.
- The majority of these successful business sell locally (78%) rather than nationwide (17%) and sell their products in a retail store (61%) or through other venues (22%). These results align with the findings of Foley (1985) and Miller and Toulouse (1986), which established that a small firm's success has a positive correlation with the existence of a marketing/sales department.

Urban/Interface Wood Business Strategies

- The majority (72%) of successful businesses do not price their products lower than competitors, while 28% of the respondents do. Those that do not use this business strategy are larger primary and secondary industries (20 or more employees) that have a net profit (before tax) of \$20,000–99,000; 28% of the respondents that apply this business strategy are small primary industries (1–5 employees) that have a net profit (before tax) less than \$19,999 per year.
- The majority of respondents (94%) employ consultants or professionals in areas that the owner is not an expert. These findings parallel Kent (1994) and Lussier (1995), who determined that when firms rely on professionals, their business improves; in other words it helps to reduce the risk of failure.

- It is important for businesses to acquire knowledge about their competitor's activities, of which 56% of respondents did so always, 22% sometimes, and 17% often. Only 6% never did. These results support the finding of Steiner and Solem (1988), who found that acquiring knowledge of competitors' activities is crucial to the success of smaller firms that are competing with larger firms within the same market.
- One-hundred percent of successful businesses emphasize product quality. These results support the finding of Hall and Adams (1996), which indicated that high product quality was an important influence on the profitability for small businesses.
- Seventy-eight percent of the respondents do not emphasize high sales turnover. Specifically, 67% never and 11% rarely apply this business strategy. Twenty-three percent (17% sometimes and 6% always) of the respondents agreed that they emphasize high sales turnover. The seventy-eight percent includes companies that think that businesses involved with urban/interface wood are not aimed to make profit and are more like a hobby.
- The majority (78%) of the businesses emphasize cost reduction in their businesses, while only twenty-two percent never apply this business strategy.
- Seventy-nine percent of the respondents agreed that they involve employees in decision-making, and while 22% answered that they never use this in their businesses strategy, this is only because they are the owner or co-owner and have no employees.
- It is important to focus on unique products and not compete with commodity products. One-hundred percent of the respondents agreed that they provide unique products. Eighty-nine percent answered that always, and six percent said that often and sometimes.
- When asked "What do you attribute to making your business successful?", most respondents agreed that telling the story of how they came up with the business, the importance of not wasting material, and how their product is helping the environment helped them to be successful. Also some of the respondents attributed their age to success because they are older people with established careers and long-term vision. Also, they believe that creating and marketing new products, hard work, and honesty have made their business successful.

EDUCATIONAL AND TECHNICAL ASSISTANCE PREFERENCES OF URBAN FOREST STAKEHOLDERS

Municipal and private contractor respondents to the urban forests survey were asked to rate their preferences for educational and technical assistance programs in UFW utilization. Both groups were nearly neutral, on average, in their experience with education and training. Most had only slightly engaged in self-education or training on UFW utilization and only slightly agreed that they had found satisfactory opportunities when they sought them out. There was a slight indication that the respondents would seek out education or training in the near future.

The urban forests survey also asked respondents to rank nine potential educational or technical assistance programs aimed at increasing UFW utilization. No strong preference was shown for any

single program type, which corroborates with the diverse viewpoints expressed earlier about barriers to UFW utilization – multiple programs are preferred because multiple barriers are perceived. The most frequently cited program preference by both groups was “a local, centralized facility for marshalling UFW”, identified as a top-three incentive by 46% of municipal respondents and 50% of private contractor respondents. About one-third of respondents expressed interest in “a cooperative business facility for urban forest products” (33% municipal and 36% private contractors) and an online networking database for waste wood generators and utilizers (31% municipal and 39% private contractors). In terms of educational products, municipal employees and private contractors showed distinct preferences for passive versus active education. Nearly half of municipal respondents (46%) expressed interest in an educational conference compared to 30% of private contractors, whereas 39% of contractors expressed interest in field demonstrations compared to 29% of municipal respondents. Cooperative Extension or VDOF publications were the least preferred product for private contractors (7%), yet may be appropriate for municipal employees (27% expressed interest).

CONCLUSIONS AND RECOMMENDATIONS

AREAS NEEDING FURTHER STUDY

The study results indicate a potential for significant value gain by better utilization of UIW, using more material for lumber and lumber products; however, to fully understand the potential value increase, information about the form and quality must first be determined. The quality of wood material was listed as the second most common barrier to the utilization of waste wood by loggers and fourth most common by traditional forestry operations currently utilizing the material from UIF.

While attempts were made to estimate the volumes of urban/interface forest materials generated and utilized, lack of usable responses by all groups made such estimates impossible. It is important to understand the volumes of the material and the forms that it is currently produced in. This understanding may only be possible through intensive and rigorous tracking by an assessment team or by voluntary documentation of waste wood generators over a time series. Keeping detailed records of waste wood generation would allow operations to more accurately assess the current costs of disposal and the potential benefits of further utilization. This type of data would be important for market analysis and business modeling as well. Future educational or technical programs should encourage practitioners to accurately document waste wood generation and provide cost/benefit analyses so informed decisions can be made regarding further utilization.

According to previous estimates and studies, UFW is generated in significant amounts across Virginia. However, our urban forests survey results indicate that both municipal governments and private tree care operations have a difficult time estimating the amount of UFW they generate. Only one-third of respondents kept detailed records or could estimate amounts, while the remainder could not provide estimates. Of the operations that could provide estimates, the results were extremely variable, but even after normalizing these amounts by the number of employees in each operation, the results were still highly variable. This was an inherent limitation of using a web-based

survey to ask respondents to provide estimates of UFW generation from memory. Based on the data acquired, private contractors tended to generate more logs and chips, while municipalities tended to generate more brush.

NEEDS FOR UTILIZATION INFRASTRUCTURE AND LOGISTICAL SUPPORT

The second most commonly listed barrier listed by traditional forestry operations that currently utilize urban/interface wood was lack of infrastructure to handle materials (log trucks, sorting yard, distance to mill), which is also related to the third most commonly listed barrier: variable supply of material. This clearly indicates that increasing utilization of this material will require some type of infrastructure and logistical support. Further efforts in narrowing the infrastructure and logistical support needs are also suggested.

Highly-ranked barriers of municipal governments and private tree care contractors were lack of in-house equipment for processing waste wood, lack of in-house space for stockpiling waste wood, and lack of local processors to utilize waste wood. The following programs were frequently preferred by both municipal employees and private tree care contractors and should be developed with both operations in mind:

1. A local, centralized facility for receiving, sorting, and stockpiling UFW
2. A cooperative business facility for selling and/or producing urban forest products
3. An online database that networks UFW generators, processors, & producers

NEEDS FOR OUTREACH AND TECHNICAL ASSISTANCE

The results of this work clearly indicate the need for outreach and technical assistance. This need was listed as one of the top five barriers by traditional forestry operations currently utilizing urban/interface wood, loggers who currently do harvest urban/interface wood, and loggers who currently do not harvest this material. Based on the barriers identified by these groups, outreach and technical assistance efforts should focus on liability, contamination, and utilization.

Although incentives for further UFW utilization were generally agreed upon by municipal employees and private tree care contractors, their differing opinions on barriers should be taken into account when developing future educational or technical programs aimed at increasing UFW utilization. Based on survey responses, the following programs should be developed with private tree care contractors in mind:

1. Hands-on workshops or field demonstrations
2. Industry standards or best management practices
3. An online course or webinar

Based on survey responses, the following programs should be developed with municipal government employees in mind:

1. Educational seminars or conferences
2. Cooperative Extension or VDOF publications
3. An educational website

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Appendix I: Interface Forest Waste Wood Supporting Documents

Poster Presentation presented at the Forest Products Society's 68th International Convention in Quebec City, Canada, August 10-13, 2014

- Bond, B. H., S. Lyon, S. Barrett and C. Becker. 2014. *Opportunities and Barriers to Utilizing Urban/Forest Interface Waste-wood in Virginia*. Forest Products Society's 68th International Convention. August 10-13, 2014. Quebec City, Canada. – Poster Presentation

Fully detailed report on the opportunities and barriers to utilizing interface forest waste wood, which includes greater details about the methods, analysis and results.

- Bond, B. H. Final Report Opportunities and Barriers to Utilizing Forest Interface Waste-Wood. Submitted to the Virginia Department of Forestry, June 30, 2015.

Appendix II: Urban Forest Waste Wood Supporting Documents

The urban forests survey study reported here was conceived, designed, implemented, and analyzed by Graduate Assistant Jordan Endahl, under the supervision of his major professor Dr. P. Eric Wiseman. This study was the basis of Jordan's graduate thesis, entitled Urban Forest Waste Generation and Utilization by Municipal and Private Arboricultural Operations in Virginia, which was submitted to and approved by the faculty of Virginia Tech (Blacksburg, VA) in partial fulfillment of the requirements for the degree of Master of Science in Forestry on January 29, 2015.

Jordan's thesis describes in full detail the background and methodology of the survey study and its statistical analysis. A copy of the survey instrument can also be found in the thesis. A copy of the thesis is on file with the Virginia Department of Forestry. The thesis can be accessed electronically at: <https://vtechworks.lib.vt.edu/handle/10919/51567>. A printed copy may be requested at the following address:

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