The Potential Certified Wood Supply Chain Bottleneck and Its Impact on Leadership in Energy and Environmental Design Construction Projects in New York State

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Abstract

Sustainability is playing a larger role in how we construct buildings. Many organizations are trying to reduce the life-cycle costs of their buildings by using ''green building'' practices. Currently, the US Green Building Council's Leadership in Energy and Environmental Design (LEED) program dominates the building certification scheme. Most new construction projects require a substantial amount of wood. The only approved wood source that can help qualify new construction for LEED certification is Forest Stewardship Council (FSC)–certified wood. Given the dramatic increase in new green construction, this study assessed the availability and use of FSC wood in LEED certification projects throughout New York State (NYS). We surveyed architects working on LEED projects to determine how FSC-certified wood was used and if they were having difficulty acquiring such wood. We suspected a green supply chain bottleneck at the sawmill level may impact end users in the LEED certification process. Our results indicate that architects are very knowledgeable about FSC wood and would like to incorporate it into their designs. We found no issues in sourcing FSC wood for LEED projects. Although architects prefer to buy locally, many must procure FSC wood outside of NYS. Many architects are paying a premium price for FSC wood, which may impact their decision to use it on future LEED construction projects.

The United States is undergoing a ''green construction boom.'' Public concerns about reducing carbon emissions and energy costs are the primary drivers of this ''green'' movement. Consumer demand is increasing for environmental building products (Vonasek and Warnock 2008). Even with the current downturn in the housing industry, green building prospects look promising. A 2008 American Institute of Architects poll showed that 91 percent of registered voters nationwide would pay more for a house if that meant a reduced impact on the environment (Rizzo 2008). The commercial building sector also is undergoing a ''green renaissance.'' Many construction companies indicate that environmental investment in design and construction can offer a return on investment over the life of the structure (Bauld and McGuinness 2007). Green building products and services in the United States are expected to grow from $12 billion dollars in 2007 to $60 billion dollars in 2010 (Bowyer 2008).

The Leadership in Energy and Environmental Design (LEED) program, administered by the US Green Building Council (USGBC), is the leading third-party certifier of sustainable construction projects in North America. It was initiated in 1998 as a voluntary program for designing sustainable, high-performance buildings. There are an estimated 40 other green building programs in the United States, most notably Green Globes, administered by the Green Building Initiative (Bowyer 2008). This study focused on LEED projects. Owners of these buildings seek LEED certification to help reduce their operating costs while increasing the value of the building asset. A LEED-certified building is expected to use less energy, emit less carbon, conserve energy and water, and reduce the amount of waste placed in landfills. The emphasis on energy savings

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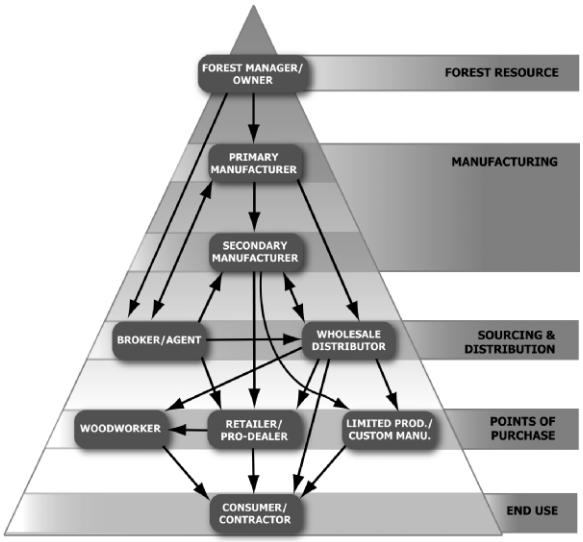

Figure 1.—How chain of custody works from forest to final end use (Wartelle 2003).

is critical given that in 2005, buildings accounted for 40 percent of total energy and 72 percent of total electricity consumption in the United States (US Department of Energy 2008). The LEED program provides measurable standards to follow when developing sustainable buildings. These standards fall within five major areas related to human and environmental health: (1) sustainable sites, (2) water efficiency, (3) energy and atmosphere, (4) materials and resources, and (5) indoor environmental quality. LEED certification for new-construction buildings offers four levels of certification based on a point system, with a higher point total signifying a higher certification level (USGBC 2010). The project collects points for meeting prerequisites and benchmarks within each of the aforementioned categories. The certification levels for LEED are as follows: certified (26 to 32 points), silver (33 to 38 points), gold (39 to 51 points), and platinum (52 to 59 points).

Most construction projects require a substantial amount of wood. Although wood is a renewable resource that some perceive as environmentally friendly and ''carbon neutral'' (Bowyer 2008), the use of wood alone will not secure the project certification points. However, the use of certified wood through the Forest Stewardship Council (FSC) is worth one point in the LEED rating system (USGBC 2010). The USGBC recently evaluated the potential to accept wood from other forest certification programs, such as the Sustainable Forestry Initiative (SFI) and the Programme for the Endorsement of Forest Certification (PEFC), but FSC remains the only accepted forest certification program under LEED Version 3 (effective March 17, 2010; USGBC 2010). To qualify for that point, 50 percent of the project's wood-based materials and products (by cost) must be FSC certified. The components include, but are not limited to, structural and general dimensional framing, flooring, subflooring, wood doors, molding, and even furniture as long as it is permanently installed in the project. FSC-certified wood includes a chain-of-custody certification process (Fig. 1), which states that the wood was tracked from sustainably managed, FSC-certified forestland and segregated throughout the wood supply chain to the final end use (FSC 2010a, USGBC 2010). Each wood products vendor in the supply chain that invoices FSC-certified products must be chain-of-custody certified by an FSC-accredited certifier. For instance, the sawlogs must originate from FSC-certified forestland. The sawmill processing logs from FSC-certified forestlands into dimensional lumber must be FSC certified. The wholesaler purchasing and distributing the dimensional lumber must also be FSC certified. The millwork company using dimensional lumber to produce molding and trim work must be FSC certified. Whether rough lumber or finished cabinetry, the FSC chain of custody must be intact by the time the product arrives at a LEED project. Wood products that are identified on invoices as ''FSC Pure'' are valued at 100 percent of the product cost. FSC ''Mixed'' sources are valued at the indicated percentage of their cost; e.g., a product identified as ''FSC Mixed 75 percent'' would be valued at 75 percent of the cost. Wood products identified as ''FSC Recycled'' or ''FSC Recycled Credit'' do not count toward certified wood credits. They qualify instead as recycled content products (FSC 2010a, Rainforest Alliance 2010).

Study Rationale

Given the increase in LEED green construction projects, this exploratory study sought to determine the role of FSC-certified wood in LEED certification projects across New York State (NYS) by surveying the lead architects involved in these projects. According to a database disclosed by the USGBC, NYS is among the leaders in green construction, ranking second in the country, with more than 400 new construction applications for LEED public projects. Fifty-five percent of the applications were from the New York City (NYC) area, with the balance scattered throughout upstate New York. In addition to determining how FSC-certified wood was used in the projects, we were particularly interested in discovering whether end users were having difficulty sourcing FSC-certified wood. This question arose from anecdotal evidence from suppliers and users over the past several years suggesting a supply shortfall. Furthermore, a recent analysis conducted by the Yale Program on Forest Policy and Governance determined that the current supply of FSC wood is limited (Yale Program on Forest Policy and Governance 2008).

Based on the acreage of FSC-certified forestland in NYS, FSC stumpage and logs would appear to be plentiful. Any supply shortfall in FSC-certified wood products may stem from the limited number of FSC-certified sawmills to process the logs, resulting in a substantial amount of wood potentially exiting the green supply chain before processing. Therefore, the question driving this study was whether LEED construction projects seeking FSC-certified wood have found a potential bottleneck in the supply of such wood.

The Potential Bottleneck

New York has an estimated 1.46 million acres of FSC-certified forestland (FSC 2010b). Of that total acreage, the NYS Department of Environmental Conservation (DEC) represents nearly half of the area (762,677 acres). Various Timber Investment Management Organizations (TIMO), including Upper Hudson Woodlands (92,000 acres), Lyme Adirondack Forest Company (275,435 acres), and Forest-

land Group (240,000 acres), represent most of the balance, along with smaller tracts owned by Protect the Adirondacks (10,789 acres), Paul Smith's College (11,656 acres), Trust to Conserve Northeast Forestlands (3,278 acres), and scattered private owners managed under a group certification by Fountain Forestry (55,845 acres) as well as small acreages managed by forestry consulting firms (FSC 2010b).

Of the total 27.7 billion ft^3 of stumpage available for harvest in NYS (Smith et al. 2007), 263 million ft^3 were harvested in 2007. This equates to a cutting intensity of less than 1 percent of the standing volume and a growth-to-cut ratio of 2:1 (Crawford 2009). The 2007 harvest yielded the following distribution of roundwood types: 500 million board feet (bdft) of hardwood sawlogs (58 million ft^3), 135 million bdft of softwood sawlogs (26 million ft^3), 2.2 million tons of pulpwood/chips (78 million ft^3), and 800,000 cords of firewood (101 million ft^3). An estimated 35 percent (by ft^3 volume) of the annual state harvest consisted of sawlogs (Crawford 2009). The annual sawtimber harvest from FSC-certified forestlands represents a subset of that total figure of 635 million bdft.

Based on figures provided by the NYS DEC, in 2009 NYS harvested the equivalent of 43 million bdft, which includes cordwood and chips, from their certified acreage, with approximately 20 million bdft represented in sawlog form. In a recent report to the NYS DEC, Bevilacqua and Bueno (2010) estimated that state forestlands grow approximately 119 bdft of sawtimber per acre per year. Assuming a growth-to-cut ratio of 2:1, the NYS DEC could harvest approximately 60 bdft per acre per year, yielding roughly 46 million bdft annually. This represents twice the current harvest rate of 26 bdft per acre per year.

Unfortunately, actual harvest removals are not available for private ownerships under FSC certification. However, we do know that these former industrial forestlands, now primarily under TIMO management, continue to be managed intensively for timber production. Consequently, they are probably exceeding NYS DEC cutting levels and likely harvesting more than 60 bdft per acre annually. For this analysis, we will assume a conservative harvest rate of 26 bdft per acre per year across the 697,918 acres, resulting in an annual harvest level of approximately 18 million bdft of sawtimber. Combining the harvest volumes from state and private forestlands results in 38 million bdft of FSC-certified sawtimber each year. Again, keep in mind this a conservative estimate.

More importantly, where are the estimated 38 million bdft of certified sawlogs being processed? Crawford (2009) estimates that 74 percent of the logs harvested in NYS are processed within the state. As of 2010, only one sawmill in NYS is FCS chain-of-custody certified, with an annual sawing capacity of approximately 6 million bdft. This mill is one of the two mills owned by Baillie Lumber. According to Terry Brennan, Director of Sawmill Operations with the company, certified logs account for less than 5 percent of their annual production. Consequently, it would appear that the estimated 28 million bdft (74% of 38 million bdft) of FSC-certified sawlogs available for processing in NYS are exiting the green supply chain. Sawlogs processed outside the state could remain in the green supply chain if processed by mills with FSC chain-of-custody certification in neighboring states. However, the number of FSC-certified sawmills in other states is, as in NYS, small. In 2010, only 10 such mills existed: 3 in Pennsylvania, 2 in Vermont, 2 in Massachusetts, 2 in Connecticut, and 1 in New Jersey (FSC 2010b). A few certified mills also exist in the Canadian provinces of Ontario and Quebec.

In this article, we examine whether the FSC sawlog processing bottleneck is impacting end users involved in LEED construction projects in NYS. Furthermore, we describe the degree to which FSC wood is used, where it is sourced, and how it is being utilized.

Methods

The primary database for the study originated from the USGBC's listing of LEED public projects in NYS. Our population of interest was architects because of the critical role they play in coordinating new construction within the LEED application process. Based on a spreadsheet provided by the USGBC, as of November 2008 a total of 404 LEED-disclosed public projects were on file: 48 were completed and 356 were in progress. Of the 48 completed projects, 14 (29%) used FSC-certified wood. We could not determine the use of FSC-certified wood with respect to the 356 on-going projects.

We conducted a census of the 14 architects associated with completed projects that used FSC-certified wood. We then randomly generated a list of architects involved in on-going LEED building projects across NYS with a goal of interviewing approximately 10 percent of the population. The exploratory nature of the study, along with the extensive time associated with phone interviews, dictated this sample size. Our sampling reflected the geographic representation of LEED projects in the state, with 55 percent in the NYC area and the remainder upstate.

A 20-question telephone survey was developed and administered to the architects working on these NYS LEED projects. The survey focused on the use of FSC-certified wood. Specifically, the survey included questions about general awareness of FSC-certified wood in the supply chain and whether they used FSC-certified wood for the project in question or intend to use FSC-certified wood for future projects. The architects were asked how and where they sourced FSC-certified wood, whether they had difficulty finding it, and whether they had to pay a premium price. We also asked users of FSC-certified wood why they use such wood as well as what species they purchased and the end use of the wood. We were able to complete 40 telephone surveys, 12 with architects of completed projects that used FSC-certified wood and 28 with architects from on-going projects in which use of FSC-certified wood was unknown before the survey.

The data were entered into a general-purpose statistical package, Stata, used by researchers in business and academia. The χ^2 analysis was used to determine if there were associations and differences between categorical variables. An alpha level of 0.10 established statistical significance. Most of the findings are descriptive because of the small sample size. No attempt was made to address nonresponse bias. Late respondents are often used as a proxy for nonrespondents, but because this was a telephone survey, we did not have late respondents for this analysis. When reporting results on whether FSC-certified wood was used, we separated the completed versus the on-going project samples. The entire sample is included when reporting questions addressing how FSC-certified wood was sourced and used.

Results

The projects in both groups represent a wide variety of certification levels, with silver as the most frequent (15), followed by gold (12), certified (7), and platinum (6). We could not find any statistical relationship between certification level and the use of FSC-certified wood. We also examined if an association existed between location (NYC vs. upstate) and the use of FSC-certified wood, but we found no effect. Ninety-six percent (27) of the architects involved with on-going projects are aware of FSC-certified wood, and 50 percent (14) are currently incorporating FSC-certified wood into the LEED project linked with the survey. Nearly all of the architects (88%) intend to use FSC-certified wood on future projects.

When the group of 26 FSC-certified wood users was asked why they are using such wood, 92 percent (24) responded that LEED points and good stewardship were the driving factors. Approximately one-quarter of the respondents stated that it was requested by the client. In terms of tree species, hardwoods (sugar maple [*Acer saccharum*], black cherry [*Prunus serotina*], and red oak [*Quercus rubra*]) were favored over softwoods by a two-to-one margin. Also represented were exotic hardwood species, such as Brazilian ironwood (*Cæsalpinia ferrea*), Brazilian cherry (*Hymenaea courbaril*), and various species of bamboo. Approximately two-thirds of FSC-certified wood was dedicated to visual uses (e.g., cabinetry, flooring, and millwork) rather than structural uses (e.g., framing, roofs, and trusses).

For those 26 architects using FSC-certified wood, 27 percent (7) reported having difficulty locating a supplier. A slightly higher percentage (42%), based on the sample of all architects interviewed, perceived a shortage of FSC-certified wood in the marketplace. The majority of respondents (77%) accessed FSC-certified wood through their suppliers and contractors. All of the architects we surveyed would prefer to buy their wood locally, but more than 30 percent purchased their FSC-certified wood out-of-state for the project linked with the survey. Nearly three-quarters (73%) of the architects using FSC-certified wood stated that they paid a premium price. We found a marginally significant difference ($z = -1.72$, $P = 0.085$) in whether builders paid a premium price for FSC-certified wood based on the location of the project. LEED projects based in NYC were more likely to pay a premium price than those projects in upstate New York. On a qualitative note, many architects added that price will impact their decision to use FSC-certified wood in the future.

Discussion

This exploratory study confirmed a high awareness among LEED project architects of FSC-certified wood in the supply chain. If architects were not using FSC-certified wood on the project linked to the survey, their intentions were high to use such wood on future projects. Based on our sample, the level of LEED certification had no bearing on whether FSC-certified wood was used. Although the additional point in the LEED certification system was the leading motivating factor for using FSC-certified wood, we expect it would play a larger role if the point system rewarded builders with more than one point. Given that nearly 50 other credit categories provide one or more points, it is understandable if builders focus on categories with higher benefit-to-cost ratios. A methodology could be developed that would rank LEED points by cost. Unfortunately, cost is only one piece of the equation, and other variables, such as availability and time, may influence the decision on what points should be pursued.

The preferred tree species and use of FSC-certified wood indicated in this study suggest that builders want to showcase the certified wood for their clients and the public (Wartelle 2003, Suttell 2004). Many of the LEED projects in the study are larger commercial buildings, which have minimal structural demands for wood components. Consequently, the dominant uses for FSC-certified wood were associated with exposed wood flooring, millwork, and other visual woodwork that often calls for high-quality hardwoods. Ultimately, wood utilization plays a critical role in contributing to the aesthetics of a LEED building.

We were somewhat surprised that nearly three-quarters of the architects stated they paid a premium price for FSC-certified wood. Most of the literature on certified wood products has reported that price premiums are rare (Jensen et al. 2003, Anderson et al. 2005, Perera et al. 2008), but notable exceptions exist. Vlosky et al. (2003) reported that manufacturers were paying a premium for certified wood as a raw material but in turn did not receive a premium for their respective value-added products in the form of cabinets, fixtures, and furniture. Aguilar and Vlosky (2007) did find that consumers in affluent markets showed a willingness to pay more for certified wood products originating from tropical forests. A small percentage of wood described in this study does have origins in the tropics, which could partially explain the price premium. Also, the price premium reported in this study would indicate that those manufacturers of cabinets, fixtures, and furniture may be getting a premium price. Another contributing factor may have more to do with supply and demand and the interplay with construction work schedules. For instance, if it is time to install the FSC-certified hard maple floor and the marketplace is short on the quantity and quality required to complete the task, those few suppliers with FSC chain-of-custody certification will have the leverage to charge a premium. Anecdotal evidence gathered during this exploratory study supports this premise.

We believe this potential supplier leverage is a manifestation of the green supply chain bottleneck mentioned earlier. Although our results indicate that only about one-quarter of FSC-certified wood users reported difficulties sourcing the product, nearly double that amount perceived a general shortage of FSC-certified wood in the marketplace. This perception may simply stem from a lack of sophistication with FSC-certified wood sourcing. Nonetheless, it is noteworthy that most LEED projects were required to purchase FSC-certified wood at a premium price from neighboring states, which suggests a lack of product in NYS and evidence of supplier leverage on a regional basis. Recall that as of 2010, only one sawmill in NYS had FSC chain-of-custody certification. The aforementioned neighboring states of Pennsylvania, Vermont, Massachusetts, Connecticut, and New Jersey, as well as the Canadian provinces of Ontario and Quebec, all have a limited number of FSC chain-of-custody-certified sawmills. However, the question of whether enough supply exists to meet demand still remains. Lack of supply coupled with high prices could potentially force LEED builders to forego FSC-certified

wood, or even use nonwood alternatives that do not offer the well-documented environmental benefits of wood.

During the past decade, the FSC has done an admirable job of enrolling forestland into their certification program, resulting in large volumes of certified stumpage. Silvicultural practices conducted on these certified forestlands in NYS generate nearly 40 million bdft annually, with the majority processed at mills that are not affiliated with the FSC. To increase the supply of FSC-certified wood in the marketplace, the FSC must focus downstream in the supply chain on the primary processors of roundwood. To date, a greener corporate image and market access have been key factors driving sawmills to seek FSC certification (Anderson et al. 2005). As the green construction movement grows, the current processing bottleneck should continue to pull FSC-certified wood prices in favor of a price premium. Higher prices may entice more sawmills to consider FSC certification, given the increased possibilities of receiving a premium for their investment and efforts.

Another alternative for alleviating this potential shortage of certified wood in the marketplace is for the USGBC to reconsider their certified wood criteria for LEED to possibly include other certification programs, such as the SFI. The SFI-certified products are recognized by many leading green building rating programs in the United States, Canada, and overseas, including the National Green Building Standard, National Association of Home Builders, and Green Globes. Including the SFI program would add a considerable area of certified forestland and stumpage, which in turn would make more certified logs available for primary processing. However, assuming that chain of custody remains an important underlying criterion for end use in a LEED project, the green supply chain bottleneck remains, because even fewer sawmills are certified under the SFI chain of custody (SFI Program 2010). As described earlier, most of these logs would exit the green supply chain when processed by uncertified mills. Regardless of the certification system, the majority of sawmills have yet to embrace supply-chain certification.

During the past 10 to 15 years, the innovation of forest certification has been strongly adopted by forestland owners from both the private and public sectors. At the other end of the value chain, green construction programs such as LEED have created a demand for certified wood. In terms of sustainability, the ultimate goal should be to increase the use of wood from well-managed forestlands in construction. The role of certified wood in the green construction boom could contract if this bottleneck is not addressed.

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