Consumers' Willingness to Pay for Eco-Certified Wood Products

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Abstract

We use Kriström's simple spike model to assess the factors influencing consumers' willingness to pay a premium for a variety of certified wood products. A survey of over 1600 Pennsylvania and Tennessee residents found that approximately 35% were willing to pay some positive "premium" for environmentally certified wood products. For three types of wood products (a $29 shelf, a $200 chair, and a $800 table) we find the estimated market premiums to be 12.9%, 8.5%, and 2.8%, respectively.

Key Words: eco-labeling, eco-certification, spike models, price premium

Introduction

During the past several years, forest certification programs have attracted increased interest in the United States. Both the Forest Stewardship Council, an international non-profit organization that accredits third party certifiers, and the American Forest & Paper Association (AF&PA), an industry organization, operate environmental certification programs. The primary purposes of these programs are to improve environmental quality and to promote sustainable forest management (Cabarle, *et al*. 1995). Major home improvement chains such as Home Depot and Lowe's have committed to these programs by endorsing or giving preferences to certified wood products, purchasing specific proportions of their wood products from firms or organizations that have had their forest management and production practices monitored and certified.

Certification programs must be economically feasible for growers and manufacturers if they are to succeed. The production and marketing practices in certified growing, harvesting, manufacturing, and/or handling must either be cost competitive with uncertified methods or consumers must be willing to pay a price-premium for the costlier certified products. The purpose of this study is to ascertain consumers' willingness to pay a premium for environmentally certified products. While other researchers have studied this issue, this study differs from previous eco-labeled wood products studies in several ways. In particular, we use non-market valuation survey techniques that mitigate the potential for hypothetical bias on the part of respondents. It is unfortunate that the vast majority of eco-labeled wood products marketing literature have followed out-of-date or substantially biased valuation approaches.[1] We

[1] See, for example, Ozanne and Vlosky (1997); Rametsteiner (1999); Winterhalter and Cassens (1993); Forsyth et al. (1999); and Spinnaze and Kent (1999). Each of these studies violated one or more of the major protocols defined for contingent markets (Arrow et al. (1993)).

employ modern techniques that have been found to mitigate the hypothetical and yea-saying biases associated with many contingent markets. Secondly, our analysis uses a "spike" modeling approach that accounts for the preponderance of people who are not willing to pay a premium for certified wood products. The three products studied were an oak shelving board, an oak chair, and an oak table. Results from the study were obtained through a telephone survey of over 1600 Pennsylvania and Tennessee residents.

Survey Data and Methods of Analysis

Survey Data

The survey consisted of two parts. First, a telephone survey was conducted to assess whether respondents would be willing to pay a premium for environmentally certified wood products and, thus, participate in the market. For the second part of the survey, an information booklet regarding certification of hardwood products was sent to those who said they would be willing to participate in the market. A follow-up phone call was used to collect information from these respondents regarding their willingness to buy any of three certified wood products at a specified premium. All respondents were aged 18 or older. The caller requested that the person most responsible for the household's wood product purchases respond to the survey. Phone calls were placed until at least 800 completed surveys were obtained. The University of Tennessee Human Dimensions Lab conducted the survey under the supervision of the project researchers, following the standard survey procedures recommended by Dillman (2000).

Residents of six Pennsylvania and six Tennessee counties were randomly sampled from telephone lists. Both Tennessee and Pennsylvania are major hardwood producing states in the U.S. In addition, Pennsylvania has the largest number of certified hardwood acres of any state in the U.S. (Jacobsen, 2000; Pennsylvania Hardwood Development Council, 2001). The counties

were chosen on the basis of whether they had high (low) concentrations of hardwood removals and were rural (urban). In each case, the urban counties had population densities of greater than 500 people per square mile, and hardwood removals of less than 2 million cubic feet per year. The rural counties had population densities of less than 75 persons per square mile (Census Bureau), and hardwood removals of 10 million cubic feet per year or greater (Timber Product Output Database Retrieval System). Urban counties with low hardwood output included Allegheny, Northampton, and Montgomery counties, whereas rural counties with high hardwood output included Clearfield, Elk and McKean counties. In Tennessee, the urban, low output counties were Davidson, Hamilton, and Knox, while the rural, high output counties were Hardeman, McNairy, and Wayne. The 1614 residents surveyed were divided almost equally across states (811 and 803 Pennsylvania and Tennessee respondents, respectively) and county types (809 and 805 rural and urban counties, respectively).

Two versions of the survey were used. One version included a "full" scope of certification, while the other included a "partial" (growing and harvesting only) scope of certification. The text for the certification programs was as follows

"Full" Program

> Environmental certification means a product has passed a voluntary environmental screening process by an independent third party organization, not the wood products company, the wood products industry, or the government. All aspects of production, including timber growing and harvesting, product manufacturing, and handling methods, are monitored to ensure that practices are used that help sustain our environment for current and future generations. A product label assuring certification appears on or nearby the product.

"Partial" Program

> Environmental certification means a product has passed a voluntary environmental screening process by an independent third party organization, not the wood products company, the wood products industry, or the government.

> Timber growing and harvesting methods are monitored to ensure that practices are used that help sustain our environment for current and future generations. Product manufacturing and handling would not be monitored or certified. A product label assuring certification appears on or nearby the product.

Each respondent was randomly assigned to the "full" certification or "partial" certification treatment. Some 816 respondents completed the "full" certification survey and another 798 respondents completed the "partial" certification" survey. Following Ozanne, et al., the certifying entity was an independent third party organization, not the wood products company, the wood products industry, or the government.

After the caller read the certification text to the respondent, they were asked to indicate which of the following three statements most closely reflected their opinions about environmental certification of hardwoods:

> "I support environmental certification and would pay a higher price for hardwood products if they were certified".
>
> "I support environmental certification but not if it requires paying a higher price for hardwood products".
>
> "I do not support environmental certification regardless of whether it costs me anything".

By allowing respondents to express support for environmental certification without being willing to pay higher prices, bias associated with "yea saying" may be minimized (Blamey, Bennett, and Morrison 1999). In other words, any pressure to provide a "socially responsible" response of support for the environment may be decreased, providing a more realistic estimate of consumers' behavior in the marketplace. Demographic data were also collected, as well as information regarding membership in environmental or conservation organizations, and frequency of recreation in forests.

Those who indicated willingness to pay a non-zero premium for eco-labeled hardwood products were asked to participate in a second round survey. Of the 1614 original survey respondents, 516 (32%) were eligible for and agreed to participate in a second round survey. These respondents were sent a survey booklet describing in detail the definition and scope of the certification process as well as pictures and product descriptions for each of three products. The three products were an oak shelving board, the uncertified version of which sold for $28.80, an oak chair, the uncertified version of which sold for $199, and an oak table, the uncertified version of which sold for $799.[2] Immediately adjacent to the picture and description of the uncertified wood product was a picture of an identical, yet certified, product. No price for the certified product was printed in the booklet; this price was stated at the time of the second telephone interview.

The booklet also defined environmental certification using both text and a graphic to depict the scope of the certification (Figure 1). For the "full" scope certification program, it was indicated that certification would occur at the timber growing and harvesting stage, product manufacturing stage, and the product handling stage. The "partial" scope certification program indicated that the timber growing and harvesting stage would be certified, but neither the product manufacturing stage nor product handling stage would be certified.[3] An example of a certification label that would be displayed near eco-labeled products was also included (Figure 2). The certification label was placed adjacent to the picture of the certified product, while the picture of the uncertified product had no label. The certified and uncertified products were indicated as being identical in all characteristics except whether the product had been certified.

[2] The pictures were taken of uncertified products offered at a major chain store in Knoxville, Tennessee. Actual market prices were used for the uncertified products.
[3] Of course, the scope of certification described in the booklet and follow-up phone call matched that described in the initial phone contact.

The respondents receiving the booklet also were asked to read a section on making hypothetical choices. A page of text reassured respondents that some people might be willing to pay more for environmentally certified products, while others might not. The text also described hypothetical bias and the problems it may cause when providing market information to the wood products industry, and asked respondent to "carefully consider the choices" and think about "those for which you would truly be willing to buy and pay." The purpose of these statements was to mitigate the potential effects of hypothetical bias (Cummings and Taylor 1999). Following Arrow et al. (1993), the text of the booklet contained a statement asking respondents to carefully consider their budget constraint in their decisions. As part of the second phone call, the respondents were verbally reminded to carefully consider their budget constraint and to make as realistic a choice as possible in a hypothetical situation (Kotchen and Reiling 1999).

During a second phone call, the respondents were asked to refer to the product description, picture, and price for the uncertified product contained in the booklet.[4] The price premium, or additional cost, for each product was selected randomly from a set of five levels.[5] The premium amounts were selected on the basis of a pre-test survey. Respondents were asked to indicate which product (certified, uncertified, or neither) they would be willing to purchase at the given attributes, including price.

[4] The order in which the products were referenced by the interviewer was random, though respondents could peruse the booklet prior to the phone call and anticipate questions for three wood products.

[5] The price premiums for the certified shelving board were [$1.50, $4, $5, $6, $10]; for the certified chair the premiums were [$10, $15, $20, $25, $40]; for the certified table the premiums were [$25, $45, $50, $55, $60].

Methods of Analysis

The simple spike model of Kriström (1997) is used to examine people's willingness to pay for eco-certified wood products. This model allows for the explicit recognition that the sample is split into two groups: those whose WTP is zero and those whose WTP is greater than zero. Further, the model does not allow for a negative willingness to pay. Thus, the model allows for a spike in the WTP distribution at zero that accounts for "non-participants", where non-participants are those respondents stating that they did not support certification of wood products, or that they did support certification but only if the additional cost was zero. "Participants" are those who are, in principle, willing to pay some non-zero premium for certified wood products. Given a price premium the respondent is willing to pay, say *P*, the distribution of WTP is given by,

$$
\begin{aligned}
F_{WTP}(P) &= 0 && \text{if } P < 0 \\
&= 1/[1+\exp(\alpha X)] && \text{if } P = 0 \\
&= 1/[1+\exp(\alpha X - \beta P)] && \text{if } P > 0
\end{aligned} \tag{1}
$$

where the parameters of $F_{WTP}(.)$ (α and β) are estimated via maximum likelihood. The vector X represents all factors other than price that are believed to influence WTP and β is the coefficient on the premium faced by the respondent. The likelihood function consisting of three parts: those who are not willing to pay a positive premium (non-participants), those who are willing to pay a non-zero premium but the posted price is greater than their willingness to pay, and those who are willing to pay a non-zero premium and whose willingness to pay exceeds the posted price. Mean WTP is given by,

$$WTP = \ln[1+\exp(\alpha X)]/\beta \tag{2}$$

where β is the price coefficient. The spike model requires $\beta>0$, that is, a positive marginal utility of income.

The "full" certification program was hypothesized to have a positive influence on market participation relative to the "partial" certification program. This was anticipated because the potential positive environmental effects of the "full" certification would be throughout the market channel versus only at growing and harvesting. Based on findings from previous studies, those living in an urban area and females were hypothesized to be more likely to have a non-zero WTP relative to those who did not have these characteristics. Further, those who contribute to environmental advocacy organizations (e.g., Sierra Club, The Nature Conservancy) or hunting/fishing conservation organizations (e.g., Ducks Unlimited), and those who frequently recreate in forested areas were hypothesized to be have non-zero WTP for certified wood products relative to those who did not share these characteristics because these measures may reflect values the respondents place on the environment and forest resources. If income effects were present, income was postulated to have a positive influence on willingness to buy the shelf, because as incomes rise, consumers could afford to pay higher premiums.[6]

Results

Of the 1614 respondents participating in the survey, roughly 760 provided complete information needed for the study (Table 1).[7] Just under 35% supported certification and were willing to pay a non-zero premium for eco-certified wood products. Some 55% supported certification but were not willing to pay higher prices, and 10% did not support certification regardless of costs.[8]

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[6] Statistically insignificant coefficients on the income variables would imply a constant marginal utility of income, a potential outcome given the relatively small percentage change in income implied by the premium.

[7] The key limiting variable was income, which had an unusually high item non-response rate of 36%.

[8] Some commonly cited reasons for not supporting certification were that the respondent did not believe certification would work to improve the environment, other causes were of higher priority, and companies should be regulated rather than using voluntary certification. Some commonly cited reasons for not being willing to pay more were that the respondent could not

The initial spike model results appear in Table 2. The models were remarkably stable across the various products: every variable that is statistically significant for one product is statistically significant for all products. Thus, the initial discussion with respect to hypotheses concerning any one variable applies to all products. Those who make donations to environmental organizations (*Environmental Advocate*) and who use national forests frequently (*Forest User*) are more likely to have a non-zero WTP relative to those who do not share these characteristics. Contrary to expectations, those who make donations to hunting or fishing organizations (*Hunting/Fishing Advocate*) are no more likely than others to have a positive WTP. Residents of Tennessee were not significantly different from residents of Pennsylvania in willingness to pay a premium for environmentally certified wood products.

In terms of demographic factors, males were less likely than females to be willing to pay a non-zero premium for certified wood products, a result that is congruent with other studies. The likelihood a respondent was willing to pay a premium increased with age; residents living in urban counties were more willing to pay a non-zero premium relative to residents of rural counties. Income was a statistically insignificant factor in willingness to pay a premium regardless of income level, implying that the marginal utility of income is constant. With respect to "treatment" variables, the scope effect is not present. That is, respondents presented with the "full" certification scenario were no more willing to pay a premium than those respondents presented with the "partial" certification scenario. Finally, as the price premium increased, respondents were less likely to pay the non-zero premium.[9]

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afford to pay more, they did not believe it costs more, or that manufacturers should not charge higher prices even if it costs more.

[9] Recall the WTP distribution of equation (1), in which the β coefficient is multiplied by minus one. Thus, WTP a premium varies inversely with the magnitude of the premium.

None of the income coefficients were, individually, significantly different from zero. The chi-square statistics reported in Table 2 are for the hypothesis test that all four income variables are jointly insignificant. The test statistics for all models suggests that this hypothesis not be rejected. In addition to indicating that income effects are unlikely to be present, the test also means that we can increase the number of observations used in the models by recovering all observations dropped due to item non-response on the income measure. Doing so allows us to add more than 350 observations to the analysis.

Table 3 presents the product models after recovering the additional observations. All of the variables that were statistically significant in the "fully" specified models retained the same sign and at least the same level of statistical significance in the models that do not include the income variables. The models presented in Table 3 were used to calculate unconditional estimates of WTP that can be applied to the population as a whole. Relative to the $28.80 uncertified oak shelving board, respondents were willing to spend, on average, an additional $3.72 for a certified board. This represents a 12.9% premium over an uncertified board. The 95% confidence interval for the premium is between $2.96 and $4.48.[10] Turning to the oak chair, respondents were willing to pay and additional $16.86 for a certified product, relative to a $199 uncertified. This is an 8.5% premium. The 95% confidence interval is $13.21–$20.51. Finally, respondents were willing to pay an additional $22.68 for the certified oak table relative to the $799 uncertified oak table, a 3.2% premium. The 95% confidence interval on the estimate

[10] The variance of the conditional willingness to pay estimates was calculated using the delta method (Greene, 2000):

$$Var(WTP) = (\partial WTP / \partial \Gamma')Var(\Gamma)(\partial WTP / \partial \Gamma)'$$

where *WTP* is given by equation 2, the Γ parameters are estimated via maximum likelihood, and $Var(\Gamma)$ is the variance-covariance matrix of the model.

was $17.30–$28.06. The declining premium as the product price increases is a feature found by more than one study.

Conclusions

As with the study by Grönroos and Bowyer (1999), the results from this study show that the majority of consumers would not be willing to pay a premium for certified products. The data indicate that just under 35% percent of consumers would be market participants for certified hardwood products. This percentage is much lower than findings from studies by Ozanne and Vlosky (1997) and Winterhalter and Cassens (1993), who report that 60 to 80 percent of the sample would be willing to pay a premium. One possible explanation for this lower estimate of willingness to pay may be that respondents were allowed to express support for environmental certification without having to pay a premium, therefore "yea saying" bias may have been reduced.

The profile of those most likely to be willing to pay a premium includes females and older respondents, as well as those who contribute to environmental advocacy groups. Further, frequent forest users were also more willing to pay a non-zero premium. This profile is similar to findings from previous studies, with respect to female gender and those who are environmentally concerned being more likely to be willing to pay a premium.

The willingness to buy a certified product over an uncertified one is responsive to the premium level (price). The mean WTP for an oak shelving board was $3.72 (or 12.9% premium); mean WTP for the chair was $16.86 (8.5% premium); mean WTP for the table was $22.68 (2.8% premium). The pattern of the percentage premium (i.e., declining as the product

price increases) is similar to the findings from previous studies that have examined wood products of similar cost.

Income did not have a significant impact on willingness to pay a premium, even for products with a relatively large expense (e.g., the oak table). Perhaps income effects take place for products in excess of the $799 cost of the table and if environmental certification is viewed as a normal good. In this case one would anticipate that those with higher incomes would be more likely to pay any given premium. Further research may examine a variety of products across a greater price range to see if this result holds across higher-priced products.

As with all contingent market studies, consumers' stated purchasing decisions may not be borne out in the marketplace. While measures were taken in this study to help respondents make a realistic choice in a hypothetical situation, as the markets for environmentally certified products become more developed, the actual preferences of consumers may be differ somewhat from the stated preferences examined in this study. This highlights the need for market studies as consumers become more aware of certified products and these products are more readily available on the market.

The scope of the certification did not appear to have any influence of the willingness to pay for certified products. This result is surprising, because the broader scope of the "full" certification program represents greater potential benefits to the environment; thus, it would be expected that consumers would place a greater value on the certified product. The finding points to several possibilities. First, it could reflect consumers' doubts about the ability of certification organizations to monitor environmental management practices throughout the market channel for wood products. Second, it could reflect that consumers place the greatest

value on environmental management practices at the timber growing and harvesting level of the market channel. Finally, it could point to the importance of effective education programs regarding certification programs that will outline how monitoring is performed at each stage of the market channel and the potential benefits to the environment.

At this time, firms considering adoption of environmental certification of their products may wish to focus on certification of timber growing harvesting, rather than focusing on certification at other stages of processing and handling. Perhaps if the market can be developed through educational programs regarding the potential benefits of certification throughout the market channel, then there may be economic benefits to firms from further certification. It should be noted that this study was done in only two states, Pennsylvania and Tennessee. Future research should likely address potential regional differences in market participation and WTP for certified products.

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Table 1. Variable names and definitions.

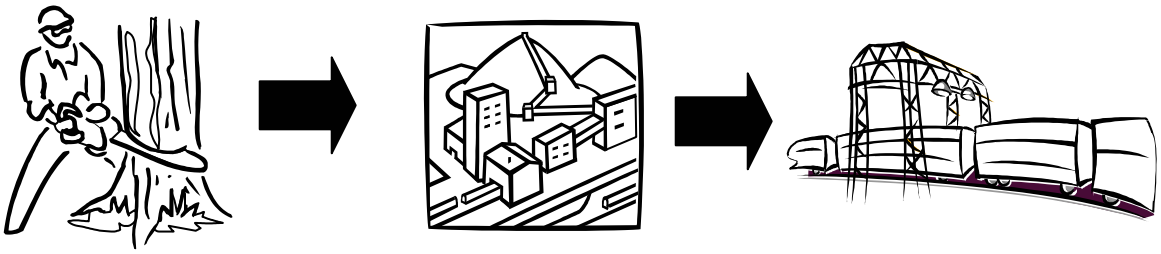
Variable Names	Definitions	Mean
Age	Age, in years	48.01 years
Male	1 if male, 0 otherwise	57.3%
Urban	1 if urban area, 0 otherwise	50.6%
Environmental Advocate	1 if contributed time or money to an environmental advocacy organization, 0 otherwise	40.1%
Hunting/Fishing Advocate	1 if contributed time or money to hunting or fishing organization, 0 otherwise	31.1%
Forestuser	1 if use forests for recreation purposes at least once per month or more, 0 otherwise	46.3%
Income 25-35	1 if \$25,000 ≤ household income < \$35,000, 0 otherwise	15.1%
Income 35-50	1 if \$35,000 ≤ household income < \$50,000, 0 otherwise	16.4%
Income 50-75	1 if \$50,000 ≤ household income < \$75,000, 0 otherwise	26.9%
Income 75	1 if \$75,000 ≤ household income	22.3%
TN Resident	1 if a Tennessee resident, 0 otherwise	49.0%
Full	1 if "full" certification program, 0 otherwise	51.0%
Price	Premium faced by respondent for the eco-certified wood product	See footnote 5

Table 2. Spike Models for Three Certified Wood (Oak) Products–Full Specification

Variable	Shelf		Chair		Table	
	beta	t-ratio	beta	t-ratio	beta	t-ratio
Intercept	-1.753	-4.027	-2.100	-4.770	-2.027	-4.571
Environmental Advocate	0.779	4.791	0.840	5.168	0.749	4.590
Forest User	0.585	3.336	0.676	3.844	0.610	3.425
Hunting/Fishing Advocate	-0.021	-0.110	-0.081	-0.423	-0.012	-0.060
TN Resident	0.040	0.255	0.082	0.513	0.049	0.306
Male	-0.447	-2.740	-0.404	-2.454	-0.340	-2.060
Age	0.013	2.265	0.015	2.495	0.014	2.367
Urban	0.322	1.737	0.318	1.814	0.330	1.863
Income > $75K	-0.173	-0.673	0.031	0.118	-0.049	-0.186
Income $50-75K	-0.135	-0.556	0.020	0.081	0.012	0.048
Income $35-50K	-0.014	-0.052	0.091	0.335	0.064	0.237
Income $25-35K	-0.068	-0.253	0.061	0.220	-0.078	-0.273
"Full" Cert. Treatment	0.068	0.435	0.129	0.818	0.174	1.101
Price	0.097	9.102	0.019	8.220	0.007	7.286
Ln-L	-618.041		-597.534		-586.254	
χ^2 (Income β=0)	0.722		0.144		0.332	
Observations	763		759		756	

Table 3. Spike Models for Three Certified Wood (Oak) Products–Drop Income Variables

Variable	Shelf		Chair		Table	
	beta	t-ratio	beta	t-ratio	beta	t-ratio
Intercept	-2.172	-6.497	-2.351	-6.982	-2.328	-6.893
Environmental Advocate	0.770	5.593	0.838	6.097	0.763	5.530
Forest User	0.585	4.814	0.778	5.185	0.734	4.861
Hunting/Fishing Advocate	-0.002	-0.010	-0.031	-0.195	0.026	0.161
TN Resident	0.093	0.694	0.103	0.765	0.070	0.518
Male	-0.52	-3.782	-0.485	-3.468	-0.436	-3.114
Age	0.014	2.856	0.015	3.007	0.014	2.835
Urban	0.374	2.616	0.400	2.776	0.427	2.923
"Full" Cert. Treatment	0.128	0.963	0.186	1.396	0.222	1.647
Price	0.092	10.303	0.020	9.704	0.015	8.650
Ln-L	-846.634		-827.567		-816.551	
WTP	$3.72 ($0.39 s.e.)		$16.86 ($1.87 s.e.)		$22.68 ($2.76 s.e.)	
% Premium	12.9%		8.5%		2.8%	
Observations	1127		1124		1120	

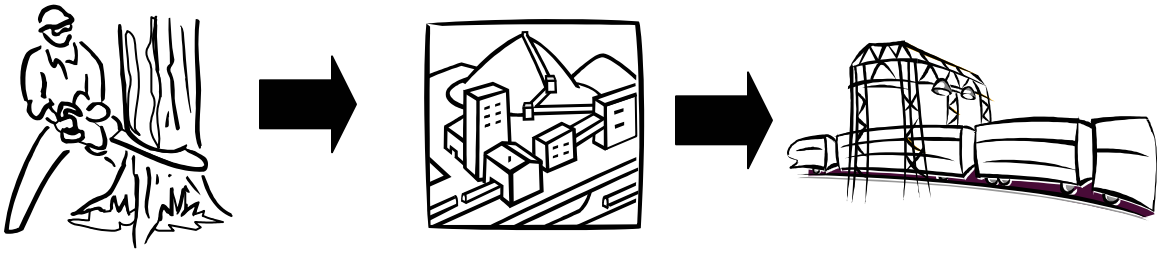


Timber Growing & Harvesting is Environmentally Certified

Product Manufacturing is Environmentally Certified

Product Handling is Environmentally Certified

"Full" certification program



Timber Growing & Harvesting is Environmentally Certified

Product Manufacturing is NOT Environmentally Certified

Product Handling is NOT Environmentally Certified

"Partial" certification program

Figure 1. Diagrams depicting "Full" and "Partial" certification programs.

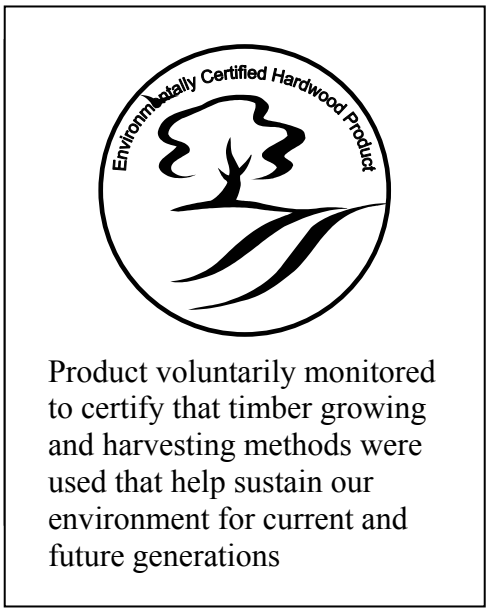


Figure 2. Example environmental certification label ("Partial" certification program).