

# Character-marked furniture made from red alder harvested in southeast Alaska: product perspectives from consumers and retailers

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**Abstract:** In recent decades, red alder (*Alnus rubra* Bong.) has become an important Pacific Northwest hardwood in appearance-grade lumber markets, such as exports, furniture, and cabinets. However, red alder generally is a short-lived pioneer species, and small logs can result in proportionally large volumes of lower grade lumber containing numerous visual defects, such as knots, often referred to as character marks. Given that markets for character-marked wood could provide an income stream for management of red alder, it becomes important to understand consumer and retailer response to character-marked red alder products. In the current study, we used a policy capturing approach (the lens model) to assess the cues used by furniture consumers and retailers to evaluate several furniture pieces constructed from character-marked red alder lumber. The cues used by consumers and retailers to form willingness-to-pay judgments were found to be different. Character marks, design, and naturalness were important to consumers. None of the investigated cues were significant to retailers, suggesting they were using an entirely different model. Such divergence creates challenges in the forestry supply chain for development of new forest products.

**Résumé :** Au cours des récentes décennies, l'aulne rouge (*Alnus rubra* Bong.) est devenu une importante essence feuillue de la région nord-ouest du Pacifique dans les marchés de bois d'œuvre de catégorie finition tels que les exportations, les meubles et les armoires. Cependant, l'aulne rouge est généralement une espèce pionnière qui a une courte durée de vie, ce qui peut entraîner la production de petites billes avec un volume proportionnellement élevé de bois d'œuvre de qualité inférieure qui contient de nombreux défauts apparents, tels que des nœuds, souvent appelés marques de caractère. Étant donné que les marchés pour le bois avec des marques de caractère pourraient fournir un flux de rentrées pour l'aménagement de l'aulne rouge, il devient important de comprendre la réaction des clients et des détaillants face aux produits fabriqués avec de l'aulne rouge qui porte des marques de caractère. Dans cette étude, nous avons utilisé une approche de capture politique (le modèle lentille) dans le but de déterminer les indicateurs utilisés par les consommateurs et les détaillants de meubles pour évaluer plusieurs pièces de mobilier faites de bois d'aulne rouge avec des marques de caractère. Les indicateurs utilisés par les consommateurs et les détaillants pour arriver à un jugement qui se traduit par la volonté de payer étaient différents. Les marques de caractère, le style et l'aspect naturel étaient importants pour les consommateurs. Aucun des indicateurs étudiés n'était important pour les détaillants, ce qui indique qu'ils utilisent un modèle complètement différent. Une telle divergence crée des défis dans la chaîne d'approvisionnement du secteur forestier pour le développement de nouveaux produits.

[Traduit par la Rédaction]

## Introduction

Changes in the composition and relative value of hardwood resources are having far-reaching effects on products and markets. Smith et al. (2005) suggested that changes in resource quality and availability of more traditional species have caused manufacturers to consider alternative species in their respective product mixes. Luppold and Bumgardner

(2007) showed how changes in species popularity in the marketplace relative to supply have affected prices for individual hardwood lumber species. With erratic trends in interspecies and intergrade hardwood lumber prices for major species, opportunities for using a broader array of species become possible. As a pioneer species once routinely eliminated from higher-valued conifer stands (Burns and Honkala 1990), red alder (*Alnus rubra* Bong.) is an example of an historically nontraditional species that has gained wide market acceptance over the past 25 years, with a substantial forest and manufacturing base in the Pacific Northwest.

## Red alder resources in the Pacific Northwest

In recent years, annual removals of red alder throughout its range in the Pacific Northwest (including Washington, Oregon, California, British Columbia, and Alaska) have totaled about  $4.6 \times 10^6$  m<sup>3</sup> (approximately  $598 \times 10^6$  board feet, Scribner scale) (Ahrens 2006). Between 2000 and 2005, prices for red alder saw logs have at times surpassed prices for No.2 and No.3 Douglas-fir (*Pseudotsuga menziesii*

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**Fig. 1.** Examples of five grades of red alder lumber, as discussed in Brackley et al. (2009). The furniture samples for the present study were made from Frame-grade material, represented by the board second from the top.



*sii* (Mirb.) Franco) sawlogs in the Pacific Northwest (DeBell 2006). The value of red alder lumber exports has also increased sharply in recent years, with red alder becoming the leading hardwood lumber species exported to China in the late 1990s and remaining a major export species since (USDA Foreign Agricultural Service).

In southeast Alaska, the net growing stock volume of red alder in 2000 was approximately  $2.1 \times 10^6 \text{ m}^3$  (about  $73.4 \times 10^6 \text{ feet}^3$ ) (van Hees 2003). Red alder represented approximately 52% of the total hardwood growing stock volume in southeast Alaska and approximately 43% of the total hardwood sawtimber volume on timberlands in 2000 (van Hees 2003). An analysis of this data indicates that 57% of the growing stock volume is in trees in the 12 inch (1 in. = 25.4 mm) and larger diameter breast height (dbh) classes. Approximately 31% of the total volume is on private ownerships, and the bulk of the remainder (67%) is within the Tongass National Forest (van Hees 2003). Owing to red alder's generally rapid growth, many of these stands are now reaching commercial sawtimber size. Currently, there is very little production of red alder lumber in Alaska (Brackley et al. 2009). However, if current trends continue, economics could stimulate more harvesting of red alder in Alaska to supplement more traditional production in Washington and Oregon. Increased utilization of red alder from Alaska could potentially lead to a range of new opportunities for local mills, including manufacture of kiln-dried lumber for export and (or) manufacture of secondary products such as furniture and kitchen cabinets.

To help facilitate increased utilization of red alder in Alaska, a lumber recovery study was recently conducted (Brackley et al. 2009). In this study, 183 logs harvested from small-diameter trees in southeast Alaska were evaluated. The trees were estimated to be 46 years of age, slightly younger than maturity age, which is typically 60-70 years for red alder (Burns and Honkala 1990). Using a proprietary grading system similar to the National Hardwood Lumber Association (2007) rules for red alder, overall

volume recovery by grade was as follows: Superior, 10.8%; Cabinet/Custom Shop, 18.6%; Common Shop, 17.8%; Frame, 40.8%; Economy, 7.5%; and Pallet, 4.5% (Brackley et al. 2009). Thus, Frame-grade and lower material represented about 53% of total lumber production, and Frame was the most common grade produced. By definition, Frame-grade and lower material yields high amounts of sound, short lengths but not necessarily clear cuttings. Conversely, it exhibits more visual defects or character marks than higher grades. Figure 1 shows an example board for these grades (excluding Pallet grade). Furniture pieces made from Frame-grade boards (second from top) were evaluated by consumers and furniture retailers in the present study.

Increased use of character marks in products made from red alder lumber could improve the value and utilization of this material. For example, studies quantifying the possible yield improvements associated with including character marks in hardwood furniture suggest a possible yield improvement of up to 14 percentage points by allowing character marks <2 inches in diameter (1 in. = 25.4 mm) in red oak (*Quercus rubra* L.) furniture parts (Buehlmann et al. 1998). In the broadest sense, character marks are visual defects, such as knots, small holes (e.g., bird pecks or worm holes), and stain, that can lower the grade of the hardwood lumber by reducing the volume and (or) size of clear cuttings that can be obtained from the lumber. However, establishing a working definition of a character mark can be difficult because acceptable levels and types of defects can vary from one user to another. Although opportunities exist for improved utilization of red alder, consumer and retailer preferences, including the cues used in evaluating character-marked wood furniture, need to be evaluated to assist with more extensive product development.

#### **Problem statement and study objectives**

To date, little is known regarding the comparative perceptions of character-marked red alder products among potential end-users (consumers) and those making the decisions

concerning the products to offer for sale to consumers (furniture retailers). To the extent that such perceptions differ, there will be challenges to increased utilization of character-marked material. Ultimately, finding ways to market character-marked wood for high value uses could provide an income stream for management of red alder (and other hardwoods) used in appearance-based applications.

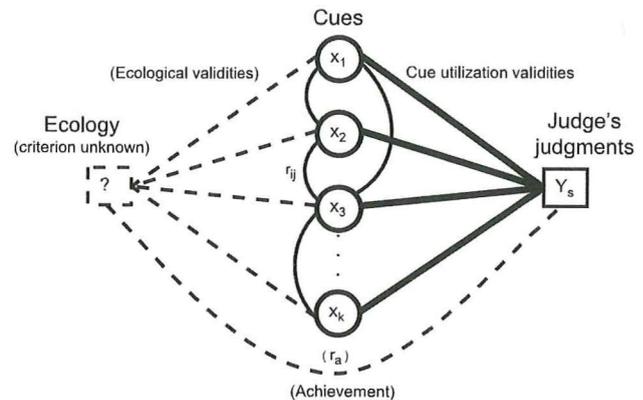
The primary objective of this study was to assess the cues associated with willingness-to-pay perceptions of character-marked red alder furniture by two different groups in the supply chain for wood furniture, consumers and retailers. The models used by consumers and retailers were compared and contrasted. The results can be used to identify opportunities for (cues used in common) and challenges to (cues used differently) matching perceptions for two important links at the end of the supply chain for red alder furniture. Additionally, the models used by male and female consumers were contrasted. Nicholls and Bumgardner (2007) found some differences between males and females in their preferences for red alder furniture, and Brinberg et al. (2007) found differences by gender in the policies used to evaluate character-marked oak (*Quercus* spp.) and cherry (*Prunus* spp.) furniture. A secondary objective was to compare perceptions and willingness-to-pay evaluations for two end tables, identical in design and size, but one made from Frame-grade red alder lumber and the other from defect-free material (taken from Superior-grade lumber).

#### Market acceptance of red alder and character-marked products

It has been posited that the barriers to increased use of character-marked products by the forest products industry, despite the potential advantages in resource utilization and materials costs savings, are similar to those existing for introduction of lesser-known wood species. For example, there may be a learning curve associated with the use of "new" materials in traditional wood products (Bumgardner et al. 2000; Smith et al. 2005). In the case of red alder, although it has gained widespread acceptance in industrial markets, it is not well known among many downstream market intermediaries (retailers) or end-users (consumers). Red alder is often stained to appear similar to other species, such as cherry, and thus is not promoted as "alder". Studies including side-by-side comparisons of red alder with other species have generally found red alder to have intermediate popularity (Nicholls et al. 2004; Bumgardner et al. 2007); however, preferences for red alder were greater in the Pacific Northwest than in other geographic regions (Roos and Nicholls 2006).

The results of several studies suggest that consumers are generally more receptive to character-marked features in furniture than are retailers, who generally are more risk-averse (Bumgardner et al. 2001; Donovan and Nicholls 2003; Wang et al. 2004; Brinberg et al. 2007). However, most of these studies have not measured consumers and retailers concurrently. Such risk-averse behavior by retailers seems rational when considering what is at stake in stocking furniture they feel will appeal to the broadest spectrum of their respective customer bases. However, for character-marked products to ultimately be successful in the marketplace, acceptance at both the consumer and retail levels of the supply

**Fig. 2.** The single system design for lens model studies (Cooksey 1996, adapted from pp. 143 and 146).



chain for hardwood products is necessary. Bumgardner et al. (2000) identified some of the challenges associated with developing and marketing character-marked products. Among the more prominent challenges were (1) manufacturer-retailer interactions in finding the optimal level of character markings for consumer acceptance (without losing revenue in the process), and (2) educating consumers as to the presence of character marks in wood products, such as furniture, which have traditionally been made from generally defect-free wood. With character-marked furniture, each piece naturally is different in appearance.

#### Theoretical approach - the lens model

The current study was designed to provide an increased understanding of both retailer and consumer perceptions of character-marked red alder furniture. The lens model, as first developed by Egon Brunswik (Hammond and Stewart 2001) was used as the framework for assessing these perceptions. The lens model posits that the way an individual perceives an object is determined by the cues the individual uses (i.e., the "lens"), and the weight assigned to those cues, in processing the object. The model also provides for comparisons between different groups, such as consumers and retailers, on the cues used to evaluate products. Inherent to the development of lens model designs is selection of the stimuli and attributes that are representative of conditions outside the study (Brinberg et al. 2007).

A graphical representation is shown in Fig. 2. The lens model consists of two interacting subsystems: the environment (or ecology) and the cognitive processes associated with the individual's judgments. In the present study, we focused only on the right-hand side of the model, sometimes called a single system design or policy capturing approach (Cooksey 1996). This method has been used in forest products research to model the judgment of veneer log value by buyers, for example see Alderman et al. (2004). In double system designs, individuals' judgments can be compared with a criterion measure in the environment to measure achievement; such designs have been used to model and evaluate human judgments in the fields of medical decision-making and meteorological forecasting, to name a few (Cooksey 1996).

**Fig. 3.** The four red alder furniture pieces, as displayed at the Home Show in Wasilla, Alaska (September 2007). From left to right: character-marked dresser, character-marked end table, defect-free end table, character-marked coffee table.



## Methods

### Selection of stimuli and attributes

The red alder lumber used for furniture construction was selected from an inventory of lumber produced from trees harvested near Ketchikan, Alaska. Three pieces of solid wood household furniture were constructed from Frame-grade red alder lumber, which is the second-lowest grade in terms of the level of visual defects present, such as knots, and thus is relatively low in value (Fig. 1). The term "frame-grade" suggests the most common use for this material, unexposed upholstered furniture frames, where the visual defects are not important. The character-marked pieces included a small dresser, a coffee table, and an end table, as shown in Fig. 3. A fourth piece, an end table identical in design to the end table made from the character-marked wood, was made from defect-free alder lumber. This enabled comparisons between the character-marked end table and the end table free of character marks, but the defect-free table was not included in the lens model analysis. A local craftsman fabricated the furniture samples based on instructions and dimensions provided by the authors.

As can be seen in Fig. 3, even though the character-marked furniture pieces were all made from the same grade of red alder lumber, each had a distinct look based on the randomly occurring locations of specific character marks. All furniture had a clear-coat finish but no other treatments to alter the original color of the wood. The samples were constructed as knock-down furniture for easy transportation and set up at the trade shows used for data collection. The inclusion of multiple pieces, fabricated from the same lumber grade, is consistent with the notion of representative design in the lens model. The results can thus be seen as being typical of the looks possible when using Frame-grade red alder lumber in appearance-based applications.

Study participants were visitors to a booth at two trade shows: one geared toward consumers, the other toward furniture retailers. Six attributes, deemed important to the wood furniture purchasing decision, comprised the cues used in the study. These were a subset of the eight cues developed by Brinberg et al. (2007) in a similar wood furniture study employing the lens model. The list was shortened primarily to reduce the length of the survey instrument. (It was important to have a one-page form to facilitate response at the trade show booths; natural blemishes and color were not used given their similarity with other attributes.) The attributes included character marks<sup>2</sup>, design, finish, grain consistency, color consistency, and naturalness. The attributes were measured on a five-point scale anchored by "excellent" and "poor", and with "good", "neutral", and "fair" as points between. On a one-page questionnaire, respondents checked a box corresponding to each evaluation, which was then coded by the researchers with poor = 1, fair = 2, etc. This data was then treated as interval-scaled in nature (Jaccard and Wan 1996; Dawes 2008). The dependent measure was willingness-to-pay, where respondents indicated a price on a blank line for each piece after the question, "With all characteristics considered, how much would you be willing to pay for this product?" Retailers were asked to provide a wholesale price.

### Sample descriptions

Approximately 190 consumers visited the booth at the Home Show in Wasilla, Alaska, in September 2007 (Fig. 3) and provided evaluations of the furniture pieces. The sample breakdown was as follows: 52% were female, 74% were 31-60 years of age (a plurality of 33% were between 51 and 60), 70% had income of \$26,000 - \$100,000 (a plurality of 30% had income between \$51,000 and \$75,000), and 58%

<sup>2</sup>For retailers, this attribute appeared as "wood character marks". Overall, the consumer and retailer questionnaires were quite similar.

**Table 1.** Comparison of selected covariance structure modeling methods.

Covariance structure	No. of parameters	AIC
<b>Consumers</b>		
Variance components	1	4313.0
Compound symmetry	2	4185.6
Unstructured	6	4121.4
Heterogeneous compound symmetry	4	4117.5
<b>Retailers</b>		
Variance components	1	1438.4
Compound symmetry	2	1371.3
Unstructured	6	1341.1
Heterogeneous compound symmetry	4	1338.2

had either purchased \$100-worth or more of furniture in the previous 6 months or planned to in the next 6 months.

Approximately 97 retailers visited a very similar booth at the Las Vegas Furniture Market in July 2008 and completed the questionnaire. The Las Vegas Furniture Market has become a major venue for product display, marketing, and wholesale purchasing in the furniture industry, and is held twice annually. The sample breakdown was as follows: 46% were female; furniture was the primary product for 69%, and 57% were directly involved in furniture retailing; 55% had sales of \$1 million or more; and 68% had ten or fewer employees. Thus the sample tended toward smaller furniture retailers and stores. In addition, only 28% of the retail sample indicated past use of red alder in their stores, suggesting that for some this was the first time they had evaluated furniture made from red alder wood and that the results reflect a first impression. Nearly 60% of respondents were directly involved in furniture retailing; it was assumed that the remainder was also involved in the home furnishings industry given their attendance at the Las Vegas Market.

#### Data analysis and model

The data were structured so that each row represented a consumer (or retailer) response to a specific furniture piece. Thus, each respondent had three rows of data; for each piece, there was a score for each of the six attributes and a price. Since the data structure potentially caused some dependencies in the data, the linear mixed model was used to derive parameter estimates for the lens model cues. The general linear mixed model, in its most general form, is represented in eq. 1 (Cue 2003; Kincaid 2005; West et al. 2007).

$$[1] \quad Y_i = X_i\beta + Z_i\gamma_i + \epsilon_i$$

where, in the present context,  $Y_i$  is the vector of continuous responses (willingness-to-pay) for the  $i$ th respondent,  $X_i$  is the design matrix associated with the fixed effects -  $u_i$ ; furniture piece (piece 1, piece 2, piece 3), and the quantitative variables representing the lens model cues character, design, finish, graincon, colorcon, and natural;  $\gamma_i$  is the vector of unknown fixed effects parameters (to be estimated);  $Z_i$  is the design matrix associated with the random effects of the re-

spondents;  $y_i$  is the vector of unknown respondent effects; and  $\epsilon_i$  is the vector of random residuals.

The within-subject covariance structure was modeled using several common methods available in the SAS version 9.2 Analyst repeated measures ANOVA program (based on PROC MIXED) (SAS Institute, Inc., Cary, North Carolina). Several possible structures were analyzed for the  $R_i$  matrix using the REPEATED statement. These structures represent blocks in a diagonal matrix, with each block corresponding to a respondent. The results are shown in Table 1. Akaike's information criterion (AIC) is a measure of the difference between a given model and the "true" model. The model with the smallest AIC value generally is deemed the most appropriate in that it indicates a better fit (Kincaid 2005; West et al. 2007). The variance components structure is the simplest (one parameter) and can be viewed as the default-representing a model with no covariance structure included. For both consumers and retailers, the heterogeneous compound symmetry method resulted in the lowest AIC and was used in subsequent analyses". This suggests that differences in the variances for willingness-to-pay among the three trials were relatively large, while the covariance coefficient between each pair of trials was similar. The heterogeneous compound symmetry structure, with each trial having its own variance and each pair of trials sharing a single covariance coefficient (thus requiring four parameters), is shown in eq. 2. For example, for the retailer model, the values of the parameter estimates were variance 1 = 4169.3, variance 2 = 1344.4, variance 3 = 3203.0, and covariance coefficient = 0.8271.

$$[2] \quad R_i = \begin{bmatrix} \sigma_1 & & \\ \sigma_2\sigma_1\rho & \sigma_2 & \\ \sigma_3\sigma_1\rho & \sigma_3\sigma_2\rho & \sigma_3 \end{bmatrix}$$

In addition, to compare perceptions of the characterized and defect-free end table, paired  $t$  tests were used to compare the average rating for each attribute, as well to compare average willingness-to-pay evaluations, in both the consumer and retailer samples.

## Results

### Descriptive statistics

Table 2 presents summaries of the dependent and predictor variables for the consumer and retailer samples. The were outliers or extreme values identified in some of the unadjusted dollar distributions. One extreme outlier (defined; the upper quartile of the distribution plus 3 times the IQR or interquartile range) was present in both the consumer and retailer dollar distributions for one of the pieces. Further, three consumer respondents reported a willingness-to-pay of \$0 for at least one of the furniture pieces. These respondent as well as the respondents with the extreme outliers, were removed from the analyses, creating an adjusted dollars distribution. For both consumers and retailers, the overall adjusted dollar distributions reflected skewness and kurtosis values of less than 1.0 and were used in subsequent analysis as the dependent variable. The overall range (across a

<sup>3</sup>As might be expected given their similar AIC values, modeling results using the unstructured covariance structure were comparable to the reported results using the heterogeneous compound symmetry structure.

**Table 2.** Summary statistics of predictor and outcome variables for consumers (Wasilla, Alaska) and retailers (Las Vegas, Nevada).

Variable	Consumers			Retailers		
	<i>n</i>	Mean	St. dev.	<i>n</i>	Mean	St. dev.
Dollars (adjusted) piece 1	140	184.54	79.27	52	137.67	62.89
Dollars (adjusted) piece 2	140	91.69	47.07	52	72.75	37.68
Dollars (adjusted) piece 3	138	161.92	81.01	46	115.93	58.83
Character marks	559	3.97	1.00	273	3.78	1.01
Design	562	4.00	0.89	269	3.32	1.05
Finish	555	3.79	0.99	270	3.64	0.96
Grain consistency	549	3.64	1.11	271	3.52	1.00
Color consistency	559	3.71	1.09	273	3.59	1.09
Naturalness	554	4.16	0.85	273	3.95	0.88

**Table 3.** Summary of fixed-effect coefficients for consumers, *n* = 388.

Parameter	Estimate	Standard error	<i>t</i>	Significance	Lower 90% confidence interval	Upper 90% confidence interval
Intercept	75.37	16.17	4.66	<0.01		
Piece 1	19.55	5.84	3.35	0.01		
Piece 2	-65.78	5.20	-12.66	<0.01		
Piece 3	0.00	—	—	—		
Character marks	12.24	3.35	3.66	<0.01	6.71	17.77
Design	5.32	3.18	1.68	0.09	0.08	10.57
Finish	-4.13	3.80	-1.09	0.28	-10.40	2.13
Grain consistency	4.10	3.62	1.13	0.26	-1.88	10.08
Color consistency	-0.72	3.65	-0.20	0.84	-6.75	5.31
Naturalness	5.18	3.79	1.37	0.17	-1.08	11.44

pieces) for the dependent variable was \$10 to \$450 for consumers and \$18 to \$280 for retailers.

**Relative importance of cues to willingness-to-pay judgments**

Several analyses were conducted to assess the relationships between the cues and willingness-to-pay for the red alder furniture products. First, results are reported for the consumer and retailer samples, and the cues these groups used to evaluate the furniture pieces are compared and contrasted. Then, the cues used by male and female consumers to form judgments about the alder furniture are reported and discussed.

**Importance of cues for consumers and retailers**

For the consumers intercepted at the trade show in Wasilla, Alaska, wood character marks and design were significantly and positively related to willingness-to-pay for alder furniture (Table 3). This suggests that wood character marks were an important cue to evaluation of the furniture and that these consumers were willing to pay a premium for character-marked products. That is, the higher the evaluation of character marks, the more they were willing to pay. Conversely, willingness-to-pay was negatively impacted by dislike for character marks. Either way, this result suggests that character marks are noticed by consumers in a significant way when present in furniture. Design was also a cue relied upon by these consumers to make willingness-to-pay judgments about the furniture, with the relationship again

positive, although the statistical evidence for significance was marginal.

For the retailers intercepted at the Las Vegas, Nevada, furniture show, none of the attributes were significantly related to willingness-to-pay (Table 4). This suggests that retailers were using an entirely different set of cues to evaluate the alder furniture pieces presented in this study.

**Importance of cues for female and male consumers**

In addition to the aggregate model for consumers, separate models were analyzed for female and male consumers. For female consumers, wood character marks and naturalness was positively related to willingness-to-pay; that is, the more they liked these features of the furniture, the more they were willing to pay (Table 5). Brinberg et al. (2007) found that female consumers interviewed at furniture stores in Virginia based their willingness-to-pay judgments on design and grain consistency when evaluating oak and cherry furniture. The closed-grain appearance of red alder may have contributed to this inconsistency, as oak is conspicuously open-grained in appearance, thus grain consistency could become an important cue when dealing with oak furniture.

For male consumers at the Wasilla home show, wood character marks were significant and positive predictors of willingness-to-pay, suggesting that it was possible to obtain a price premium for character-marked products with some male consumers. This was the only significant cue for males (Table 6). Interestingly, Brinberg et al. (2007) obtained a similar result for the male consumers in their study, based

**Table 4.** Summary of fixed-effect coefficients for retailers,  $n = 139$ .

Parameter	Estimate	Standard error	$t$	Significance	Lower 90% confidence interval	Upper 90% confidence interval
Intercept	111.34	17.91	6.22	<0.01		
Piece 1	21.53	5.69	3.78	<0.01		
Piece 2	-45.92	5.16	-8.89	<0.01		
Piece 3	0.00	—	—	—		
Character marks	-3.53	3.53	-1.06	0.29	-9.61	2.00
Design	1.84	3.09	0.60	0.55	-3.29	6.97
Finish	0.33	3.97	0.08	0.93	-6.27	6.93
Grain consistency	3.81	3.61	1.05	0.29	-2.20	9.82
Color consistency	-0.87	3.70	-0.23	0.81	-7.02	5.28
Naturalness	0.76	3.61	0.21	0.83	-5.24	6.77

**Table 5.** Summary of fixed-effect coefficients for female consumers only,  $n = 200$ .

Parameter	Estimate	Standard error	$t$	Significance	Lower 90% confidence interval	Upper 90% confidence interval
Intercept	93.27	20.10	4.64	<0.01		
Piece 1	15.33	7.94	1.93	0.06		
Piece 2	-72.82	7.52	-9.68	<0.01		
Piece 3	0.00	—	—	—		
Character marks	7.92	4.60	1.72	0.09	0.29	15.55
Design	2.53	4.34	0.58	0.56	-4.67	9.72
Finish	-3.36	5.58	-0.60	0.55	-12.62	5.89
Grain consistency	4.55	5.02	0.91	0.37	-3.78	12.89
Color consistency	-4.51	5.32	-0.85	0.40	-13.33	4.31
Naturalness	10.67	5.46	1.93	0.05	1.62	19.72

**Table 6.** Summary of fixed-effect coefficients for male consumers only,  $n = 158$ .

Parameter	Estimate	Standard error	$t$	Significance	Lower 90% confidence interval	Upper 90% confidence interval
Intercept	67.46	28.74	2.35	0.02		
Piece 1	18.30	9.18	1.99	0.05		
Piece 2	-62.92	8.08	-7.78	<0.01		
Piece 3	0.00	—	—	—		
Character marks	17.90	5.44	3.29	0.01	8.86	26.93
Design	6.93	5.13	1.35	0.18	-1.58	15.45
Finish	-6.64	6.03	-1.10	0.27	-16.64	3.37
Grain consistency	8.03	5.72	1.40	0.16	-1.45	17.51
Color consistency	-1.96	5.46	-0.36	0.72	-11.02	7.10
Naturalness	-0.48	6.03	-0.08	0.94	-10.49	9.53

on furniture made from oak and cherry, although design was found to be significant for males as well in that study.

#### Comparing perceptions of character-marked vs. defect-free furniture

A secondary objective was to compare the perceptions and willingness-to-pay for two end tables identical in design and size, but one made from Frame-grade red alder lumber and the other from clear cuttings made from Superior-grade material (Fig. 3). Data were collected at the trade show booths. Comparisons between the tables were made for both the consumer and retailer data sets. The results are shown in

Table 7. Consumers rated the defect-free tables significantly higher on every attribute investigated and were willing to pay significantly more for the defect-free table. Retailers, on the other hand, rated the defect-free table higher on only two attributes (grain and color consistency) but were still willing to pay significantly more for the defect-free table. While this suggests that wood consistency is important to retailers' evaluations, the substantive difference in the willingness-to-pay for the two tables was not large (less than \$2 on average). In summary, the results of the policy capturing analysis, which showed that consumers were willing to pay a premium for character marks when they favored such

**Table 7.** Comparisons between the character-marked and defect-free end tables, based on paired *t* tests.

Variable	Character-marked table (mean)	Defect-free table (mean)	<i>t</i>	Significance
<b>Consumers</b>				
Character marks <sup>a,b</sup>	3.7	4.0	-2.60	0.01
Design	3.9	4.0	-2.90	<0.01
Finish	3.6	4.1	-6.19	<0.01
Grain consistency	3.4	4.3	-9.31	<0.01
Color consistency	3.4	4.3	-9.68	<0.01
Naturalness	3.9	4.1	-2.48	0.01
Dollars (willing to pay) <sup>c</sup>	92.46	105.39	-4.81	<0.01
<b>Retailers</b>				
Character marks <sup>a,d</sup>	3.5	3.8	-1.52	0.13
Design	3.3	3.4	-1.58	0.12
Finish	3.5	3.6	-1.65	0.10
Grain consistency	3.1	4.1	-7.42	<0.01
Color consistency	3.3	4.1	-6.82	<0.01
Naturalness	3.8	3.9	-0.88	0.38
Dollars (willing to pay) <sup>e</sup>	74.57	76.37	-2.25	0.03

<sup>a</sup>Based on a scale anchored by 1 = poor to 5 = excellent.

<sup>b</sup>Sample size was approximately 185 for scaled variable tests.

<sup>c</sup>All "zero" values removed; sample size was 141.

<sup>d</sup>Sample size was approximately 88 for scaled variable tests.

<sup>e</sup>All "zero" values removed; sample size was 51.

marks, must be tempered with the finding that overall, the character-marked table was rated less favorably than the defect-free table.

## Discussion

The present study indicated that consumers and retailers used a different set of cues to determine their willingness-to-pay for character-marked red alder furniture, a finding consistent with a similar study based on eastern hardwood species conducted in the mid-Atlantic (Brinberg et al. 2007). Consistent with Brinberg et al. (2007), character marks and design were important attributes to consumers in forming their judgments. In all cases, the nature of the relationships was positive; that is, the more respondents liked the design and wood character marks, the more they were willing to pay for the furniture. The present study also identified naturalness as an important (and positive) cue to female consumers' perceptions of character-marked red alder furniture. Perhaps this is a finding unique to the region where the presented study was conducted (south-central Alaska).

Also consistent with Brinberg et al. (2007), none of the investigated attributes were significant in the retailer model. Retailers seem to be using an entirely different set of cues to form their judgments. To expand acceptance of character-marked red alder furniture in the marketplace, this "gap" between retailers and consumers will need to be bridged, as retailers may have difficulty understanding consumers' perceptions. For example, for consumers in Alaska, retailers might fail to understand the importance of naturalness as a cue to consumer evaluation of furniture, which is a lost opportunity for marketing communication about character-marked wood.

One attribute that has been shown to be important across multiple furniture perception studies, including the present one, is product design (Wang et al. 2004; Brinberg et al. 2007). As stated by Bloch (1995, p. 16), "The physical form or design of a product is an unquestioned determinant of its marketplace success." An implication is that desirable designs can be used to draw consumers toward lesser-known species, such as red alder, and toward more character-marked products that make more efficient use of harvested forest resources.

The policy capturing analysis was based only on character-marked furniture pieces. When comparing the character-marked end table to a defect-free end table, consumers demonstrated clear preference for the defect-free table. Thus the finding from the policy capturing analysis that wood character marks were positively related to consumers' willingness-to-pay must be tempered with the finding that when presented with a character-free alternative, consumers rated this alternative more favorably and were willing to pay more. Retailers were somewhat more ambivalent toward the defect-free table but still showed some preference for this furniture piece.

Overall, it seems that the literature remains mixed as to whether consumers prefer character-marked products over defect-free products; individual study findings might be influenced by species, the type of wood products displayed (whether intermediate products such as panels or finished products like furniture), respondent demographics, and geographic location. If retailers find similar inconsistencies in their respective market analyses, then a general ambivalence and (or) risk-averse attitude toward stocking character-marked products is not an unexpected outcome. In the end, character-marked products, including those made from red

alder, are most likely to be successful when they fit with the overall design theme of individual furniture groups, and thus there are niches where character marks can be desirable (Bumgardner et al. 2000). Opportunities also might exist for smaller manufacturers in Alaska and elsewhere to work directly with consumers to develop customized furniture pieces where specific pieces of character-marked wood are used.

## Summary and limitations

This study drew consumer responses from a narrow geographic region. While this limits extrapolation of the results to other regions, this study does highlight the possible regional variations in consumer judgments when compared with similar studies conducted in other regions; for example, the importance of naturalness to female consumers in Alaska was not found in a similar study conducted in Virginia. At the same time, attributes consistently important across different regions (and wood species), such as design and character marks, lend credence to the notion that some attributes are important to perceptions of wood furniture generally. For the retailer sample in this study, the size was limited, although larger than those in similar studies. This reflects the difficulty of attracting retail buyers to a research-type booth when their primary objectives for attending market events are to conduct business and discern product trends by seeing new product lines (Michael and Smith 1995).

There is some consistency forming with the notion that retailers are using an entirely different set of cues than consumers are to form judgments about wood furniture. This creates challenges in the forestry supply chain for development of economic opportunities associated with character-marked products, even though such products could offer a higher value use for this material.

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