How Established and Underutilized Wood Species Are Perceived: Perspectives from Wisconsin Consumers

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Abstract

Consumer preferences are always changing, and wood species are not immune to those trends. Grain pattern, color, density, and other characteristics found in wood can play vital roles in how consumers decide which secondary wood products to purchase or, in the case of customized products, which species to select. This study investigated consumer perceptions of common and underutilized wood species available for use in secondary wood products, which addresses an evolving gap in understanding consumer decision-making. The research measured appearance-based evaluations of 10 different wood species native to Wisconsin. Data were collected from consumers at two home shows in Wisconsin in January and February 2023 using semantic differential scales with eight attributes. Findings revealed distinct consumer perceptions across species and attributes, and often the underutilized species compared favorably with more established species. Walnut, cherry, red oak, and white oak were perceived as formal, with walnut being the most formal. Softwoods (white pine, tamarack) were seen as casual. All species were viewed as sustainable, with white pine being perceived as the most sustainable. Except for white pine, all species also were perceived as being durable. Hardwoods were largely considered stately, whereas softwoods were seen as modest. Overall, the favorable attributes associated with hardwoods were tempered by the fact that most hardwoods were perceived to be expensive.

The selection of appropriate wood species for use in fashion-based secondary wood products, such as furniture and cabinets, is a critical design decision for manufacturers. This decision extends beyond mere functional utility to encompass significant psychological and emotional dimensions for consumers. In a competitive market, understanding how consumers perceive different wood species is essential for manufacturers developing desirable products and communicating their value effectively. The total product concept posits that consumers purchase a comprehensive bundle of benefits, both tangible and intangible, indicating that the psychological contributions of individual wood species are a relevant consideration (Levitt 1986). This concept considers attributes such as prestige, status, reliability, and aesthetic appeal, all of which are significantly influenced by the chosen material. For secondary wood products, the wood species used is acknowledged as a key element of the total product concept. For example, Scholz and Decker (2007) present a hierarchy of attributes to define wooden dining tables and then show how different hardwood species contribute to consumer evaluations within the hierarchy. Bumgardner et al. (2001) describe the importance of decisions regarding species use within the furniture product development process.

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Manufacturers and designers often consider multiple species based on appearance, cost, and processing criteria, emphasizing the need to understand how species selection influences consumer perceptions and, ultimately, product success.

Historically, species selection has been a key component in furniture product development, with traditional associations between certain species and specific styles (e.g., oak for Mission and Arts and Crafts style furniture; Kaiser 1997). However, correlation between style and species has been decreasing over time, suggesting that a broader array of species and finishes are being considered by designers and manufacturers (Frye 1996, Ohm 2001). In addition, the hardwood industry is becoming increasingly customized, which enables consumers to pick their own species and other attributes in furniture and cabinet products (Bumgardner et al. 2011, Nicholls and Bumgardner 2018). Lihra et al. (2012), for example, found a consumer segment that was especially favorable to customized furniture products and that the customization generally was considered somewhat relevant to hypothetical furniture purchases. Another change has been a decline in US consumption of wood household furniture overall, which has decreased by 45 percent since 2005 (Luppold and Bumgardner 2022).

Additionally, an increased focus on using previously underutilized species to augment regional production is occurring (Bernard et al. 2018). This focus is particularly apparent with initiatives regarding urban wood utilization (Thomas and Espinoza 2024). This attention is pressing because invasive species such as the emerald ash borer are causing large-scale mortality of potentially viable economic species such as ash (Poland and McCullough 2006). In addition to understanding the mechanical properties of urban wood, knowing the attributes that consumers value, such as perceived sustainability, durability, or aesthetic appeal, also can affect the potential market opportunities for these species (Sonti et al. 2025). These shifts underscore the significance of gaining a nuanced understanding of consumer perceptions rather than relying solely on traditional uses or assumed preferences.

Despite the recognized value of species selection in furniture and cabinet product development and emerging consumer choice regarding species use in their customized products, relatively few studies have assessed consumer perceptions of specific wood species. Research suggests that consumers hold varying perceptions of different wood species and that these perceptions, if understood, can be leveraged for marketing and product development advantages (Bumgardner and Bowe 2002, Bowe and Bumgardner 2004, Nicholls et al. 2004, Roos et al. 2005, Lowell et al. 2017). For instance, wood has been found to possess emotional appeal that can be used to gain a marketing advantage over competing materials (Blomgren 1965).

In related work, wood use in building design has been examined for the psychological benefits it could provide to individuals at health care facilities, workplaces, and in homes (Fell 2010, Nyrud and Bringslimark 2010, Strobel et al. 2017). Several benefits were identified, including reduced stress; lowered blood pressure and heart rate, along with a creativity boost; and better ability to stay focused in the workplace. Wood has been shown to provide a sense of warmth to individuals. Using wood in biophilic design or incorporating nature into the building helps promote comfort and encourages people to be happier, allowing them to heal quicker in the hospital or enjoy arriving at work, reducing absenteeism and increasing productivity. Thus, psychological benefits may play a part in how consumers perceive characteristics found in different wood species.

The objectives of this study were to measure appearance-based perceptions of 10 different wood species, many of which were common in production of secondary products. Additionally, this study sought to discern consumer perceptions of some underutilized wood species found in Wisconsin and to identify key attributes and potential opportunities for increased use of these species. By examining how consumers visually perceive different wood species, this study provides valuable insights for designers and secondary wood manufacturers, allowing them to make more informed design decisions and develop more effective promotional strategies that resonate with consumers.

Methods

Species selection

This paper reports findings of a partial replication of previous species perception studies by the authors (Bumgardner and Bowe 2002, Bowe and Bumgardner 2004). In those tudies, six species were used, including oak, mahogany, cherry, walnut, maple, and pine, and participants were asked to evaluate the species as furniture woods. In the current study, species native to Wisconsin were used including red oak (*Quercus rubra*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), sugar maple (*Acer saccharum*), and eastern white pine (*Pinus strobus*). In addition, ash (*Fraxinus sp.*), eastern tamarack (*Larix laricina*), ambrosia maple, and honeylocust (*Gleditsia triacanthos*) were used. Ambrosia maple typically is a soft maple species (e.g., *Acer rubrum* or *Acer saccharinum*) with fungal stains facilitated by the ambrosia beetle. Mahogany, a tropical species, was omitted from the study. Tamarack, ambrosia maple, and honeylocust are not widely used commercially, but they are gaining traction for their potential in urban wood utilization, and ongoing projects in Wisconsin are investigating their utilization (Wisconsin Department of Natural Resources 2026). Understanding consumer preference for these less common species is crucial for their market integration, so their addition allows for comparisons with more established species. Finally, ash has been a common commercial wood for decades, but increased volumes of ash wood are a near term issue for some communities because of the decimation of trees of this species due to the emerald ash borer, an exotic invasive insect from Asia.

Wood panel preparation

Kiln-dried lumber for each of the 10 study species was purchased from local suppliers in Wisconsin. The boards were plain sawn, which is standard milling practice in Wisconsin and represented the typical grain pattern for each species. Plain sawn boards have the wide face of the board showing the tangential plane and the edge of the board showing the radial plane. The authors planed, jointed, edge-glued, sanded, then finished each of the panels to a final dimension of 16 by 20 by 1 inches. A clear natural polyurethane was sprayed on each panel. Panels were selected to be generally clear of visual defects and uncommon characteristics, except for ambrosia maple where character specifically is part of the look. The white pine panel also contained

Figure 1.—Wood panels used for data collection in the study. Species are tamarack, eastern white pine, sugar maple, ambrosia maple, red oak, ash, honeylocust, cherry, white oak, and walnut.

some knots, similar to its typical appearance. Figure 1 shows the wood panels used. The questionnaire instructed participants to view the panels in terms of use in tabletops.

Scale and questionnaire description

Details of the semantic differential scale development methods can be found in Bumgardner and Bowe (2002). As discussed in that work, the final scales were developed and pretested from an initial pool of 24 possible word pairs to represent the underlying wood furniture perception factors found in previous wood furniture studies (Dicther 1964, Blomgren 1965, Hardwood Manufacturers Association 1995, Ozanne and Smith 1996). Seven of the scales used in this study were very similar to those used previously, including casual versus formal, cold versus warm, expensive versus inexpensive, fragile versus durable, old-fashioned versus modern, sustainable versus non-sustainable, and stately versus modest. The differential rustic versus clean was added to the current study because of interest by the Wisconsin Department of Natural Resources in better utilizing low-quality fiber, bringing the study total to eight scales.

Scales were anchored by the differential word pairs using a 7-point scale, and the scale midpoint of 4 was labeled as neutral. Each species sample was evaluated on each of the scales. The questionnaire also contained questions to help summarize the demographics of the sample and a question asking participants to indicate the panels they would most prefer when purchasing furniture in the future.

Data collection

Data were collected at two home shows in Wisconsin: the Madison Home Expo, January 6 through 8, 2023, at the Veterans Memorial Coliseum, Madison, Wisconsin; and the Fox Cities Home and Garden Show, February 17 through 19, 2023, at the Fox Cities Exhibition Center, Appleton, Wisconsin. These home shows provide ideas in home building and design and attract a mix of builders, homeowners, and consumers interested in remodeling or new home construction. Thus, the respondents were judged to be consumers that would have an interest in wood household furniture. Standard vendor booth space was reserved at both home shows. A mall intercept procedure was used with a 3 by 3-foot sign displayed at the booth to describe the study (Fig. 2).

When a potential participant passed the booth, they were invited to take part in the study. The objectives of the study were explained, and a paper questionnaire was given to those willing to participate. A brief set of instructions were printed on the questionnaire stating the following: “In the next set of questions there will be a set of opposing words. For each sample, circle the number within the opposing

Figure 2.—Panel displays shown at the Fox Cities Home and Garden Show at the Fox Cities Exhibition Center, Appleton, Wisconsin.

words that approximately comes closest to your feelings about the sample. Don't think too much, just go with your gut reaction." The intention was not to coach respondents but to collect their first impressions. Three long tables were arranged in a U pattern, with the wood panels arranged upright on these tables and available for respondents to view, touch, etc. While study participants were engaged, they could move along the tables with their questionnaire to evaluate the panels and then exited when they completed the last panel at the opposite end. A full-sized candy bar was offered as an incentive to each participant who completed the questionnaire.

A total of 326 total usable responses were received across the two locations (184 from Madison, Wisconsin, and 142 from Appleton, Wisconsin). Slightly more than 69 percent of participants were 46 years of age or older. Nearly 71 percent of participants were either 4-year college graduates or held an advanced degree, and nearly 54 percent had an annual household gross income of at least US$100,000. The sample was split nearly equally between male (49.8%) and female (48.5%) participants; 1.7 percent did not answer.

Data analysis

For each attribute and species, one-sample t tests were conducted with the null hypothesis that the mean did not differ from the semantic differential scale midpoint of 4.0. It is common for scale-based data such as semantic differential data to be treated as interval in nature for analysis (Malhotra 1996). It also was assumed that the data were normally distributed (per the central limit theorem) given the sample size was approximately 326 for each t test (the number of respondents per species per attribute). Given the large number of tests for each attribute (10 species each), an alpha level of 0.01 was set for the t tests to help control the overall type I error rate, which collectively might be higher than 0.01. If a test was significant, it indicated that the species mean was different from the scale midpoint and therefore tended toward one side of the scale and could be characterized as such. For example, for the casual versus formal scale, it was concluded that walnut (mean = 5.6; $p < 0.01$) was perceived as being formal. By contrast, honeylocust (mean = 4.0; $p = 0.94$) was not statistically different from the scale midpoint and therefore was perceived as neither casual nor formal.

Results and Discussion

Results for each attribute by species are shown in Figures 3 through 10. The single strongest effect by species and attribute was for white pine as casual (mean = 1.8). Other substantial effects were for cherry as warm (mean = 5.7); white oak and red oak both as durable (mean = 5.7 for both); and

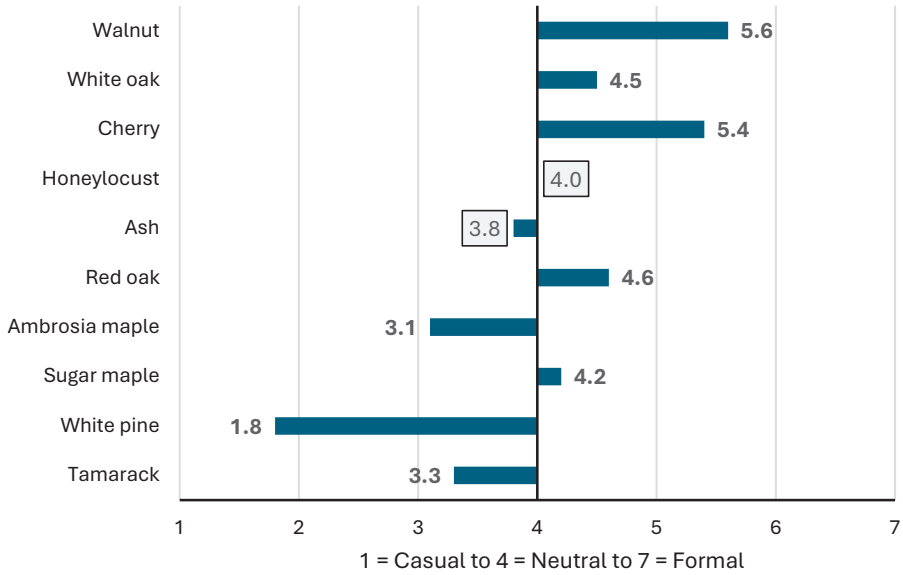

Figure 3.—Mean scores by species for casual versus formal. Boxed values denote means not statistically different from the scale midpoint of 4.0.

walnut as formal (mean = 5.6), warm (mean = 5.6), durable (mean = 5.6), and expensive (mean = 2.4).

Casual versus formal

For the casual versus formal scale, walnut, cherry, red oak, and white oak were perceived as formal. Sugar maple also barely fell on the formal side of the scale. The softwoods (white pine, tamarack) and ambrosia maple were viewed as casual in appearance (Fig. 3). The darkest hardwoods (walnut, cherry) were viewed as the most formal, although it was notable that honeylocust was not different from the scale midpoint even though it is a darker wood. Perhaps the distinct grain pattern in honeylocust results in a more casual look. The oaks also were perceived as formal, although less so than walnut and cherry. The white pine mean for casual was the most extreme score of any species on any attribute, suggesting it was perceived as quite casual and not an optimal choice for more formal designs. It also was notable that sugar maple and ambrosia maple scored on opposite sides of the scale midpoint, suggesting that character-marking can make wood appear more casual.

Cold versus warm

Most of the species were viewed as warm or neutral, with only white pine being viewed as slightly cold (Fig. 4). This suggests wood, especially many hardwoods, is generally considered to be a warm material and can add this sense to interior designs. Darker woods were viewed as the warmest, including walnut, cherry, and honeylocust. As an underutilized species, honeylocust in particular was notable for its

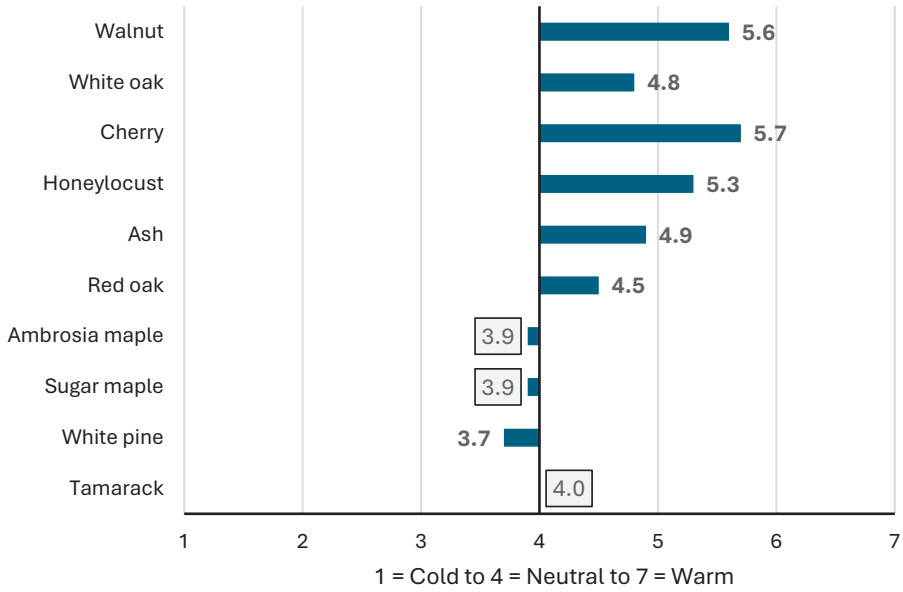

Figure 4.—Mean scores by species for cold versus warm. Boxed values denote means not statistically different from the scale midpoint of 4.0.

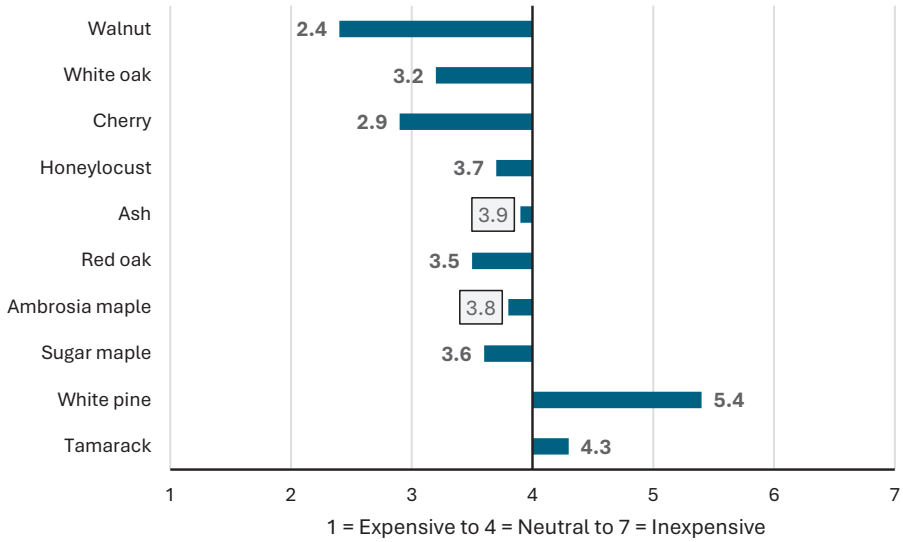

Figure 5.—Mean scores by species for expensive versus inexpensive. Boxed values denote means not statistically different from the scale midpoint of 4.0.

relatively high warmth rating, falling just short of cherry and walnut. Tamarack and the maples were viewed as being near the scale midpoint. The character-marking of ambrosia maple did not seem to affect the perception of cold versus warm with respondents, given the similar result with sugar maple.

Expensive versus inexpensive

Most of the hardwoods were perceived as expensive, with only ash and ambrosia maple being viewed as neutral (Fig. 5). Conversely, both softwood species were viewed as inexpensive, especially white pine. Perhaps the character-marking associated with ambrosia maple reduced the perceived expensiveness. It was less clear why ash was viewed as relatively inexpensive, perhaps due to the straight grain pattern that could be seen as resembling softwoods. Walnut, cherry, and white oak were viewed as especially expensive, with honeylocust, red oak, and sugar maple perceived as less expensive but still on the expensive side of the scale. These results show one of the fundamental challenges of promoting hardwoods as a finishing material: how to convince consumers that the favorable attributes of hardwoods (e.g., warm, durability, sustainability) justify the extra cost over competing materials.

Fragile versus durable

Except for white pine, all species were perceived as durable (Fig. 6). This was especially true for white oak, red oak, and walnut. This result suggests that durability is a general feature of wood that can be promoted as a favorable attribute, especially for oak. This might help explain, for example, the popularity of oak as a flooring material. It also appeared that underutilized species (e.g., honeylocust, tamarack, and even ambrosia maple) were viewed as durable, suggesting that underutilized wood of almost any species can be positioned as durable when promoting wood versus competing materials. This scale also was another example

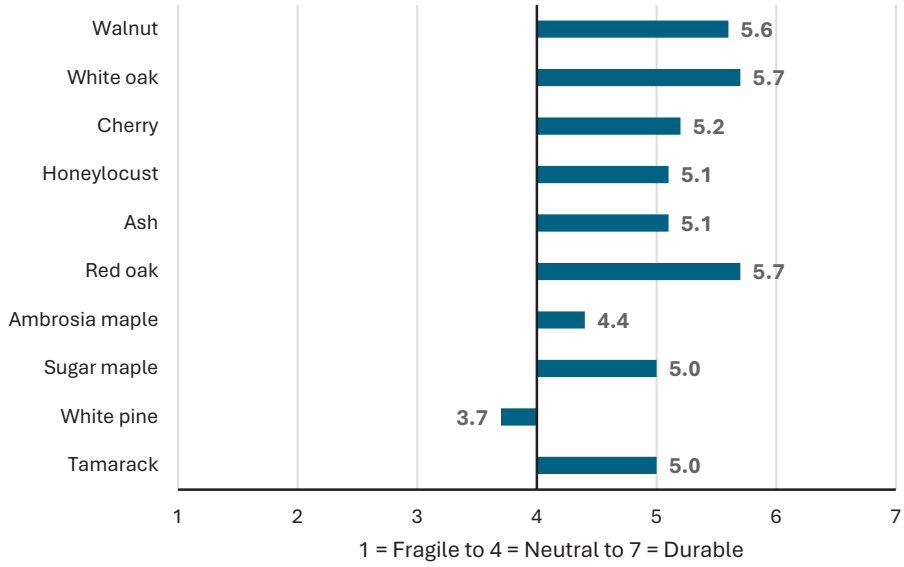

Figure 6.—Mean scores by species for fragile versus durable. All values were statistically different from the scale midpoint of 4.0.

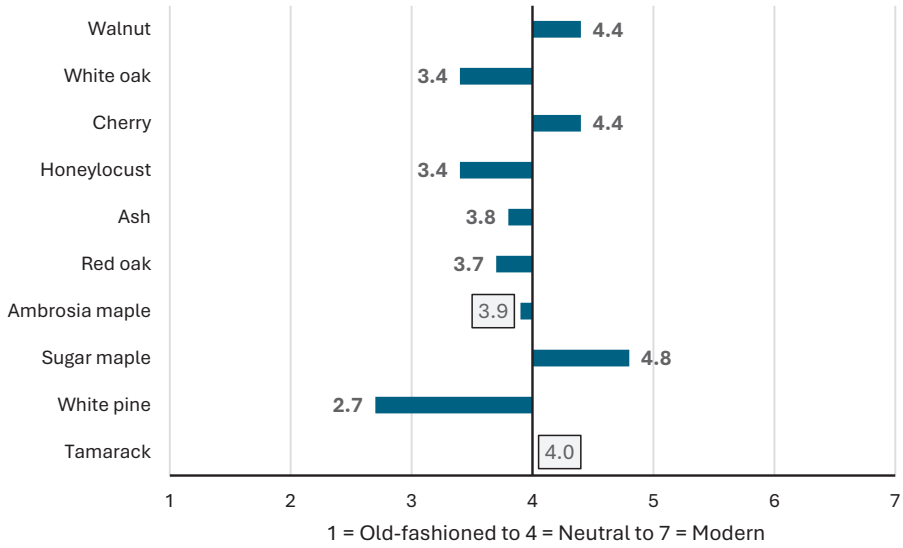

Figure 7.—Mean scores by species for old-fashioned versus modern. Boxed values denote means not statistically different from the scale midpoint of 4.0.

of how white pine often was viewed as unique among the different wood species.

Old-fashioned versus modern

Results were mixed for this semantic attribute, with most species scoring on or near the scale midpoint. However, three species emerged as modern, including walnut, cherry, and sugar maple (Fig. 7). This grouping was interesting given the stark color differences among these species and suggests that something other than color was affecting the perception of modernness. These species are all diffuse or semidiffuse porous; perhaps perception of modern is analogous with subtle grain. White oak, red oak, honeylocust, ash, and white pine were viewed as old-fashioned; most of these species (except white pine) are ring porous and thus show heavier grain. Results such as these, with clear differences among species and not always clear explanations as to why, can be useful when designing furniture or cabinets with a unique look in mind and shows how specific species choices can be leveraged in product design to evoke a certain consumer response.

Sustainable versus non-sustainable

All the study species were viewed as being sustainable (Fig. 8). It was notable that most of the species' averages were quite similar, regardless of whether it was a hardwood or softwood or whether it was an established or underutilized species. This finding suggests that wood generally is considered a sustainable material. This information could be a valuable source of promotion and product communication of wood as a manufacturing material. Most averages ranged from 3.3 to 3.4, with white pine being viewed as the most sustainable with a mean of 2.9.

Stately versus modest

All the hardwood species were viewed as stately or neutral, whereas the softwood species both were viewed as

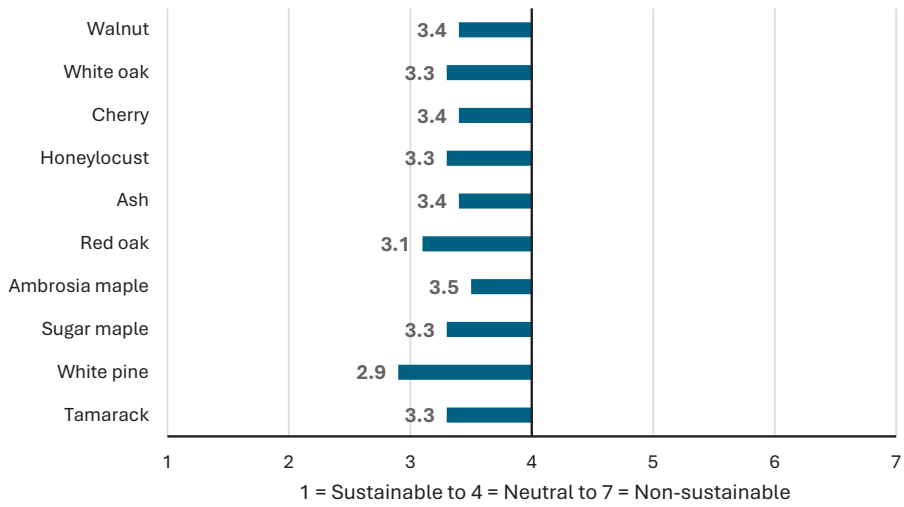

Figure 8.—Mean scores by species for sustainable versus non-sustainable. All values were statistically different from the scale midpoint of 4.0.

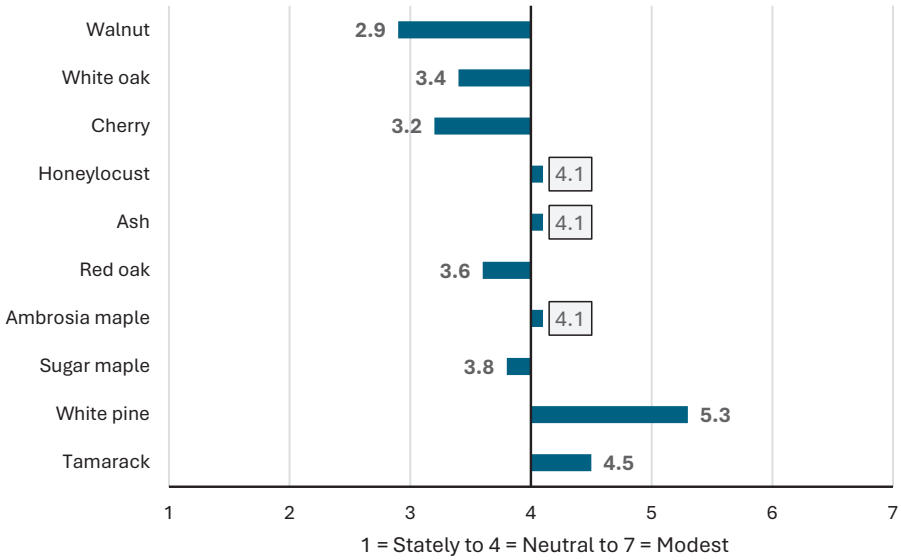

Figure 9.—Mean scores by species for stately versus modest. Boxed values denote means not statistically different from the scale midpoint of 4.0.

modest (Fig. 9). Walnut and cherry were rated as the most stately, whereas white oak and red oak also were rated as stately, but slightly less so. Sugar maple was barely viewed as stately but was statistically different than the scale midpoint. The strongest effect on this attribute was again for white pine, which was viewed as the most modest. It was notable that the underutilized hardwood species were viewed as neutral regarding this attribute, suggesting that established hardwoods were viewed as more stately.

Rustic versus clean

Substantial variability was found among the study species on this semantic differential scale (Fig. 10). White pine and ambrosia maple were viewed as the most rustic, possibly associated with the presence of character in these samples. Honeylocust held potential as a rustic species. Sugar maple was viewed as the most clean, with cherry, red oak, and walnut also falling on the clean side of the scale. Some noteworthy contrasts were found with this attribute, which illustrate that different design objectives could be achieved using a specific wood. The effect of character-marking was apparent because ambrosia maple was rated as somewhat rustic, whereas sugar maple was viewed as somewhat clean. In addition, red oak was rated as clean, and white oak was rated as neutral. This was the only instance where white oak and red oak were viewed as being on different parts of a scale.

Most preferred species

After evaluating the species samples on the noted scales, respondents then were asked to look again and indicate the top three they would most prefer when purchasing furniture in the future. Table 1 provides the results of the rankings.

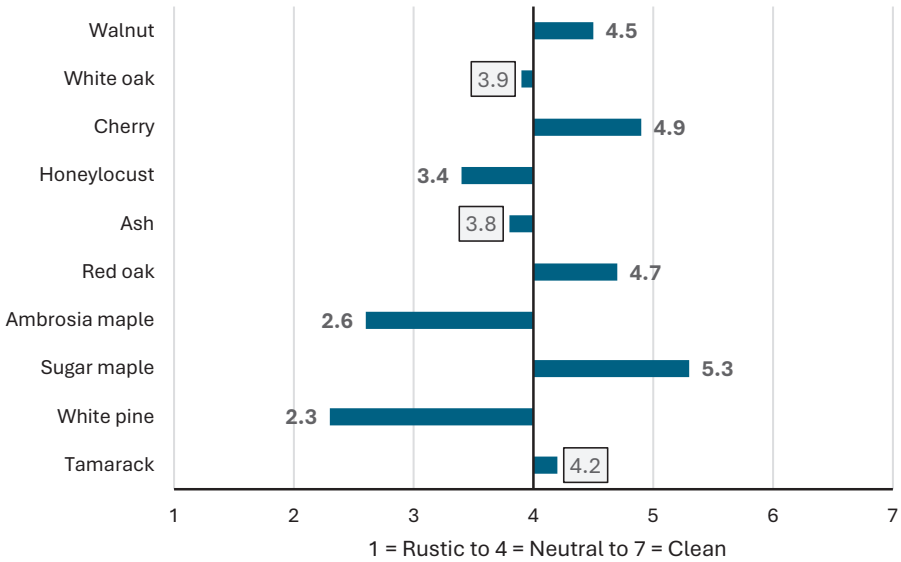

Figure 10.—Mean scores by species for rustic versus clean. Boxed values denote means not statistically different from the scale midpoint of 4.0.

Table 1.—For each species panel, percentage of respondents indicating that the species was in their top 3 for purchasing furniture in the future.

Species	Percentage of time selected in top 3
Walnut	65.0
Cherry	52.9
Honeylocust	33.2
Ambrosia maple	30.2
White oak	28.7
Red oak	28.2
Sugar maple	26.7
Ash	18.3
Tamarack	17.5
Eastern white pine	3.9

Other than walnut and cherry, none of the remaining species were chosen more than 50.0 percent of the time. Several species fell within the 26.7 to 33.2 percent range, including some of the underutilized species (honeylocust, ambrosia maple). Two other species fell just short of 20.0 percent (tamarack, ash). Overall, consumer preferences were somewhat diverse and spread across many different species, which illustrates the diversity of appearance that different woods can provide. It also shows the potential advantages of allowing consumers to choose their own species in customized models.

Summary and Conclusions

Extant literature demonstrates the pivotal role of species selection and consumer perceptions in the success of secondary wood products. Although previous research has laid the groundwork by identifying perceptual differences that could affect product design and development, a continued focus on appearance-based evaluations, including for underutilized species, is critical. By examining the perceptions associated with specific wood species appearances, this study provides guidance for enhancing product design and suggests potential elements of communication strategies that can resonate with consumers, especially in an environment where wood is losing market shares in many segments.

This study shows that hardwood species generally are perceived to possess several favorable attributes, including warmth, formality, durability, and sustainability. These are all potential themes for product communication about hardwoods in the current marketplace. Previous research also has shown that hardwood species were viewed as sustainable and durable in appearance-based consumer evaluations (Bowe and Bumgardner 2004). However, the caveat is that most hardwoods also were perceived as expensive, so the trade-off for the industry is to show how the positive attributes of solid wood are worth the extra cost compared with lower cost substitutes. Other authors have found similar trade-offs associated with solid wood. Stalling and Sinclair (1989), for example, found that solid cedar and pine residential siding scored highest among competing materials (plywood, hardboard, aluminum, and vinyl) for beautiful appearance and high-status image, but solid wood also was perceived to require more maintenance than the alternatives.

The study also shows that there are other emotive attributes for which different species can be used to elicit specific design objectives. This information can be used by manufacturers and designers during product development to choose the best species to portray the desired look they intend. It also can be used to better understand how consumers might choose among specific species when buying products in a customized marketing model. For example, walnut, cherry, or maple might be used for a modern look whereas white oak, red oak, or white pine might be used when an old-fashioned look is the objective. Another finding included adding character-marking to hardwoods (sugar maple vs. ambrosia maple), which could make product designs appear more casual and rustic.

Finally, results show how underutilized species compare with more established species regarding consumer perception, which is a key step in greater value-added use of these species (Bernard et al. 2018). Honeylocust was perceived to be warm, expensive, durable, old-fashioned, sustainable, and rustic. Conversely, tamarack was viewed as being casual, inexpensive, durable, sustainable, modest, and clean. It also was notable that the underutilized species were never the extreme point on any of the scales, suggesting they fit within the parameters of more established species. White pine and walnut tended to be the most extreme values on most of the scales.

Study limitations

This study was based on appearance-based evaluations of different species without knowing whether respondents knew how to correctly identify the species they were evaluating. This is a study limitation because other work has shown that word-based perceptions of species might be different from appearance-based evaluations (Bumgardner and Bowe 2002). If consumers know what they are viewing, it could affect their evaluations. However, it also has been shown that, except for pine (and to a lesser extent oak and walnut), most consumers are not able to correctly identify wood species (Swearingen et al. 1998, Bowe and Bumgardner 2004). Thus any real-world evaluation of wood species likely will be a combination of any preconceived notions of the species (if identification is known) and the actual appearance of the wood. In addition, the sample of respondents was collected at home shows and was not fully representative of the wider population. Finally, the research was based on perceptions and conducted under conditions that did not reflect real purchasing situations; thus, the results cannot be fully applied to the market.

Hardwoods are a fashion-based product with various looks and features, which is one of their greatest advantages in the marketplace. Understanding consumer perceptions of these woods is critical for design and promotional considerations.

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