FACTORS DETERMINING THE SUITABILITY OF TREES AND LOGS FOR THE FACE VENEER INDUSTRY

Daniel L. Cassens[†]

ABSTRACT.—Trees and logs suitable for use as fine face veneer command the absolute highest prices of any fiber products entering the commercial hardwood market. Many factors determine whether a tree or log will be suitable for face veneer and its value. These factors include species, size, geographic and site location, growth rate, and most importantly, uniformity of growth rate, color, concentricity of growth rings and a centered pith. Other factors include absence of mineral; absence of pin knots, especially in oaks and walnut; absence of glass worms in ash; absence of sugar streaks in hard maple; absence of gum spots in cherry; and absence of bird peck in several species. This paper will review these factors and explain their significance to foresters and other land managers.

Hardwood veneer logs command a premium price in comparison to sawlogs and other fiber products of the forest. As an example, Hoover and Gann (2002) report that the prices paid for the highest quality delivered white oak sawlogs in Indiana averaged $634 per thousand board feet, Doyle Scale in 2002. In the same report, several diameter categories and two quality classifications are used to report delivered veneer log prices. For the lower quality classification and the smallest DIB class (13-14 inches) the price for white oak veneer logs was $770 per MBF but increasing to nearly $2940 per MBF for 28 inch DIB logs of the highest quality. Thus, it makes good economic sense to market high quality logs of the appropriate species to the face veneer industry.

In addition to the increased economic value, the use of hardwood timber for veneer has other positive attributes. First processing a log into veneer ranging from 1/32 to 1/50 inch in thickness greatly extends the resource in comparison to cutting standard 4/4 lumber which is somewhat over 1 inch thick. Veneering also allows for the production of matched grain patterns, inlays, and other artistic designs. Also, veneer can now be wrapped around profiles made of reconstituted wood thus reducing the need for long, thick clear moulding blanks. It can also be formed over machined panels of reconstituted products such as for raised panels in cabinet doors.

Veneering is a fascinating industry and successful marketing of veneer quality logs or trees is dependent upon the seller knowing what constitutes veneer quality logs and an understanding of the marketing process. Unfortunately, most landowners and many individuals who market timber are not aware of the basic requirements for trees or logs to be considered “face veneer quality”. Buyers will likely not spend much time visiting tree or log offerings if they detect the seller does not understand the quality levels needed and the material is over represented due to the sellers lack of knowledge. This paper will provide insight into what constitutes veneer log quality.

Methods

The hardwood face veneer industry is composed of only 30 flat slicing operations in eastern North America. Within this industry, there are no scientific studies and very few current publications which have attempted to define log and veneer quality from an appearance aspect. These companies purchase the quality of logs as dictated by their customers, cut them into flitches (log halves or quarters) and slice them into fancy face veneers (figs. 1, 2A, B). Rotary cut veneer or peeling a log around the circumference constitutes a different industry.

Figure 1.—Veneer slicing operation showing the flitch or log half (back and right) being moved up and down against a stationary knife and the individual veneer sheets being stacked in the order that they are sliced.

[†]Professor, Wood Research Lab, Purdue University, 175 Marsteller Street, West Lafayette, IN 47907-2033

A 

B 

Figures 2A, B.—During processing for the domestic market, three sample sheets are taken from each flitch. These sample sheets are shown to potential buyers. Considering B, the sheet on the left is from the outside of this walnut log and the one on the right is from near the heart. Note the absence of defects, excellent color and uniformity, and cathedral patterns in the first two sheets on the left of this high quality flitch. A much lower quality walnut flitch (B) with an irregular color, knots, and excessive sapwood is shown on the right. Each flitch is bar coded as to origin, log buyer, square footage, grade and value.

However, the Department of Forestry and Natural Resources at Purdue University has held numerous workshops on the subject and developed some written materials on log quality (Cassens 1992, Cassens et al. 2001). In these workshops the head log buyer for different companies will show, by using logs, what characteristics are important and the range in quality which can be accepted. Veneer sample sheets are used to demonstrate how the various log characteristics affect the appearance and value of the resulting veneer. Quality standards and species desirability vary between companies and change over time.

Basic Requirements For All Species

There are certain basic requirements that any tree or log intended for the face veneer industry must meet. In addition, there are specific features which are unique to each species. Bark surface irregularities such as overgrown branch stubs, insect damage, old mechanical damage, etc. will likely disqualify the log as a potential veneer log. It is generally assumed that no surface indicators of interior defects are present in a quality veneer tree or log.

Veneer logs or the trees from which the logs are produced should be straight and well rounded. Bow and crook in a log creates an aesthetic problem by causing the cathedral pattern in flat sliced veneer to run in and out of the sheet. Tension wood is frequently present in leaning trees and buckle can occur when the veneer is dried. Logs which are not well rounded or have an off-center pith also result in veneer with less than a desirable grain pattern and are also likely to result in veneer buckle (fig. 3).

Figure 3.—Buckle or irregular surface in walnut veneer. Note the irregular appearance of the tag.

Growth rates and thus ring width need to be uniform across the entire cross section of the log. Thus, thinning to encourage faster growth of potential veneer trees is not desirable. Growth rates of six to nine rings per inch are usually acceptable. Fast growth or a very slow growth rate are not preferred.

Veneer quality trees should be healthy, well formed trees on well-drained timber sites. A past history of grazing and or fire will reduce the quality and value of any potential veneer tree.

Most hardwood species grow over a wide geographic range. As such, climatic conditions, soil types, elevations, insect and disease potential, and other factors vary. Within the geographic range of each species there are certain specific areas where buyers feel the highest quality trees come from. Buyers will indicate that high quality trees can come from other regions as well but the probability of finding a superior tree is much reduced.

Cherry (*Prunus serotina* Ehrh.*)* is currently one of the most valuable hardwood veneer species and an excellent example of the importance of geographic location. Figure 4 shows two 19 inch DIB by 10 foot logs each containing 141 board feet Doyle Scale. The log on the left is from Indiana and it is valued at about $280 while the one on the right is from Pennsylvania and it is valued at about $1200. The Indiana log has irregular, darker reddish color and numerous gum spots. The Pennsylvania log has a lighter pink color and is much less prone to gum spots. On the other hand, walnut (*Juglans nigra L.*) from Indiana and Iowa would likely command a premium over that from other states and hard maple (*Acer saccharum* Marsh.) from Michigan and the Northeast would be preferred, as compared to that from other locations.

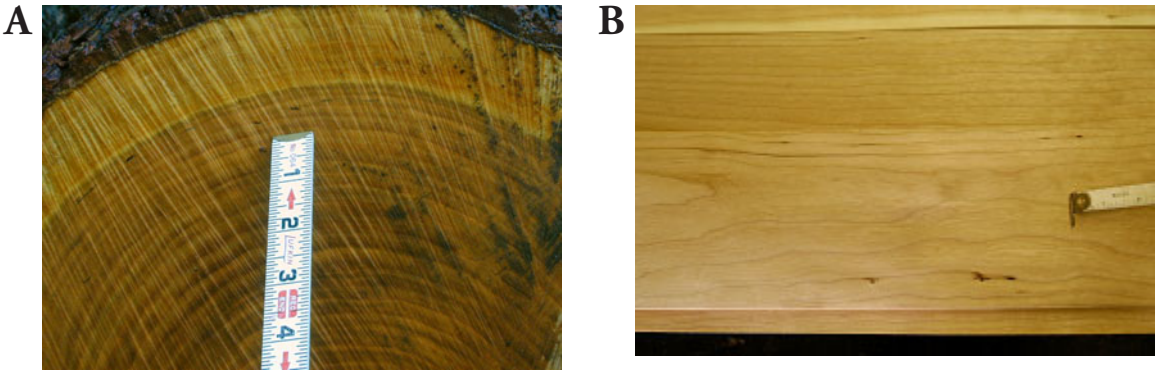
Figure 4.—Geographic origin can be very important in determining veneer log value. The cherry log on the left is valued at $280 while the one on the right is valued at $1200. The diameter and length is the same for each.

Cherry

Gum (figs. 5A, B) is probably the most serious defect affecting veneer quality in cherry. In addition to small spots, gum can be found in large patches, probably as a result of wounding, or even in a ring completely circling a portion of the stem. The presence of gum cannot be detected in standing trees unless a surface residue happens to be present. Buyers prefer to purchase cherry timber in those regions of the country where gum spots are least likely to be found. These regions include the higher elevations in Pennsylvania and parts of New York and West Virginia. Cherry grown in other parts of the country almost always has some gum spots present.

Most gum spots are caused by at least two different groups of insects. The most common insect is the peach bark beetle (Rexrode, 1981). These beetles occur throughout the geographic range of cherry and sometimes actually kill relatively large trees. The beetle can be found in the gum which is exuded from the trees. The beetles attack the cambium layer, and the gum is formed in response to the insect. Unfortunately, it appears that peach bark beetles may build up in large numbers in tree tops after a timber harvest. The beetles then emerge and attack the residual crop trees, causing permanent gum spots in the main tree bole. Therefore, it would appear that cherry veneer which is relatively free of gum spots from peach bark beetles would come from undisturbed stands which also have had little natural mortality or damage.

Cambium miners (Rexrode and Baumgras, 1980) can also cause gum spots in cherry. By carving its galleries, the cambium miner destroys a portion of the cambium, which later becomes covered over by healthy cambium growth and wood. These galleries consist of damaged parenchyma cells and insect feces. The cell damage can, but does not always, result in the production of gum. The parenchyma flecks or damaged parenchyma cells are seldom a defect in themselves. Parenchyma cells are just one of several different cell types which make up the wood of hardwood trees. These cells are generally used for food storage and are relatively thin-walled compared to wood fibers.



Figures 5A, B.—The small dark spots on the end of this cherry log are gum spots (A). They disfigure the otherwise clear veneer shown (B).

"Tear drops" or an irregular bump in the growth rings (fig. 6) can also be found in the ends of cut cherry logs. These tear drops cause a dimple in the veneer and are objectionable.

A light reddish brown heartwood color is preferred in cherry. A dark red color, variable color, or a greenish cast which can develop at the heartwood sapwood interface and wide sapwood is objectionable.

Figure 6.—Cherry log showing irregularity in the concentricity of the growth rings or "Tear Drop" which causes a dimple effect in the veneer sheet.

Walnut

Black walnut (*Juglars nigra L.*) was the premier domestic North American species since the beginning of the sliced veneer industry. Due to increased costs, over cutting, and consumer preference its popularity declined in the 1980's. Now, it is once again in good demand and the availability of logs is also good.

Wood color as well as uniformity of color in walnut is an important factor. The best colored walnut when first cut is light greenish or mint color. As the wood is exposed to the air, it turns a gray or mousy brown color (fig. 2A), which is considered ideal. Unfortunately, the color can vary or it can lack uniformity (fig. 2B). Muddy walnut, that which is dark or splotchy, is objectionable. The color of walnut can also be affected by manufacturing variables such as cooking schedules and processing time before drying.

Small amounts of figure, sometimes called flash are also not desirable (fig. 7). Bird peck, also called worm by the veneer industry, is an important defect in walnut (fig. 8). Yellow-bellied sapsuckers probably cause most of the bird peck in walnut. It is generally believed that the bird pecks a hole to cause the flow of sap. Insects are attracted to the sap, and the bird then feeds on them. A small hole plus stain or flagging can result in the veneer.

Figure 7.—Figure or flash in walnut veneer. Small amounts of figure as shown here are usually not desirable. A highly figured flitch, on the other hand, commands a premium price.

Pin knots (fig. 9A, B, C) like bird peck can be hard to recognize in standing walnut trees, especially when only a few are present. These defects are the result of suppressed dormant buds which persist for many years as a bud trace or pin knot. As the name implies, the buds may not actually break through the bark, so in some instances they cannot be easily detected. However, sometimes, due to a stimulus such as thinning and light, the bud may sprout. The sprout may develop into a small limb that often dies, but normally the bud trace continues to form. Pin knots are best observed on the ends of the log after the tree is cut or where the bark has peeled loose and they appear as sharp spikes. On flat-sliced veneer, they appear as pin knots, but on quartered surfaces they appear as a streak or "spike" across the sheet of veneer.

Growth rate is important in walnut. The industry uses the word "texture" to define growth rate. Soft texture refers to a slow growth rate while hard texture refers to a fast growth rate. Many buyers will find 8 to 9 rings per inch of diameter the most desirable.

Fast growth trees also tend to have a wide sapwood zone (fig. 10). The sapwood is the light colored wood to the outside of the darker heartwood. Sapwood is usually discarded in high quality walnut veneer. Deeply furrowed bark which is not patchy tends to be faster growth and have a wide ring of sapwood. Figure 11A, B shows the bark on fast growth and slow growth trees.

Figure 8.—Excessive bird peck or "worm" in black walnut and irregular color throughout the heartwood region.

A B C

Figures 9A, B, C.—Pin knot in black walnut. Note the "spike" where it penetrates the bark (A) and the light radial streak (B) an finally the pin knot in veneer (C).

Figure 10.—Fast growth walnut trees tend to have a wide sapwood (left) while slow growth trees tend to have a narrow sapwood (right)

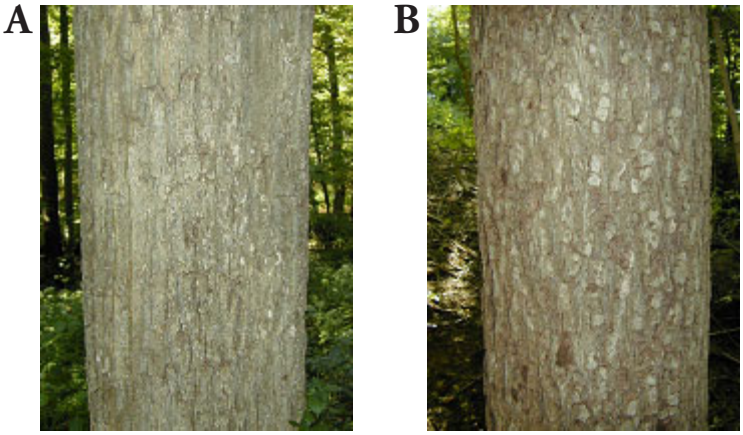


Figure 11.—Bark of fast growth (A) and slow growth (B) walnut trees.

White Oak

White oak is another very important veneer species, particularly in the export market.

True white oak (*Quercus alba L.*), especially trees with large patches of flaky bark in the upper portions or "forked leaf" white oak, are the most desirable in the white oak group. Chinkapin oak (*Quercus muchlenbergii Engelm.*) sometimes is used, but the resulting veneer has a greenish to brownish cast. Bur oak (*Quercus macrocarpa Michx.*) is also used, but careful selection is required to avoid its more common dark brown color and possible "scalloped" appearance of the growth rings which can be seen on the ends of the logs. The scallops result in shiny spots on the veneer sheets.

Color in white oak, like all veneer species, is critical. Current markets prefer a very light, uniform-colored white oak. Contrast in color and dark colors are objectionable (fig. 12A, B). Obviously, color cannot be judged in standing trees. Buyers do, however, develop preferences for certain geographical areas and site

Figures 12A, B.—Note the unique light color and centered uniform cathedral of the white oak flitch (A) as compared to the coarse, irregular flitch (B).

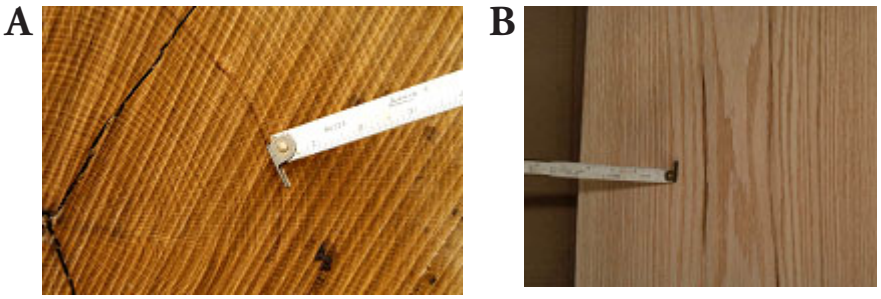


Figure 13A, B.—Mineral stain following a growth ring on the end of a white oak log (A) and appearance of mineral in white oak veneer (B).

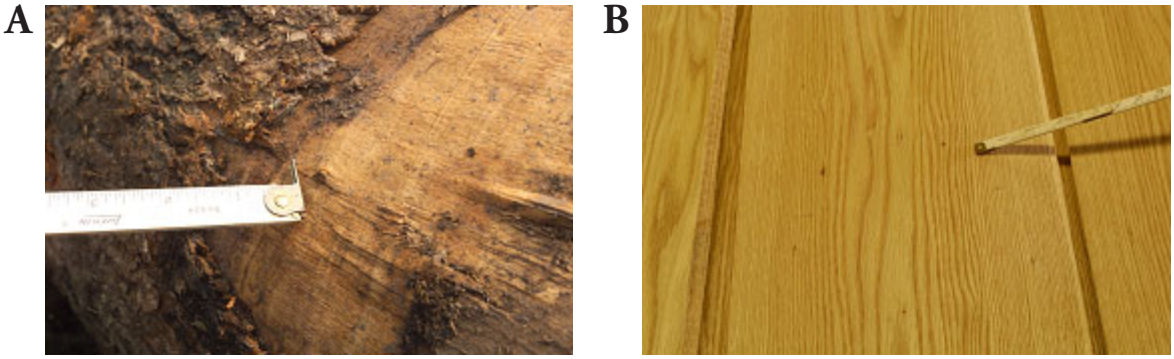


Figure 14A, B.—Pin knots in a white oak log (A) and in the veneer (B).

characteristics because their past cutting experience has taught them that those areas produce the desired color and quality of veneer. Also, very old and slow-growth white oak trees tend to be pink in the center and brown to the outside. Mineral streaks are also a common defect (figs. 13A, B)

Epicormic branching or sprouting from latent buds is a common defect in white oak (figs. 14A, B). Several buds may form a cluster. The resulting veneer will have a small pin knot or cluster of pin knots.

Stump worms and the surrounding dark flagging or mineral stain is associated with white oak grown in areas which are poorly drained or have been pastured. This defect is generally concentrated in the bottom two feet of the butt log, and it is often impossible to detect until cutting occurs.

A number of different species of borers can affect white oak (Solomon, 1980). White oak borers attack trees less than about 8 inches in diameter (fig. 15). Thus, they are generally not detectable in veneer-sized trees, nor do they damage the outer more valuable portion of the tree. Other borer species also attack white oak, but normally the damage is restricted to declining trees. Bore damage is difficult to see in standing trees. Consequently, when it is found, buyers will assume that more damage is present than what can be seen and severely degrade the tree.

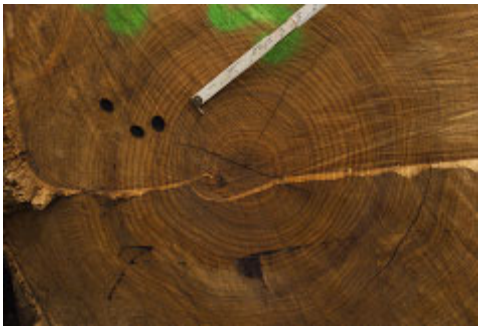


Figure 15.—Bore damage in the butt log of white oak. This log also exhibits slow and fast growth rate, ring shake, and very poor color.

Finally, some large white oak trees will have a "bulge" (fig. 16) near the base of the tree that resembles an old time coke bottle. This is not considered a defect for veneer logs.

Figure 16.—Bulges at the base of some large white oak, also called "coke bottle effect" are not considered defects.

Red Oak

Red oak (*Quercus rubra L.*) is also commonly veneered. Color and mineral stain are two of the most common problems associated with red oak veneer, in addition to obvious defects such as overgrown limbs, borers, wounds, etc. Again, the premium material demanded by the market is a very light-colored veneer. Mineral stain is common in red oak and may take the form of isolated spots or follow along the annual rings (fig. 17). It is objectionable in most finished products particularly if a natural finish is being applied. In addition, the wood often tends to split or break apart when mineral stain is present.

Figure 17.—Mineral stain along an annual ring in red oak.

Mineral-free, light-colored red oak is more commonly found in certain regions of the country such as lower New York, Pennsylvania, northern Indiana, and southern Michigan. Therefore, it would seem that site or soil might also be a factor. Regardless of the cause, the presence of mineral in a particular area will result in veneer log buyers offering reduced prices for standing trees of potential veneer quality.

There are three major types of borers which attack red oak. According to Donley and Terry (1977) these are red oak borers *Enaphalodes rufus* (Haldeman), carpenter worm *Prionoxystos robiniae* (Peck) and *P. macmurtrci* (Guerin-Meneville), and the oak timber worm *Arrhemodes minutus* (Drury). Borer holes can range from 1/100 to 1-1/2 inches in diameter. Smaller borer damage is nearly impossible to detect. Larger borer holes which have healed over can be seen by experienced people and if "sap wet" are easily detected. Carpenter ants often enter trees through large borer holes and keep the wood open and further damage the tree. Old trees or stressed trees are more prone to damage.

Since most borer damage is hard to detect, buyers will be very cautious if any borer holes are found.

Crossbars or oblong horizontal bumps on a red oak log may indicate a defect that goes all of the way to the heart. However, buyers have also indicated that in some regions no defect results.

Sugar Maple

Sugar or hard maple (*Acer saccharum marsh.*) is prized for its white sapwood (fig. 18). The whitest maple is reported from Michigan and the Northeast. However, maple from other regions is also veneered. The color of maple

Figure 18.—High quality hard maple log from Vermont. Note the near absence of any heartwood.

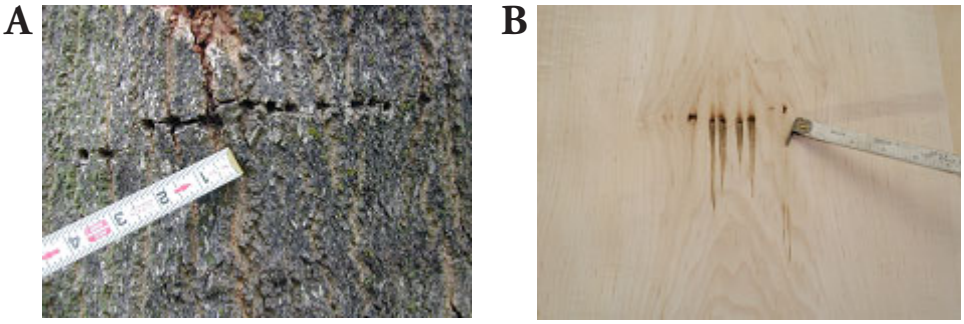
sapwood is also affected by the season of the year and length of log storage as well as processing variables. From a color perspective, it is a very difficult wood to process.

The heartwood in sugar maple is a brown color and is considered "false" heartwood (Shigo and Larson, 1969). False heartwood is normally caused by a wound or opening in the bark of the tree such as a broken or dead limb stub.

Figure 19.—Mineral stain in hard maple.

The extent and intensity of false heartwood depends on the vigor of the tree, the severity of the wound, and the time that the wound is open. Discoloration continues to advance as long as the wound is open and is often irregularly formed throughout the stem. If the wound heals, the entire cylinder of wood present when the tree was wounded may not become discolored. The cambium continues to form new growth rings that are free of discoloration. Thus, vigorous fast growing trees with few branch stubs or wounds will produce the widest sapwood.

Mineral streaks ranging from 1 inch to several feet long are a common defect in maple and result from wounds such as broken or dead branches, bird peck, and mechanical damage (figs. 19, 20A, B). After a wound occurs, the living cells in the wood surrounding the injury react by forming materials that inhibit the infection. These materials are deposited in the cells and may appear green initially but later turn different shades of brown. High percentages of mineral, especially potassium, are found in the cells. Some of the wood is very hard and difficult to machine and cutting tools can be damaged.



Figures 20A, B.—Bird peck on a hard maple tree (A) and resulting defect in the veneer (B).

Sugar streaks or flecks, narrow brown-colored marks about 1/4 to 1 inch long, can also occur in sugar maple (fig. 21) The streaks are caused by cambium miners. Cambium miners attack and disrupt the cambium or growth layer of the tree (Anderson, 1960, Graham and Knight, 1965 and Hardwood Research Council, 1987) The tree plugs the gap in response, but the grain pattern has been disrupted. Cambium miners may bore from the top of the tree all of the way to the rail soil before they exit.

Figure 21.—Sugar streaks or flecks in hard maple

White Ash

White ash (*Fraxinus americana L.*) is sliced into veneer and it is also the white sapwood of this species that is preferred. Like hard maple, white ash has a false brown heartwood. With this species it is not uncommon for the heartwood to be very small at the butt of the tree but then expand to a significant portion of the tree diameter further up the stem. Unfortunately, the extent of objectionable heartwood in the top of the butt log is not known until after it is crosscut often to a shorter length veneer log as compared to a longer sawlog.

Glass worms, also called “turkey tracks” or “worm tracks”, occur in white ash. This zig zag pattern of light-colored wood is caused by the cambium miner. In some cases the wood associated with the glass worm damage turns nearly black. The characteristic is objectionable because it will not accept stain and finish like normal ash wood.

Other Species

There are several other central hardwood species all of which are processed into veneer at various times. In terms of volume and or value, these are relatively minor species and thus not included in this limited discussion.

Acknowledgments

The following companies have been most generous in sharing their knowledge of log quality with the author and many other members of the forestry, sawmilling, and logging industry as well as with landowners.

Coldwater Veneer, Inc., 548 Race Street, Coldwater, MI 49036-2122; 517-278-5676

G. R. Wood, Inc., 260 Park Drive, Mooresville, IN 46158; 317-831-8060;
grwood@iquest.net

Thiesing Veneer Company, 300 Park Drive, Mooresville, IN 46158; 317-831-4040;
thiesing@indy.net

David R. Webb Company, Inc., Box 8, Edinburgh, IN 46124; 812-526-2601;
drw@davidrwebb.com
www.davidrwebb.com

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