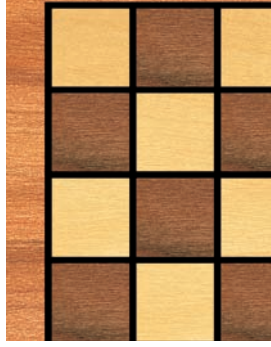


Guide to American Hardwoods

Products



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Introduction

The American hardwood industry, which dates back to the first European settlers, has a wealth of experience in processing the native hardwoods of North America. The eastern United States, as we now know them, were heavily forested from Maine in the North to the Gulf of Mexico in the South, and westwards across to the Mississippi valley. The Appalachian mountain range, which runs through the centre of the eastern states, provides a wide variety of growing sites at different altitudes, which in turn gives rise to the varied characteristics of many species. In fact, the USA has more temperate hardwood species than any other region of the world. Technical information about the main commercially available American hardwoods is contained in a separate American Hardwood Export Council (AHEC) publication 'Species'.

From the late 18th century until the early 20th century, the eastern forests were heavily cut, first for land clearance for agriculture and housing, and later for mining, railroads and other industrial uses. The last 70 years of improved forest management and state and federal regulations, together with greater silvicultural understanding and public desire to conserve forests, have resulted in a dramatic recovery in American hardwood resources. For example, according to data from the US Forest Service, the net growing stock of hardwood increased by 82% between 1952 and 1992. As a result of this regeneration 43% (equivalent to 126 million hectares) of the designated timber land in the forests of the USA is now hardwood.

Based on this sustainable resource the domestic market in the USA has been self sufficient in hardwoods, importing only a few species such as aspen from Canada for low cost products, and tropical hardwoods such as teak and mahogany for specialist purposes. This is

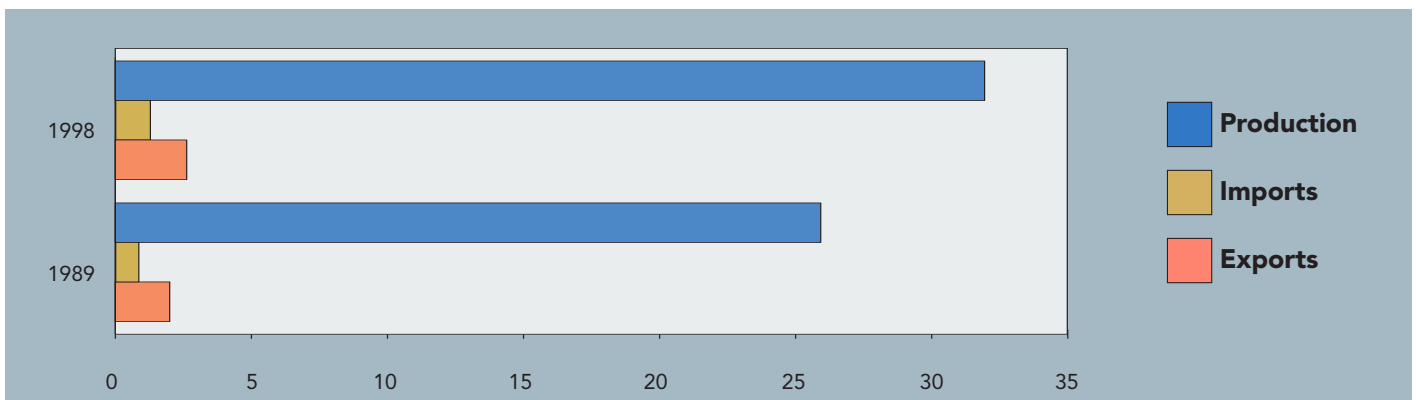
illustrated by the bar chart below which shows production, exports and imports for sawn hardwood lumber in 1989 and 1998. This chart also shows that in volume terms the vast majority of hardwood lumber produced is consumed in the USA, although the export proportion contains the higher value grades.

A massive hardwood processing capacity has been built in the USA to supply this domestic and growing export demand. Today the USA is the largest producer of sawn hardwood in the world. Sawmills, dry kilns, moulding and dimension plants, veneer slicing and plywood factories, flooring plants and concentration yards for distribution of hardwood material, exist across all eastern states. There is also a small but significant processing capacity in the Pacific Northwest, based on a few local species, the most important of which is western red alder.

This publication provides information about the American hardwood processing industry, its products and their availability, according to species and region. Further information can be obtained from AHEC (see page 20 for contact details).

AHEC is the leading international trade association for the American hardwood industry, representing the committed exporters among American hardwood companies and all the major American hardwood product trade associations. AHEC's member companies service the growing global demand for American hardwood and represent the full range of American hardwood products including: lumber, veneer, plywood, flooring, moulding and dimension materials. AHEC can provide the hardwood trade – importers, specifiers, and users – with promotional assistance, technical information and sources of supply for American hardwoods.

American hardwood sawn lumber – 1989/1998 ('000,000 cubic metres)



Source ECE/FAO TIMBER database

American hardwood lumber

This section covers information on the sawn hardwood lumber industry – the production process, product availability by species, export grades and details of the relevant hardwood product associations in the USA.

American hardwood lumber refers to rough sawn lumber boards, normally square edged and end trimmed, air dried or kiln dried, produced to nominal thickness by individual species.

HARDWOOD LUMBER INDUSTRY

Sawn lumber is the primary product of the American hardwood industry, which is fragmented and comprises many thousands of sawmills spread throughout the eastern USA. A small percentage is also produced in the Pacific Northwest. These processing units vary from very small 'circular saw' forest operations through to larger integrated wood processing factories which harness the latest technologies. Most of the industry is privately owned, comprising small to medium sized companies.

The USA is the largest sawn hardwood producer in the world with a current production of around 30-32 million m³ per annum. The American domestic market consumes around 90%, with about 10% exported to more than 50 countries world-wide. The industry has always been committed to export, and in recent years the number of exporters in all regions has increased significantly. This has helped improve the export availability of a wider range of commercial species.

PRODUCTION

The approach to the primary conversion of hardwood logs varies to some extent, both by sawmill and by species. The industry works on principles designed to achieve maximum lumber yields, by cutting boards from around the log to optimise volume. As export demand grows, production techniques are being used to further improve yields of higher grades and to offer special cuts, such as rift and quarter sawn.

American hardwoods are produced in non-metric measure – lengths in feet, widths in inches, and thickness expressed in quarters of an inch. Therefore 1 inch (1") is expressed as 'four quarter', written as 4/4".

Thickness

The standard thicknesses produced are:

| | |
|--------------|--|
| 3/4" | (³ / ₄ " = 19.0mm) |
| 4/4" | (1" = 25.4mm) |
| 5/4" | (1 ¹ / ₄ " = 31.8mm) |
| 6/4" | (1 ¹ / ₂ " = 38.1mm) |
| 8/4" | (2" = 50.8mm) |
| 10/4" | (2 ¹ / ₂ " = 63.5mm) |
| 12/4" | (3" = 76.2mm) |
| 16/4" | (4" = 101.6mm) |

Width

Lumber is produced in random widths (measured to the nearest inch) usually 3" (76.2mm) and wider. Width specification will vary from producer to producer, by geographic region and by species, although ultimately it is the size of the tree that will be the determining factor. Generally, widths over 12" (304.8mm) are rare. Some producers do cut fixed widths as special requirements, but this tends to be part of further processing (described on pages 14-15 in the dimension and components section).





Length

Lumber is produced in random lengths (measured to the next lowest foot) usually 4' (1.22m) and longer up to a maximum of 16' (4.88m), depending on the grade. As a general rule lengths over 12' (3.66m) are relatively rare. Some producers offer fixed lengths although availability tends to be limited.

Measurement

Board feet are the units of measure used by the American hardwood lumber industry and are referred to as board measure. A board foot (bf) is 1' (0.30m) long, 1' wide and 4/4" (25.4mm) thick. Lumber prices are usually expressed in terms of cost per thousand board feet (mbf). 1,000 bf is equal to 2.36m³ (for 4/4" and thicker). Lumber cut to 3/4" (19mm), or planed below 4/4" is usually charged as 4/4" for weight purposes.

Drying/Kilning

The industry has extensive experience of drying hardwood lumber. In fact much of the research over the last 30 years related to drying temperate hardwood has emanated from the United States. Drying times will vary enormously depending on thickness and species. For example, 4/4" (25.4mm) tulipwood can be dried from green in 7-10 days, whereas 12/4" (76.2mm) white oak may take up to 8 months to kiln following an extensive period of air drying.

Economics dictate that in the majority of cases domestic and export lumber is kilned together. Therefore, export lumber will usually be dried to the domestic standard moisture content (MC) of 6-8%. Thicker material in some species may be up to 10-12% MC. Refractory drying species such as the oaks require air drying or controlled drying in pre-dryers prior to kilning to minimise degrade.

Other species such as aspen, cottonwood and hackberry are susceptible to blue staining and therefore require prompt kilning of fresh sawn material. Sticker stain or shadow can also be a problem with some species, notably hard maple. The American industry makes great efforts to minimise such problems where they are known to exist, by employing techniques such as conditioning schedules and profiled stickers.

Grading

Although preliminary grading is carried out on green lumber for the purposes of monitoring yield and inventory, the final grade of each board is usually determined after drying. All sawn lumber is inspected and graded to the rules of the National Hardwood Lumber Association (NHLA), details of which are published in their Rule Book and summarised together with visual examples in the AHEC publication 'An Illustrated Guide to Hardwood Lumber Grades'.

These rules were first established by the lumber industry over 100 years ago to service the American domestic furniture trade, and are nationally and internationally accepted. They are used as a basis for export, and are widely acknowledged as the most consistent grading standards for temperate hardwoods anywhere in the world. This is in contrast to Europe where many national and regional approaches require a greater element of buyer inspection.

The NHLA rules consist of lumber grades which are determined by visual inspection based on yields of clear (free of defect) cutting areas. They are provable by mathematical calculation. The official grades set out minimum requirements, however industry interpretation does vary on upper limits. Many individual exporters have established modified rules for specific export markets. For example, Comsels grade, and the allowance of a small percentage of 4" (101.6mm) and 5" (127mm) widths and 6' (1.83m) and 7' (2.13m) lengths in FAS "prime" parcels. In the United States special grading rules were developed many years ago for walnut and butternut, full details of which are included in the rules for the measurement and inspection of hardwood available from the NHLA.

Export packaging

Export lumber is packaged to thickness and generally sorted to length where possible, although in reality there is often more than one length in a bundle. For example, a bundle of 10' (3.05m) lengths may well contain a percentage of 9' (2.74m) lengths.

Presentation is an important marketing factor and most export material is trimmed both ends, end waxed or painted to protect against splitting, and marked with the exporter's brand or logo.



American hardwood lumber

EXPORT AVAILABILITY

The availability of all American hardwood lumber for export is influenced by domestic availability and by the export demand in individual countries for certain species.

The market for hardwood in the United States is dominated by the thinner sizes. Therefore, for most species, 4/4" (25.4mm) represents a significant percentage of production. In cases where thicker material is required, such as joinery applications, it is usual to laminate thinner sections, in contrast to the approach of many other countries. This often leads to a more stable and cost effective product, and does explain why thicker material in some species is more difficult to source.

One of the reasons that the USA is able to offer significant volumes of higher grade material for export is that there is a strong and sustained domestic demand that is able to utilise the lower grades. Therefore, some species that are limited in their domestic use may be available for export only in mixed parcels of higher and lower grades.

Availability of logs will of course have the strongest influence on what lumber is produced by the industry. For example, red oak is the most widely used hardwood in the USA because it is the most widely grown in the forest. Whereas species such as sassafras and elm are limited in the forest, which affects lumber availability.

The table below indicates lumber availability for the main commercial American hardwoods. This information is cross-referenced with the AHEC publication 'Species'.

Other available species

There are a number of additional species that are commercially available in small volumes but are generally considered as rare. They include: black locust, butternut (white walnut), persimmon and tupelo.

There are also a number of important commercial coniferous softwoods that grow in the hardwood forests of the eastern United States, which are: cypress (*Taxodium distichum*), eastern red cedar (*Juniperus virginiana*), eastern white pine (*Pinus strobus*) and the southern yellow pines (*Pinus* spp.).

| SPECIES | EXPORT AVAILABILITY – LUMBER |
|--------------|---|
| Alder | Readily available in some markets but limited in others |
| Ash | Good availability, often sold by region – Northern or Southern |
| Aspen | Limited due to low demand |
| Basswood | Volumes can be limited but available in a full range of specifications |
| Beech | Very limited due to low demand and wide availability of European beech |
| Yellow birch | Limited due to low demand, but increasing |
| Cherry | Widely available in a full range of specifications and grades |
| Cottonwood | Maybe limited in some markets where demand is low |
| Elm | Limited |
| Gum | Limited in some markets due to low demand. Increasingly popular |
| Hackberry | Limited due to low demand and concerns about internal staining |
| Hickory | Limited due to low demand. Available from specialist importers in thin stock only |
| Pecan | Limited due to low demand. Available from specialist importers in thin stock only |
| Hard maple | Widely available. Higher grades available selected for white colour (sapwood) |
| Soft maple | Availability is improving as demand increases |
| Red oak | Good availability. Often sold by region – Southern or Northern |
| White oak | Very widely available all grades and specifications. Most important hardwood export |
| Sassafras | Extremely limited |
| Sycamore | Limited due to sporadic demand |
| Tulipwood | Widely available in a full range of specifications |
| Walnut | Readily available – growing stocks increasing |
| Willow | Limited due to low demand |



EXPORT DISTRIBUTION

American hardwood lumber exporters distribute their product in export markets, generally in accordance with the timber trade structure established there.

AMERICAN INDUSTRY REPRESENTATION

All the major hardwood trade associations support AHEC, and collectively they represent the great majority of the industry. Some of these lumber associations are national and others are regional representing a specific geographical area. The associations that provide technical support and work with AHEC to promote export of American hardwood lumber are listed below. The contact details for each organisation can be found at the back of this publication under technical contacts.

National

American Walnut Manufacturers Association (AWMA)

Information on the manufacture of walnut products.

Hardwood Manufacturers Association (HMA)

Technical hardwood promotion in the USA.

National Hardwood Lumber Association (NHLA)

Administration of the national lumber grading rules.

Regional

Appalachian Hardwood Manufacturers, Inc (AHMI)

Lake States Lumber Association (LSLA)

Northeastern Loggers Association (NELA)

Southeastern Lumber Manufacturers Association (SLMA)

Virginia Forest Products Association



American hardwood veneer

This section provides information on the American hardwood veneer industry, the production process, species availability, export grades and details of the relevant product association in the USA.

Veneer is a thin layer of wood of uniform thickness produced by peeling logs or slicing flitches.

HARDWOOD VENEER INDUSTRY

The veneer industry has a long tradition of technical advance, which today enables it to produce high quality, sliced and rotary cut veneer for furniture, panelling, doors and panel products. There are approximately 35 veneer slicing facilities in the USA, operating nearly 100 slicers in total and 32 half-round slicers. Many lengthwise slicers and approximately 50 rotary lathes are operated by 35 additional companies. Total sliced production is nearly 669 million square metres annually, with exports representing 354 million square metres – 53% of total production.

PRODUCTION

Different methods of veneer manufacture

Different slicing methods are used to produce different visual effects. Logs of a given species, cut by different methods will produce a variety of appearances.

Rotary cut:

In rotary cutting, the log is mounted centrally in the lathe and turned against a knife, as if unwinding a roll of paper. A multi-patterned grain marking is produced with this method. Rotary cut veneer can be sufficiently wide to provide full sheet (one piece) faces.

Flat slicing:

Flat cut, flat sliced, crown cut or plain sliced are synonymous terms used in different countries. The half log (flitch) is mounted with the heart side away from the knife against the flitch table of the slicer. The slicing is done parallel to a line through the centre of the log. This produces a distinctive "cathedral", or heart figure. The ratio of quartered to crown faces produced by this method naturally runs about 60-40% in favour of crown.

The width of the veneer sheet depends on the size and species of the log. The oaks can produce widths in excess of 410mm, however requirements for specific sized logs should be pre-arranged between buyer and seller. Plain slicing produces the largest width veneer of the slicing methods as a log is cut into two flitches before slicing. The other slicing methods use logs which have been cut into several flitches prior to slicing.

Quarter slicing:

Quarter slicing involves first cutting the log into four pieces. Then the manufacturer places the quarter log (flitch) on the flitch table so that the growth rings of the log strike the knife at approximately right angles, producing a series of stripes, straight in some species, varied in others. The width of veneer produced through quarter slicing is less than plain slicing, with an average less than 200mm – depending on log size. The "flake" appearance in oak is produced by the quarter slicing method.





Half-round slicing: Veneer is sliced on an arc roughly parallel to the centre of the log to achieve a flat cut appearance. The “cathedral” pattern can have more rounded tops than the pattern produced by flat slicing.

Rift-cutting: Rift-cut veneer is produced from the various species of oaks. The logs are cut into four pieces. Rift-cut veneer has a straight grained look, which is obtained by periodically changing the cutting angle to stay about 15 degrees off the quartered position to avoid the “flake” figure. The width of veneer produced through rift-cutting is less than plain slicing, with an average less than 200mm – depending on log size.

Lengthwise slicing: A board of flat sawn lumber is passed flat over a stationary knife. As it passes, a sheet of veneer is sliced from the bottom of the board. The width of the veneer and figure produced with this method depends on the width and figure of the sawn lumber and is typically variegated.

Veneer thickness and moisture content

A log or “flitch” can be cut to produce whatever thickness of veneer is required. However, in reality, the American industry has two main production thicknesses, as detailed in the Hardwood Plywood & Veneer Association's “Voluntary Standard for Sliced Decorative Wood Face Veneer – Industry Standard DFV-1 1995”. The thickness for most species in the domestic market is 0.65mm, and 0.55mm for export with the exception of cherry and walnut which is 0.50mm. Any requirement that is more specific than the details in the Standard requires special arrangements between buyer and seller. Special cuts are available; for example, 1.2mm thick rotary veneer is produced in some species for the American market for the production of engineered hardwood flooring.

Freshly sliced or peeled veneers are passed through continuous press dryers on moving belts, the speed of which is varied according to the species and thickness of the veneer. The moisture content standard for export veneer is 12-16%. This allows for the natural drying of veneer that occurs during shipment. Most veneer users allow the veneer to remain in their facilities for a few days before manufacturing. This delay allows for the wood's natural conditioning in that specific environment as equilibrium moisture conditions in the USA and export markets such as Europe tend to vary.

Veneer grading

A specific industry-wide grading system does not exist for veneer: it is not sold as a commodity on the open market, but according to the requirements established by individual customers. Veneer is sold based on personal inspection or a clear understanding of grade between buyer and seller. Length, width, thickness, quantity, and other factors that affect yield and price, form the basis of this buyer-seller understanding.

The length of the log will establish whether the manufacturer will market the veneer for furniture, doors, panelling, or architectural applications. Width will also vary according to the intended end use, with the minimum width of veneer usually 90mm or 100mm.

Door and panel: Top grades used for joinery, such as architectural panels and doors, with a minimum requirement in length for doors of 2.1m and panels of 2.5m. Within a typical panel or door grade there may well be many other sub-grades selected according to colour and grain pattern.

Furniture: For furniture grades, length is not so critical and will typically run from 0.45m to 2.0m. There are fewer restrictions regarding natural characteristics, such as colour and grain pattern.

Falling bundle: The term “falling bundle” refers to a pallet or group of veneer consisting of single or odd bundles. The grade of the veneer in this grouping will likely express a wide variety of colour, character and grain variations.

The final price of hardwood veneer is determined by the natural limitations of what the forest can produce combined with the market demand. In addition, size and grade considerations weigh heavily on the final price. Only a small percentage of logs in a forest produce the top grades of veneer in terms of lengths, widths and natural characteristics. Special handling or shipping requirements and specific requests relating to length, width and/or thickness can also add to the final price.



American hardwood veneer

Preparation and packaging of veneer for export markets

In addition to the difference in thickness, veneer for export is prepared differently from veneer produced for the domestic market. It is "clipped and bundled" or "export prepared". The edges are trimmed on the sides and ends and sheets are tied in bundles. This extra manufacturing process helps improve presentation and assists in defining grades, whereas domestic veneer is left untrimmed.

The number of sheets in a bundle depends on the thickness, with 24 or 32 sheets per bundle standard for most species and thicknesses (0.4mm-0.6mm). The bundles from the flitch are usually kept and sold together, although on occasion they may be separated and regrouped with other flitches for specific customers.

EXPORT AVAILABILITY

In reality most commercial American hardwood species can be sliced or rotary cut to produce veneers. Therefore demand plays an important role in availability. The table below indicates veneer availability for the main commercial American hardwoods. This information is cross-referenced with the AHEC publication "Species".

Other available species

In some species certain logs occasionally produce dramatic grain patterns when specially sliced. Examples of some of these unusual figured veneers include walnut and oak burl, quilted maple and aspen, bird's-eye maple, vavona (redwood burl) and madronna. Availability of these specially figured veneers will be limited as only a relatively small number of logs processed will have the necessary grain pattern.

| SPECIES | EXPORT AVAILABILITY – VENEER |
|--------------|--|
| Alder | Rare |
| Ash | Readily available in a wide range of grades and colour sorts |
| Aspen | Limited availability due to low demand |
| Basswood | Available, but can be limited in some markets due to low demand |
| Beech | Very limited due to low demand and wide availability of European beech |
| Yellow birch | Rare |
| Cherry | Widely available in all grades |
| Cottonwood | Rare |
| Elm | Limited |
| Gum | Available but limited due to low demand |
| Hackberry | Available but limited due to low demand |
| Hickory | Limited due to low demand |
| Pecan | Limited due to low demand |
| Hard maple | Widely available in all grades – bird's-eye figure limited |
| Soft maple | Availability increasing in response to demand |
| Red oak | Widely available in all grades and a range of colour sorts |
| White oak | Widely available in all grades and a range of colour sorts |
| Sassafras | Limited |
| Sycamore | Available but limited in some markets due to low demand |
| Tulipwood | Readily available |
| Walnut | Wide availability in all grades – burl figure limited |
| Willow | Limited |



EXPORT DISTRIBUTION

American hardwood veneer exporters distribute their product in export markets, through specialised importers and distributors. These companies typically hold stock in a wide range of species and grades in order to respond to user demand by inspection.

Significant volumes of hardwood veneers are sold to sheet material manufacturers, who then lay them on a range of substrates, such as medium density fibreboard (MDF) or particleboard. These panel products are then distributed to manufacturers and end users as decorative panels. It is important to note that under American terminology, these products are grouped together and known as hardwood plywood.

AMERICAN INDUSTRY REPRESENTATION

The hardwood veneer industry is now represented by one association, following the merger of the former Fine Hardwood Veneer Association, into the activities of The Hardwood Plywood & Veneer Association. The contact details for each organisation can be found at the back of this publication under technical contacts.

Hardwood Plywood & Veneer Association (HPVA)

The association sponsors industry standards and supports national/international promotion. HPVA provides technical information about hardwood sliced and rotary veneer, hardwood veneer faces, hardwood plywood products, engineered hardwood flooring, and supply of equipment and necessary services to the industry.



American hardwood plywood

This section provides information on the American hardwood plywood industry, the approach to manufacture, guidance on availability for export, and American hardwood industry representation. In the United States the term hardwood plywood is used to describe a composite board with wood veneered faces regardless of the core material. The dominant substrate material in the United States is veneer core. In many other countries worldwide, particleboard and MDF ("engineered" core) are the primary substrates.

HARDWOOD PLYWOOD INDUSTRY

The American domestic hardwood plywood industry should not be confused with the tropical hardwood plywood industry from which the USA imports considerable quantities. The American industry, represented by AHEC, produces hardwood plywood with veneer from native American hardwoods. It is made up of a relatively small number of companies, but most of them are significant in terms of size and turnover. This is mainly due to the process itself, which requires a high level of technology and a sizeable investment in specialised machinery. The industry is widespread in the USA with production plants in the east, west and south. Hardwood plywood is widely used for decorative panelling, cabinets, furniture and many other specialist applications.

PRODUCTION

Hardwood plywood can be made using either rotary or sliced hardwood veneers for the faces and backs. The core material can be a variety of materials including MDF, particleboard, veneers and solid wood. The choice of solid wood core material may be influenced by location. For example, hardwood plywood manufactured in the hardwood forests of the east coast is more likely to have a solid wood core made of tulipwood. This is because it is more cost efficient and more readily available than suitable softwood material. On the west coast, the reverse is true.

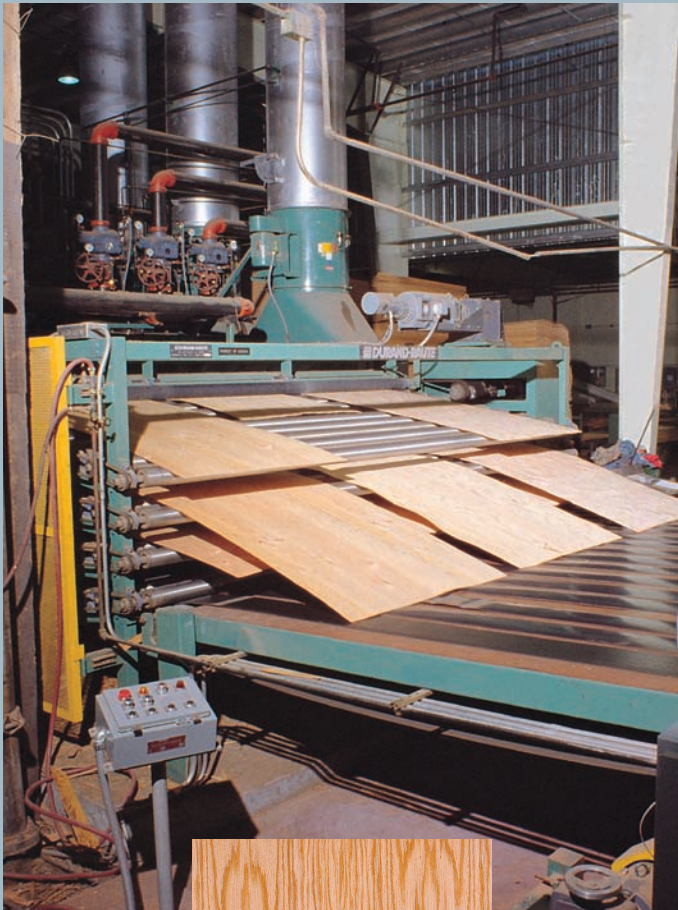
The majority of hardwood plywood is produced for consumption in the American domestic market. Due to the nature of the product, and the ability to choose from a range of face and core materials, hardwood plywood is usually produced to customer requirement. However, the larger producers offer standard products for certain applications, such as the retail DIY market.

As a composite wood product, plywood is flexible in terms of application. Not only is there a wide choice of face material to produce numerous aesthetic affects, but plywood can be manufactured to be water resistant or to contain a fire retardant, thus enhancing its performance for particular applications.

Hardwood plywood can be made in many sizes and thicknesses, depending on its intended use, but the standard panel is 4' wide by 8' long (1219mm x 2438mm). Other common sizes are 4' wide by 6' long (1219mm x 1829mm) and 4' wide by 10' long (1219mm x 3048mm). Plywood is also available cut or made to special sizes, according individual buyers' specific requirements.

Grading

The plywood industry has developed voluntary industry grades and standards for hardwood plywood in conjunction with the American National Standards Institute (ANSI). This standard – "American National Standard for Hardwood and Decorative Plywood ANSI/HPVA HP-1-1994", published and administered by the Hardwood Plywood & Veneer Association (HPVA), describes natural and other characteristics allowed in each veneer or ply. It should be noted that sliced hardwood veneer is only governed by these standard grades when it is a part of a plywood product.





EXPORT AVAILABILITY

The vast majority of hardwood plywood exported from the United States is produced to customer order. The availability of face veneers depends on the availability and suitability of the various US hardwood species. For information on the availability of sliced veneers please refer to the table on page 8 of this publication. The availability of hardwood species as rotary veneer differs from that of sliced veneer. The main rotary species in terms of volume production are red oak, white oak, maple and birch. Most species can be peeled although it is not very practical to peel hard species like hickory. The higher value species, such as cherry and walnut, where the growing resource is limited, are also hardly ever peeled. Logs suitable for high quality veneer applications are almost always sliced.

EXPORT DISTRIBUTION

American hardwood plywood can be obtained in export markets through specialised importers and distributors.

AMERICAN INDUSTRY REPRESENTATION

The contact details for each organisation can be found at the back of this publication under technical contacts.

Hardwood Plywood & Veneer Association (HPVA)

The association sponsors industry standards and supports national/international promotion. HPVA provides technical information about hardwood sliced and rotary veneer, hardwood veneer faces, hardwood plywood products, engineered hardwood flooring, and supply of equipment and necessary services to the industry.



American hardwood flooring

This section provides information about the American solid hardwood flooring industry, the production process and product and species availability in export markets. Solid hardwood flooring refers mainly to machined profiles, manufactured from American native species.

HARDWOOD FLOORING INDUSTRY

The hardwood flooring industry is spread throughout the eastern USA. The bulk of solid hardwood flooring is manufactured for the American domestic market and the primary product is strip flooring. Other products include wide board (plank) flooring, and block or parquet flooring. The industry comprises specialist manufacturers whose primary function is to service demand in the USA for hardwood flooring. In addition, hardwood sawmills and lumber producers, who have diversified into added value manufacture, play an increasingly important role in servicing both USA and export markets, particularly with board or plank flooring.

PRODUCTION

Kiln-dried sawn hardwood lumber is selected for suitability according to grade and specification. The lumber is then ripped to obtain the correct width according to the required specification.

Lumber used for the manufacture of flooring is kiln dried to 6-9% MC in line with industry standards and USA building code requirements.

The main NHLA lumber grade used by the flooring industry is No 2 Common, although higher grades will be utilised for wide board flooring and special colour and quality requirements.

Solid hardwood flooring falls in to three main categories:

Strip: Strip flooring is planed, and tongue and grooved on the sides and ends. The main thickness is $\frac{3}{4}$ " (19mm), other thickness are less common but can be produced to order. Face widths (excluding tongue) range from $1\frac{1}{2}$ " (38.1mm) to $3\frac{1}{4}$ " (82.6mm). The main strip size in the USA is $2\frac{1}{4}$ " (57.2mm). Lengths are random and will range usually from 9" (228.6mm) to 8' (2.44m).

Plank: Plank flooring is the same as strip flooring but is available in widths from 4" (101.6mm) to 8" (203.2mm).

Parquet/block: Defined as a short narrow strip, usually less than 4" wide and 18" or less in length. Blocks are usually tongue and grooved, but not necessarily end matched.

Grading

Flooring is graded according to appearance. There is no nationally or internationally accepted standard applicable to all flooring manufacture, in the way the NHLA rules apply to hardwood lumber production. Therefore grades and quality standards tend to be set by individual producers based on customer requirements.

However, flooring standards do exist and are adhered to by specific groups of producers. For example, the National Oak Flooring Manufacturers Association (NOFMA), which represents most of the major producers of hardwood flooring in the USA, publishes and enforces hardwood flooring standards for its members who produce strip flooring, and most producers of solid hardwood flooring incorporate the basic principles upon which these rules are structured. The NOFMA rules also cover other species such as ash, walnut, maple, hickory, pecan, beech and birch.





Board/plank flooring grades tend to relate to the NHLA lumber grade the flooring profile is manufactured from, for example ex No 1 Common, or ex FAS.

Export packaging

Most pre-machined flooring is bundled to thickness and width and in random lengths. For strip flooring produced to the NOFMA rules, individual bundles will be stamped with the appropriate quality mark. Bundles are strapped and palletised to assist with handling, and some may be wrapped in polythene for protection.

EXPORT AVAILABILITY

The table below indicates flooring product availability for the main commercial American hardwood species suitable for flooring. This information is cross-referenced with AHEC's publication 'Species'.

Hardwood flooring profiles and fixing methods can vary greatly from one country to another. Therefore some export markets demand products that have different specifications, tolerances and quality requirements from the standard products sold and produced for the market in the USA. For example, 2 1/4" (57.16mm) width tongue and groove strip flooring is a mainstay of the American domestic market, but for many exports markets there is very little demand for this size. Flooring companies that specialise in export are able to tailor production to meet specific market or customer needs. The lack of standardisation of flooring internationally and the need for flexibility, quick delivery and a cost effective product, mean that significant volumes of American hardwood flooring are manufactured from imported lumber in export markets. This results in improved species and product availability.

EXPORT DISTRIBUTION

American hardwood flooring is distributed in two main forms – either as a pre-machined (and sometimes factory-finished) product exported from the USA and channelled through distribution outlets in export markets, or as flooring products (solid, multi-layered and other veneered products) manufactured in export markets from imported American hardwood lumber and dimension.

AMERICAN INDUSTRY REPRESENTATION

The contact details for each organisation can be found at the back of this publication under technical contacts.

National Oak Flooring Manufacturers Association (NOFMA)

Upholds industry standards. Registered quality certification (including engineered hardwood flooring).

Hardwood Plywood & Veneer Association (HPVA)

Administers the national standard for engineered hardwood flooring.

A category not covered in this section is engineered hardwood flooring. American production adheres to the "American National Standard for Laminated Wood Flooring – ANSI/HPVA LF 1996".

| SPECIES | HARDNESS (N) | EXPORT AVAILABILITY – FLOORING |
|---|--------------|---|
| Pecan (<i>Carya illinoensis</i>) | 8095 | Limited due to low demand |
| Hickory (<i>Carya glabra</i>) | N/A | Limited due to low demand |
| Hard maple (<i>Acer saccharum</i>) | 6450 | Widely available in all grades and a range of products |
| White oak (<i>Quercus alba</i>) | 6049 | Widely available in all grades and a range of products |
| Ash (<i>Fraxinus americana</i>) | 5871 | Reasonable availability in a range of products |
| Beech (<i>Fagus grandifolia</i>) | 5782 | Very limited due low demand & wide availability of European beech |
| Red oak (<i>Quercus rubra</i>) | 5738 | Widely available in all grades, and a range of products |
| Yellow birch (<i>Betula alleghaniensis</i>) | 5604 | Limited, but this could change with increased demand |
| Walnut (<i>Juglans nigra</i>) | 4492 | Reasonable availability in a range of products |
| Cherry (<i>Prunus serotina</i>) | 4226 | Available in a range of products |
| Elm (<i>Ulmus rubra</i>) | 3825 | Limited |
| Sycamore (<i>Platanus occidentalis</i>) | 3425 | Available but limited in some markets due to low demand |

American hardwood dimension and components

This section provides information on the American hardwood dimension and component industry, the approach to manufacture, guidance on availability for export and industry representation in the USA.

Dimension is defined as lumber that has been re-manufactured to specific sizes and is normally surfaced on two or more sides. These boards can be cut to exact lengths, widths and thicknesses specified by the customer. They are often referred to as cut-to-size dimension blanks. Wood components can be either semi or fully machined parts of an end product.

HARDWOOD DIMENSION AND COMPONENTS INDUSTRY

The dimension and components industry in the United States exists primarily to service the requirements of furniture, kitchen, and joinery manufacturers, as well as DIY consumers.

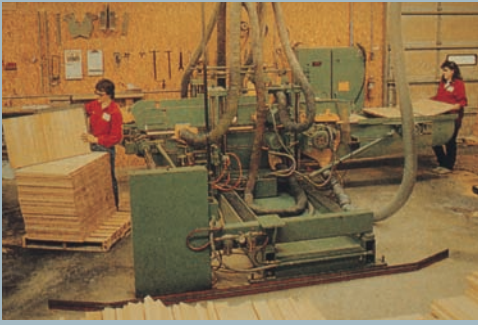
Of the specialist producers, some companies specialise in either softwood or hardwood, others do both. The capacity of the industry to produce hardwood dimension and components is increasing as a result of hardwood sawmills and producers investing in added value manufacture and thus diversifying their activity. Many of these producers are already committed exporters of lumber so this development has helped improve the potential for export.

PRODUCTION

Semi-machined components begin as rough dimension blanks and are carried one or more steps further in the manufacturing process. These processes can include surfacing, gluing, finger-jointing, tenoning, trimming, shaping, mortising and routing. Examples of semi-machined components include edge-glued panels, solid and laminated squares, and cabinet frames. Fully machined components are parts that are completely machined with no additional work necessary prior to assembly. Examples of fully machined components include cabinet and kitchen doors, table and chair legs, staircase spindles, table tops and mouldings.

For the domestic market in the USA the industry produces a wide range of products specifically to customer order, as well as standard ranges of building and joinery components. In the main, manufacturers are able to utilise the lower grades of lumber, using equipment and technology such as optimisers that can help to maximise yields, without losing product flexibility. Yield is also improved by techniques such as edge gluing and finger jointing, with the added benefit of improving the stability of the end product. Edge-glued and finger-jointed components are widely accepted throughout the American domestic market and are gaining in popularity in several export markets.

Product grades tend to be set by individual producers and are appearance-based, incorporating many of the criteria used for lumber grading. Hardwood dimension and components buyers are encouraged to follow the guidelines set out in the Wood Components Manufacturers Association "Rules and Specifications for Dimension and Woodwork". These guidelines are established as a basis for common understanding between the manufacturer, distributor, exporter and user when specifying dimension and components.





EXPORT AVAILABILITY

Dimension and components for export are custom produced. Therefore, in principle, availability is limited by a minimum volume for each item at which it is cost effective for the producer to manufacture. Availability of dimension and components will also depend on the lumber supply of a given species. The grade and specifications of the lumber available will also determine the type of products that can be produced.

Examples of typical dimension and component products that are exported include:

- **rough sawn dimension strips** for flooring manufacture
- **edge-glued panels** for furniture and kitchen manufacture
- **planed dimension blanks** for furniture and kitchen manufacture
- **mouldings** for joinery applications
- **cabinet doors** for kitchen and furniture manufacture

EXPORT DISTRIBUTION

Generally, dimension is not held in stock in export markets as dimension and components are usually manufactured to individual customer requirements. Therefore, specialist hardwood importers and agents are able to supply products to order from producers in the United States.

A wider range of dimension and component profiles, especially for custom sizes or smaller production volumes, is likely to be available from producers in export markets. These are companies who specialise in the manufacture of dimension and components from imported American hardwood lumber.

AMERICAN INDUSTRY REPRESENTATION

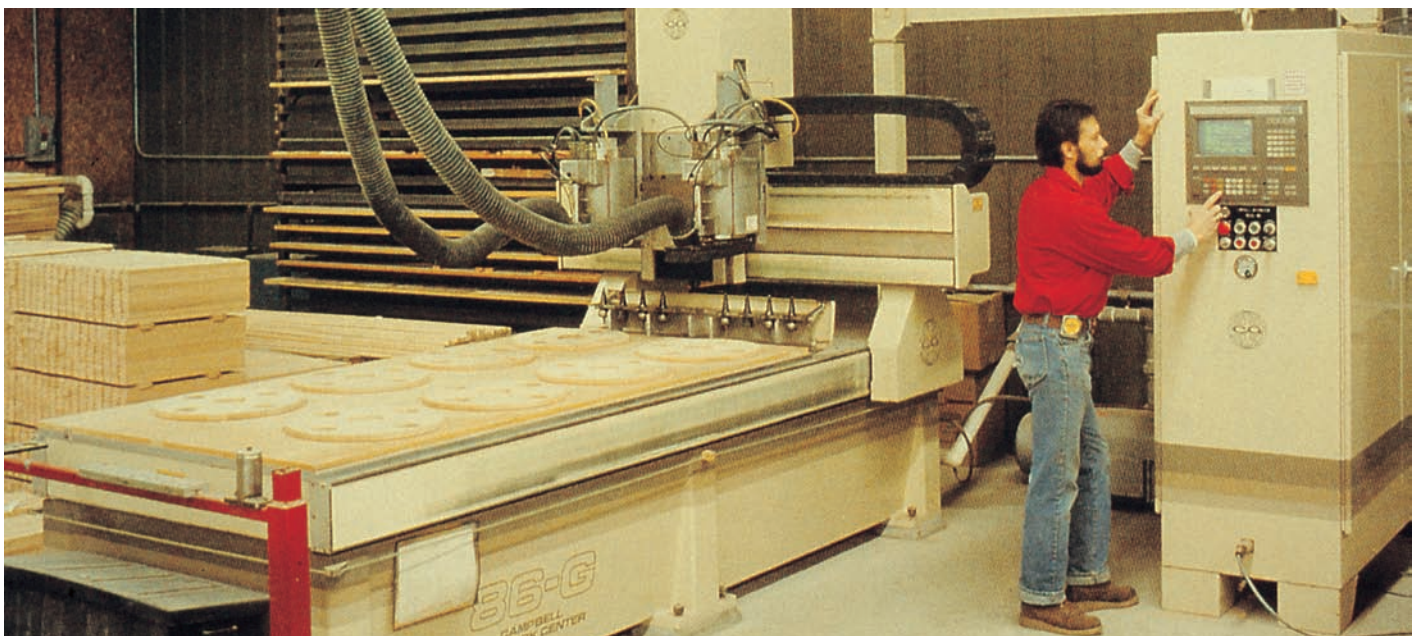
The contact details for each organisation can be found at the back of this publication under technical contacts.

Wood Component Manufacturers Association (WCMA)

Technical information on hardwood and softwood dimension and components.

Wood Moulding & Millwork Producers Association (WMMPA)

Technical information on hardwood and softwood dimension and components.



American hardwood moulding

This section provides information on the American hardwood moulding industry, the approach to manufacture, guidance on availability for export and industry representation in the USA.

A moulding is a profile machined from solid lumber and then sanded if required to a smooth finish. Mouldings can also be composite with a solid wood core (either hardwood or softwood) with a hardwood veneer wrapped around to give the appearance of a solid moulding.

HARDWOOD MOULDING INDUSTRY

The American hardwood moulding industry is similar in its composition to the dimension and components industry. In fact many of the specialist manufacturers have the capability to produce all three product types. The moulding industry primarily services the domestic market in the USA with both standard and one-off moulded profiles. Some companies specialise in softwood, while others produce hardwood mouldings as well. There is a concentration of specialist moulding companies along the west coast of the United States because California has a very large consumption, by product manufacturers (ie kitchens) and distribution centres servicing the building and DIY sectors.

Some hardwood sawmills have diversified their production and invested in moulding capability as a way to add value and maximise yields.

PRODUCTION

Mouldings are produced according to customer requirement, often requiring detailed drawings and clearly identified quality criteria. For every new profile there is a set up cost for producing the required cutters. Therefore, for a profile to be manufactured cost effectively, a minimum volume is required.

Many hardwood moulded profiles are dimensionally small, ie lippings, beading, dowels, and quadrant, so they can be manufactured either from lower grades of lumber, or narrows and off cuts from other lumber and dimension production. It is also common to find window and door frames, skirting boards and ceiling crowns up to 133.35mm in width, especially in red oak and tulipwood.

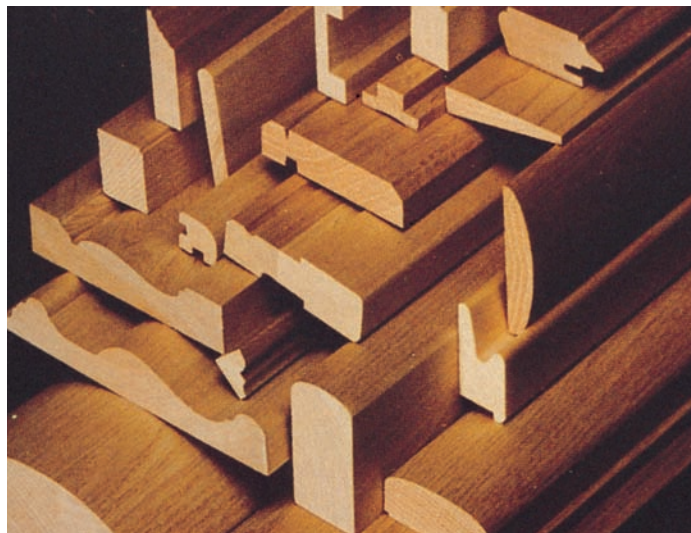
Red oak is the main species for hardwood moulding in the American market, due to its acceptance in a range of furniture and building products and its widespread availability. Most commercial hardwood species can be moulded, although some, such as hickory, cottonwood and aspen, need special care with knife preparation, cutting angles and feed speeds. Other species such as tulipwood and basswood are ideal and present minimal technical difficulties.

EXPORT AVAILABILITY

The American hardwood moulding industry is large and sophisticated, with access to significant volumes of lumber, and therefore capable of offering a wide range of machined profiles for export. However, influencing factors will be:

- **volume** required
- **sufficient lead times** for production and shipment
- **species availability**
- **specification and length** requirement
- **colour** selection
- **acceptance of natural characteristics**





EXPORT DISTRIBUTION

Generally stocks of pre-finished mouldings are not held in export markets as they are usually manufactured to individual customer requirements. Therefore specialist hardwood importers and agents are able to supply hardwood mouldings to order from producers in the United States.

A wide range of hardwood moulding profiles, especially for one-off sizes or smaller production volumes, is also likely to be available from producers in export markets. These are companies specialising in the manufacture of mouldings from stocks of imported American hardwood lumber.

AMERICAN INDUSTRY REPRESENTATION

The contact details for each organisation can be found at the back of this publication under technical contacts.

Wood Component Manufacturers Association (WCMA)

Technical information on hardwood and softwood moulding.

Wood Moulding & Millwork Producers Association (WMMPA)

Technical information on hardwood and softwood moulding.



Glossary of terms

- Figure:** The pattern produced in a wood surface by annual growth rings, rays, knots and deviations from regular grain.
- Flitch:** A log or part of a log, trimmed and prepared for conversion into veneers, or part of a converted log suitable for further conversion.
- Hardness:** The resistance of wood against indentation and abrasion. Values are given in Newtons (N) and are a measure of the load required to embed an 11.3mm ball to one half its diameter in the wood.
- Hardwood:** A description applied to woods from deciduous and evergreen broad-leaved trees (Angiosperms). The term has no reference to the actual hardness of the wood.
- Heartwood:** The inner layers of wood in growing trees that have ceased to contain living cells. Heartwood is generally darker than sapwood, but the two are not always clearly differentiated.
- Kilning:** The process of drying lumber artificially under scientifically controlled conditions. Kilns are the chambers used for this process.
- Lumber:** The American term for converted wood or sawn timber. Lumber mills and sawmills are terms used to describe the processing units that carry out this conversion.
- Moisture Content:** Abbreviated as MC the weight of water contained in wood expressed as a percentage of the weight of the oven dry wood.
- Quarter/ rift sawn:** Lumber that is cut from the log on or near to the radial axis to produce "edge", "straight" or "vertical" grain patterns.
- Sapwood:** The outer zone of wood in a tree, next to the bark. Sapwood is generally lighter in colour than heartwood but lacks resistance to decay.
- Stain:** A variation from the natural colour of the wood or a discoloration that may be caused by micro-organisms, metal or chemicals. The term also applies to materials used to impart colour to the wood.
- Surfaced:** The American term that is used to describe lumber that has been planed.
- Tally:** The American term for lumber measure. (Green tally refers to measurement before kilning and net tally to measurement after kilning.)

Abbreviations

- " : inches
' : feet
mm: millimetres
m: metres
m²: square metres
m³: cubic metres
N: Newtons
FAS: Highest quality NHLA grade
PAR: Planed (surfaced) all round (same as S4S)
S4S: Surfaced (planed) 4 sides (same as PAR)
S2S: Surfaced 2 sides
Bf: Board feet
Mbf: Thousand board feet
Bm: Board measure
Sm: Surface measure
RWL: Random widths and lengths

Conversion factors

- 1"**: 25.4 millimetres (mm)
1m: 3.281feet
1Mbf: 2.36 cubic metres (m³)
1m³: 424 board feet (bf)
1m³: 35.315 cubic feet (cu.ft)

References and further reading

| | | |
|--------------------|------|--|
| Corkhill T. | 1979 | <i>A Glossary of Wood</i> |
| ANSI | 1994 | <i>American National Standard for Hardwood and Decorative Plywood (ANSI/HPVA HP –1-1994)</i> |
| NHLA | 1994 | <i>An Introduction to Grading Hardwood Lumber</i> |
| Alden H.A. | 1995 | <i>Hardwoods of North America</i> |
| HPVA | 1995 | <i>Voluntary Standard for Sliced Decorative Wood Face Veneer (Industry Standard DFV –1-1995)</i> |
| WCMA | 1995 | <i>Rules and Specifications for Dimension and Woodwork</i> |
| ANSI | 1996 | <i>American National Standard for Laminated Wood Flooring (ANSI/HPVA LF 1996)</i> |
| NOFMA | 1996 | <i>Flooring Grading Rules</i> |
| AHEC | 1998 | <i>An Illustrated Guide to Hardwood Lumber Grades</i> |
| AHEC | 1998 | <i>Guide to American Hardwoods – Species</i> |
| NHLA | 1998 | <i>Rules for the Measurement and Inspection of Hardwood and Cypress</i> |
| AHEC | 1999 | <i>American Hardwood Resources</i> |
| HPVA | 1999 | <i>The Hardwood Plywood Reference Guide (3rd edition)</i> |

Photograph Acknowledgments

| | |
|---|---|
| Contents <i>Stuart Flooring Corp. (B) • WCMA (Lb) • HPVA (Lt)</i> | Page 13 <i>Bruce Hardwood Floors Ltd</i> |
| Page 3 <i>Michael Odsgard (B)</i> | Page 14 <i>WCMA (T, LM & B) • Karl Danzer UK (UM)</i> |
| Page 9 <i>HPVA (T & B)</i> | Page 15 <i>WCMA (T & B)</i> |
| Page 10 <i>HPVA (T, UM & LM)</i> | Page 16 <i>WCMA (UM & B)</i> |
| Page 11 <i>Columbia Forest Products (T) • HPVA (B)</i> | Page 17 <i>WCMA (T & B)</i> |
| Page 12 <i>Stuart Flooring Corp. (T, LM & B)</i> | <i>All other photographs – AHEC.</i> |

bottom = (B); left bottom = (Lb); left top = (Lt); top = (T); lower middle = (LM); upper middle = (UM).

AHEC offices worldwide

For **sources of supply** of American hardwood species and information on AHEC activities worldwide contact the following offices:

United States Headquarters

1111 19th Street, NW
Suite 800
Washington, D.C. 20036
Tel: (202) 463-2720
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www.ahec.org

AHEC – Europe/Middle East/India

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London EC3V 9DS
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Tel: (44) 20 7626-4111
Fax: (44) 20 7626-4222
www.ahec-europe.org
www.sustainablehardwoods.info
www.americanredoak.info

AHEC – Mexico

Torre Candela
Sierra Candela No. 111, Int. 507/508
Col. Lomas de Chapultepec
Mexico, D.F. 11000
Tel: (52) 55 2623-1850
Fax: (52) 55 2623-1853
www.ahec-mexico.org

AHEC – China

Room 306, Building A
Far East International Plaza
99 Xianxia Road
Shanghai 200051
China
Tel: (86) 21 6270 2222 ext 316
Fax: (86) 21 6270 5555
www.ahec-china.org

AHEC – Japan

c/o American Consulate General
2-11-5 Nishitenma
Kita-ku, Osaka 530, Japan
Tel: (81) 6-6315-5101
Fax: (81) 6-6315-5103
www.ahec-japan.org

AHEC – Korea

U.S. Agricultural Trade Office
c/o American Forest & Paper Association
Room #303, Leema Building
146-1, Susong-dong, Chongro-ku
Seoul (110-140), Korea
Tel: (82) 2-722-3685/6
Fax: (82) 2-720-1898
www.afpa-korea.org

AHEC – Southeast Asia

Room 528, West Wing
New World Office Building
20 Salisbury Road
Tsimshatsui, Hong Kong
Tel: (852) 2724-0228
Fax: (852) 2366-8931
www.ahec-seasia.org

Technical contacts

For additional **technical information** on American hardwood species contact the following organisations:

American Walnut Manufacturers Association

PO Box 5046
Zionsville, IN 46077
Tel: (317) 873-8780
Fax: (317) 873-8780
www.walnutassociation.org

Appalachian Hardwood Manufacturers, Inc.

712 W. Lexington Avenue, Suite 202
High Point, NC 27262
Tel: (336) 885-8315
Fax: (336) 886-8865
www.appalachianwood.org

Hardwood Manufacturers Association

400 Penn Center Boulevard, #530
Pittsburgh, PA 15235
Tel: (412) 829-0770
Fax: (412) 829-0844
www.hardwood.org

Hardwood Plywood & Veneer Association

1825 Michael Faraday Drive
Reston, VA 20190-2900
Tel: (703) 435-2900
Fax: (703) 435-2537
www.hpva.org

National Hardwood Lumber Association

P.O. Box 34518
Memphis, TN 38184-0518
Tel: (901) 377-1818
Fax: (901) 382-6419
www.natlhardwood.org

Northeastern Loggers Association

3311 State RT 28
P.O. Box 69
Old Forge, NY 13420
Tel: (315) 369-3078
Fax: (315) 369-3736
E-mail: nela@telenet.net

Southeastern Lumber Manufacturers Association

P.O. Box 1788
Forest Park, GA 30298
Tel: (404) 361-1445
Fax: (404) 361-5963
www.slma.org

Southern Cypress Manufacturers Association

400 Penn Center Blvd
Suite 530
Pittsburgh, PA 15235
Tel: (877) 607-7262
www.cypressinfo.org

Virginia Forest Products Association

220 E. Williamsburg Road
Sandston, VA 23150
Tel: (804) 737-5625
Fax: (804) 737-9437
www.vfpa.net

Wood Component Manufacturers Association

1000 Johnson Ferry Road, Suite A-130
Marietta, GA 30068
Tel: (770) 565-6660
Fax: (770) 565-6663
www.woodcomponents.org

