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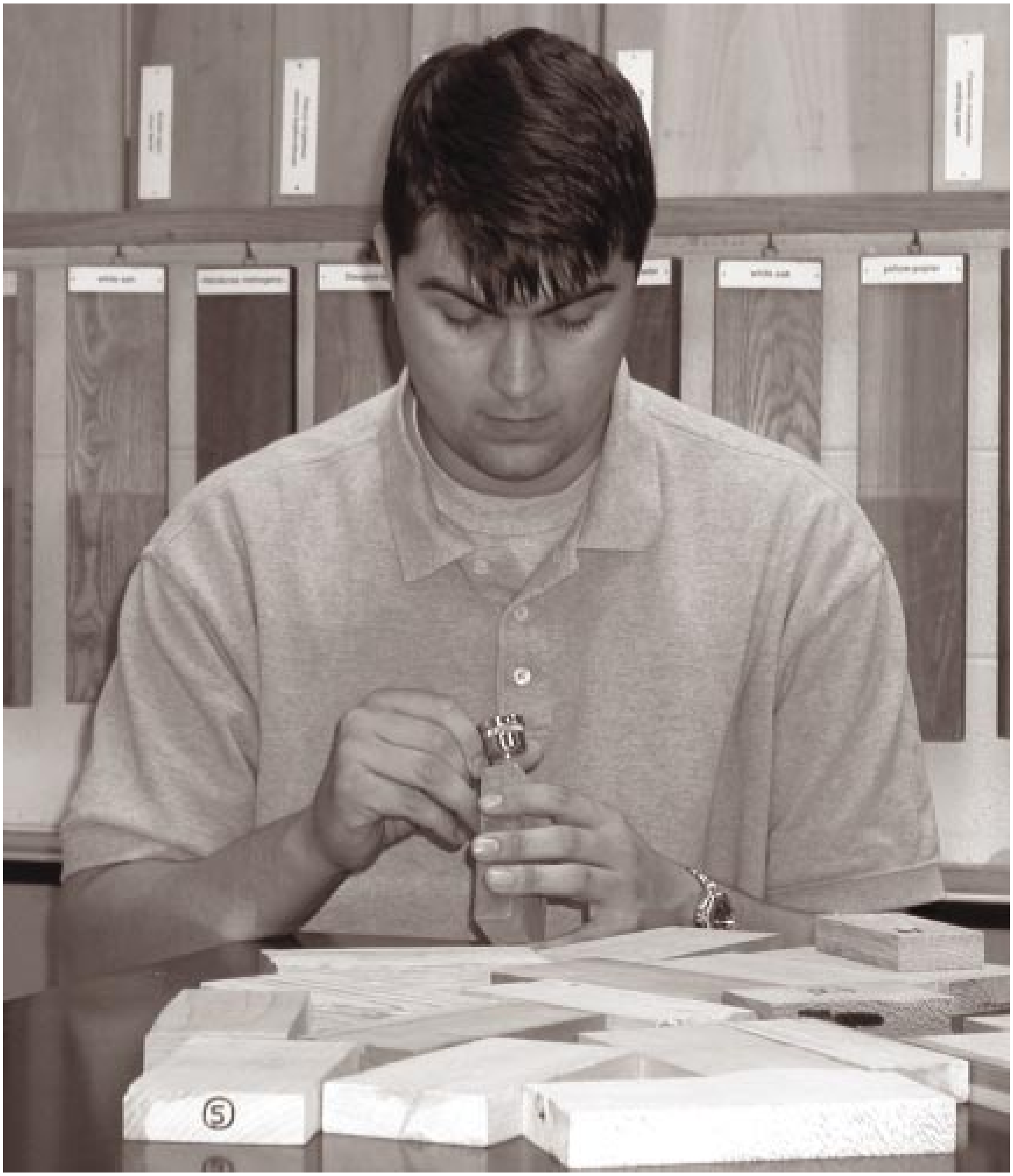
Wood Identification for Hardwood and Softwood Species Native to Tennessee



Contents

Wood Identification for Hardwood and Softwood Species Native to Tennessee

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Introduction

This publication provides information on how to identify wood of several species common to Tennessee by using a hand-magnifying lens. Included in this publication are a wood identification key for some common Tennessee species, a list of key specie characteristics and a list of companies that sell wood identification sample sets.

Tennessee has a rich variety of tree species, and the wood produced from each of these has unique structure, physical and mechanical properties. The differences in wood structure and properties allow for the manufacture of wood-based products with many different appearances and uses. Since wood is a popular and useful material, it is important that enthusiasts and professionals be able to distinguish the wood of one species from another. For example, how would a barrel manufacturer tell the difference between red oak, which doesn't hold liquids, and white oak, which does?

Wood of a particular species can be identified by its unique features. These features include strength, density, hardness, odor, texture and color. Reliable wood identification usually requires the ability to recognize basic differences in cellular structure and wood anatomy. Each species has unique cellular structure that creates differences in wood properties and ultimately determines the suitability for a particular use. Cellular characteristics provide a blueprint for accurate wood identification.

Wood is composed of many small cells and its structure is determined by the type, size, shape and arrangement of these cells. The structure and characteristics of wood can vary between species and within the same species. With practice, a small hand lens (10x) can be used to distinguish the different cell types and their arrangements. By using the proper techniques, you can become efficient and accurate at wood identification.

Wood Surfaces

Most of the wood cell structure characteristics discussed in this publication are best viewed from the **cross-section** surface of the wood. Wood surfaces are classified into three categories, or geometric planes of reference, that indicate the type of surface uncovered after a cut has been made. The three reference planes are the cross section, radial section and tangential section. **Figure 1** depicts the three reference planes of wood. The cross section is produced by cutting the cells perpendicular to the direction of growth in the tree. The cross section is the same surface seen on

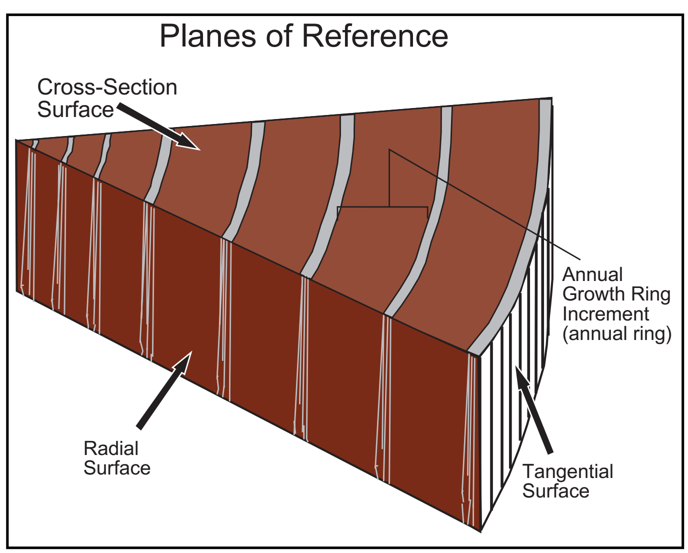

Figure 1. *Three-dimensional orientation of wood material.*

a stump after felling a tree. It is important to determine which reference plane you are viewing when identifying wood, because cell structure is three-dimensional and varies based on orientation.

Macro Cross-section Characteristics

By cutting a tree and exposing the cross section, you can observe the bark, phloem (bark-producing layer), cambium (a thin layer inside the bark where cell division takes place) and xylem (sapwood and heartwood) **(Figure 2)**. The heartwood is the darker-colored material that is formed in the center of the tree. Although heartwood is formed in the tree center, it may not occur uniformly across the surface of the section. The heartwood contains extractives, which are the chemical components that give cedar its pleasant aroma, redwood its decay resistance and walnut its dark color. The sapwood surrounds the heartwood and is lighter-colored. The size and width of the sapwood will vary greatly between species. For example, the sapwood of locust is a very narrow outer band and the sapwood of black cherry is very wide. The color and odor of heartwood can also be useful in identifying certain species like redcedar, sassafras and black walnut.

Another feature that can be observed when viewing the cross section is the growth rings. A growth ring represents one year of wood formation. The development of the wood material inside a growth ring is caused by the changes that occur during the growing season. Earlywood, or springwood, is formed in the spring and early summer at the beginning of the growing season when warm and wet conditions promote rapid growth. Earlywood cells have large diameters and thin cell walls. Latewood, or summerwood, is formed in late summer and fall toward the end of the growing season when dryer conditions slow the development of new wood growth. Latewood occurs at the outer region of a growth ring, and is characterized by cells with greatly thickened cell walls and narrow diameters.

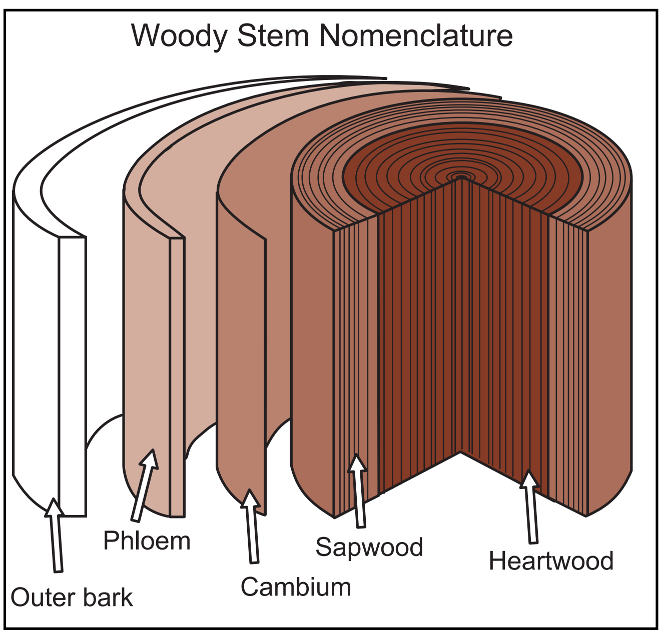

Figure 2. *Primary layers of wood tissue through the diameter of a tree.*

Preparing the Wood Surface

To view the cellular characteristics of wood, it is very useful to have a 10-power (10x) hand lens to magnify the section you are looking at. Preparation of the wood surface is important and can affect your ability to locate and identify specific cell types. The cross section is the best section to begin your observation of the cell structure in wood. To prepare a cross section for viewing, make a thin, clean cut with a razor blade or sharp knife. Make the cut across the surface at a slight angle. It is important not to take off too much material or to cut too deeply. You are better to make several thin slicing cuts to enlarge the viewing area rather than trying to make one large cut. Using a dull blade or cutting too deeply will create a poor surface and mask otherwise useful identifying features. Only a small area with a few growth rings is needed for adequate observation and identification.

Identifying wood is a process of elimination. The best strategy is to search for particular features that will help you to categorize the species or group of species withe those features, and thus eliminate others that do not. The use of an identification key can be helpful for this separation. A wood identification key is provided for the species discussed in this publication.

Separating Hardwoods from Softwoods

After preparing a surface to view, the first step is to determine whether a specimen is softwood or a hardwood. The terms softwood and hardwood are used to reference the taxonomical division that separates a species and have little to do with the actual hardness of the wood. Hardwood trees have broad leaves and are deciduous – they lose their leaves at the end of the growing season. Hardwoods are angiosperms – using flowers to pollinate for seed reproduction. Oaks, maples, birches and fruit trees are examples of hardwood trees. Softwood trees are conifers (evergreens), have needles or scale-like foliage and are not deciduous. Softwoods are gymnosperms, meaning they do not have flowers and use cones for seed reproduction. Examples of softwoods include pines, spruces, firs and hemlocks.

Softwood cellular structure is simple and 90-95 percent of the cells are **longitudinal tracheids**. Longitudinal tracheids function in water conduction and support. The limited number of cell types makes softwoods more difficult to differentiate from one another.

Hardwood structure is more complex than softwood structure, and varies considerably between species. The majority of hardwood volume is composed of fiber cells that offer structural support to the stem. The major difference between hardwoods and softwoods is the presence of **vessel elements**, or **pores,** that exist in hardwoods only. The main function of vessel elements is water conduction. Vessel elements can vary greatly in size, number and spacing from one species to another, and from earlywood to latewood. Some species, like oak, have vessel elements that are extremely large and numerous. Other species, such as yellow-poplar, gum and birch, have vessel elements that are uniform in size and number, and are evenly spaced throughout the growth ring. By using a hand lens, you can determine if vessel elements are present or not, thus separating hardwoods from softwoods. **Figure 3** illustrates the three dimensional differences between hardwood and softwood cell structure.

After determining whether a wood sample is a hardwood or softwood – based on the presence or absence of vessel elements – we can begin to look more closely at other cell types for further assistance with identification.

How to prepare a good surface for viewing wood structure with a hand lens

- A sharp blade is required for good surface preparation. A razor blade is best.
- A good clean surface is one where cells have been cleanly cut rather than torn.
- Do not cut too deep. Deep cuts will resort in torn fibers in the wood section and possible injury to your hands and fingers!
- Only a few growth rings on the cross section are needed.
- Wetting the surface with water can be helpful in getting a good, clean section.

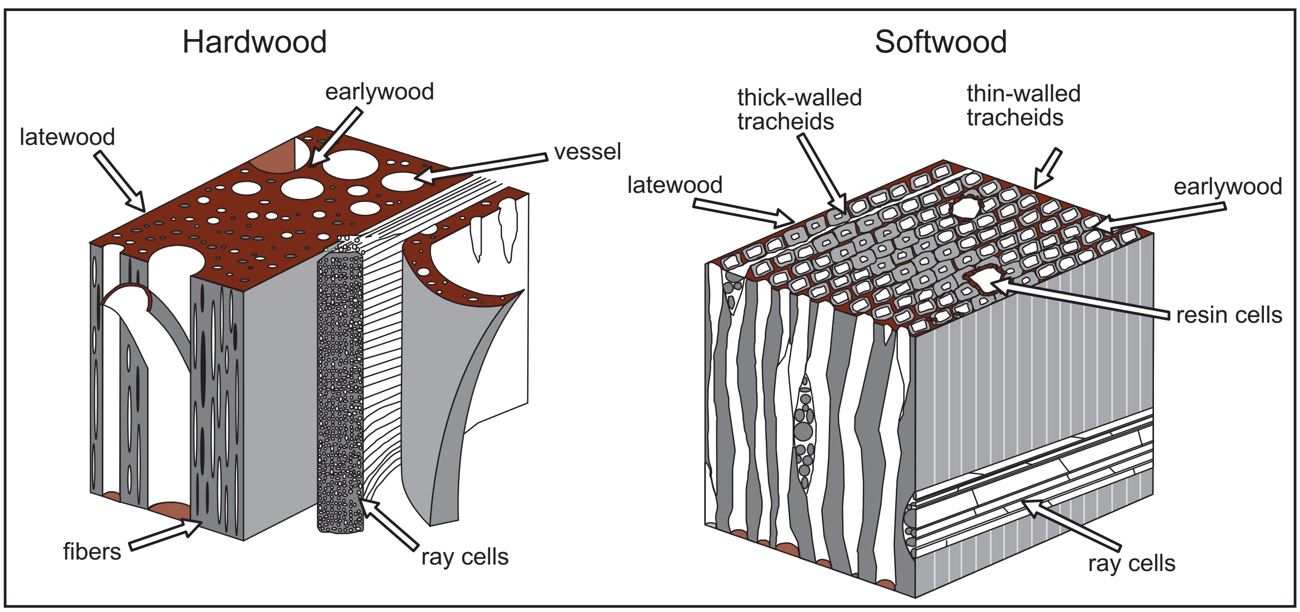

Figure 3. *Three-dimensional cell level comparison between hardwood and softwoods.*

Hardwoods

Growth Ring Pore Arrangement

The next major step in identifying hardwoods is to observe and categorize how the change, or transition, in pore size occurs from earlywood to latewood within a growth ring. There are three general classifications for this earlywood/latewood transition, as depicted in **Figure 4.**

(1) **Ring-porous hardwoods (Figure 4a)**. For some groups of species (oaks and elms) the earlywood/latewood transition occurs abruptly and is very distinct. Within each growth ring, a band of large earlywood vessels (pores) is clearly visible to the naked eye, after which a band of latewood vessels appears much smaller and requires the use of a hand lens to see.

(2) **Semi-ring-porous hardwoods (Figure 4b)**. For another group of species (black walnut, butternut and hickory) the pore transition from large to small diameter within a growth ring is gradual. The pores in the earlywood zone have a large diameter that gradually decreases in size as pores enter the latewood zone.

(3) Diffuse-porous hardwoods (Figure 4c). The last group of species has vessels (pores) that are uniform in size across the entire growth ring (yellow poplar, gum and maple). These vessels are usually small, uniform in size and are very difficult to see with the naked eye (a hand lens is needed).

Vessel (Pore) Arrangement

Vessel elements (pores) can be described by their position relative to each other in a cross section. Different species have unique vessel arrangements. **Figure 5** shows some of the more common vessel arrangements.

Solitary pores (Figure 5a): single pores that do not touch any other pores – evenly spaced across cross section (maples).

Pore multiples (Figure 5b): arrangement where two to five pores appear grouped together.

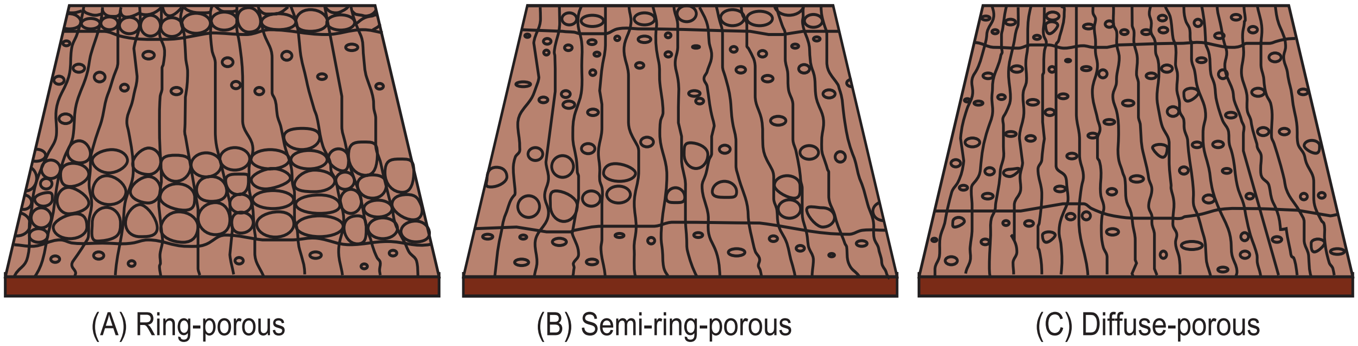

Figure 4. *Classification of pore transition from earlywood to latewood.*

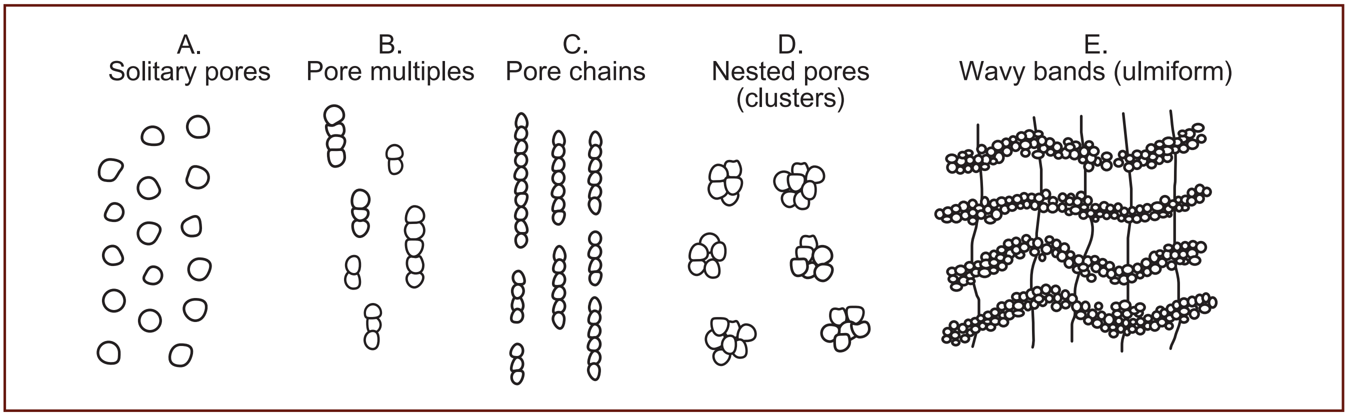

Figure 5. *Vessel (pore) arrangement.*

Pore multiples usually occur in radial rows (cottonwood), but can occur in both radial and tangential directions (Kentucky coffeetree).

Pore chains (Figure 5b): arrangement where pore multiples appear in radial direction only.

Nested pores (Figure 5c): when larger numbers of pores contact each other both radially and tangentially (cluster).

Wavy bands (Figure 5d): Pores are arranged in irregular concentric bands. Also called ***ulmiform*** because this characteristic is distinctive of all elms (also hackberry).

Wood Rays

Once the pore distribution and arrangement have been identified, it is important to look at the size and arrangement of **wood rays.** Wood rays are seen as narrow stripes or lines that extend across the growth rings in the radial direction – from the bark to the center of the tree. Wood rays function to transport food and water horizontally across the diameter of a tree.

The size and distribution of rays on the cross section are quite unique for many species and groups of species. Species such as red and white oak have very wide rays (many cells wide) that are easily seen without a hand lens. Species such as yellow-poplar, ash and maple have numerous and extremely narrow rays (just 1-2 cells wide). The distribution of rays can also be used to separate some species. For example, beech and sycamore both have large, conspicuous rays with fine, narrow rays running between them. Another useful characteristic of rays that can be observed on the cross section of some species is the presence of *nodes*, or a swelling of the ray, at the intersection of a new growth ring – where the earlywood zone begins. Ray nodes are seen in yellow-poplar, beech and sycamore.

When viewing a piece of wood from either the radial or tangential surface, wood rays can be a key characteristic to help identify the species. Rays vary not only in width, but also in height. The height of a ray is best observed from the tangential surface. Ray height varies between species from imperceptibly small to several inches high. For example, in red oak, ray height never exceeds 1 inch, while in white oak, the height of the rays are consistently greater than $1^1/_4$ inch.

When wood is cut radially, across the plane where rays extend through the diameter of the cross section surface, many rays are split and exposed in patches on the radial surface. In many species – maple, sycamore and beech especially – these patches of split rays contrast in color from the longitudinal tissue around them and form a freckled pattern on the radial surface called *ray fleck*.

Tyloses

Tyloses are inclusions that form inside the vessels of some hardwoods. Because tyloses are unique to certain hardwood species, they are useful for wood identification. Tyloses are outgrowths of parenchyma cells into the hollow lumens of vessels and they look like bubbles or cellophane-like structures clogging the openings of the vessel elements. Tyloses may be absent or sparse, as in red oak; variable, in the case of chestnut and ash; or densely packed and abundant, as they appear in white oak and locust. Tyloses effectively clog the vessels and subsequently restrict moisture movement. The presence of tyloses is the reason white oak is used for making whisky barrels.

Parenchyma

Parenchyma are small, thin-walled, longitudinal cells that provide food storage. These cells are sparse in softwoods but are often quite significant in hardwoods. Parenchyma are often very small and difficult to see. However, there are many species with visible and unique arrangements of parenchyma cells that offer a clear structural feature for decisive identification.

There are two basic types of parenchyma: *paratracheal* and *apotracheal*. The major difference between them is that paratracheal parenchyma make contact with the pores or vessel elements, while apotracheal parenchyma are separated from pores by fibers or rays. **Figure 6** shows the various types of paratracheal and apotracheal parenchyma.

In most species, apotracheal parenchyma are not be useful in identifying wood with just a hand lens. One exception is yellow-poplar, which has a fine, clear, bright line of marginal apotracheal parenchyma at the edge of every growth ring. Since yellow poplar is a diffuse porous species, the presence of marginal parenchyma aids tremendously in its identification. Paratrachal parenchyma appears in many forms, and is often more

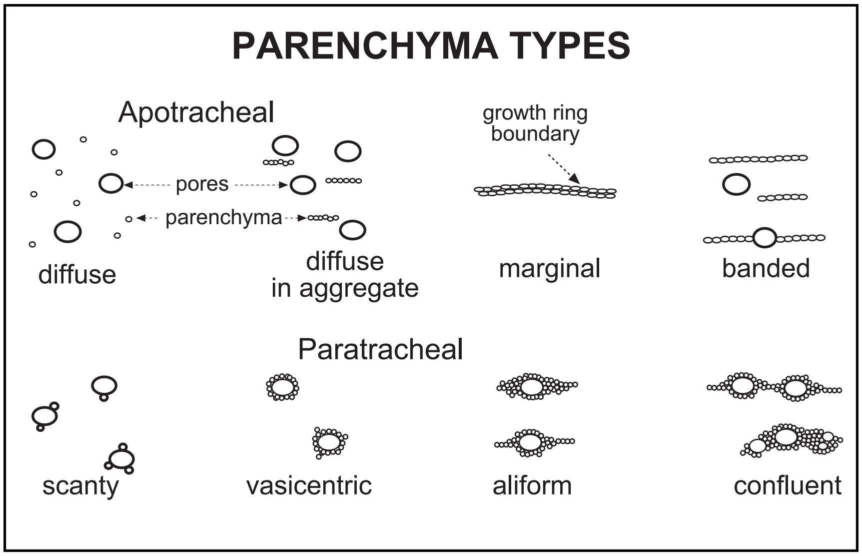

Figure 6*. Classification of parenchyma arrangements around hardwood pores. (cross-section view)*

useful for identification. For example, in hickory the banded parenchyma looks like a reticulate, "web-like" formation as it connects between the rays and pores. This "web-like" appearance is unique to hickory.

Color, Odor and Density

Other characteristics of wood species that are fundamental to wood identification include: color, odor and density. These characteristics are remarkably variable in hardwoods and often provide the first clue to identify a particular wood species. Hardwoods come in a variety of colors and shades that often allow immediate and unmistakable recognition. Consider the lush reddish brown of black cherry, the deep chocolate brown of black walnut or the creamy white of hard maple.

Less obvious, but certainly helpful to wood identification are odor characteristics. Many hardwoods have distinctive natural odors. Black cherry, for example, has an unmistakably fragrant aroma, while red oak is more bitter and acidic smelling.

Hardwoods also vary significantly with respect to density. The density of wood is related to its hardness, strength and weight. Typically, a dense species of wood is heavier, harder and stronger than other, less dense species. Hardness is particularly useful when distinguishing between hard and soft maple. Soft maple can be easily dented with your fingernail or sliced with a razor blade, while hard maple is significantly more difficult to make an impression. Hickory, black locust and osage-orange are quite heavy compared to most other species. It is often helpful to keep in mind how difficult or easy it is to make a cut on the cross section of a piece of wood when preparing the surface for examination.

Softwoods

Resin Canals

The first step after making the determination that a wood specimen is softwood – due to the absence of pores – is to inspect the cross-section surface for the presence of resin canals. **Resin canals** are tubular passages in wood that exude pitch, or resin, to seal off wounds that occur due to insect or mechanical damage. Resin canals most often occur in or near the latewood zone of the growth rings. Softwoods can be separated into two classifications based on the presence or absence of resin canals. Species that have resin canals include pines, spruces, larches and Douglas-fir. The species that do not have resin canals include firs, hemlocks, cedars, redwood, baldcypress and yew.

Woods with resin canals are further separated into two groups: (1) those with large resin canals – pines, and (2) those with small resin canals – Douglas fir, spruce and larch. Using a sample wood identification set to compare the size and number of resin canals of different species is useful in determining how much they can differ between species. For example, most pines have quite large and numerous resin canals that can be seen without the aid of a hand lens. Spruce and larch, on the other hand, have much smaller resin canals that occur less frequently. Douglas fir has many small resin canals. Because the presence of resin canals is quite variable, it may be necessary to make several cuts on the cross section of a specimen to uncover enough surface area to make a good determination.

Growth Rings: Earlywood and Latewood

In softwoods, earlywood/latewood characteristics can provide useful information for identification. The features to compare are: (1) the nature of the earlywood/latewood transition – abrupt or gradual, and (2) the percentage of latewood occupying the growth ring.

When identifying hardwoods, the size and distribution of pores between earlywood and latewood are discriminating factors. Since softwoods have no pores, the difference between the earlywood and latewood zones in the growth ring occurs due to effects that the growing season has on the longitudinal tracheids (the dominant cell type in softwoods). The earlywood zone of a growth ring typically consists of thin-walled, larger-diameter cells, while the latewood zone features thick-walled, smaller-diameter cells. Thus, for many species, the earlywood zone appears lighter, contrasting with the latewood zone, which is often a darker or browner shade.

For some species the transition from the lighter-colored earlywood to the darker-colored latewood is distinct and abrupt (southern yellow pine, Douglas fir, redwood). For other woods, this transition is extremely gradual and even imperceptible (white pine, cedars). Some species have an earlywood and latewood transition that falls between gradual to abrupt (spruce, fir, hemlock).

Color, Odor and Density

As with the hardwoods, color, odor and density are useful characteristics in identifying softwoods. Some species have distinct color differences, while others do not. Eastern white pine is consistently yellowish white, darkening to light brown with age. Eastern redcedar has a distinctive deep purplish-red color, and redwood a deep reddish-brown. Examples of odors include the "piney" fragrance of pines, the "cedar chest" scent of eastern redcedar and the relative absence of smell in spruce, firs and hemlocks.

Softwoods also vary substantially in density. Because many species are quite dense and strong, softwood lumber is typically used for structural or construction purposes. Southern yellow pine, spruce, hemlock, fir and Douglas fir are all commonly used in the construction industry. White pine and cedars, on the other hand, are considerably less dense and lighter in weight than the other species, while white pine and cedars are easier to slice with a razor blade when preparing a surface for identification.

Summary

Becoming familiar with wood characteristics and structure, as well as the techniques used to identify them, requires practice and dedication. If you know what to look for and where to look, your eye can be trained to pick up unique wood characteristics, enabling accurate and efficient wood identification. While this publication outlines the general principles of wood identification using a hand lens, anyone seeking more in-depth and complete methods should refer to one of the publications listed below.

Other Publications Related to Wood Identification

Panshin, A. J. and C. de Zeeuw. *Textbook of Wood Technology*. McGraw-Hill. 1980.

Hoadley, R. B. *Identifying Wood: Accurate Results with Simple Tools*. Taunton Press, Inc. Newton, CT. 1990.

Woods of the World CD-ROM. Tree Talk Inc. 1994. Burlington, VT.

Sources of Wood Samples for Identification
Carolina Biological Supply Company
2700 York Road
Burlington, NC 27215
919-584-0381

International Wood Collectors Society
13249 Hwy. 84 N
Cordova, IL 61242-9708
309-523-2852

Wisconsin Crafts
W6407 20th St.
Necedah, WI 54646
608-565-2101

Garret Wade Company
161 Avenue of the Americas
New York, NY 10013
1-800-221-2912

Educational Lumber Co., Inc.
Box 5373
Asheville, NC 28803
704-255-8765

Wood ID: Species Characteristics

Ring-porous hardwoods

American Elm
Ulmus Americana

Average specific gravity: 0.50
Heartwood color: Light brown to brown or reddish brown
Pore distribution: Ring-porous
Earlywood: Pores large, in continuous row
Latewood: Pores in wavy bands
Tyloses: Present in earlywood, but usually sparse
Rays: Not distinct without lens; homogeneous 1-7 (mostly 4-6) seriate.

Ash
***Fraxinus* spp.**

Average specific gravity: 0.60
Heartwood color: Light brown or grayish brown.
Sapwood color: Creamy white (may be very wide)
Pore distribution: Ring-porous
Earlywood: 2-4 pores wide; pores moderately large, surrounded by lighter tissue
Latewood: Pores solitary and in radial multiples of 2-3, surrounded by vasicentric parenchyma or connected by confluent parenchyma in outer latewood. Thick-walled.
Tyloses: Fairly abundant (some vessels open)
Rays: Not distinct to eye, but clearly visible with lens; 1-3 seriate

Black Locust
Robinia pseudoacacia

Average specific gravity: 0.69
Heartwood color: Olive or yellow-brown to dark yellow-brown; dark russet brown with exposure
Fluorescence: Bright yellow
Sapwood: Never more than 3 growth rings wide
Pore distribution: Ring-porous
Earlywood: 2-3 pores wide; pores large.
Latewood: Pores in nest-like groups, which merge into interrupted or somewhat continuous bands in outer latewood; latewood fiber mass appears dense and dark in contrast to yellowish; tyloses filled pores and rays.
Tyloses: Extremely abundant with yellowish cast and sparkle, solidly packing vessels and making adjacent pores indistinct.
Rays: 1-7 (mostly 3-5) seriate

Hickory
Carya spp.

Average specific gravity: 0.72
Heartwood color: Light to medium brown or reddish brown
Pore distribution: Ring-porous
Earlywood: Mostly an intermittent single row or thick-walled pores with fiber mass where interrupted
Latewood: Pores not numerous, solitary and in radial multiples of 2-5. Thick-walled.
Tyloses: Moderately abundant
Rays: 1-4 seriate
Parenchyma: Banded parenchyma and rays form a reticulate pattern distinctly visible against the background fiber mass with a hand lens (but banded parenchyma absent from earlywood zone)

Northern Red Oak
Quercus rubra

Average specific gravity: 0.63
Heartwood Color: Light brown, usually with flesh or pinkish-colored cast.
Pore Distribution: Ring-porous
Earlywood: Up to 4 or 5 rows or large solitary pores.
Latewood: Pores solitary in radial lines, few and distinct ("countable"), vessels thickwalled
Tyloses: Absent or sparse in earlywood
Rays: Largest rays conspicuous; tallest less than 1 in. (tangential surface). Narrow rays uniseriate (one cell wide) or in part bisariate

White Oak
Quercus alba

Average specific gravity: 0.68
Heartwood color: Light to dark brown to grayish brown.
Pore Distribution: Ring-porous
Earlywood: Up to 4 rows of large pores
Latewood: Pores small, solitary or in multiples, in spreading radial arrangement, numerous and indistinct ("uncountable"), grading to invisibly small with lens. Vessels thin-walled.
Tyloses: Abundant
Rays: Largest rays conspicuous; tallest greater than 1¼ in. Narrow rays uniseriate or in part biseriate.

Semi-Ring-Porous Hardwoods

Black Walnut
Juglans nigra

Average specific gravity: 0.55
Heartwood color: medium brown to deep chocolate brown
Pore distribution: semi-ring-porous
Pores: earlywood pores fairly large, decreasing gradually to quite small in outer latewood; pores solitary or in radial multiples of 2 to several
Tyloses: Moderately abundant
Rays: fine, visible but not conspicuous with hand lens, 1-5 seriate, cells appear round in tangential view
Crystals: Occur sporadically in longitudinal parenchyma cells

Diffuse-Porous Hardwoods

American Basswood
Tilia americana

Average specific gravity: 0.37
Heartwood color: Creamy white to pale brown
Odor: Faint but characteristic musty odor
Pore distribution: Diffuse-porous; growth rings indistinct or faintly delineated by marginal parynchyma, sometimes with blurry whitish spots along the growth ring boundary
Pores: Small, mostly in irregular multiples and clusters
Rays: Distinct but not conspicuous on transverse surface with lens. 1-6 seriate; ray cells appear laterally compressed in tangential view; rays have bright yellow cast

American Beech
Fagus grandifolia

Average specific gravity: 0.64
Heartwood color: Creamy white with reddish tinge to medium reddish-brown
Pore distribution: Diffuse porous; growth rings distinct.
Pores: Small, solitary and in irregular multiples and clusters, numerous and evenly distributed throughout most of the ring; narrow but distinct latewood in each ring due to fewer, smaller pores
Rays: Largest rays conspicuous on all surfaces; darker ray fleck against lighter background on radial surfaces. Largest rays 15-25 seriate; uniseriate rays common

Black Cherry
Prunus serotina

Average specific gravity: 0.50
Heartwood color: Light to dark cinnamon or reddish-brown
Pore distribution: Diffuse-porous; growth rings sometimes distinct because of narrow zone or row of numerous slightly larger pores along initial earlywood.
Pores: Pores through growth ring solitary and in radial or irregular multiples and small clusters
Gum Defects: Common
Rays: Not visible on tangential surface; conspicuous light ray fleck on radial surfaces; distinct bright lines across transverse surface, conspicuous with lens. 1-6 (mostly 3-4) seriate.

Black Gum
Nyssa sylvatica

Average Specific Gravity: 0.50
Heartwood Color: Medium grey or grey with green or brown cast (wood usually has interlocked grain)
Pore Distribution: Diffuse-porous
Pores: Very small, numerous, solitary and in multiples and small clusters
Rays: Barely visible even with hand lens; 1-4 seriate

Eastern Cottonwood
Populus deltoides

Average specific gravity: 0.40
Heartwood color: Grayish to light grayish-brown. Occationally olive.
Pore distribution: Diffuse porous or semi-diffuse-porus. Usually an apparent size graduation from earlywood to latewood
Pores: Small to medium small; Solitary and in radial multiples of 2 to several
Rays: Very fine, not easily seen with hand lens

Sycamore
Platanus occidentalis

Average specific gravity: 0.49
Heartwood color: Light to dark brown, usually with a reddish cast
Pore distribution: Diffuse-porous; growth rings distinct due to unusual lighter color of latewood (thinner band and clearer than beech)
Pores: Small, solitary and in irregular multiples and clusters, numerous and evenly distributed through-

out most of the growth ring; latewood zone evident by fewer, smaller pores

Rays: Easily visible without hand lens on all surfaces, appearing uniform in size and evenly spaced on transverse and tangential surfaces, producing conspicuous dark ray fleck on radial surfaces. Largest rays up to 14 seriate; uniseriate rays not common.

Sugar Maple

Acer saccharum

Average specific gravity: 0.63
Heartwood color: Creamy white to light reddish-brown
Pore distribution: Diffuse-porous; growth rings distinct due to darker brown, narrow latewood line
Pores: Small, with largest approximately equal to maximum ray width in cross section; solitary or in radial multiples; very evenly distributed
Rays: Visible to eye on tangential surface as very fine, even-sized, evenly distributed lines; on radial surfaces, ray fleck usually conspicuous. Rays: Two distinct sizes: largest 7-8 seriate; uniseriate rays numerous.

Red Maple

Acer rubrum

Average specific gravity: 0.54
Heartwood color: Creamy white to light reddish-brown, commonly with grayish cast or streaks.
Pore distribution: Diffuse-porous
Pores: Small, solitary and in radial multiples, very evenly distributed; largest as large or slightly larger than widest rays on cross section.
Rays: May be visible on tangential surface as very fine, even-sized and evenly spaced lines; on radial surface, ray fleck usually conspicuous. 1-5 seriate.

Yellow Birch

Betula alleghaniensis

Average specific gravity: 0.62
Heartwood color: Light brown to dark brown, reddish-brown.
Pore distribution: Diffuse porous
Pores: Small to medium, solitary and in radial multiples of two to several pores
Rays: Rays smaller than pore diameters. Some pores may appear to be filled with a substance; 1-5 seriate.

Yellow Poplar

Liriodendron tulipifera

Average specific gravity: 0.42
Heartwood color: Green, or yellow to tan with greenish cast
Sapwood color: creamy white (often wide)
Pore distribution: Diffuse-porous; growth rings delineated by distinct light cream or yellowish line of marginal parenchyma.
Pores: Small, solitary, but mostly in radial or irregular multiples and small clusters
Rays: Distinct on cross section with lens; produce conspicuous fine light ray fleck on radial surfaces. 1-5 (mostly 2-3) seriate

Softwood Identification

Eastern White Pine

Pinus strobus

Average specific gravity: 0.35
Odor: Pleasant, piney
Heartwood: Distinct, darkening with age
Grain appearance: Fairly even
Earlywood / Latewood transition: Gradual
Resin Canals: large, numerous, mostly solitary, evenly distributed

Southern Yellow Pine

Pinus spp.

Average specific gravity: 0.51 to 0.61
Odor: “pitchy” pine odor
Heartwood: Distinct
Grain appearance: Uneven
Earlywood / Latewood transition: abrupt
Resin Canals: Large, numerous, mostly solitary, evenly distributed

Red Spruce

Picea rubens

Average specific gravity: 0.40
Odor: None
Heartwood: Light in color; indistinct from sapwood
Grain appearance: Fairly even to moderately even
Earlywood / Latewood transition: Gradual
Resin Canals: Small, relatively few; solitary or several in tangential groups, variably distributed

Hemlock

Tsuga Canadensis

Average specific gravity: 0.40
Odor: None
Heartwood: Indistinct, light in color
Grain appearance: Fairly uneven
Earlywood / Latewood transition: Fairly abrupt to gradual
Texture: Medium to medium-coarse

Balsam Fir

Abies balsamea

Average specific gravity: 0.36
Odor: None
Heartwood: Indistinct, light in color
Grain appearance: moderately uneven to moderately even
Earlywood / Latewood transition: Very gradual
Texture: Medium

Eastern Red Cedar

Juniperus virginiana

Average specific gravity: 0.47
Odor: "cedar-chest" odor, very distinct
Heartwood: Distinct, deep purplish red, aging to reddish-brown
Grain appearance: Moderately uneven to fairly even; latewood narrow
Earlywood / Latewood transition: Gradual
Texture: Very fine

Baldcypress

Taxodium distichum

Average specific gravity: 0.46
Odor: Faint to moderately rancid
Heartwood: Usually distinct
Grain appearance: Uneven
Earlywood / Latewood transition: Abrupt; earlywood medium yellow-brown; latewood amber to dark brown
Texture: Coarse to very coarse

For more information or to inquire about wood identification short courses hosted by The University of Tennessee and the Tennessee Forest Products Center, please contact:

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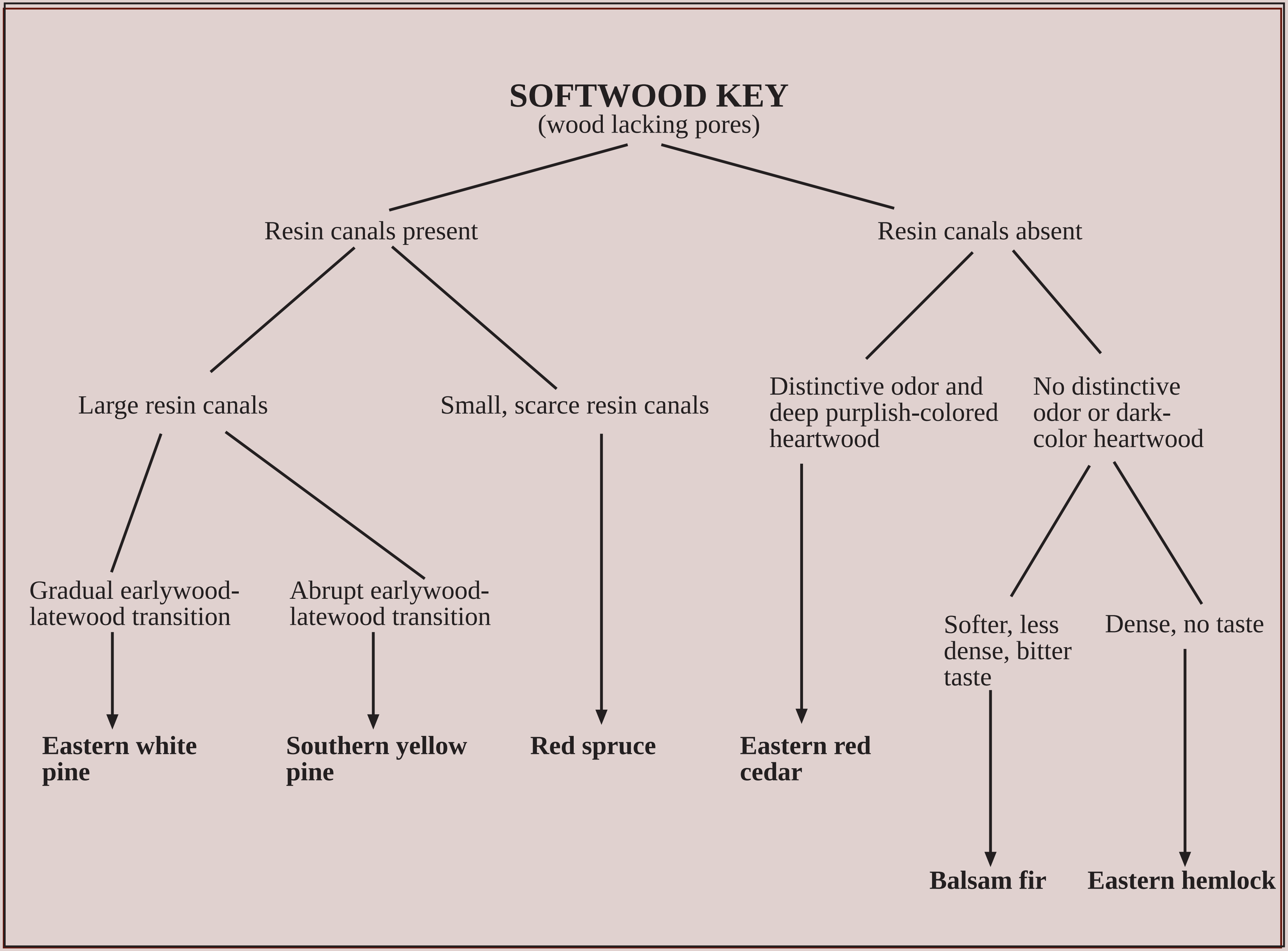
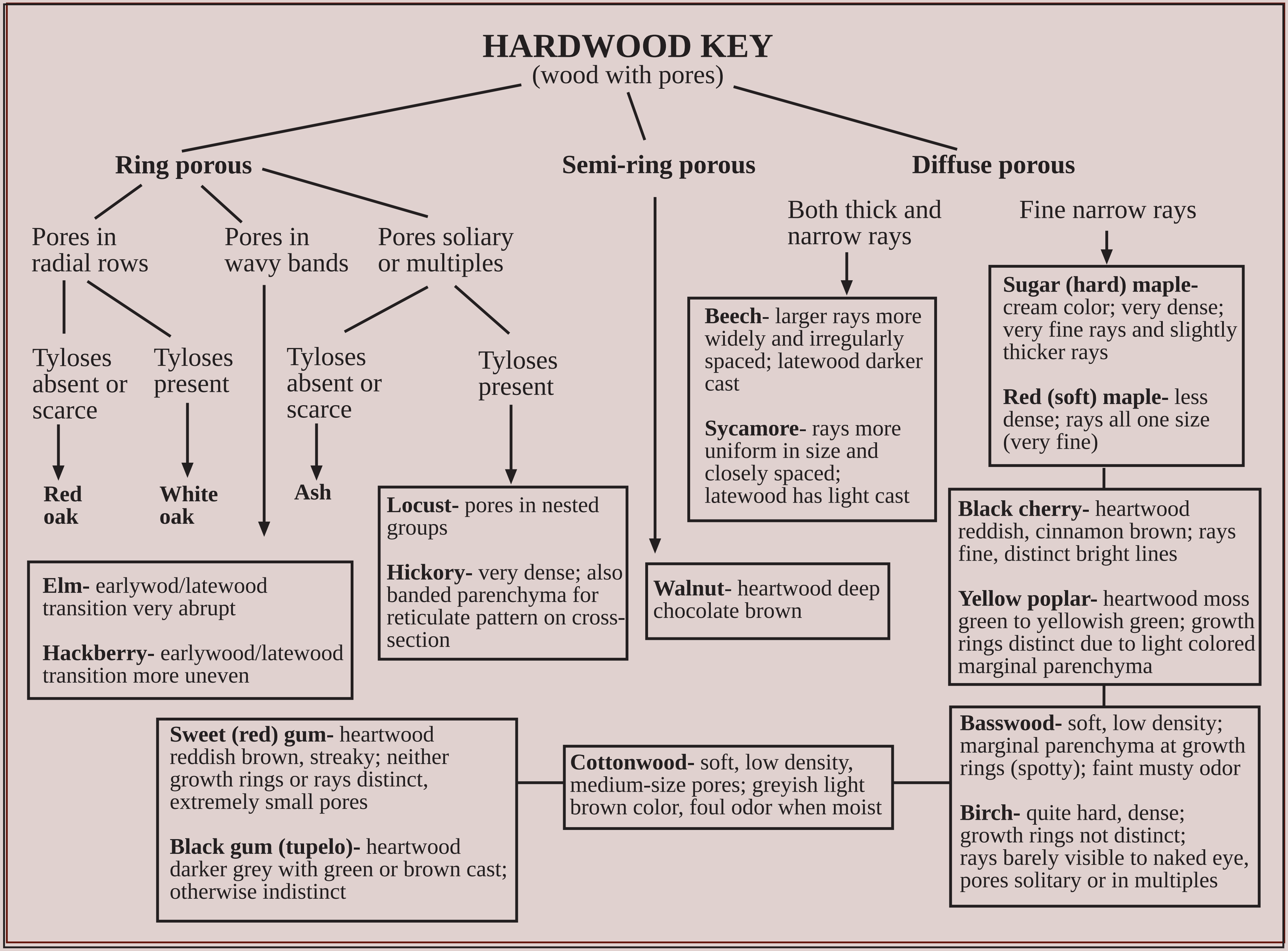

SOFTWOOD KEY
(wood lacking pores)
Resin canals present
Resin canals absent
Large resin canals
Small, scarce resin canals
Distinctive odor and deep purplish-colored heartwood
No distinctive odor or dark-color heartwood
Gradual earlywood-latewood transition
Abrupt earlywood-latewood transition
Softer, less dense, bitter taste
Dense, no taste
Eastern white pine
Southern yellow pine
Red spruce
Eastern red cedar
Balsam fir
Eastern hemlock


HARDWOOD KEY
(wood with pores)
Ring porous
Semi-ring porous
Diffuse porous
Pores in radial rows
Pores in wavy bands
Pores soliary or multiples
Tyloses absent or scarce
Tyloses present
Tyloses absent or scarce
Tyloses present
Red oak
White oak
Ash
Elm- earlywod/latewood transition very abrupt
Hackberry- earlywod/latewood transition more uneven
Locust- pores in nested groups
Hickory- very dense; also banded parenchyma for reticulate pattern on cross-section
Walnut- heartwood deep chocolate brown
Both thick and narrow rays
Fine narrow rays
Beech- larger rays more widely and irregularly spaced; latewood darker cast
Sycamore- rays more uniform in size and closely spaced; latewood has light cast
Sugar (hard) maple- cream color; very dense; very fine rays and slightly thicker rays
Red (soft) maple- less dense; rays all one size (very fine)
Black cherry- heartwood reddish, cinnamon brown; rays fine, distinct bright lines
Yellow poplar- heartwood moss green to yellowish green; growth rings distinct due to light colored marginal parenchyma
Basswood- soft, low density; marginal parenchyma at growth rings (spotty); faint musty odor
Birch- quite hard, dense; growth rings not distinct; rays barely visible to naked eye, pores solitary or in multiples
Cottonwood- soft, low density, medium-size pores; greyish light brown color, foul odor when moist
Sweet (red) gum- heartwood reddish brown, streaky; neither growth rings or rays distinct, extremely small pores
Black gum (tupelo)- heartwood darker grey with green or brown cast; otherwise indistinct

Visit the Agricultural Extension Service Web site at:
http://www.utextension.utk.edu/

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