LUMBER
FROM
LOCAL WOODLOTS

Woodlot Resources
Harvesting Timber
Sawing Logs Into Lumber
Seasoning Lumber
Glossary

RURAL CONSTRUCTION SERIES

Northeast Regional Agricultural Engineering Service

COORDERATIVE EXTENSION
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Introduction

Local woodlots offer an often overlooked source of good quality, low-cost wood products for flooring, paneling, siding, furniture, building construction, crating, specialty forest products, woodworking projects, and more. *Lumber from Local Woodlots* emphasizes the use of tree species native to the Eastern United States. Trees from this area have helped supply the nation's timber needs for more than three centuries. In many areas, native tree species can provide lumber for all wood-framed building needs. With good forestry management practices, these woodlots will yield a steady supply of quality lumber indefinitely.

This bulletin is intended to encourage the use of local woodlot resources for building construction and finishing. It is written for persons who are interested in an overview of the woodlot-to-lumber process. Topics discussed include wood properties, sources of professional assistance and training, the need for proper woodlot management, contracting with loggers and sawyers, good harvesting practices, sawing methods, lumber drying, and lumber storage. The discussions are not intended to replace professional services that should be relied upon when managing a woodlot. Instead, they give the reader the background knowledge necessary to discuss his or her needs with professionals.

Those interested in an overview of any of the steps in the woodlot-to-lumber process will also find the book useful. For instance, those interested in buying lumber from local sawmills would benefit from the discussion of tree species, wood properties, sawing, drying and storing lumber. For those interested in developing woodlot resources but not in using the wood, the chapters on woodlot resources and harvesting timber would be of interest.

Seek Professional Advice

The first step in the woodlot-to-lumber process is to have a professional forester assess the timber potential of the woodlot. With this completed, you can discuss your construction needs with the forester and develop a woodlot management plan. Foresters with the appropriate training understand the value of forest resources and can guide you on managing the resources to maximize income and long term productivity. It is wise to consult a professional to be sure the most value is obtained from your woodlot.

Harvesting trees and sawing logs into lumber requires experience and training to avoid life-threatening accidents. To achieve the most value from the woodlot and logs, you should not attempt these tasks unless you have experience or obtain training from a professional. The state or county cooperative extension office or state forester's office can provide contact information for public or private foresters in the state. County extension offices may also have information on how to contact local foresters.

Estimating Construction Needs

The estimate of construction needs is stated on the bill of materials for the project. The bill of materials lists the number of board feet of lumber by the dimensions and use as indicated by the plan. The intended use of lumber is important because it will define the wood properties necessary. For instance, the poles in a pole building must be strong to support the building's weight. The strength, decay resistance, and other properties vary with tree species. Wood properties will be discussed in Chapter 1, "Woodlot Resources."

The first step in preparing a bill of materials is to prepare or select a set of plans for the construction or repair project. There are several sources of idea plans, some of which are given in Appendix A. Idea plans may be modified depending on specific needs. If extensive modification is done, consult a professional engineer to ensure the building will be safe.

Using locally grown lumber for building projects may require that lumber sizes and other details specified in plans be changed. For instance, a building plan may require a floor joist to be as strong as eastern hemlock, but the local woodlot may be predominantly aspen, which is significantly weaker.

When using lumber from local woodlots, a decision must be made on whether to dry the lumber or use it green. Air-drying lumber can take between two and six months or more, depending on the local weather conditions and species of wood. Kiln-drying is faster but is more expensive in energy and equipment. Chapter 4 discusses the procedure for air-drying lumber.
Chapter 1: Woodlot Resources

Woodlot resources reach their full potential through thoughtful management. The management plan is most important for maximizing the long term productivity of woodlot resources, including protection of wildlife habitat and maintenance of a steady supply of valuable timber. In creating a woodlot management plan, the quality and timber volume of each type of tree should be considered. This chapter includes an overview of tree species in the eastern United States, their properties, the need for a management plan, and the methods used by professional foresters to estimate timber volume in a woodlot. The best woodlot management plan will result from a knowledge of the woodlot environment, woodlot capability, and the value and uses of available timber.

**Softwood and Hardwood Trees**

Woods native to the United States and Canada are classified as either softwood or hardwood. Softwood lumber is obtained from coniferous or needle-bearing trees. Hardwood lumber is obtained from deciduous trees, those that lose their leaves in autumn. In this context, the terms “hardwood” and “softwood” do not refer to the actual hardness of the wood. Wood from some hardwood trees is softer than wood from some softwood trees. For example, poplar is classified as hardwood, but it is actually quite soft. Eastern hemlock, on the other hand, is classified as softwood, although it is moderately hard.

Either softwood or hardwood may be used in construction if the timbers selected are large enough to carry the expected loads. If a choice of species is available, choose wood for structural use on the basis of strength and ease of working.

The following species descriptions include a sampling of tree species that may be growing in eastern woodlots and that can be used for lumber. The descriptions tell where the species grow and note their common commercial uses. The guide does not include all tree species. Instead, the authors have selected the species that may be suitable for building construction or finishing. For help in identifying trees, an excellent reference is *Important Trees in Eastern Forests*, which is listed in the reference section at the end of the book.

The species descriptions are based on descriptions given in the *Wood Handbook: Wood as an Engineering Material*, also listed in the reference section, and the experience of the authors and others. If you have questions concerning a species not mentioned, consult the *Wood Handbook*, a wood technology specialist, or a professional forester.

**Softwoods**

Cedar, Eastern Red. Found throughout the eastern half of the United States, except in northern Maine and Florida, eastern red cedar is frequently used for fence posts because of its excellent durability. Small sawlogs

**Figure 1-1. Examples of softwood and hardwood trees.**

Lumber from Local Woodlots
are processed for lumber that is frequently used for lining chests and closets. The pungent cedar odor repels many insects. In building construction, it may be used for flooring.

**Cedar, White.** White cedar includes both northern and Atlantic white cedar. Northern white cedar grows southward from Maine along the Appalachians and in the northern part of the Lake States. Atlantic white cedar is strictly a swamp tree. White cedar is light, soft, durable, and fragrant. It is used for lumber, posts, rails, boats, shingles, and log homes.

![Northern white cedar branchlets.](image)

**Figure 1-2.** Northern white cedar branchlets.

**Douglas-fir** grows in the western United States but is commonly found in lumber yards throughout the country. The structural properties of Douglas-fir as well as southern pine are often used as the standard for evaluating other woods. However, many northeastern species have excellent structural properties and may be less expensive. Douglas-fir is included in this list and Table 1–1 to allow comparison with eastern species.

**Fir, Balsam.** Found in New England, New York, Pennsylvania, and the Lake States, balsam fir is used for frame lumber, although spruce is preferred for framing because it is stronger. Balsam fir machines very well.

![Balsam fir needles.](image)

**Figure 1-3.** Balsam fir needles.

**Hemlock, Eastern.** This species is strong and makes an excellent building material. It is found from New England to northern Alabama and Georgia and in the Lake States. Many older homes, barns, and utility buildings in the northeastern states are framed and sheathed with rough-cut hemlock. The Northeast Lumber Manufacturers Association (NELMA) design values indicate that hemlock is a good wood for structural use. Eastern hemlock makes good dimension stock for framing, but it nails easier when the wood is not completely air-dried. It is also used for sheathing, subflooring, roof boards, and trusses.

![Eastern white pine needles.](image)

**Figure 1-4.** Eastern white pine needles.

**Pine, Eastern White.** This pine species grows from Maine to northern Georgia and in the Lake States. It has been used extensively since colonial days as a building material. The wood is light, straight-grained, and easily worked, but it is not as strong as spruce or hemlock. White pine is frequently used for studs, but is not recommended for rafters or floor and ceiling joists. It is used often for cabinets, interior finishes, paneling, and sheathing.

**Pine, Jack.** Sometimes known as scrub pine, gray pine, or black pine, jack pine grows naturally in the Lake States and in a few scattered areas of New England and New York. In commercial lumber, jack pine is not always separated from the other pines with which it grows, including red pine and eastern white pine. Jack pine is moderately lightweight, moderately low in bending and compressive strength, and moderately low in stiffness and shock resistance. Lumber from jack pine is rather coarse-grained, resinous, and generally knotty.

**Pine, Pitch.** Pitch pine grows from Maine along the Appalachians to eastern Tennessee and northern Georgia. The wood is moderately heavy, hard, and strong in bending and endwise compression. Pitch pine is coarse-grained and very durable. It can be used for structural lumber, but requires careful drying techniques.
Pine, Pond. This pine species grows along the Atlantic coast from New Jersey to Florida, usually in low flats with other pines. The wood is heavy, coarse-grained, and resinous. Pond pine is moderately strong, stiff, moderately hard, and moderately shock resistant. The wood is used in general construction, and for railway ties, posts, and poles.

Pine, Red (Norway Pine). Red pine is found primarily in New England, New York, Pennsylvania, and the Lake States. The wood is moderately heavy, moderately strong and stiff, moderately soft, and moderately high in shock resistance. It has a tendency to twist in drying. Red pine is principally used for poles, posts, and piling, but is also used for lumber, siding, flooring, and doors.

Pine, Southern. This pine is found in southern and south Atlantic states. Included under the name southern pine are longleaf pine, shortleaf pine, loblolly pine, and slash pine. They are commonly used for construction, especially dimension lumber and flooring. Southern pine takes wood preservative treatments well and is used extensively in prefabricated trusses. The strength of southern pine varies, but properly selected southern pine can be used for beams, posts, and joists.

Ash can be found throughout the eastern United States. Both white and green ash are included in this group. It is heavy, strong, hard, and stiff with high shock resistance. It is straight-grained, seasons well, and holds its shape when dry, but it has low resistance to decay. For construction purposes, ash has about the same bending strength as commercial Douglas-fir lumber of the same size and grade. However, since it stays smooth under constant rubbing, ash has higher value for specialty items such as handles, oars, and baseball bats. If you prefer to make handles rather than use store-bought ones, white ash is an excellent wood. The best pieces to use have between five and seventeen growth rings per inch.

Aspen lumber generally comes from the northeast and Lake States, with some production in the Rocky Mountain states. It is also known as poplar or popple, but is a different species than yellow-poplar. It can be used as a construction material in areas where it grows in plentiful quantities and where traditional softwoods are in short supply. When using aspen for construction, it may be necessary to use larger pieces than shown in plans, since it is significantly weaker than standard construction grade lumber. Contact your state extension agricultural engineer for assistance.

Tamarack (Eastern Larch). Tamarack is hard, heavy, durable, and strong, but is difficult to work with tools.
Basswood grows from the Canadian provinces southward through the eastern United States. It is a soft, lightweight hard wood that is the preferred species for wood carvers. It has been used for ladders and applications where lightweight wood is needed, such as large barn doors.

![Beech leaf](image)

**Figure 1-8. Beech leaf.**

Beech. Found in the eastern United States and adjacent Canadian provinces, beech is heavy, hard, and very shock resistant. However, it shrinks quite a bit and must be dried carefully to prevent strength-reducing defects. Two other disadvantages are its low resistance to decay and difficulty of working. This wood makes good flooring, handles, veneer, and containers.

Birch is found primarily in the northeast and Lake States and includes yellow birch, sweet birch, and paper birch. In construction, birch is mainly used for doors, paneling, and interior finish. It is also used for boxes, baskets, veneer, and furniture. This wood shrinks considerably during drying and is uniform and fine in texture. Paper birch is lower in weight, softer, and lower in strength than yellow and sweet birch.

![Buckeye leaf](image)

**Figure 1-9. Buckeye leaf.**

Buckeye consists of two species: yellow and Ohio buckeye. Growth ranges from the Appalachians of Pennsylvania southward to North Carolina and then westward to Texas. The wood is uniform in texture, straight-grained, low in shock resistance, and does not machine well. Buckeye is not customarily separated from other species when manufactured into lumber and can be utilized for the same purposes as aspen, basswood, and yellow-poplar.

Butternut grows westward from Maine to Minnesota and south to North Carolina and Arkansas. It is a close relative of black walnut, but it is slightly weaker and softer. Its light brown wood is attractive and easy to work. Butternut makes excellent paneling. The lower grades of butternut have worm holes and knots, and are often used to give paneling a unique character.

**Figure 1-10. Black cherry leaves.**

Cherry, Black. Cherry is found in southeastern Canada and the eastern United States. It resists warping and splitting during seasoning and is exceptionally stable afterwards, which makes it ideal for wood carving. Cherry is quite strong, has reddish-brown heartwood, and is used primarily for furniture, veneer panels, and woodworking.

Chestnut, American. Also known as sweet chestnut, American chestnut once grew in commercial quantities throughout the Northeast, until it was practically destroyed by a blight. There are still some stands of dead chestnut left in the Appalachian Mountains. Due to the high decay resistance of the wood, these stands could still be harvested. Chestnut is moderately hard, moderately lightweight, moderately low in strength and shock resistance, and low in stiffness. However, it seasons well and is easy to work with tools. Chestnut was used for poles, railroad ties, furniture, caskets, and veneer. It now appears mostly as “wormy chestnut” for paneling and trim.

Cottonwood can be found throughout the eastern United States. The wood is uniform in texture and straight-grained. Some cottonwood may be difficult to work because of fuzzy surfaces. Cottonwood lumber and veneer are used for boxes, crates, baskets, and pallets.

Elm species growing in the United States include American elm, slippery elm, rock elm, winged elm, cedar elm, and September elm. American elm is also known as white elm, water elm, and grey elm. Most elm is found in
the Lake, Central, and Southern States. The supply of American elm is threatened by both Dutch elm disease and phloem necrosis, diseases which have killed hundreds of thousands of trees. Elms may be divided into two classes: hard and soft. American elm and slippery elm are soft elms; the remainder are hard elms. Soft elm is moderately heavy, high in shock resistance, and moderately hard and stiff. Hard elm is heavier than soft elm. All elm has excellent bending qualities. Elm lumber is used principally in decorative panels, crates, furniture, and caskets.

Hackberry and sugarberry supply lumber generally known only as hackberry. Hackberry grows east of the Great Plains from Alabama and Georgia northward, except along the Canadian border. Sugarberry grows mainly throughout the Southern and South Atlantic States. Hackberry lumber is moderately heavy, moderately high in bending strength, moderately weak in compressive strength, and moderately hard. It is high in shock resistance but low in stiffness. Hackberry is moderately high in shrinkage but keeps its shape well during seasoning. Most hackberry is cut into lumber, some into dimension stock, and some into veneer.

![Figure 1-11. Hackberry twig with leaves and berry.](image)

Hickory is found throughout the eastern United States and is exceptionally tough, heavy, hard, strong, and resilient. Hickory shrinks considerably during drying, and this may result in checking and warping if drying is not done carefully. It has low resistance to decay and is slightly stronger than Douglas-fir lumber of the same size and grade. It is often quite knotty, but the knottier boards make good pallets. Hickory is preferred for hand tool handles and also makes good ladder rungs, dowels, and poles. Hickory sawdust is used to smoke meats.

Holly, American. This species is sometimes called white holly, evergreen holly, and boxwood. Its natural growth area includes the Atlantic coast. The wood is moderately low in strength and stiffness, but it is heavy, hard, and high in shock resistance. Holly is readily penetrable by liquids and can be satisfactorily dyed. The wood works well, cuts smoothly, and is used principally for scientific and musical instruments, furniture inlays, and athletic goods.

Honeylocust is found primarily in the eastern United States, except for New England, the South Atlantic and Gulf Coastal Plains. The wood is very heavy, very hard, high in bending strength, and very stiff. Honeylocust is very shock resistant and decay resistant. The wood is restricted primarily to local uses, such as fence posts and lumber for general construction.

Locust, Black. This locust species grows from Pennsylvania along the Appalachians to northern Georgia. The wood is very heavy, very hard, very tough, and high in strength and stiffness, but it is low in resistance to decay. The wood is used for fence posts, rough construction, and poles.

Magnolia for commercial purposes includes three species—southern magnolia, sweetbay, and cucumbertree. Although Louisiana leads in production of magnolia lumber, the wood also grows along the Atlantic and Gulf coasts from Long Island to Texas. Cucumbertree wood is similar to that of yellow poplar, and lumber harvested with the poplar is not generally separated when marketed. Magnolia wood is straight-grained, moderately heavy, moderately low in bending and compressive strength, moderately hard and stiff, and moderately high in shock resistance. Magnolia lumber is used principally for furniture, pallets, venetian blinds, doors, veneer, and millwork.

![Figure 1-13. Magnolia leaf and flower.](image)

Lumber from Local Woodlots
Maples are a diverse family of trees found throughout the eastern United States. In the lumber industry, maples are classified either as hard (sugar maple and black maple) or soft (primarily red maple and silver maple). Hard maples are heavy, strong, stiff, and, as the term implies, hard. They are generally straight-grained, though they sometimes develop a "curly" grain, and they are especially prized for making butcher blocks. Soft maples are less dense than hard maples and are only about 60% as strong. Most maple lumber comes from the middle Atlantic, Lake States, and New England. Maple is used for flooring, veneer, and furniture.

Oak, Red. The red oak species can be found throughout the eastern United States. The principal species considered to be part of the red oak group are northern red oak, scarlet oak, shumard oak, nattall oak, black oak, southern red oak, cherry bark oak, water oak, laurel oak, and willow oak. It is heavy, hard, and stiff, but unlike white oak, it is extremely porous. It is generally straight-grained and easy to work, but it decays quickly in contact with soil and requires preservative treatments for most outside applications. This wood has high value for furniture and veneer, and it is also in strong demand for flooring.

Oak, White. White oak species can be found throughout the eastern United States. The principal species considered to be part of the white oak group are white oak, chestnut oak, post oak, overcup oak, swamp chestnut oak, bur oak, chinkapin oak, swamp white oak, and line oak. It is heavy, hard, and very strong. The pores of white oak heartwood are plugged with membranous growth called tyloses, which makes the wood impenetrable by liquids, so it is a favored material for wooden water tanks and silos. White oak is also used for flooring, veneer, tool handles, pallets, fencing, truck and wagon floors, doors, and many other items. White oak is moderately resistant to decay and, when green, has about the same bending strength as Douglas-fir. It hardens as it seasons—a fact that can be attested to by anyone who has tried to drive a nail into well-seasoned oak. Because it is difficult to season properly, white oak is usually used while green.

Sassafras grows throughout the eastern half of the United States, except for northern New England. The wood is moderately heavy, moderately hard, moderately low in bending and compressive strength, and moderately high in shock resistance and decay resistance. Sassafras has a characteristic odor, and its roots may be used to produce flavoring. Sassafras was prized by Indians for dugout canoes and is still used for small boats. The lumber is used for fence posts, rails, and general millwork.

Sweetgum grows from southwestern Connecticut westward into Missouri and southward to the Gulf of Mexico. The lumber is usually divided into two classes—sap gum, the light-colored sapwood, and red gum, the reddish-brown heartwood. Sweetgum has interlocked grain and must be carefully dried. The grain causes a ribbon stripe, however, that is desirable for finish and furniture. The wood is moderately strong, moderately stiff, and moderately high in shock resistance. The wood is used for lumber, veneer, and plywood. The lumber is used for furniture and interior trim.
Sycamore (Buttonwood) grows from Maine to Nebraska, south to Texas, and east to Florida. It is moderately heavy and strong, with good shock resistance. It grows very fast, and it is still possible to find a few forest specimens with a diameter of six feet or more. It can be used for flooring in barns, trucks, and wagons if oak is unavailable. Sycamore is also used for butcher blocks, boxes, and pallets. Sycamore veneer is used for fruit and vegetable baskets and paneling.

Walnut, Black. Found from Vermont to Texas, black walnut is hard and takes natural finishes well. The wood is straight-grained, easy to work with tools, and very stable after seasoning. It is a slow-growing tree much prized for its dark brown heartwood. When a black walnut tree of sufficient size falls or is cut down, it is often sold as veneer logs. Contact your state forestry officials for details on how to advertise and sell veneer trees to log and stumpage buyers.

Figure 1-17. Black walnut leaf.

Willow, Black. The most important willow grown in the United States, it is produced mainly in the Mississippi Valley but is found throughout the northeast. The wood is uniform in texture, lightweight, very low in compressive strength, and moderately soft. Black willow is moderately high in shock resistance and has moderately high shrinkage. The lumber is suitable for roof and wall sheathing, subflooring, and studding.

Figure 1-18. Yellow-poplar leaf.

Yellow-Poplar (Tulip Poplar) grows from Connecticut to the Midwest and south to Florida and Missouri. It is a soft, moderately light, and moderately stiff wood. It is straight-grained and generally free of knots, which makes it suitable for a wide range of building projects. It is a fast-growing tree which is often cut into large timbers. Yellow-poplar shrinks a good bit during seasoning but stays in place well afterward. Yellow-poplar is also known as poplar, tulip poplar, tulip tree, white wood, or hickory poplar. It is often confused with aspen.

Properties of Woods

Table 1–1 on page 9 classifies several tree species according to their working, strength, and surface characteristics. Class A includes species relatively high in the specific property or characteristic listed; class B species are intermediate, and class C species are relatively low. However, all wood species in a single class, for example, class A, are not equal by any means. These species are higher, in general, in a specific property in relation to the remaining classes B and C. In some cases, the classifications are rather subjective.

When determining the suitability of a wood for load-bearing members of structures, Table 1–1 can be used as a guide to comparative strength properties. It is important to understand that the property comparisons made in Table 1–1 are based on the average properties observed for the wood. The strength and other wood properties can vary, and it is important to select pieces of lumber that do not have defects which can alter the property of interest.

The properties in Table 1–1 are described in the following paragraphs. Table 1–1 and the descriptions are adapted from Selection and Use of Wood Products for Home and Farm Building, listed in the reference section. Appendix B discusses the properties desirable for specific use.

Hardness
Hardness is the property that makes a surface difficult to dent, scratch, or cut. The harder the wood, the better it resists wear and the better it can be polished. On the
Table 1-1. Broad Classification of Woods According to Properties and Characteristics

(Woods classified as “A” are relatively high in respect to the listed property; “B” are intermediate, and “C” are relatively low. “—” indicates not enough information was available to rate the species.

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<td>Maple, Hard</td>
<td>A</td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td>Maple, Soft</td>
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<td>B</td>
<td>C</td>
</tr>
<tr>
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<td>A</td>
<td>B</td>
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<tr>
<td>Oak, White</td>
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<td>A</td>
<td>B</td>
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<tr>
<td>Pine, Eastern White</td>
<td>C</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>Pine, Jack</td>
<td>B</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>Pine, Pitch</td>
<td>B</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>Pine, Pond</td>
<td>C</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>Pine, Red</td>
<td>C</td>
<td>C</td>
<td>A</td>
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<tr>
<td>Pine, Southern Yellow</td>
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<td>B</td>
<td>A</td>
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<tr>
<td>Pine, Virginia</td>
<td>B</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>Sassafras</td>
<td>B</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>Spruce, Red &amp; White</td>
<td>C</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>Sweetgum</td>
<td>B</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Sycamore</td>
<td>B</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>Tamarack (Larch)</td>
<td>A</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Walnut, Black</td>
<td>B</td>
<td>B</td>
<td>B</td>
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<tr>
<td>Willow, Black</td>
<td>C</td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td>Yellow-Poplar</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>

other hand, hard wood is more difficult to cut with tools, harder to nail, and more likely to split when nailed. Hardness is a particular concern in flooring and interior trim.

**Weight**
Weight, in addition to being important in itself, is usually a reliable index of strength. A heavy piece of wood is generally stronger than a lighter piece with the same moisture content and size, whether it is of the same or a different species. The classification in Table 1–1 is based on weights of air-dried wood.

**Freedom from Shrinkage**
Most materials change in dimension with changes in temperature or moisture. Wood, like any fibrous material, shrinks as it dries and swells as it absorbs moisture (Figure 1–19). The classification in Table 1–1 compares the amount of shrinkage that occurs when green wood is dried to air-dry conditions. For more discussion of moisture content and shrinkage, refer to Chapter 4, “Seasoning Lumber.”

![Figure 1–19. Dimensions of shrinkage.](image)

**Freedom from Warp**
Warping occurs because wood shrinks at different rates across its three dimensions. These dimensions are illustrated in Figure 1–19. Table 1–1 classifies species according to their tendencies to warp during drying or for dry wood as a result of changes in atmospheric conditions.

**Ease of Working**
Ease of working refers to the ease with which wood can be cut, shaped, and fastened with ordinary tools on the building site. For some purposes, the difference in ease of working between woods is negligible, but for others it may decidedly affect the quality and cost of a finished job.

The classification in Table 1–1 is based on a combination of the hardness, texture, and character of the wood surface. Woods in class A have soft, uniform textures and finish to smooth surfaces; woods in class C are hard, nonuniform in texture, and more difficult to surface without chipping or raising the grain.

**Paint Holding**
The ability of a wood surface to hold paint depends on several factors, including the kind of paint, surface conditions and application factors, and the kind of wood. The ratings of the species in Table 1–1 indicate their abilities to hold paint under exposure to the weather; the best species are those in Class A. Knots, particularly resinous ones, high pitch content, or high moisture content will also detract from the paint holding capacity.

**Nail Holding**
The resistance offered by the wood to the withdrawal of nails is important to structural soundness. Usually, the more dense and harder the wood, the greater the inherent nail holding ability, assuming the wood does not split. The grouping of woods in Table 1–1 according to their nail holding ability is based on tests that measured the force required to pull nails from wood.

**Decay Resistance**
Most wood in ordinary buildings is in a dry location and is not in danger of decay. It is only in parts of a building where wood may become damp or where wood touches or is embedded in the ground that decay resistance becomes important. The woods in Table 1–1 are classified in accordance with their natural decay resistance, which applies solely to the heartwood, because sapwood of all species in an untreated condition has low decay resistance. The different types of wood are illustrated in the tree cross section in Figure 1–20.

![Figure 1–20. Cross section of a tree trunk.](image)
Bending Strength
Bending strength is a measure of the load-carrying capacity of members ordinarily used in a horizontal or moderate slope position and resting on two or more supports. Examples of members in which bending strength is important are rafters, ceiling and floor joists, beams or girders, purlins, and scaffold platforms. Species low in bending strength may still be selected for uses where this property is essential. However, larger pieces are needed to meet the required load-carrying capacity.

![Diagram of Bending Strength and Deflection](image)

**Figure 1-21.** Bending and compressive strength.

Stiffness
Stiffness is a measure of the resistance to bending or deflection under a load. In floor and ceiling joists of a house, stiffness may be more important than actual breaking strength, because excessive deflection will cause uneven floors and cracks in walls and ceiling panels. Stiffness is also important in shelving, beams, and long, slender columns.

Toughness (shock resistance)
Toughness is a measure of the capacity to withstand suddenly applied loads. Hence, woods high in shock resistance excel in withstanding repeated shocks, jars, jolts, and blows. The heavier hardwoods—hickory, birch, oak, maple, and ash—are so much higher in shock resistance than the toughest of the softwoods that these hardwoods are used almost exclusively where an exceptionally tough wood is required.

Strength as a Post
Posts or compression members are generally square or circular in cross section, usually upright, and they support loads that act in the direction of the length. An example would be a post supporting a hay loft or one supporting a rafter in a home. Compressive strength is not important in fence posts, which carry no loads.

The woods in any class may be safely used as posts, provided that larger cross sectional areas are used for lower strength woods. The compressive strength of a wood is not always the most important factor in determining the cross sectional area of a post; bearing area, stiffness, and stability are also considered.

Surface Characteristics
Lumber is often selected for a use because of its appearance as well as its working and strength characteristics. Surface properties affect the appearance of the wood and at times its suitability for a use. For example, knots can enhance a wood’s suitability for paneling but decrease the wood’s strength.

Table 1 classifies the species according to the size and number of the more important surface characteristics: knots and pitch pockets. The woods in class A have the least number of these surface features and are generally the most desirable for construction lumber.

**Summary**

Local woodlots can provide lumber for all wood frame building needs as well as many other uses. The selection of wood for construction depends on the intended use but is not always based on a single property. At least two or more of the most desirable properties should be present in the species selected, even if one or two undesirable properties are also present. For example, certain hardwoods are used for construction because they are strong and stiff, although they may also be difficult to work and to nail. The properties desirable for different uses in wood frame constructions are given in Appendix B.

**Woodlot Management**

Woodlot management is more than harvesting trees that you need or removing poorly formed or dying trees. Removing only the best trees is usually shortsighted. The best trees in the woodlot will often increase greatly in value if allowed to grow and seed a new generation of high quality trees. Woodlot owners should seek advice from a professional forester to choose the best type of harvest for the woodlot and timber needs. Forest growth is a long term proposition; it takes a long time to correct mistakes in the woodlot.

Silviculture is the practice of forestry through scientific methods. A woodlot is managed much like any crop through knowledge of soil, light, moisture, and an understanding of topography, tree species, and market conditions. Orderly cutting and removal of trees can be done by silvicultural methods such as selective cutting, shelterwood cutting, and clearcutting, as well as many others.
With a knowledge of type, quality, and quantity of the timber resources, a management plan can be developed that will balance construction needs with the long-term value and productivity of the woodlot. If you intend to harvest for a building project, let the forester review your bill of materials. Work with the forester to develop an understanding of local market conditions and the potential value of the trees in your woodlot. It may be better to sell trees from the woodlot, buy lumber with the income, and have money left over.

**Timber Volume Estimation**

The volume, quality, and value of a timber stand can best be determined by a professional forester who understands local markets and the woodlot’s capability. Foresters who estimate timber volume for a living call it “timber cruising.” The art of timber cruising takes years to master.

![Figure 1-22](image-url) Forester using a “cruising stick” to estimate timber volume.

Estimates can be measured in cords, board feet, cubic feet, and tons. Saw timber generally is measured in board feet. In an increasing number of states, the International 1/4” Kerf Log Rule is being used to estimate the board foot volume of logs and timber. This log rule estimates the volume of lumber which would be sawn from a log using the most common circular saw. If a different log rule is used in your area, contact the Cooperative Extension System or county forester for information.

The procedure described below can be used by the landowner to get a rough estimate of timber volume. It is not intended to be a substitute for professional expertise but will allow the landowner to become familiar with the resources. When developing a rough estimate, note if trees have visible defects. Trees with straight, limb-free trunks and no visible defects usually have greater potential for producing high quality timber. Trees with large branches, seams, logging wounds, crooked trunks, or an abundance of limbs will usually yield poor grade construction lumber. Such trees could be an excellent wood source for other uses, including paneling and siding.

**Estimating Timber for an Individual Tree**

A cruising stick is used to estimate the diameter of a tree and the number of sixteen-foot logs it will yield. This information is converted to timber volume in board feet using Table 1-2. Using a photocopy of the pattern on the inside back cover of this book, a cruising stick can be made; the photocopy must be the same size as the original. The instructions for making a cruising stick are included on the pattern.

To determine the diameter of a tree, hold the “cruising stick” against the tree 25 inches from your eyes. Place the left end of the stick at the left side of the tree, as illustrated in Figure 1-23, and read the diameter of the tree where you see the right side of the tree across the stick. Diameters should be measured at 4 1/2 feet above the ground; this is referred to as “diameter-at-breast height” or d.b.h.

![Figure 1-23](image-url) Overhead view of a cruising stick being used to estimate tree diameter at breast height (d.b.h.).

To measure the height of a tree in terms of its number of sixteen-foot logs, hold the stick 25 inches from the eyes while standing 66 feet from the base of the tree as illustrated in Figure 1-24. Align the bottom of the height...
scale with the base of the tree at the point where it would be cut, and measure to the top of the usable height, usually a top diameter of between six and ten inches or where the tree forms a crown of large branches. For the International 1/4-inch Kerf Log Rule, tree volume is estimated in terms of usable sixteen-foot logs yielded per tree. Use the tree volume measurement scale in Table 1–2 to convert your height and diameter data for each tree into board foot volume. The estimate does not account for cull or waste, which may reduce the board foot volume obtained from the tree.

Using the cruising stick, estimate the volume of saw timber in each tree large enough to yield lumber. Tally the volumes according to the different species. It is a good idea to mark the trees tallied so you won’t recount them. One method of leaving a good temporary mark is to fill a sock with powdered lime and slap it against the tree on the side facing the uncounted portion of the stand. Lime will wash off with rain and will not be confused with the paint marks used to select trees to be cut.
Chapter 2: Harvesting Timber

Harvesting trees is the most dangerous step in developing woodlot resources. This chapter provides an overview of logging terminology, contracting with loggers, good harvesting practices, and estimating the usable lumber from logs. If you are not experienced, do not have the appropriate equipment, or are not in top physical and mental condition, do not attempt a task as dangerous as logging.

The logging process is critical in obtaining the most value from woodlot resources. Loss in lumber value and yield regularly occurs with inexperienced loggers. A lack of knowledge or lack of attention to details can undo the benefits of several years’ growth of trees. It makes sense to plan the logging with a professional forester, hire an experienced contractor, develop a good contract, and oversee the operation. If you plan to log yourself but do not have experience, contact the Cooperative Extension System to inquire about training programs.

Logging Language

Whether contracting for logging services or doing it yourself, an understanding of logging terms is important. This section covers many terms which are likely to arise in logging discussions. They are not intended to be technical definitions but are a layperson’s introduction to the language of logging and forestry.

Trees in a forest stand which have not been severed from the stump are referred to as standing timber, stumpage, or simply timber. Stumpage price is the price paid for standing timber; it can be in terms of 1,000 board feet, cords, or a lump sum price. A log has been cut (bucked) to a length appropriate to saw into lumber. Lumber refers to usable boards sawn from logs.

Felling refers to cutting a standing tree. Directional felling is felling so the tree falls in a predetermined

Figure 2-1. A skidder in a woodlot landing, surrounded by piles of logs and slash.
direction. The goal is to minimize the damage to residual trees or the tree being felled, and minimize risk to the logger. Limbing is the removal of limbs from a felled tree. Bucking is the making of logs or bolts according to specifications determined by the owner or user.

Residual trees are the trees remaining on the woodlot after the harvest is completed. These trees become candidates for the next harvest. Slash refers to the residue left in the woodlot from a logging operation, such as tops of trees or other unused parts. Some trees have no merchantable value and are referred to as culls. Even good trees may have a cull, or non-merchantable, portion.

There are several terms used to describe a log in terms of its original location on the tree. A butt log refers to the log cut from the bottom-most portion of a tree, often the most valuable part of a hardwood tree. The second log is cut from the portion of the tree directly above the butt log portion. Top logs are smaller diameter logs which may have more limbs than bottom logs, and are usually found in the upper part of the tree trunk.

A veneer log can be marketed for rotary cut or sliced veneer, which are very thin sheets of wood used in furniture, paneling, plywood and other products. Generally, a veneer quality log is more valuable for the veneer log market than for the saw log market.

Top lopping is the practice of cutting the limbs or stems of a felled treetop so no part of it remains above a specified height, or so the stem of a felled tree is severed at a specified diameter. This practice is used at times for fire protection or aesthetics.

Skidding refers to the dragging of logs or trees out of the woodlot to a landing. A skidder is a generic term for a machine used to skid logs. Horses may also be used for skidding. A skid trail is the route taken to skid logs through the woods and is not used by log trucks. The landing is the cleared area to which trees or logs are skidded; the landing is used for log storage and truck loading.

Log grading refers to the assignment of a quality class to a log. The quality of a log depends on straightness, decay, splits, the location and size of knots, and other indicators of internal characteristics which may reduce or enhance the lumber yield, usefulness, or appearance. In the northeastern states, there is no standard log grade which is used by all mills. Sawmills generally establish their own grades, and high grade logs are worth considerably more than low grade logs. The U.S. Forest Service has established a log grade system for hardwoods and another one for softwoods, which are available from a Cooperative Extension System forester.

It is also important to have a working knowledge of the machinery involved in logging before choosing a contractor or deciding to log yourself. Consult a contractor or professional forester concerning machinery requirements for logging and safe operating procedures.

**Marking Trees For Cutting**

It is recommended that trees be marked for cutting by a forester who can judge the suitability of the trees for the intended use. Each tree that is to be harvested should be marked with paint that will last for the duration of the harvest.

If your goal is to obtain lumber for wood frame construction, give the forester the part of the bill of materials that lists sizes and amounts of boards and dimension lumber that will be cut from your timber. The forester will use the list to determine the number of logs to be harvested for lumber needs as is consistent with management objectives and available trees. If the woodlot does not have enough suitable trees of a desired species, it may be possible to harvest logs to be traded for lumber.

**Contracting For Logging Services**

Contact a county, state, or extension forester to find the names of independent contractors and sawmills who purchase stumpage or private foresters who can manage the harvest for you. Check with several and ask to see references. Ask for phone numbers of landowners who hired the logger over the last two years. Contractors who follow recommended safety and maintenance practices have less downtime and less risk of accidents.

A good way to check a contractor’s work is to inspect job sites where the contractor’s work is completed. Note the heights of the stumps which were left; high stumps indicate wasted timber. Look at the tree tops to see what was left in the woods. Check to see if the directional felling and skidding skills are adequate by looking at the damage to the residual trees. Refer to the good harvesting practices at the end of this chapter and make sure the logger has followed these practices. In checking a job site, it is important to be aware of the limitations imposed by the landowner.

**Drawing Up a Contract**

Always have a written contract and avoid verbal side agreements. Spell out clearly what is to be done, the time
limits on the job, the method and amount of payments, types of penalties assigned, and a method for settling disputes. Every timber harvest agreement is unique. If a consulting forester is retained to manage a sale, he or she will provide a time-tested contract. Some sample contracts have a blank for the maximum length of a tree which can be skidded to avoid damage to other trees. However, avoid hindering the logger with restrictions such as this unless there is a specific concern. Keep the contract simple, and you will entice more loggers to quote a price to log the woodlot.

An important and often overlooked aspect of a contract concerns placement of erosion control structures and grading of skid roads and landings. These are necessary to avoid damage to the woodlot.

**Workers’ Compensation and Liability Insurance**

Always obtain a certificate of workers’ compensation insurance directly from the contractor’s insurance carrier. A photocopy from the contractor is not adequate. If the carrier sends the certificate directly, the carrier will also notify you in advance if the contractor’s coverage will be cancelled.

Without proof of workers’ compensation, you could be deemed to be the employer of the contractor and his or her employees, even if there is documentation to the contrary. This means you could be held responsible for medical costs and a portion of lost wages for an injured or deceased worker.

Uninsured contractors may claim that they work alone and do not need workers’ compensation insurance. Such contractors may not require insurance under the labor laws, but you are still exposed and need a certificate. Such contractors also may sign an agreement stating that they are not your employee, but these documents have little legal value.

The compensation requirement may cause some problems, delays, and hard feelings in the search for a contractor, but it is an important consideration in this type of service where you own the timber and the final product.

Liability insurance is also a consideration and will protect you from liability in the case of damage to another’s property, such as a tree felled on to a power line, or in the case of damage to your property, such as a log truck damaging an underground septic tank. Ask for a certificate from the contractor’s liability insurance carrier.

**Logging Regulations**

You will need to know local, state, and federal timber harvesting laws. Find out who bears the legal responsibility for logging practices, permits, and yield taxes. Check for exemptions on yield taxes for timber cut for your own use. The contract drawn up with a logger should spell out such responsibilities where the law does not specify them. The State Forester’s Office can provide information about timber harvesting laws.

Logging is a hazardous occupation and the law restricts employees under the age of eighteen years from such work.

**Avoid Logging Yourself**

Logging is dangerous. It is recommended that a woodlot owner always consult professional foresters before harvesting timber. A professional logger should be hired to do the job when a woodlot owner has little or no training or experience in the harvesting process. If training is needed, contact the Cooperative Extension forester in your area. Many teach improved felling techniques for safety, increased production, and better wood utilization.

**Good Harvesting Practices**

The woodlot owner should understand the difference between good and poor logging practices. Whether you plan to do the logging or have it contracted, care must be taken to avoid costly damage to the woodlot, residual trees, and property.

The time of year that wood is harvested can be critical. Some lots can only be logged on frozen ground, some in the driest part of summer. Springtime generally presents a series of problems on a woodlot, such as soft ground and easily damaged residual trees. A particularly well-drained woodlot may be acceptable for springtime logging and would be a premium for a logger to consider.

**Damage to Trees**

A common and costly type of damage occurring during logging is scarring of a tree. When bark is taken off a tree...
through abrasion, the wood is exposed, creating a defect by altering the growth in that area and providing an entry point for decay organisms. The risk of scarring is greater in the springtime when bark can be easily knocked off a tree.

The most costly scars on quality hardwoods are butt scars, as the most valuable part of the tree is affected. Careless skidding can cause butt scarring, so extra care must be taken on curves in skid trails to avoid the swing of long logs against standing trees. Bumper trees are often left along curves and other susceptible points of a skid trail and removed at the end of the job. Skid trails should be placed such that valuable trees and reproduction processes will receive the least damage or interference. A good log skidding plan should be developed before harvesting.

Directional felling techniques are used by all good loggers to fell a tree in the area of least damage potential. What a tree will fall on or against and how it will be pulled out of the woods must be planned for each individual tree prior to felling. It may be impossible to harvest without causing some damage to residual trees. A good logger will use directional felling to minimize damage to valuable trees.

Trees remaining on the woodlot after harvest are candidates for the next crop. Scars, broken tops, and other damage will greatly affect the value of residual trees when they are harvested.

Erosion Control

Loggers should be familiar with grading, ditching, and water diversion techniques. Some methods acceptable twenty years ago, such as ditching a road drainage directly into a stream, are no longer considered good practice. Landings located at the bottom of a slope where skid trails bring in flowing water are sources of erosion and operational problems and should be avoided.

Several conservation methods are common practices of professional foresters. Water bars are a type of water diversion method used for erosion control on sloped skid trails and logging roads. A water bar is a shallow ditch with a mound of earth on the downhill side and is constructed across a trail or road at a diagonal. A system of water bars is shown in Figure 2–2.

Pipe culverts are used instead of water bars for permanent roads at the time of construction. They are commonly used where vehicle traffic will be heavy following the logging activities.

When an area is logged, exposed, or disturbed, soil erosion increases. Filter strips, as shown in Figure 2–3 on page 18, are essentially undisturbed areas lying between streams and skid trails, roads, or landings to prevent sediment-rich water from entering a water system. For a filter strip to be effective, the water should spread over it. To accomplish this, the natural vegetation may be supplemented with brush, rocks, or logs. The width of filter strips necessary is dependent on local conditions and may be regulated by law. Professional foresters can assist in determining the location and size of filter strips.

Back blading is smoothing out a skid trail or landing using the blade of a bulldozer. At the completion of a logging operation, ditches should be cleaned and regraded to their original condition or better. Culverts should be cleaned out, the landing should be back bladed, water bars should be placed on skidding and trucking slopes where necessary, and landings and skid trails should be seeded. Seeding is a conservation measure by which landings or skid trails are sown with grass seed. It is not always necessary, as regrowth may occur naturally. Foresters can recommend a “conservation mix” if they decide seeding is necessary.

Most states have laws governing the crossing of streams, even intermittent ones. Crossing waterways is serious business; fines and public reaction can be severe. Know these laws before logging begins, since they will probably influence the location of skid trails and the volume of timber cut, especially if filter strips are required.
Table 2-1. Board Foot Volume of A Log Based on The International 1/4" Log Rule Table for Volume Estimation.

<table>
<thead>
<tr>
<th>Diameter (Small End Inside Bark) Inches</th>
<th>Length of Log in Feet</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
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<th>18</th>
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<td>495</td>
<td>585</td>
<td>675</td>
<td>765</td>
<td>860</td>
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</table>

Table 2-2. A comparison of board foot volume of 12-foot logs as determined by six different log rules.

<table>
<thead>
<tr>
<th>Diameter (inches)</th>
<th>International</th>
<th>Scribner Decimal C.</th>
<th>Doyle</th>
<th>Vermont</th>
<th>Maine</th>
<th>Quebec</th>
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<tr>
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<td>300</td>
<td>300</td>
<td>288</td>
<td>327</td>
<td>315</td>
</tr>
</tbody>
</table>

1. In this example, an entire portion of the log along its length is to be culled.

4' + 16' = 25% of the log's length. To calculate the actual board foot volume of the log, reduce the original volume by 25%. 290 x .25 = 72 board feet of cull. 290 board feet - 72 board feet = 218 net board feet.

2. In the example below, 1/4 of the log is bad for 1/2 of its length.

1/4 x 1/2 = 1/8 or 12.5% of the volume of the log. Reduce the original board foot volume by 12.5%. 290 x .125 = 36 board feet of cull. 290 board feet - 36 board feet = 254 net board feet.


3. The final example shows how to calculate deductions for sweep (curve) in a log.

Establish a straight line of sight along the log and then measure the maximum amount of sweep from the line of sight to the log. Divide the amount of sweep by 4 (this number is a constant and was derived as a result of research at the Thompson School of Applied Science at the University of New Hampshire). Subtract the result from the scaling diameter and use Table 2–1 to estimate the actual net board foot scale. Using the log pictured above as an example, 4 inches of sweep + 4 = 1 inch. Reduce the scaling diameter by 1 inch (from 20 inches to 19 inches). Using Table 2–1, a 16-foot log with a 19-inch scaling diameter has a board foot scale of 260 board feet.

NOTE: Cull deductions as calculated above should be used as estimates only. Professional log scalers use more detailed methods and judgment to make accurate estimates.
Chapter 3: Sawing Logs Into Lumber

Once the logs are harvested and the lumber needs are defined, the next consideration is to saw the logs to achieve the optimum combination of timber volume and quality. Sawing transforms logs into rough-cut lumber that is ready for seasoning or use in construction.

The timber milling process, like the harvesting process, requires skill and experience. You have the option to hire someone to custom saw the logs or to saw them yourself. The decision depends on your access to sawing equipment, level of skill, and available time.

Custom Sawing

Talk to people who have had lumber custom sawn to find out who will do the best job. Obtain references from the operator if you have no other contacts. Get a good idea of the dependability of the saw operator, since logs could deteriorate while waiting to be sawn into lumber, or you could miss ideal construction time or labor availability. Logs are especially susceptible to decay and stain during the spring and summer when insects and fungi are active. Price may be the least important consideration when hiring an operator. The difference in sawing charges from one operator to another makes up only a small fraction of the total costs.

Figure 3-1. Portable band saw.

Today, due to the increasing popularity of portable sawmills in some areas, there are a growing number of persons capable of custom sawing at the woodlot location. The advantage to sawing at the woodlot or at the place where the lumber is to be used is the savings in trucking costs. Generally, the cost is higher for sawing on location than for sawing at a stationary sawmill. There may be “set up” charges for each time the saw is transported and set up on your property. However, a portable sawmill operator will usually price the job so there are still savings over conventional stationary mills.

Contracting for Sawing

A written contract with the operator is highly recommended. The contract could specify if you will participate in the sawing operation (by piling lumber, for instance), if the lumber will be piled with stickers, if the stickers are provided by the Sawyer, if you are buying or borrowing the stickers, or who will own the slabs. Slabs are the products of the sawing process that cannot be used for the lumber; they may have value for firewood. Stickers are used to separate layers of lumber in a pile to allow air flow; this facilitates seasoning, as discussed in Chapter 4.

Prior to sawing, review the bill of materials to determine the thickness and board feet needed for each species. Provide the saw operator with the list of materials needed, but do not tell the Sawyer to saw specific materials from specific logs. Let the Sawyer know if certain species were harvested to fill specific needs because of strength requirement. The Sawyer’s judgment will help realize the best yield from the logs.

The nominal and actual thicknesses are different. A one-inch board may be sawn 15/16", 1", 1 1/8", or 1 1/4"; this must be specified with the Sawyer. Remember, lumber will shrink when it is seasoned.

If the mill will operate on your property, it is a good idea to have the operator’s insurance carrier provide a certificate showing coverage for workers’ compensation insurance and liability insurance. However, these may be difficult or impossible to obtain when dealing with a one-person portable sawmill operation.

Payment

The payment options are to pay for sawing by the hour, by the thousand board feet of log scale, or by the thousand board feet of lumber scale, called mill scale. There will probably be fewer problems with the mill scale, since charges are based on the number of pieces sawn from the logs, an easy figure to determine when the job is finished. With other methods of payment, either the size of the original logs or the hours spent sawing...
lumber must be known. The payment method is decided by negotiation, and full payment is generally due upon completion of the sawing.

If mill scale is used, you will have to pay for pieces that are not serviceable for your needs. It costs the saw operator the same amount or more to saw a poor log than to saw a good log, so it is reasonable for the operator to charge for cutting pieces that are not usable.

In some areas, it is common to pay by log scale, since it is fast and easy to estimate. If a log scale is used as a measure for payment, be sure the log rule is defined. There are several log rules in use around the Northeast, each of which estimates the volume of sawn lumber differently (see Table 2–2).

An operator may reasonably charge for downtime or damage to a saw from foreign objects, such as nails, barbed wire, or sap stiles in your wood. You should be notified in advance of sawing if such a charge is possible.

Types of Saws

Figures 3–1 and 3–2 illustrate different portable band saws; Figure 3–3 illustrates a portable circular saw; and Figure 3–4 illustrates a traditional stationary circular saw. Logs properly sawn with a band saw may yield more lumber than logs sawn with a circular saw, because band saws produce less sawdust. The selection of a good saw operator is more critical than the type of saw.

Sawing Logs Yourself

Many people saw their own logs into lumber. Small portable and stationary sawmills have made sawyers out of many woodlot owners, farmers, homeowners, wood workers, and others. Manufacturers of small mills have become very customer-oriented and provide good guidance to new sawmill owners. If you are considering buying a sawmill, refer to Checklist 3–1 on the following page for information to consider before buying.

Regulations

Sawmills are usually allowed in agricultural zones if used for processing timber logged from the property on which they are operating. Milling may be classified in a
Checklist 3-1. Questions to ask before purchasing a saw.

- Is there enough work to make it pay?
- Can it be sold after the job is completed?
- Do you have the mechanical expertise to operate it?
- Do you have the physical stamina to safely run it?
- Which type of sawmill should you buy?
- Do you know enough about sawing methods?
- If not, is there somewhere you can learn or get help?
- Can it be used to sell custom sawing services or custom made products?
- Are there local zoning and neighborhood considerations or restrictions?
- Will additional labor be required? Who? How will labor costs be paid?
- Will the purchase really save money, time, and control over having lumber custom sawn?

light industrial or similar category if logs are brought to the property for processing. Know the situation which exists in your township prior to investing in a stationary sawmill. Saw milling, like logging, is classified by the Federal and State Labor Departments as a hazardous occupation. People under 18 years of age are not allowed to work in such activities.

Sawing Methods

You must develop the ability to “look inside a log” in order to position it for a first cut and to make correct thickness and turning choices while sawing. Depending on the tree species and the intended use of the lumber, different sawing methods are used to produce the final product.

Sawing Hardwoods

Hardwoods are sawn differently from softwoods. Generally, in hardwoods, a knot is a defect. A sawyer will try to produce boards with as much clear length as possible. The clearest and consequently most valuable lumber in hardwood trees is that closest to the outside of the logs and from logs closest to the stump. If hardwoods are used for construction rather than for cabinets or other projects where appearance is important, knots present no more of a problem than in softwoods.

To get the most knot-free lumber from a hardwood log, sawyers will taper saw the log as illustrated in Figure 3-5. Taper sawing is a method by which boards are sawn parallel to the bark of the log. This method produces the longest and clearest boards of lumber from a hardwood log. Because logs are tapered, i.e., one end is larger than the other, taper sawing results in a wedge-shaped piece of lumber from the center of the log. This wedge contains the knotty, low-quality portion of the log. A cross section of a hardwood log is shown in Figure 3-5.

In hardwood trees, the log located closest to the stump, the butt log, will have the most taper and will yield the largest percentage of clear wood. When long, clear boards are desired, hardwood butt logs should be taper sawn. If the desired product is squared timbers, however, the sawyer may consider other sawing methods.

Saw lines parallel to side of log

Figure 3-5. A taper sawn hardwood log.

Sawing through-and-through, also called live sawing, is a method in which boards are sawn parallel to each other, one after the other, without turning the log. On high-quality hardwood logs, however, a sawyer may saw around the log, removing boards from the best face showing and turning the log often. This method often yields the most valuable lumber but requires more time to saw an equivalent volume of lumber than sawing through-and-through.

When sawing through-and-through, some sawyers cut boards from one-half to two-thirds of the log before turning the log over to cut boards from the opposite side. Thick or thin lumber can result when this method is used, because the log may bend as stress is relieved in the log on one side and not the other during sawing. To correct this problem, cut boards from about one-third of the log and then turn the log over to start cutting boards from the opposite side.

Lumber from Local Woodlots
Sawing Softwoods

Knots occurring in softwoods are either red or black. A red knot is produced when live branches are sawn through. A red knot is tight, with fibers of the branch intertwined with fibers of the surrounding wood. A black knot is formed when the tree grows around a dead branch; these are likely to fall out of boards during the sawing or drying processes. A cross section of a softwood log is illustrated in Figure 3–6.

The center of a softwood tree has red knots, but further from the center they become black knots if the branches that have formed the knots have died. The knots will remain red if the branches were alive at harvest. It is important to understand knots and other tree characteristics to obtain the most usable lumber from the logs.

Generally, taper sawing is not used for softwood logs. Instead, the log is sawn so that boards are produced parallel to the center of the tree. Usable boards are sawn from the center of the tree where the red knots occur, and the less desirable black knots are left in the wedge-shaped slabs from the outside of the tree. Sawyers will turn a log as necessary to obtain the best quality or highest quantity of lumber from a log.

General Sawing Considerations

The goal while sawing is to obtain the most useful, highest grade lumber possible from each log. To avoid losses in lumber yield, stay within 1/16" of the target thickness when sawing. A target thickness for 1" hardwood lumber is usually 1 1/8", which allows for shrinkage during drying. Softwood lumber is usually sawn at an even 1" and is surfaced on both faces, after drying, to a thickness of 3/4".

Cutting lumber below the target thickness, or undersizing, can have a considerable effect on the strength of the board. A 2" x 6" cut 1/4" undersize in width and thickness is reduced 20% in bending strength. Improper sawing can result in some lumber defects. Wane refers to exposed bark on a board or an area where bark has fallen off cut timber. Wane can be minimized by proper sawing and edging. Although wane mainly affects the appearance of wood, it may also affect the strength, grade, and usefulness of a board.

Cross grain is a strength-reducing defect that results when crooked logs are sawn or when the main stem of the tree is affected by the grain of the large branches sawn. Cross grain is defined by the slope of the grain, which refers to the angle formed by the annual growth rings with the edge or long axis of the timber. Ideally, the grain should be parallel to the edge of a board.

Cross grain cannot always be avoided. Lumber with cross grain should be trimmed to eliminate weak areas before it is used for structural purposes. A cross grain defect may present problems during planing, because chips may occur on the surface. Cross-grained areas will stain differently than the rest of the board.

Saw Maintenance

Proper saw maintenance is one key to accurately sawn lumber. Some noncommercial sawmill owners have found the new small band saws easier to maintain than circular saws. Keeping the band saw sharp is the most critical factor. Circular saws are highly productive, but tend to be more difficult to maintain. Many factors affect the operation of a circular saw, even the sun shining on the saw blade. Diagnosing saw problems can be difficult for an inexperienced operator. An excellent reference on the maintenance of circular saws is Circular Sawmills and their Efficient Operation, listed in the reference section.

Guidance on sawing lumber is available in most states through the Cooperative Extension Service or through the state’s department concerned with natural resources. If you are thinking about purchasing a small sawmill, review Checklist 3–1.

Figure 3–6. Softwood logs are sawn parallel to the center of the tree, so the undesirable black knots are left in the slabs from the outside of the log.
Chapter 4: Seasoning Lumber

Seasoning refers to drying wood. Seasoning will usually result in some shrinkage of the lumber, and this may cause splits or distortions that could affect suitability for construction. This chapter discusses seasoning, defects that can occur during seasoning, and the procedure for drying lumber to minimize defects.

Lumber can be air-dried or kiln-dried. Air-drying will reduce the moisture content of the wood to between 15% and 20%, which is satisfactory for most uses. Kiln-drying can reduce the moisture content further and is necessary if the wood will be used in heated spaces; the air in artificially heated spaces is usually dry compared to the outside. Air-dried wood in such spaces will undergo further drying and shrinkage. An exception to this is heated livestock buildings; air in these spaces is kept damp by moisture from livestock.

Lumber for unheated farm or utility buildings as well as most lumber for human housing, including sills, joists, studs, rafters, roof boards, sheathing, and subflooring, need only be air-dried. Kilns can reduce the lumber moisture content sufficiently to allow its use for cabinets, flooring, furniture, or interior trim inside a home. Kiln-drying is faster but more expensive than air-drying. Lumber intended for in-home uses can be partially air-dried and finished in the kiln to save fuel costs.

Further discussion of kiln-drying is beyond the scope of this bulletin. Contact the wood utilization and marketing specialist in your state for more information on kiln-drying or refer to the Dry Kiln Operator's Manual, listed in the reference section.

Dried lumber is recommended for wood frame construction. Moisture affects many qualities of wood. The quality of planing depends upon the moisture content of the board. Green wood tends to be fuzzy when planed. Moisture will also affect a board's ability to accept paint or preservatives. Stains may vary in hue if the moisture content varies. Green lumber can be used successfully in wood frame construction, but special construction techniques are required. For species that tend to split when nailed dry, it is advisable to build with the lumber before it is fully dried.

Moisture in Wood

Wood is composed primarily of tubelike cells that travel up and down the trunk of the tree. If a cut is made across the trunk of a tree, several different kinds of wood are exposed as illustrated in Figure 1–20 on page 10. The sapwood forms part of the living section of a tree. Inside the sapwood is the heartwood, composed of dead cells that help support a tree. In general, sapwood is lighter than heartwood and contains more moisture. The deeper heartwood dries more slowly than sapwood because it is less permeable to moisture.

The difference between green wood and seasoned wood is moisture content, a measure of the amount of moisture in wood given on a dry weight basis. The moisture content for green lumber can range from 30% to over 120% for the sapwood of certain species. Much of this water is "free" water in the cell cavities and evaporates first and relatively fast. After a few weeks, depending on the season of the year, all of the free water evaporates. At this point, referred to as the fiber saturation point, the moisture content is about 30%, as indicated in Figure 4–1. No dimensional change occurs with the evaporation of free water.

<table>
<thead>
<tr>
<th>Moisture Content</th>
<th>Free water</th>
<th>Bound water</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>fiber</td>
<td>saturation</td>
</tr>
<tr>
<td>0%</td>
<td>&quot;bone&quot; or oven dry</td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>equilibrium moisture possible when kiln-drying (adequate for inside winter conditions)</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>equilibrium moisture possible when air-drying (adequate for outside conditions)</td>
<td></td>
</tr>
<tr>
<td>30%</td>
<td>seasoned wood below 20%</td>
<td></td>
</tr>
<tr>
<td>40%</td>
<td>fiber</td>
<td>Free water</td>
</tr>
<tr>
<td>50%</td>
<td>Green wood has 30%–120% Moisture Content</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4–1. Wood moisture contents during the drying process.

"Bound" moisture, water trapped in the cell walls, evaporates slowly over two to six months. Water in the cells located closer to the board surface will evaporate first, creating a moisture gradient that moves water from the inside cells to the surface. The factors that affect the rate of drying for a species of wood are the temperature, relative humidity, air circulation, and board thickness. The higher the temperature, the more energy available to evaporate water. The lower the relative humidity, the greater the capacity of the air to accept water evaporated from the wood. Air circulation is necessary to carry cool, humid air away from the wood surface and bring in warmer, drier air. Dried wood will cyclically gain and lose water as the relative humidity changes.
**Shrinkage and Defects**

As the bound moisture is evaporated, the wood shrinks. Since wood shrinks at different rates across its three dimensions and dries from the outside in, distortions can occur. Wood shrinks most across the grain, or tangentially; about half as much perpendicular to the grain, or radially; and only very slightly with the grain, or longitudinally. The different directions of shrinkage are shown in Figure 1-19 on page 10; note the path of the growth rings in this illustration.

Figure 4-2 shows several types of distortions in lumber, each depending on where the lumber was cut from the log in relation to the log’s center and the shape of the board. The drawing exaggerates the shrinkage. More than anything else, proper drying techniques can control the distortions due to moisture removal. Although some shrinkage will always occur, the amount varies greatly among different species. Table 4-1 ranks some species according to their degrees of shrinkage during seasoning.

**Table 4-1. Woodlot species ranked according to amount of shrinkage (combined radial and tangential).**

<table>
<thead>
<tr>
<th>Small Amount of Shrinkage</th>
<th>Medium Amount of Shrinkage</th>
<th>Great Amount of Shrinkage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butternut</td>
<td>Ash, White</td>
<td>Basswood</td>
</tr>
<tr>
<td>Cedar, Eastern Red</td>
<td>Aspen</td>
<td>Beech, American</td>
</tr>
<tr>
<td>Cedar, N. White</td>
<td>Buckeye</td>
<td>Birch</td>
</tr>
<tr>
<td>Fir, Balsam</td>
<td>Cherry, Black</td>
<td>Hickory</td>
</tr>
<tr>
<td>Hemlock, Eastern</td>
<td>Chestnut, American</td>
<td>Holly</td>
</tr>
<tr>
<td>Honeylocust</td>
<td>Cottonwood</td>
<td>Maple, Hard</td>
</tr>
<tr>
<td>Pine, E. White</td>
<td>Douglas-Fir</td>
<td>Oak, white</td>
</tr>
<tr>
<td></td>
<td>Elm</td>
<td>Sweetgum</td>
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<tr>
<td></td>
<td>Hackberry</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Locust, Black</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Magnolia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maple, Soft</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oak, Red</td>
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<td>Pine, Jack</td>
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<tr>
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</tr>
<tr>
<td></td>
<td>Pine, Southern Yellow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pine, Virginia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sassafras</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spruce, Eastern</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sycamore</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tamarack (E. Larch)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Walnut</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Willow, Black</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yellow-Poplar</td>
<td></td>
</tr>
</tbody>
</table>

**Ranges Used for Categories**

<table>
<thead>
<tr>
<th>Radial</th>
<th>Tangential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-3%</td>
<td>4-7%</td>
</tr>
<tr>
<td>3-5.5%</td>
<td>7-9%</td>
</tr>
<tr>
<td>5.5-8%</td>
<td>9-12%</td>
</tr>
</tbody>
</table>

The stresses that result from uneven shrinkage can cause the wood to warp, which may affect the suitability of the lumber for construction. The different types of warp are cup, bow, crook, twist, and kink; they are illustrated in Figure 4-3. Warp can be minimized by careful drying, as discussed in this chapter.

![Diagram of different types of warp: cup, bow, crook, twist, and kink.]

If the stresses exceed the strength of the wood, then check, shake, or splits may occur. Check is separation of the wood fibers that occurs across the annual growth rings; shake is a separation that occurs between the annual growth rings (Figure 4-4); splits begin as either check or shake but extend completely through the board.

Check and shake usually begin at the ends of a board exposed in the pile, because water is lost from ends faster than from the middle of a board. Surface check can also occur if the board's surface is receiving direct sunlight, since this would result in uneven drying. Rapid drying increases the stresses that cause separations in the wood fiber. For this reason, woods that tend to check are air-dried prior to being kiln-dried for use in heated areas. Once the wood separations are started, there is no way to stop them. Splits can result in loss of strength and loss of lumber, since the affected portion must be cut from the board. To prevent or reduce end check or shake of lumber that is two inches or more in thickness, coat the freshly cut ends with paraffin or paint.

**Air-Drying**

Lumber to be air-dried should be carefully piled and protected, and left to dry for the length of time required to reach an air-dry condition. Table 4-2 on the opposite page shows the approximate time required for seasoning one-inch boards to an air-dry condition, if part of the seasoning period occurs during May, June, or July. The lumber must be correctly stacked to keep it from warping and to prevent stain or decay.

Thick lumber takes a proportionately longer time to season than thinner lumber. The time required depends on the temperature, relative humidity, and air circulation, as mentioned above. Generally, wood seasons slowly in the late fall, winter, and early spring when temperatures are cool. Hence, it is best to start the seasoning process during those months to reduce checking. Separate lumber by species as it is piled, since the seasoning period varies for different species.

**Stacking Lumber For Drying**

Stacking is the single most important factor in quality seasoning of lumber. After lumber is sawn, immediately pile it using stickers, whether it is to be seasoned or used green. Stickers are spacers used to separate layers of lumber in a pile to allow air movement. In the spring and summer, when warm air temperature and high relative humidity provide optimum conditions for fungi, lumber should be piled on stickers the same day it is cut. Cold winter temperatures allow more leeway.

**Choosing A Site**

Select a clear, well-drained site that permits good air circulation. The ground surrounding and under the pile should be free of weeds, brush, chips, shavings, rotting

![Diagram of check and shake separations of the wood fibers in lumber.]

Lumber from Local Woodlots
Table 4-2. Average time required for lumber to reach air-dry condition *

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Beech</td>
<td>70 to 200</td>
</tr>
<tr>
<td>Ash, White</td>
<td>60 to 200</td>
</tr>
<tr>
<td>Aspen</td>
<td>50 to 150</td>
</tr>
<tr>
<td>Basswood</td>
<td>40 to 150</td>
</tr>
<tr>
<td>Birch, Yellow, Sweet</td>
<td>70 to 200</td>
</tr>
<tr>
<td>Butternut</td>
<td>60 to 200</td>
</tr>
<tr>
<td>Cedar, Eastern Red</td>
<td>50 to 90 †</td>
</tr>
<tr>
<td>Cedar, Northern White</td>
<td>80 to 130 †</td>
</tr>
<tr>
<td>Cherry, Black</td>
<td>70 to 200</td>
</tr>
<tr>
<td>Cottonwood, Eastern</td>
<td>50 to 150</td>
</tr>
<tr>
<td>Fir, Balsam</td>
<td>150 to 200 †</td>
</tr>
<tr>
<td>Douglas-fir, Interior North</td>
<td>20 to 180</td>
</tr>
<tr>
<td>Hemlock, Eastern</td>
<td>90 to 200</td>
</tr>
<tr>
<td>Hickory</td>
<td>60 to 200</td>
</tr>
<tr>
<td>Locust, Black</td>
<td>120 to 180</td>
</tr>
<tr>
<td>Maple, Hard (Sugar, Black)</td>
<td>50 to 200</td>
</tr>
<tr>
<td>Maple, Soft (Red, Silver)</td>
<td>30 to 120</td>
</tr>
<tr>
<td>Oak, Red</td>
<td>70 to 200</td>
</tr>
<tr>
<td>Oak, White</td>
<td>80 to 250</td>
</tr>
<tr>
<td>Pine, Eastern White</td>
<td>60 to 200</td>
</tr>
<tr>
<td>Pine, Red (Norway)</td>
<td>40 to 200</td>
</tr>
<tr>
<td>Pine, Southern Yellow</td>
<td>30 to 150</td>
</tr>
<tr>
<td>Yellow-Poplar</td>
<td>40 to 150</td>
</tr>
<tr>
<td>Spruce, Red and White</td>
<td>30 to 120</td>
</tr>
<tr>
<td>Sycamore</td>
<td>30 to 150</td>
</tr>
<tr>
<td>Walnut</td>
<td>70 to 200</td>
</tr>
</tbody>
</table>

* 20% moisture content
† Species usually kiln-dried


wood, and bark, all of which can contribute to the development of stain and rot in lumber.

Lumber piles must be constructed on well-compacted soils, or the piles could settle unevenly, resulting in crooked pieces of lumber. Green lumber of most species weighs between 40 and 60 pounds per cubic foot; a moderately sized stack thus represents considerable weight that will cause piles to settle unevenly on unstable soils.

Building a Foundation

Foundations are commonly made of timber bolsters, concrete blocks, railroad ties or other solid materials placed on well-drained and well-compacted soils. Gravel can be used to level the foundation. Keeping the foundation surface off the ground reduces the chance of decay in the lower layers of the pile.

Figure 4-5. A pile foundation of concrete blocks and timbers.

A recommended method of foundation construction is shown in Figure 4-5. Concrete blocks are placed as shown; one row of blocks should be used for each row of stickers expected to be used. The spacing between the rows of blocks should not be more than two to six feet along the length of the stacked lumber. The spacing will depend on the thickness of lumber being stacked; thinner lumber requires closer supports to avoid bowing when drying. At least three rows should be used to prevent bowing of the drying lumber. It is convenient to place the rows so that forklifts can be used to move the pile.

Timbers are placed on the blocks in the direction perpendicular to the length of the wood to be stacked. The timbers should be at least 4” x 4” and dry to avoid staining the lower layer of the wood. The stickers should not be placed directly on the concrete blocks, because the blocks do not supply the continuous support needed; stickers are not intended to support the lumber. Piles should be placed at least four feet apart to allow air circulation between the piles.

Common practice is to place the timbers directly on the ground without the concrete blocks. This is not recommended because it increases the chance of decay spreading to the drying wood and reduces air movement in the pile. The recommended method allows cool, moist air to pass down and out from beneath the pile and results in more uniform drying of the pile.

Using Stickers

Stickers are uniformly sized pieces of wood used to separate the layers of boards in a stack or pile. All stickers must be of the same thickness, usually about 1”, and well-seasoned. If stickers vary more than 1/8” from
the smallest to largest in thickness, the boards will be crooked when seasoning is completed. If the stickers are green, the lumber will stain.

The best way to make stickers of a constant thickness is to cut them from 1" boards or board edgings. Hardwood edgings are particularly good as they are relatively free of knots. The width of stickers should be enough greater than the thickness so one can recognize the difference and not place stickers edgewise in a pile by mistake. A width of about 1 1/4" makes a good strong sticker.

Stickers should be cut to a standard length to produce an even pile. A forty-two inch length is a practical size because the piles are narrow enough to permit air flow through the piles for drying, they are easily picked up by small equipment, and two piles can be placed on a truck bed side by side. Long, ragged ends tend to be run into by persons working in the pile area, which disrupts the sticker placement enough to cause distortion in the lumber. Figure 4-6 illustrates a partially constructed pile with stickers correctly placed over the pile supports; Figure 4-7 shows a correctly completed pile.

On the last layer of boards, place 4"x 6" timbers above the stickers to obtain more clearance. Build a roof with a layer of boards, slabs, or roofing on top of the 4"x 6" timbers and extend the ends 2' beyond each side of the pile. Wire the roof on, or weigh it down so it is secure in the wind. If elm, aspen, or cottonwood are to be seasoned uniformly, add additional weight to the top of the pile to prevent twisting and warping. The roof will protect the pile from the sun and prevent penetration of rain and snow; it should be sloped to allow water to run off.

**Mold, Stain, and Rot**

There are two types of organisms to be aware of: those that cause only stain and those that cause decay. Molds and sap staining fungi are organisms which stain wood. They do not cause decay and do not affect the strength of wood, only the appearance. Most of the mold fungi are microscopic, threadlike plants, ranging in color from blue to black to brown. The fungii grow and spread well in hot and humid weather, especially in freshly cut lumber. Stains usually develop when temperatures range from 50–90°F, although 70–80°F is the optimum growing temperature. Lumber can be treated with fungicidal solutions to protect it from being stained.

Decay fungi will attack heartwood or sapwood, appearing as fan-shaped regions of threadlike, cottony growth. Sometimes toadstools or crusts appear, which are the reproductive structures of the organisms. Wood decay is referred to as rot. Brown rot, white rot, and soft rot are the three main types. Brown rot leaves a brown residue of digested wood and causes shrinkage in the tree and cracks across the grain. White rot has a bleaching effect, does not usually crack the wood, and weakens the tree. Soft rot attacks green wood and causes a brown softening of the wood.

Wood is safe from decay below 60°F, above 100°F and at moisture contents below 20%. Fungi cannot live without moisture, oxygen, and a food source.

**Storing Your Lumber**

Storage of lumber is important whether it is green, air-dried, or kiln-dried. The fastest drying takes place immediately after lumber is cut, so it should be stacked with stickers as previously described. Even if green lumber will be used for construction, proper storage is important after sawing, because the lumber may sit for weeks before use.

Air-dried lumber should be stored under cover or in piles outside with sloping roofs to shed water. Piles should be
carefully stacked so that all pieces are lying flat. Lumber under pressure in poorly stacked piles will warp, so originally straight pieces can warp if not stacked properly. Lumber should be stacked on pallets to keep the pile off the ground; this will prevent rot and decay and allow for air circulation.

Lumber that has been kiln-dried for interior finish or cabinet work must be stored in heated rooms or wrapped in moisture resistant material. If stored outside, kiln-dried lumber will return to 12–18% moisture content as it reabsorbs moisture from the air or as a result of wetting by precipitation.

By storing lumber properly, you preserve the quality of the cut wood until construction begins. Also, because the lumber is stacked neatly and evenly, you can easily sort, grade, and select the exact pieces to be used for the construction process.

Figure 4–7. A completed lumber stack with a concrete block foundation, stickers correctly placed, and with a roof for protection from sun and precipitation.
Appendix A—Sources of Building Plans

To obtain ideas or building plans, write to the following addresses for information:

Midwest Plan Service  
Iowa State University  
122 Davidson Hall  
Ames, Iowa 50011

Cooperative Farm  
Building Plan Exchange  
Suite 306  
4321 Hartwick Road  
College Park, Maryland 20740

Northeast Regional  
Agricultural Engineering Service  
Cornell University  
152 Riley-Robb Hall  
Ithaca, New York 14853

Agricultural Engineering Extension  
at the land grant university in your state.  
Land grant universities in the Northeast are listed on the inside front cover.  
Addresses of land grant universities for states not listed may be obtained from local Cooperative Extension offices.
Appendix B—Selecting Lumber for Various Uses

To select lumber, one must first single out the key requirements for the job. Wood pieces selected for joists, girders, and rafters, for example, require high bending strength, whereas wood selected for barn siding should be resistant to weathering and take paint well. Table B-1 describes the usual requirements for various building components.

Table B-1. Use requirements for various structural components.

<table>
<thead>
<tr>
<th>Structural Component</th>
<th>Most Common Use Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poles and Posts for</td>
<td>High stiffness and strength, freedom from crook, minimum taper, good nail-holding qualities,</td>
</tr>
<tr>
<td>Pole Barn Construction</td>
<td>good decay resistance. All load-bearing poles and posts used with butt end of the pole</td>
</tr>
<tr>
<td></td>
<td>embedded in the soil should be pressure-treated from butt end to at least two or three feet</td>
</tr>
<tr>
<td></td>
<td>above the ground line. Usually the entire pole is treated.</td>
</tr>
<tr>
<td>Posts and Beams for</td>
<td>High stiffness and strength, ease of working, moderate weight, and freedom from crook.</td>
</tr>
<tr>
<td>Post and Beam Barn Construction</td>
<td></td>
</tr>
<tr>
<td>Girders, Headers</td>
<td>High stiffness, good bending strength, moderate ease of working, good nail-holding</td>
</tr>
<tr>
<td></td>
<td>qualities, and freedom from warp.</td>
</tr>
<tr>
<td>Sills</td>
<td>Good nail-holding quality, moderate hardness, and good decay resistance. (Pressure-treated</td>
</tr>
<tr>
<td></td>
<td>wood may be recommended for permanent use.)</td>
</tr>
<tr>
<td>Studs and Plates</td>
<td>Medium stiffness and strength, good nail holding, medium freedom from warp, and moderate</td>
</tr>
<tr>
<td></td>
<td>ease of working. In locations of high moisture, such as in milk houses and milking parlors</td>
</tr>
<tr>
<td></td>
<td>on dairy farms, preservative treatment or good natural decay resistance is an added</td>
</tr>
<tr>
<td></td>
<td>requirement. Studs in cribs or granaries are subjected to heavy lateral pressures from</td>
</tr>
<tr>
<td></td>
<td>stored grain and require strength and stiffness in addition to good fastenings.</td>
</tr>
<tr>
<td>Joists and Rafters</td>
<td>High stiffness and strength, good nail holding, and moderate ease of working. Woods of</td>
</tr>
<tr>
<td></td>
<td>moderate bending strength can be used with satisfactory results if lower strength is</td>
</tr>
<tr>
<td></td>
<td>compensated for by the use of larger members, closer spacing, or shorter spans.</td>
</tr>
<tr>
<td>Roof Purlins and Wall Girts</td>
<td>High stiffness and strength, good nail holding, and moderate ease of working. Strength is</td>
</tr>
<tr>
<td></td>
<td>somewhat less critical than for joists and girders because purlins and girts are not key</td>
</tr>
<tr>
<td></td>
<td>load-bearing components. Failure of one does not result in building collapse.</td>
</tr>
<tr>
<td>Siding</td>
<td>Good painting or weathering qualities, freedom from warping or splitting, low shrinkage,</td>
</tr>
<tr>
<td></td>
<td>and medium decay resistance. Medium bending strength when used without sheathing backing or</td>
</tr>
<tr>
<td></td>
<td>with only a nominal number of cross supports. Boards subjected to dampness from the ground</td>
</tr>
<tr>
<td></td>
<td>or to constant wetting should have high decay resistance or have a preservative treatment.</td>
</tr>
<tr>
<td>Structural Component</td>
<td>Most Common Use Requirement</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Roof Sheathing</td>
<td>Medium stiffness, good nail holding, low shrinkage, medium decay resistance, freedom from splitting.</td>
</tr>
<tr>
<td>Feed Racks and Feed Bunks</td>
<td>Hardness and freedom from splitting, medium decay resistance, ease of working.</td>
</tr>
<tr>
<td>Fence Posts</td>
<td>High decay resistance and little or no sapwood for untreated posts. Good bending strength, straightness, and high staple holding. Permanent installation requires a good preservative treatment. High sapwood content is desirable for fence posts to be preservative treated.</td>
</tr>
<tr>
<td>Gates and Fences</td>
<td>Good bending strength, good decay and weather resistance, high nail holding, and freedom from warp. Treatment desirable for severe conditions. Wood for gates should be lightweight.</td>
</tr>
<tr>
<td>Concrete Forms for Framing and Sheathing</td>
<td>Good stiffness, good bending strength, resistance to warping and splitting during installation and reuse, and ease of working. Smooth surfaces are desirable for wood coming in contact with concrete.</td>
</tr>
<tr>
<td>Scaffolding</td>
<td>High bending strength, high stiffness, high nail holding, medium weight, and freedom from compression failures and cross grain.</td>
</tr>
<tr>
<td>Exposed Platforms and Porches</td>
<td>High decay resistance, good stiffness and strength for framing, and good wear and splinter resistance for decking. Where wood is exposed to severe moisture conditions, treated material is recommended.</td>
</tr>
<tr>
<td>Trusses</td>
<td>High strength and stiffness, moderate ease of working, medium weight, freedom from warp, good nail holding ability, and good gluing qualities.</td>
</tr>
<tr>
<td>Flooring (Barn)</td>
<td>High resistance to wear (where heavy traffic is expected), minimum warp and shrinkage.</td>
</tr>
<tr>
<td>Miscellaneous: Doors, Door Frames, Window Frames, Exterior Trim</td>
<td>Good paint-holding ability, moderate shrinkage, freedom from warp, good nail-holding ability, and ease of working. Good to high decay resistance where moisture tends to collect, such as window sills.</td>
</tr>
<tr>
<td>Shelving</td>
<td>Stiffness and freedom from warp.</td>
</tr>
<tr>
<td>Storage Bins, Tanks, Vats, etc.</td>
<td>High decay resistance and low shrinkage. High strength desirable in some cases. Treated wood should be used in storage of silage at or below grade. Wood treated with creosote or pentachlorophenol should not come in contact with feeds for livestock.</td>
</tr>
</tbody>
</table>
Glossary

Air-dried—The dried condition of lumber, usually 12-20% moisture content, reached by exposing it for a sufficient period to prevailing outdoor weather conditions.

Air-drying—The process of drying green lumber or other wood products by exposure to prevailing natural atmospheric conditions outdoors or in an unheated shed.

All-aged forest—A forest stand in which trees of all ages and usually all sizes are present.

Allowable cut—The volume of wood or the amount of product which can be cut, under a particular management plan, during a given period of time.

Annual growth ring—The growth layer put on a tree each year in temperate climates or each growing season in other climates; each ring includes earlywood and latewood. In the temperate zone, the annual growth rings of many species (e.g., oaks and pines) are readily distinguished because of differences in the cells formed during the early and late parts of the season.

Back blading—A method for smoothing out a skid trail or landing using the blade of a bulldozer.

Backcut—Final cut in felling a tree. Made on the side opposite the direction of fall.

Blue stain—A bluish or grayish discoloration of the sapwood caused by the growth of certain dark-colored fungi on the surface and in the interior of the wood; made possible by the same conditions that favor the growth of other fungi.

Board—Yard lumber that is less than 2 inches thick and 2 or more inches wide; a term usually applied to 1-inch thick stock of all widths and lengths.

Board foot—A unit of measurement of lumber and sawlogs represented by a board 12 inches long, 12 inches wide, and 1 inch thick or the cubic equivalent. In practice, the board foot calculation for lumber 1 inch or more in thickness is based on its nominal thickness and width and the length. Lumber with a nominal thickness of less than 1 inch is calculated as 1 inch. In the lumber industry, the working unit is 1,000 board feet; abbreviated Mbd. ft., MBM, MBF.

Bolt—(1) A short section of a tree trunk; (2) In veneer production, a short log of a length suitable for peeling in a lathe.

Bound water—In wood technology, moisture that is intimately associated with the finer wood elements of the cell wall by adsorption and held with sufficient force to reduce the vapor pressure.

Brown rot—In wood, any decay in which the attack concentrates on the cellulose and associated carbohydrates rather than on the lignin, producing a light to dark brown friable residue—hence loosely termed "dry rot."

Brown stain—A rich brown to deep chocolate-brown discoloration of the sapwood of some pines caused by a fungus that acts much like the blue-stain fungi.

Buck—To saw felled trees into shorter lengths.

Buffer strip—Essentially undisturbed forest areas between skid roads, landings, or harvested areas and public roads or property. They hide the operation from public view.

Butt—The base of a tree or large end of a log.

Cambium—A thin layer of tissue between the bark and wood that repeatedly subdivides to form new wood and bark cells.

Cell—A general term for the structural units of plant tissue, including wood fibers, vessel members, and other elements of diverse structure and function.

Figure G-1. A "board foot" represented in two different but equivalent pieces of 1" lumber.
Check—A lengthwise separation of the wood fibers within a log, timber, lumber, or other wood product that usually extends across the rings of annual growth and commonly results from stresses set up in wood during seasoning. Surface checks occur on flat faces of boards; end checks occur on ends of logs, boards, or dimension parts. End checks result when the ends dry too rapidly.

Chemical stain—A general term including all stains that are due to color changes of the chemicals normally present in the wood.

Clear cutting—A loosely-used term for harvesting all of the merchantable trees (a merchantable clearcut) or all of the trees on a woodlot. Clear cutting may be bad or good, depending on the purposes for which the harvest is made.

Close-grained wood—Wood with narrow, inconspicuous annual rings. The term is sometimes used to designate wood having small and closely-spaced pores, but in this sense the term “fine textured” is more often used.

Coarse-grained wood—Wood with wide, conspicuous annual rings in which there is a considerable difference between springwood and summerwood (“earlywood” and “latewood”). The term is sometimes used to designate wood with large pores, such as oak, ash, chestnut, and walnut, but in this sense the term “coarse-textured” is more often used.

Conifer—A tree belonging to the order Coniferales which is usually evergreen, cone-bearing, and has needles, awl, or scalelike leaves, such as pines, spruces, firs, and cedars; often referred to as “softwood,” a term which does not necessarily refer to the hardness of the woods.

Cord—A unit of measure of stacked round wood. A standard cord occupies 128 cubic feet of space. A “standard cord” is a pile of wood 8’ x 4’ x 4’, consisting of a gross volume of 128 cubic feet. This measure is commonly used for pulpwood measurement. A “face cord” has no real standard and generally refers to a pile 8 feet long, 4 feet high, consisting of pieces 1-2 feet long. Cords should always be described in terms of “standard cords” in any agreement regardless of the length of the wood. The definition of a standard cord of cut and split wood varies from state to state. The Cooperative Extension forester in your state can advise you as to your state’s standards.

Crosscut—To cut a piece of wood at right angles to the grain.

Cross grain—[Cross-grained wood] Wood in which the fibers deviate from a line parallel to the sides of the piece. Cross grain may be either diagonal or spiral grain or a combination of the two.

Crown—The leaves and branches of a tree; the upper portion of a tree.

Cruise—A survey of forest land which includes the location of timber stands, their volumes, species, sizes, quality, etc.


Cull—Trees, logs, or bolts which are rejected, or volumes deducted in log scaling because of a defect.

Decay—The softening, weakening, or total decomposition of wood substance by fungi.

Deciduous tree—A tree which loses all of its leaves at some time during the year.

Defect—Any irregularity or imperfection on a tree, log, bolt, lumber, or other wood product that reduces the volume of usable wood or lowers its durability, strength, or utility value. Defects may result from knots and other growth conditions and abnormalities; from insect or fungus attack; or from logging, milling, drying, machining, or other processing procedures.

Density—The weight of wood per unit volume, usually expressed in pounds per cubic foot or grams per cubic centimeter. As changes in moisture content of wood affect its weight and volume, it is necessary to specify the conditions of wood at the time density is determined.

Diameter at breast height—The diameter of a tree measured at 4 1/2 feet above ground level.
**Discoloration**—Change in the color of lumber due to fungus and chemical stains or weathering.

**Dominant**—Trees with crowns extending above the general level of the crown cover and receiving full light from above and partial light from the side.

**Dressed lumber**—The lumber after drying and surfacing with a planing machine.

**Dressed size**—The dimensions of lumber after being surfaced with a planing machine. The dressed size is usually 1/2 to 3/4 inch less than the nominal or rough size. A 2" x 4" stud, for example, actually measures about 1 1/2" x 3 1/2".

**Drying**—The process of removing moisture from lumber to improve its serviceability in use. Syn: seasoning.

**Dry rot**—A term loosely applied to any dry, crumbly rot, but especially to that which, when in an advanced stage, permits the wood to be crushed easily to a dry powder. The term is actually a misnomer, since all fungi require considerable moisture for growth.

**Durability**—A general term for permanence or resistance to deterioration. Frequently used to refer to the degree of resistance of a species of wood to attack by wood-destroying fungi under conditions that favor such attack. In this connection the term “decay resistance” is more specific.

**Earlywood**—Wood formed during the early period of annual growth; usually less dense than wood formed later. Syn: springwood.

**End coating**—A coating of moisture-resistant material applied to the end-grain surfaces of green wood such as logs, timbers, boards, squares, etc., to retard end drying and consequent checking and splitting.

**End grain**—The ends of logs or timbers, dimension, boards, and other wood products that are cut perpendicular to the fiber direction.

**Even-aged forest**—A forest in which all of the trees present are essentially the same age (within 10 to 20 years). This is in contrast to an “all-aged” forest.

**Felling**—The cutting of a standing tree. Syn: chopping, dropping, cutting.

**Fiber-saturation point**—The stage in the drying or wetting of wood at which the cell walls are saturated with water (bound water) and the cell cavities are free of water. Wood at this point usually has an approximate 30% moisture content, based on its oven-dry weight.

**Filter strip**—An undisturbed woodland area lying between streams and skid trails, roads, or landings. The filter strip prevents eroded soil from contaminating water systems. Some states have legislation concerning filter strip requirements.

**Finish lumber**—A collective term for upper grades of lumber suitable for natural or stained finishes.

**Forest type**—A group of tree species which, because of their environmental requirements and tolerances, are repeatedly found growing together. Three examples of forest types are the red maple type, the white pine type, and the mixed hardwood type.

**Free water**—Water held in the cell cavity of the wood.

**Grade**—The designation of the quality of a manufactured piece of wood or of logs.

**Grain**—The direction, size, arrangement, appearance, or quality of the fibers in lumber or other wood products. When used with qualifying adjectives, it has special meanings concerning the direction of the fibers or the direction or size of the growth rings.

- **Across the grain**. The direction (or plane) at right angles to the length of the fibers and other longitudinal elements of the wood.
- **Along the grain**. The direction (or plane) parallel to the length of the fibers and other longitudinal elements in the wood.

**Green lumber**—Freshly sawed or undried wood. Wood that has become completely wet after immersion in water would not be considered green, but may be said to be in the “green condition.”

**Growth ring**—A layer of wood (as an annual ring) produced during a single period of growth.

**Habitat**—Natural setting where an animal or plant is likely to survive and reproduce.

**Hardness**—A property of wood that enables it to resist indentation.

**Hardwoods**—Generally one of the botanical groups of trees that have broad leaves, e.g., oak, elm, basswood. Also, the wood produced from such trees. The term has no reference to the actual hardness of the wood.
Heartwood—The wood extending from the pith to the sapwood, the cells of which no longer participate in the life processes of the tree. Heartwood may contain phenolic compounds, gums, resins, and other materials that usually make it darker and more decay resistant than sapwood.

Humidity—The moisture content of air.

Kerf—The part of a log or board disintegrated during sawing; sawdust.

Kickback—When a chain saw jumps up and back during cutting due to the top of the bar contacting something; can cause serious injuries to the operator.

Kiln—A chamber having controlled air flow, temperature, and relative humidity, for drying lumber, veneer, and other wood products.

Knot—That portion of a branch or limb that has been surrounded by subsequent growth of the wood of the trunk or other portions of the tree. As a knot appears on the sawed surface, it is merely a section of the entire knot, its shape depending upon the direction of the cut.

Landing—Where logs are accumulated and sorted prior to loading and hauling to market; the cleared area to which trees or logs are skidded and which is used for storage of logs and loading of log trucks.

Latewood—The portion of the annual growth ring that is formed after the earlywood formation has ceased. It is usually denser and stronger than earlywood. Syn: summerwood.

Limb—To remove the limbs from a felled tree. Syn: branch, knot.

Load—The weight or mass of all or part of a building or structure that is carried, lifted, or supported.

Load-bearing—A structural member in wood frame construction that helps support the weight of the structure.

Load-carrying capacity—The maximum load that can be carried by a structural member of a specific size, moisture content, species, and grade.

Log—(1) A tree segment 8 feet long or longer, suitable for processing into lumber, veneer, or other wood products. (2) To harvest trees.

Log grading—The assignment of a quality class to a log. In the northeastern states, there is no standard log grade which is used by all mills. Sawmills generally establish their own grades. The U.S. Forest Service has established a log grade system for hardwoods and one for softwoods, available from the Cooperative Extension forester in each state.

Log scaling—The estimation of the board foot volume to be sawn from a log. A log scale volume is an accepted form of measurement in log marketing.

Loose knot—A knot that is not held firmly in place by growth or position and that cannot be relied upon to remain in place.

Manufacturing defects—All defects or blemishes that are produced in manufacturing, such as chipped grain, loosened grain, raised grain, torn grain, skips in dressing, hit and miss (series of surfaced areas with skips between them), variation in sawing, miscut lumber, machine burn, machine gouge, mismatching, and insufficient tongue or groove.

Marking—Selecting and indicating by a paint spot or other method the trees to be cut or left in a cutting operation.

Maturity—For a given species or stand, the approximate age beyond which growth falls off or decay begins to increase at a rate likely to assume economic importance.

Merchantable—The portions of trees or stands that can be profitably marketed under given economic conditions.

Merchantable height—The height of a tree (or length of its trunk) up to which a particular product may be obtained.

Mill Scale—The total volume of lumber and other products sawn from a group of logs, calculated by adding the board foot volume of each piece or product sawn.

Moisture content—The amount of water contained in the wood, usually expressed as a percentage of the weight of the oven-dry wood.

Moisture meter—An instrument used for rapid determination of the moisture content of wood by electrical means.

Mold—A fungal growth on lumber or other wood products at or near the surface and, therefore, not typically resulting in deep discolorations. Mold is usually ash green to deep green in color, although black and yellow are common.
Multiple use—The management of forest land (or any other land) for more than one purpose, such as timber production, wildlife protection, recreation, and watershed.


Nominal—As applied to timber or lumber, the size by which it is known and sold in the market; often differs from actual size (see Dressed Lumber).

Notch—To make an undercut in a tree preparatory to felling it in a given direction.

Old growth—Timber in or from a mature, naturally established forest. When the trees have grown during most, if not all, of their individual lives in active competition with their companions for sunlight and moisture, the timber is usually straight and relatively free of knots.

Overmaturity—That period in the life cycle of trees and stands when growth or value is declining.

Pallet—A low wood or metal platform on which material can be stacked to facilitate mechanical handling, moving, and storage.

Patch cut—Harvesting of all or nearly all trees within a small area (0.5 to 5 acres).

Pitch pocket—An opening extending parallel to the annual growth rings and containing, or that has contained, pitch ("resins"), either solid or liquid.

Pith—The small, soft core occurring near the center of a tree trunk, branch, twig, or log.

Pole stand—A stand of trees whose diameters (dbh) range from 4 inches to approximately 8–12 inches.

Pole timber—Trees which are larger than saplings but too small for saw timber. Generally, 4–12 inches dbh.

Pre-logging—Cutting specified high value wood products, such as poles and piling, in advance of cutting the remainder of the trees.

Preservative—Any substance that, for a reasonable length of time, is effective in preventing the development and action of wood-rotting fungi, borers of various kinds, and harmful insects that deteriorate wood.

Radial—Coincident with a radius from the axis of the tree or log to the circumference. A radial section is a lengthwise section in a plane that passes through the centerline of the tree trunk.

Relative humidity—Ratio of the amount of water vapor present in the air to that which that air would hold at saturation at the same temperature. More generally, it is the ratio of the vapor pressure of water in a given space compared with the vapor pressure at saturation for the same dry bulb temperature.

Residual trees—The trees remaining on the woodlot after the harvest has been completed. These trees are the candidates for the next harvest.

Resin—inflammable, water-soluble, vegetable substances secreted by certain plants or trees, and characterizing the wood of many coniferous species. The term is also applied to synthetic organic products related to the natural resins.

Rough lumber—Lumber as it comes from the saw and that has not been surfaced or dressed.

Sap—the moisture in green wood containing nutrients and other chemicals in solution.

Sapwood—the wood or pale color near the outside of the log. In wood anatomy, the outer layers of the stem that in the living tree contain living cells and reserve materials, e.g., starch. The sapwood is generally lighter in color than the heartwood. Under most conditions the sapwood is more susceptible to decay than heartwood.

Saw kerf—1) Grooves or notches made in cutting with a saw; 2) that portion of a log, timber, or other piece of wood removed by the saw in parting the material into two pieces. 3) Sawdust.

Saw timber—Trees suitable for production of sawlogs.

Second growth—Timber that has grown after the removal, whether by cutting, fire, wind, or other manner, of all or a large part of the previous stand.

Second log—The log above the butt log.

Seeding—A conservation measure of seeding a landing or skid trails with grass seeds. Foresters can recommend a “conservation mix” for this purpose.

Selection cutting—Cutting only a portion of the trees in a stand, usually those marked or designated by a forester.

Shake—A separation along the grain, the greater part of which occurs between the rings of annual growth.

Shrinkage—The contraction of wood fibers caused by drying below the fiber saturation point. Shrinkage—longitudinal, radial, tangential and volumetric—is usually expressed as a percentage of the dimension of the wood when green.

- **Longitudinal shrinkage.** Shrinkage of wood along the grain, or in the long axis of the log.
- **Radial shrinkage.** Shrinkage across or perpendicular to the grain, in a radial-transverse direction.
- **Tangential shrinkage.** Shrinkage across or parallel to the grain, in a tangential-transverse direction.
- **Volumetric shrinkage.** Shrinkage of wood in volume.

Skid—1) To drag logs or tree lengths either wholly or partially on the ground. Syn: switch, yard, snake. 2) One or more poles placed on the ground to support logs or bolts.

Skidded—A generic term for a machine to drag logs or trees from the woods to the landing. Track vehicles are generally referred to as “crawlers” or “bulldozers.” The term is usually applied to the specialized four-wheel-drive rubber-tired vehicles built specifically for this operation.

Skid trail—The route taken to skid logs through the woods, but not used by log trucks.

Slash—The debris left in the woodlot after logging or fire.

Slope of grain—In lumber and other wood products, the degree of cross grain. The ratio between a 1” deviation of the grain from the long axis of a piece and the distance along the edge in which the deviation occurs.

Soft rot—A special type of decay developing under very wet conditions (as in cooling tower and boat timbers) in the outer wood layers, caused by cellulose-destroying microfungi that attack the secondary cell walls and not the intercellular layer.

Softwood—Generally, one of the botanical groups of trees that, in most cases, has needlelike or scalelike leaves; the conifers; the wood produced by such trees. The term has no reference to the actual hardness of wood.

Species—A group of individual plants of a particular kind; that is, a group of individuals sharing many of the same characteristics. It is a category of classification lower than the genus but higher than the variety.

Split—A separation of the fibers along the grain forming a crack or fissure that often extends through the piece from one surface to another.

Stain—1) A discoloration in wood that may be caused by microorganisms, metal or chemicals. 2) Materials used to impart colors to wood.

Stand—A group of trees occupying a given area and sufficiently uniform in composition, age and condition so as to be distinguishable from the forest on adjoining areas. A forest stand is said to be pure if 80% or more of the trees present are of the same species. If less than 80% of all trees present are of the same species, the stand is said to be mixed.

Sticker—A wood strip placed between layers of lumber in a pile or unit package and at right angles to the long axis of the stock to permit air to circulate between the layers. Syn: crosser, strip, piling strip, stick, spacer.

Sticker stain—A brown or blue stain that develops in seasoning lumber where it has been in contact with the stickers.

Straight grain—Wood in which the fibers and other longitudinal elements run parallel to the axis of a piece.

Strength—1) The ability of a member to sustain stress without failure. 2) In a specific mode of test, the maximum stress sustained by a member loaded to failure.

Stumpage—The value of timber as it stands uncut in the woods; the standing timber itself.
Stumpage price—The price offered or paid for standing timber. Often referred to just as “stumpage.”

Suppress (or overtopped)—Trees with crowns entirely below the general level of other crowns in a woodlot; they receive no direct light either from above or from the sides.

Sustained yield—Management of forest land to produce a relatively constant amount of timber, revenue or both.

Sweep—A gradual bend in a log, pole, or piling, or in a standing tree.

Tangential—Strictly speaking, coincident with a tangent at the circumference of a tree or log, or parallel to such a tangent. In practice, however, it often means roughly coincident with a growth ring.

Texture—A term often used interchangeably with grain. Sometimes used to combine the concepts of density and degree of contrast between springwood and summerwood. Texture refers to the finer structure of wood (see Grain) rather than annual rings. The sizes, distribution, and proportional volumes of the cellular elements of which wood is composed; often used interchangeably with grain. Depending on the relative size and distribution of cellular elements, texture may be coarse (open grain) or fine, even or uneven.

Thinning—A general term relating to removal of trees to improve the growing conditions of remaining trees.

Timber—A term loosely applied to forests and their products. Specifically, sawed lumber more than 4” x 4” in breadth and thickness.

Timber stand improvement (TSI)—A practice in which the quality of the residual forest stand is improved by removing the less desirable trees, vines and, occasionally, large shrubs to achieve the desired stocking of the best quality trees. It can also include such practices as pruning.

Timber, standing—Trees in a forest stand which have not been severed from the stump.

Top—To cut off the unmerchantable top of a tree.

Top log—The smaller diameter log having more limbs than the rest of the tree, found in the upper part of the tree’s stem.

Top lopping—To cut limbs on downed tree tops so that none are more than a specified height above ground.

Toughness—A quality of wood which permits the material to absorb a relatively large amount of energy, to withstand repeated shocks, and to undergo considerable deformation before breaking.

Tree length—An entire tree, other than the unmerchantable top and limbs.

Undercut—In felling, the notch made in a standing tree to guide the direction in which it will fall.

Understocked, overstocked, etc.—Refers to the number and density of trees in a forest stand.

Veneer—A very thin layer or sheet of wood used in furniture, paneling, and other specialty wood products.

Veneer log—A log which can be marketed for the end use of producing rotary cut or sliced veneer.

Virgin growth—The original growth of mature trees.

Wane—Bark, or the lack of wood from any cause, on any edge of a piece of square-edged lumber.

Warp—Distortion in lumber and other wood products causing departure from its original plane, usually developed during drying. Warp includes cup, bow, crook, twist, and kinks, or any combination thereof.

Water bar—Water diversion measure used for erosion control on skid trails and logging roads on slopes; a shallow ditch with a mound of earth on the downhill side and constructed across a trail or road at a diagonal.

White rot—In wood, any decay attacking both cellulose and lignin, producing a generally whitish residue that may be spongy or stringy or occur in pockets.

Widowmaker—1) A limb in a tree that may fall at any time. 2) A tree that is lodged against another and that may fall at any time.

Windfall—1) A tree knocked down by the wind. 2) An area of such trees. Syn: blowdown.

Wolf tree—A large older tree with a spreading crown and little or no timber value. These often have great value for wildlife.

Workability—The degree of ease and smoothness of cut obtainable with hand or machine tools.
References


Directions for making a cruising stick:

Make a full size photocopy of the diagram below. Do not reduce or enlarge the cruising stick or you will receive inaccurate results. The stick is composed of two parts, each divided into three sections below. Cut out each section along the bold lines. Tape the matching ends labelled "X" and "Y" together to form the Height Scale, and match ends "A" and "B" to form the Diameter Scale. Glue the assembled scales to opposite sides of a narrow wooden stick at least 26 inches long, such as a yardstick. See Chapter 1 for illustration and directions for use.

```
  Y
  3
  2
  4
  X
  1

STEP OFF 6 FEET, PLUMB STICK 25 FEET FROM EYE, READ NUMBER OF LOGS

NUMBER OF 16-FOOT LOGS

HOLD STICK LEVEL 25 INCHES FROM EYES AGAINST TREE AT HEIGHT OF 4 1/2 FEET

DIAMETER OF TREE (INCHES)

A
0 11
12 13
14 15
16 17
18 19
20 21
22 22
B
1
20
30
40
```