

# WOOD PRODUCTS BY SPECIES AND QUALITY IN UPLAND FORESTS

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**Abstract**—Products that can be produced from an upland forest depend on the species and quality of the trees present. Quality depends on growth rate and tree form. These variables are discussed as well as the products that can be produced such as veneer and plywood, grade lumber, handle stock, pallet stock, cross ties, and industrial lumber.

## INTRODUCTION

The wood products that can be produced from trees of the upland forest of Arkansas are discussed in this paper. These products depend on several factors such as species and quality. Therefore, the different types of wood that are present will be discussed as well as how growth rate affects the quality of each type. Also discussed will be how tree form affects wood quality. Finally, the different types of products will be presented.

## WOOD TYPES

The upland forest is mainly a hardwood forest. Hardwoods can be classified into two types: ring-porous and diffuse-porous. Ring-porous woods include species such as the oaks, hickories, and ashes. These species are the most desirable in the forest. The diffuse-porous woods include red maple and blackgum. Diffuse-porous woods are usually less desirable and used in products of lesser value. Some of these woods are referred to as soft hardwoods and are used in place of southern pine in some products. There are some softwoods such as shortleaf pine on some south facing slopes and eastern red cedar present in the upland forests.

## EFFECTS OF GROWTH RATE

The effect of growth rate on the quality of wood depends on the type of wood under consideration. With ring-porous woods, the quality improves as the growth rate increases. This is because of the structure of the growth rings. In ring-porous hardwoods, three to five rows (depending on species) of large pores or vessels are laid down at the beginning of the growing season and the remainder of the ring is made up of fibers and small vessels. No matter what the size of the growth ring is, the tree will always lay down the same number of rows of large vessels. Any extra growth or lack of growth will appear in the amount of fibers produced. Therefore, the faster the growth is, the stronger and the more appealing to the eye the wood is.

Back when the chip mills were operating in the Northwest part of the state, I was contacted by one mill manager to check the quality of their chips because the Japanese customers were refusing to pay the agreed upon price. The wood samples I examined had very small growth rings made up of mainly earlywood vessels and very few fibers. I told the manager that I could see why the Japanese were

saying that they were realizing twenty-five percent less pulp per ton of chips as compared to chips procured from east of the Mississippi. It is interesting to note that there were several groups that insisted that those trees should not be cut but allowed to grow larger. Once larger, they would provide high quality hardwood lumber. Sorry, but with the growing conditions that those trees were experiencing, they would never produce anything but very low quality wood.

With diffuse-porous hardwoods, the vessels are much smaller and located throughout the growth ring. Because of this, there is no correlation between growth rate and wood properties or quality for diffuse-porous woods. The wood is basically the same whether fast grown or slow grown.

Softwoods such as eastern red cedar, hemlock, spruce, fir, etc., show the same relationship as diffuse-porous hardwoods. Softwoods with abrupt latewood such as southern pine and Douglas-fir appear to have lower quality wood with an increase in growth rate. Some researchers believe that this is the effect of age, not growth rate.

## EFFECTS OF TREE FORM

Besides the growth rate, a tree's form greatly affects the quantity and quality of the products that can be produced. It is desirable that each tree be straight. When the bole deviates from straight, solid wood products will have cross grain, which will result in warping and splitting when dried. The more severe the sweep (curve in the bole), the shorter the logs have to be cut to minimize the effects of cross grain. Trees with crook will have portions bucked out and left in the forest.

Leaning trees are most undesirable. All trees want to be upright. If hardwood trees are leaning, they will produce tension wood on the upper side of the bole, which will force the bole into an upright position. Tension wood is bad from the start. It causes problems with machining, drying, finishing, and pulping. The chemical composition and cell structure of tension wood is different from normal wood.

The best trees have circular cross sections with the pith in the center. When a tree has a tear drop or oval cross section, the pith is located toward the smaller side and the quality of the solid wood products it produces is lower. There are two main reasons for non-circular cross sections. First, tension wood will cause the tree to produce a wide

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growth ring on the upper side and a very narrow ring on the lower side. The undesirability of tension wood has already been mentioned. Second, when there is competition on two or three sides of the tree, the crown will grow toward the sunlight and the bole will grow more on that side.

Limbs result in knots in solid wood products manufactured from the tree. Knots are the single most important quality-limiting defect and they grow from the pith outward. The best quality trees self-prune early and quickly produce a clear surface for most of the bole's length. A downside with hardwoods is that in many species, if the sunlight reaches the bole, new limbs (epicormic branching) will form at the cambium. It is sad to see a prime grade tree suddenly sprouting new branches on its lower bole and thereby, substantially lowering the grade. Therefore, one must be careful not to cause epicormic branching when thinning a hardwood stand to increase growth rate.

The hardwood tree grades for factory grade lumber are an example of how tree form affects the quality. The first limiting factor is size: grade 1 trees must be at least 16 inches in diameter at breast height (d.b.h.), grade 2 trees must be 13 inches in d.b.h., and grade 3 trees must be 10 inches in d.b.h. The second limiting factor is the amount of clear material in the third best face. Defects such as limbs, bird pecks, whorls, bulges, cracks, etc. limit the clear spaces. The next limiting factor is the amount of sweep: nine percent for grade 1, 15 percent for grade 2, and 50 percent for grade 3 trees.

## WOOD PRODUCTS

The most valuable product from the hardwood forest is veneer. Most hardwood veneers are sliced and not peeled. Grain orientation is critical to achieve the desired visual effect. The logs are sawn to produce flitches that have the desired grain orientation on their face. The flitch is attached to a veneer slicer that slices veneers with the same grain pattern. One can see that in order to obtain the desired veneer, the process must start with logs that are large, straight, circular in cross section, and clear of knots and other defects. Veneers from highly valued species are used in the production of decorative hardwood plywood, furniture, cabinets, paneling, etc. Veneers from lower valued species such as red maple, blackgum, sweetgum, and yellow-poplar are used for inner plies and back plies for products where only the face shows.

Some of the soft hardwoods are peeled and used with softwoods to make structural plywood. I have visited some plywood plants in North Carolina where red maple, sweetgum and yellow-poplar are used with southern pine to make plywood. Since defects and/or patches are permitted, the best quality logs are not required.

The most common use for quality logs is factory grade lumber. Since you do not need perfect logs to make solid wood parts, the price of factory grade logs is lower than for veneer grade logs. Many of the big sawmills do pay according to the log grade and not just by volume or weight. The price of the resulting lumber varies greatly by grade as well. The difference between the price of FAS (top grade) and No. 3 common (lowest grade) lumber could be a factor of

seven or eight for red oak and other valued species. Grade lumber can be used to make furniture, cabinets, paneling, flooring, mouldings, and architectural woodwork. It is easy to sell the high grade lumber but somewhat difficult to sell the low-grade lumber. All logs, regardless of grade, have some low-grade lumber in them.

Quality hickory and ash logs can be used to produce handle stock. Hickory is used for handles of striking tools such as hammers, picks, and axes while ash is used for long handles such as hoes, shovels, and rakes. Again, the faster the growth rate, the better the handles are from these species.

The number one user of hardwood lumber in the United States is the pallet industry. Approximately five billion board feet of hardwood lumber or almost 40 percent of the total hardwood production are used annually in the production of pallets. Here strength and stiffness are the deciding factors and not appearance. Sagging deck boards cause problems when inserting the forks of a forklift through the pallet.

Cross ties are another market for lower grade logs. These logs must be big enough so that there is no wane or other defects in the bearing plate area. The logs need to be straight so that the resulting ties will remain straight after drying.

Industrial lumber includes board road, sewer boards and dunnage. Board road is a 3-layer, reversing herringbone roadway for heavy equipment going in and out at an oil-drilling site. It minimizes the land disturbance. The law requires that any ditch over four feet deep must be bulk-headed before anyone can work in the ditch. Sewer boards are used for that purpose. Dunnage is used to insure that a cargo item does not shift or move while being transported by rail or ship.

In other parts of the country, soft hardwoods are used to make oriented strand board (OSB). The original OSB mills were in the Lake States using aspen. If the red oak borer does kill most of the oaks in the forest, red maple and other soft hardwoods may become the dominate species. But, OSB plants cost a lot of money.

The hardwood forest can also be used as a source of raw material for the pulp and paper industry. But even the pulp and paper industry requires a certain level of quality in its wood resource. Hardwood pulp is generally used to make high end paper such as coated and glossy paper used in magazines while softwood pulp is generally used for newsprint and paper bags.

Fuel is the number one use of wood in the world. Home fireplaces and stoves along with industrial energy uses can remove a lot of low-grade trees from the forest. Transportation costs may be the limiting factor in Arkansas.

The sale of products (wood, water, wildlife, etc.) offset the costs of forestry operations in the upland forest. This paper has discussed how the growth of the trees affects the quality and types of wood products that can be produced from the upland forests. This information should aid the forester in making management decisions on upland forests.