

Forestry



Student Reference

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In cooperation with
Agricultural Education Department of Practical Arts and Vocational-Technical Education
College of Education and College of Agriculture, Food and Natural Resources
University of Missouri-Columbia



Agricultural Education Section Division of Vocational and Adult Education
Department of Elementary and Secondary Education, Jefferson City, Missouri

The Importance of Forest Resources

Lesson I: The Importance of Forest Resources

Forests cover approximately 12.4 million acres of Missouri's total land area of 44 million acres. Approximately 11 million acres of this total forest area are in the Ozark region. This is the heavily forested land where trees occupy 75 to 95 percent of the total land area. The remaining 2 million acres consist of scattered farm woods throughout the state. There is always some clearing going on to make more pasture, but nature is constantly reforesting these clearings with sprouts and seedlings. Therefore, the amount of forest lands in future years should remain about the same.

Forests' resources produce a highly diverse range of benefits. The most obvious of these is associated with wood products. In some parts of the state, wood industries are key elements in the local economy, providing jobs for a significant portion of the work force. Aside from these products, forests provide other valuable benefits which are not normally sold.

Benefits of Missouri Forests

Water: Forest cover has a direct effect on the quality and availability of water. Rain passing through the upper layer of a well-stocked forest (the canopy) is deflected by leaves and branches to the point where its speed is reduced. As it travels downward it is intercepted by other layers of vegetation until finally it hits a layer of dead leaves covering an absorbent 6 to 12 inches of organic matter.

In this situation, substantially less run-off occurs than with other land use conditions. Water seeps into the ground and then gradually finds its way into streams or other bodies of water, making itself available long after the rain has ceased. Surface run-off, on the other hand, not only moves out of the local area quickly, but generally carries with it a heavy load of sediment not found in ground water.

Recreation: Forest lands provide recreational opportunities. Much of the state's tourism and recreational activities occur in the heavily forested areas of Missouri. Many of these areas also have very attractive bodies of

water, made so by forested watersheds which keep the water clean and provide an aesthetic backdrop.

Wildlife habitat: Forests are complex, interrelated communities of plants and animals. When forests are eliminated, so are the food and cover for many species of wildlife. Sound management practices, which include the proper harvesting of trees, can often enhance wildlife habitat. Also affected are a wide variety of associated plants.

Other non-marketable benefits: In the winter, trees outside insulate and reduce the chilling effects of wind. In summer, trees provide shade. Also, trees provide year-round windbreaks that slow wind erosion and canopy cover that reduces soil erosion. These windbreaks also reduce cold and heat stress on livestock.

Timber products: Missouri produces a great variety of forest products that are manufactured mostly from fine hardwoods, shortleaf pine, and red cedar. Missouri leads the nation in the production of walnut for prime cabinets and gunstocks. Missouri is also a center for producing cedar novelties and closet lining and leads the production of white oak barrel staves and charcoal. Several mills manufacture fine oak flooring, hickory and ash handles, and oak railroad ties. In addition, Missouri timber is used for veneer, fence posts, boxes, pallets, and pulpwood.

These varied market outlets and the promise of expanding future markets will add income to timber landowners. The future outlook for marketing quality wood from Missouri's 12.5 million acres of timber is bright.

Career Opportunities in Forestry

Careers in the field of forestry are of great diversity. All forestry occupations are concerned with developing, maintaining, cultivating, and protecting forests and woodlands, as well as with harvesting their products. Some of these occupations include being a professional forester, a forestry nursery person, or a Christmas tree farmer.

Forest conservation occupations: These occupations are concerned with planting tree seedlings; pruning and thinning trees to improve quality of stand; locating and

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combating fires, insects, pests, and diseases harmful to trees; and controlling the erosion and leaching of forest soil. Some of these tasks may be undertaken by a fire warden, forester aide, smoke jumper, fire ranger, forest firefighter, or tree planter.

Logging and related occupations: These occupations are concerned with felling trees and cutting them into logs or products such as cordwood, firewood, and posts using chain saws, axes, wedges, and related tools. Some of the more common occupations concerned with these practices are: felling-bucking supervisor, tree-shear operator, buckler, logger, skidder operator, and log scales.

Other forestry related occupations: Many of these occupations are based on using, processing, and/or marketing forest products. For example, wood machining occupations are concerned with shaping wooden parts. Wood processing occupations deal with wood products (such as plywood, particle board, compressed-sawdust fuel logs) and wood particles (such as chips, sawdust, and powder), removing moisture from wood, and treating wood with preservatives.

Forestry Assistance Available from Missouri Agencies

Timber growers may receive professional forestry assistance from a variety of private and public sources. No matter what your situation, there is probably an organization or individual that can help you find publications, technical advice, educational programs, financial assistance, or associations to help you manage your woodlands.

Public agencies include the Missouri Department of Conservation (and its branches of the Forestry Division, the George O. White State Forest Nursery, the Wildlife Division, and the Fisheries Division); Missouri Department of Natural Resources; Missouri Department of Agriculture; School of Natural Resources at the University of Missouri; United States Department of Agriculture; and the Missouri Soil and Water Districts Commission (SWDC).

Private organizations include the Missouri Christmas Tree Producers Association, National Walnut Council, American Tree Farm Program, Missouri Forest Products Association (MFPA), and Missouri Consulting Foresters Association.

Offices of the state forestry agencies and the county extension service have lists of professional consulting foresters. The following descriptions of agencies and associations (taken from University of Missouri Extension's Agricultural Guide G5999, *Forestry Assistance for Landowners*) will give an idea of the assistance which is available.

State Forester's Office, Forestry Division
Missouri Department of Conservation (MDC)
P.O. Box 180
Jefferson City, MO 65102
(573) 751-4115
<http://mdc.mo.gov/forest/>

The Missouri Department of Conservation, through its Forestry Division, offers free technical advice and services to landowners. The state is divided into 17 forestry districts with each district having professional foresters to give on-the-ground advice and assistance in tree planting, species selection, woodland management, fuelwood cutting, timber stand improvement, timber sales and tax treatment of these sales, harvesting and marketing, insect and disease detection, and woodland wildlife management. Assistance with utilization and marketing of timber products is also available to wood industries and private landowners.

Foresters will prepare management plans and give you advice on available financial assistance programs. Landowners can receive cost-share payments for specific forestry practices such as timber stand improvement and tree planting.

Missouri Department of Natural Resources (DNR)
P.O. Box 176
Jefferson City, MO 65102
(573) 751-3443
<http://www.dnr.mo.gov/>

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The Department of Natural Resources regulates standards for air, water, minerals, and energy, as well as administering the extensive system of state parks and historic sites in the state. Land survey staff restore original public land survey corners to insure accurate location of property boundaries. DNR's soil and water conservation program promotes good farming practices to prevent erosion and runoff. The staff assists counties in forming soil and water conservation districts to encourage watershed protection and proper land management (see section on Missouri Soil and Water Districts Commission).

Missouri Department of Agriculture
P.O. Box 630
Jefferson City, MO 65102
(573) 751-4211
<http://www.mda.mo.gov>

The Missouri Department of Agriculture licenses and regulates applicators of pesticides, conducts surveys with the assistance of other state and federal agencies to locate and control the spread of serious insect pests and plant disease, and establishes preservative retention standards for treated timber products. This department also aids pecan and other nut growers, fish farmers, and produce growers in marketing their products.

School of Natural Resources
University of Missouri-Columbia
103 Anheuser-Busch Natural Resources Building
Columbia, Missouri 65211
(573) 882-7045
<http://www.snr.missouri.edu>

As a Land Grant Institution, the University of Missouri has three functions: teaching, research, and extension. The School of Natural Resources offers a 4 year program in fisheries and wildlife sciences; forestry; and parks, recreation, and tourism as well as graduate level programs in all of these disciplines. Faculty research focuses on natural resource problems faced by Missouri landowners. The goal of the school's extension staff is to ensure transfer of research information to potential users. The extension specialists at the university provide technical information to county extension staff and landowners, as well as hold or help coordinate educational programs regarding

renewable natural resources for landowners, industry, professionals, FFA, and 4-H and youth organizations.

United States Department of Agriculture
U.S. Forest Service
Mark Twain National Forest
401 Fairgrounds Road
Rolla, MO 65401
(573) 364-4621
<http://www.fs.fed.us/r9/forests/marktwain/>

The U.S. Forest Service manages the federal lands of the Mark Twain National Forest in Missouri for multiple benefits of timber, recreation, watershed protection, grazing, and wildlife. The staff at the North Central Forest Experiment Station located in Columbia conduct research on oak culture and management. The Forest Service's State and Private Forestry Division in Broomall, Pennsylvania, cooperates with the State Forester on programs to benefit private woodland owners.

Missouri Soil and Water Districts Commission
(SWDC)
Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102
(573) 751-4932
<http://www.dnr.mo.gov/env/swcp/index.html>

The Missouri Soil and Water Districts Commission develops statewide programs of resource conservation. These programs are administered locally by county SWDCs (co-housed with USDA Soil Conservation Service). Currently, a state-funded Soil and Water Conservation cost-share program offers financial incentives to owners of agricultural land to install erosion control projects and practices. Being developed is a Soil and Water Conservation loan interest-share program. Both have as eligible projects the establishment of protection of woodlands.

Missouri Christmas Tree Producers Association
Missouri Department of Conservation
P.O. Box 180
Jefferson City, MO 65102
(573) 751-4115

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The Missouri Christmas Tree Producers Association is a non-profit organization of Christmas tree growers and technical persons dedicated to the promotion of the interests of the Christmas tree growing industry in Missouri. Objectives include advancing the production of high quality Christmas trees, promoting research related to Christmas tree production, keeping members informed about current research findings, conducting educational meetings and tours of successful Christmas tree plantations, sharing information and experiences among members, and encouraging the use of natural Christmas trees. Members receive the midwest magazine *Christmas Trees* and have the opportunity to join the National Christmas Tree Association.

Walnut Council International Office
Wright Forestry Center
1007 N 725 W
West Lafayette, IN 47906-9431
(765) 583-3501
<http://www.walnutcouncil.org/>
and
Missouri Chapter of the Walnut Council

The National Walnut Council is composed of walnut growers, university researchers, foresters, and walnut buyers and manufacturers. The common interest of all these individuals is growing and using black walnut. Landowners can exchange ideas, problems, and gain information on the planting, growing, and tending of walnut trees for nut, lumber, and veneer crops.

American Tree Farm System
American Forest Foundation
1111 Nineteenth Street N.W., Suite 780
Washington, D.C. 20036
(202) 463-2462
<http://www.treefarmssystem.org/>
or
Missouri Tree Farm Program
Missouri Forest Products Association
611 E. Capitol, Suite 1
Jefferson City, MO 65101
(573) 634-3252
<http://www.moforest.org/treefarmssystem.htm>

The Tree Farm System is a national program, sponsored by wood-using industries and coordinated by the American Forest Foundation to promote sound forest management on privately owned woodlands. To qualify as a Tree Farm, your woodlands must be privately owned with 10 or more acres which are managed for the production of timber and forest products and protected from fire, insects, disease, and grazing.

Your woodlands can be inspected free of charge by a forester to help you develop a management plan and to determine if your woods qualify for the Tree Farm Program. Owners of approved woodlands receive the green and white Tree Farm sign to post on their land and receive woodland management information.

Every year, Missouri Tree Farmers are recognized for their wise forest management through the State Tree Farm awards. Contact the State Tree Farm Program or your local forester for more information.

Missouri Forest Products Association (MFPA)
611 E. Capitol, Suite 1
Jefferson City, MO 65101
(573) 634-3252
<http://www.moforest.org/>

The Missouri Forest Products Association provides services to sawmill owners, loggers, wood products manufacturers, and forest landowners. Landowners can receive information and services relating to markets, insurance, waste utilization, and legislation. The MFPA is also co-sponsor of the Missouri Tree Farm Program.

Missouri Consulting Foresters Association (MCFA)
P.O. Box 497
Salem, MO 65560
(573) 729-4641
<http://www.missouriforesters.com/>

Consulting foresters furnish a variety of forest management activities on a fee basis. Services include woodland management plans, timber appraisals, forest and shade tree damage appraisals, marking timber, reforestation, timber stand improvement, marketing and sale supervision, surveying, mapping, and other services. Consultants

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can provide these services at a more intensive level and usually spend more time with individual clients than public foresters. A listing of the consulting foresters in the state is available from a state forester, extension forester, or the Missouri Consulting Foresters Association.

Programs of the Forestry Division

The Forestry Division in the Missouri Department of Conservation is the agency primarily responsible for management, restoration, conservation, and regulation of forest resources in the state. The state forestry program encompasses many programs designed to maximize production on all forest lands.

Fire control: Protecting forest resources from indiscriminate burning is essential before any long range management program will be successful. The Forestry Division now provides direct fire protection to nearly 16 million acres and in an average year suppresses 3,500 fires that burn approximately 35,000 acres. The Forestry Division must maintain the necessary manpower, equipment, and facilities to detect and suppress all fires occurring within protected areas. In many forest districts, primarily in the heavily timbered Ozarks, woodland fire control is a significant responsibility.

Fire prevention: Another important aspect of the fire program is preventing fires from starting in the first place. Less than 1 percent of all fires start from lightning; 99 percent are man made. A good percentage of these are started through carelessness, and many are deliberately set. Prevention activities center around publicity, information, education, and, in some cases, law enforcement. During high fire danger periods the public is informed of the necessary precautions which should be taken. This information is disseminated through news releases, radio, and television.

Insect and disease control: Forest protection activities also extend into the area of insect and disease control. While the effects of forest fires are readily apparent, losses due to insects and diseases are much less visible and are spread throughout the entire forest resources of the state.

To address these concerns, the Forestry Division employs forest entomologists and pathologists to assist and train field foresters in the diagnosis and treatment of pest problems.

State land management: The Forestry Division is directly responsible for the management of 285,000 acres of state-owned land and 100,000 acres of forest in the Fisheries Division and Wildlife Division. In general, lands owned by the department are managed under the multiple-use concept. Production of wood products, improvement of wildlife and fisheries habitat, providing recreation, maintaining high quality watersheds, and preserving unique areas are the primary objectives.

Urban and Community Forestry Program: Over one-half of Missouri's residents live in the areas of St. Louis, Kansas City, and Springfield. When residents of cities such as St. Joseph, Joplin, and Columbia are added, it becomes apparent that Missouri has a substantial urban population. The Forestry Division provides this population with an Urban and Community Forestry Program, which has three major components: urban state forests, urban forestry technical assistance, and community forestry assistance.

Advice to communities, schools, and parks falls within the Community Forestry Program. Unlike Urban Forestry Assistance, detailed plans may be designed for long range vegetation planning and management. These plans will include recommendations for the selection of kinds and sizes of trees and the care of these trees or existing vegetation. During an average year, about one hundred Community Forestry Projects are planned around the state.

George O. White State Forest Nursery: Production of tree seedlings for planting on Missouri's private and public lands is the major objective of the State Forest Nursery located in Licking, Missouri. Approximately 14,00 seedling orders are processed in a year, and over 11 million trees and shrubs are distributed. Every person living in the state would have to plant at least two trees to reach this amount. Of these figures, some seedlings are in special bundles designed for wildlife cover, windbreaks, or conservation. These bundles contain such species as

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dogwood, redbud, Osage orange, autumn olive, black locust, and several species of oak.

Quite a bit of the nursery is devoted to shortleaf pines for planting on private, state, and federal lands. Seedlings are also utilized by youth groups, garden clubs, and others for community plantings, and trees are distributed each year to all fourth grade students in the state to celebrate Arbor Day. Seedlings can be ordered for a nominal cost from November until February on a first come, first serve basis.

Tree Improvement Program: In 1967, a formal Tree Improvement Program was established. The objectives of the program are selection and development of trees that are superior in initial survival, growth, and production characteristics. Black walnut and shortleaf pine are two of the highest priority species, with pecan and eastern cottonwood following.

Forest products utilization: Direct assistance is given by the Forestry Division to loggers, manufacturers, and consumers. Area foresters and forest product specialists work with loggers to improve harvesting efficiency while also helping wood industries to better utilize and process these raw materials.

Presently about 60 percent of our wood residues are being utilized for a wide variety of products. More complete utilization of harvested timber and wood residues will favorably affect the wood industry in Missouri, help reduce potential pollution sources, and extend the forest resources.

Research and planning: Research projects conducted by the Forestry Division, often through contracts with the University of Missouri, are oriented to specific problems and needs facing forestry statewide.

Information activities: Increasing public awareness of forest resource related activities is done through presentations to groups, written articles, use of the media, distribution of pamphlets and brochures, exhibits at fairs, and working with schools. Through these programs, Missouri citizens can become caretakers of our natural

resources while also learning about many services available from the Forestry Division.

Private land management assistance: About 85 percent of Missouri's forested acreage is owned by private individuals. These landowners are highly diverse in terms of why they own forest lands and what they desire from their ownership. The Forestry Division has a very extensive program for helping these individuals realize their land ownership objectives. Foresters can recommend the number and types of trees to plant, inventory standing timber, develop management plans for cutting and forest improvements, give advice on woodland wildlife management, help select trees to harvest, and advise owners on timber sales and assistance programs.

In an average year, personnel assist with approximately 95,000 acres, make wildlife habitat recommendations on 10,000 acres, and help to sell about 30 million board feet of timber. This is enough to make crossties to build 250 miles of railroad, a distance that would connect St. Louis and Kansas City.

Several incentive and information programs are also employed to encourage better forest resource management. In some instances, landowners can receive cost share payments for conducting specific practices. Certain lands are eligible for the Forest Crop Land Program whereby landowners receive significant reduction in property taxes by agreeing to place their forest lands under approved management plans. The Department of conservation reimburses the counties to offset the property taxes lost through the Forest Crop Land practices. Good land managers are recognized through awards and enrollment in the Tree Farm Program. During an average year, the division approves about 6,000 acres for cost share payments and administers over 300,000 acres of Forest Crop Land. More than 500,000 acres are now listed as tree farms within the state.

Classifying Land as Forest Crop Land

There are several benefits to forest landowners in classifying their forest lands as Forest Crop Lands under the Forestry Division state law. These benefits include:

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- ◇ Partial tax relief for 25 years
- ◇ Intensified fire control
- ◇ Continuing forest management assistance
- ◇ Timber trespass assistance

Landowners who are part of this program have several obligations designed to practice better forestry. These obligations include:

- ◇ Ownership boundaries must be marked.
- ◇ Reasonable efforts must be made to prevent and/or extinguish wildfires.
- ◇ Land shall be devoted primarily to growing trees. It may also be used for other purposes compatible with forest practices. Lands cannot be used for grazing livestock or erecting buildings.
- ◇ Forest crop lands shall be managed to produce timber and wood products according to the plan submitted by the owner, approved by the commission, and agreed to by the owner.
- ◇ Cutting must conform to practices outlined in the management plan.
- ◇ Owners must give written notice to the commission 30 days prior to cutting any timber. Notice is not necessary for cutting firewood, posts, or timber for use on the premises.

- ◇ Within one month following a commercial cutting, the owner shall file a sworn statement showing the quantity of timber cut and price for each species sold.

To classify land as Forest Crop Land, owners should contact the Forestry Division of the Missouri Department of Conservation.

Summary

Missouri has many acres of valuable timber providing income and jobs from timber and tourist industries as well as providing beauty to all. The Forestry Division of the Missouri Department of Conservation aids in developing the potential of this natural resource through its numerous programs.

Credits

Holland, I.I., G.L. Rolfe, and D.A. Anderson (ed.). *Forests and Forestry*. 5th ed. Danville, IL: Interstate Publishers, 1997.

Stelzer, H.E. *Forestry Assistance for Landowners* (Guide G5999). Columbia: University of Missouri Extension, revised 2007. Accessed May 28, 2008, from <http://extension.missouri.edu/explore/agguides/forestry/g05999.htm>.

Lesson 2: Identifying Missouri Trees

There are over 180 species of native and commonly naturalized trees in Missouri. Being able to identify all of these species would be impossible in the short span of this unit. However, identification of and knowledge about some of these trees will be a valuable tool to the tree farmer in setting out a tree farm plan.

Taxonomic Identification

Taxonomic identification is simply recognizing living things by certain characteristics. For trees, we identify characteristics of their leaves, flowers, fruit, twigs, and bark.

Leaves: The arrangement of leaves on the stem is one of the most basic differentiating characteristics. In Missouri trees, we find opposite, alternate, and in a few cases, whorled arrangements. See Figure 2.1.

Many of our trees such as ash, hickory, and locust have compound leaves, while others such as elm, oak, and willow have simple leaves. See Figure 2.2.

Some of the leaves of various native trees are lobed – the edges of the leaves have indentations and projections or lobes. Most of our oaks and maples are lobed. See Figure 2.3.

Flowers: For our purposes, it is of value to know merely the arrangement of flowers on the tree or stem. Some species bear their flowers in various shaped clusters or singly. Many Missouri species bear their flowers in catkins. Catkins are usually flexible, drooping spikes bearing many single sexed flowers. See Figure 2.4.

Some trees may have flowers of only one sex. Others will have flowers of both sexes or, more commonly, single flowers which have both male and female components.

Fruit: Fruits of various species can be termed either dry or fleshy. The berry of the persimmon and fruit of the wild plum are fleshy. The winged seeds of the maple, the acorns of the oaks, and the pods of the locust are dry fruits.

Twigs: During certain times of the year, when there are no leaves, it may become necessary to rely on the various characteristics displayed in the twigs and buds for identification.

Bark: Although, with a little experience, it is quite easy to tell one kind of tree from another merely by bark characteristics, one must be able to recognize a range of features for each species. For example, the bark of an old oak is entirely different from that of a young oak.

Growing Areas

Soils and climate create four broad tree growing areas in the state. These areas denote major changes in general tree growing conditions that should be considered when selecting species. However, within each major area many varying sites must be considered individually for species selection. See Figure 2.5.

Ozark area (A): A high priority area for tree planting. Extensive planting for commercial timber production is feasible in this area. Often little or no site preparation is needed before planting openings.

River border area (B): This high priority area for planting has many good sites for the production of high quality hardwood species. It is essential to prepare sites well before planting. Follow planting with regular cultivation or mowing. Otherwise survival and growth will be poor. The use of herbicides may be beneficial.

Southeast lowland area (C): Planting of certain species on overflow land in this area is feasible. Bulldozing or other site preparation is essential. Low grasses may be beneficial, but weedy sites must be cultivated or mowed regularly until trees are established. Also, the use of herbicides may be useful.

Northern and western prairie areas (D): In general the soils and climate conditions of these areas are not as favorable for tree growth. Site and species selection are extremely important. Prepare sites thoroughly and take extra precautions to prevent insect and disease outbreaks. Wildlife food and cover plantings are moderately successful and much needed.

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Figure 2.1 – Arrangement of Leaves on the Stem

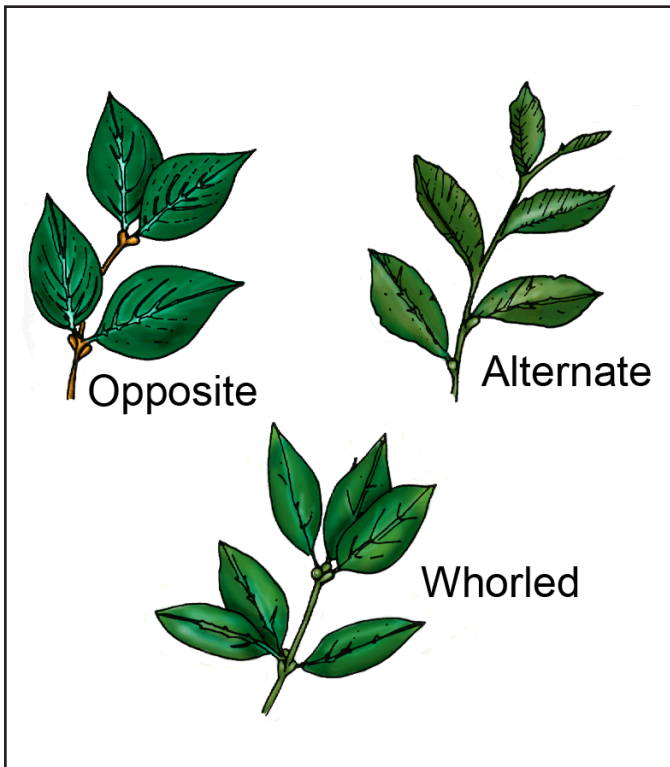


Figure 2.2 – Types of Leaves

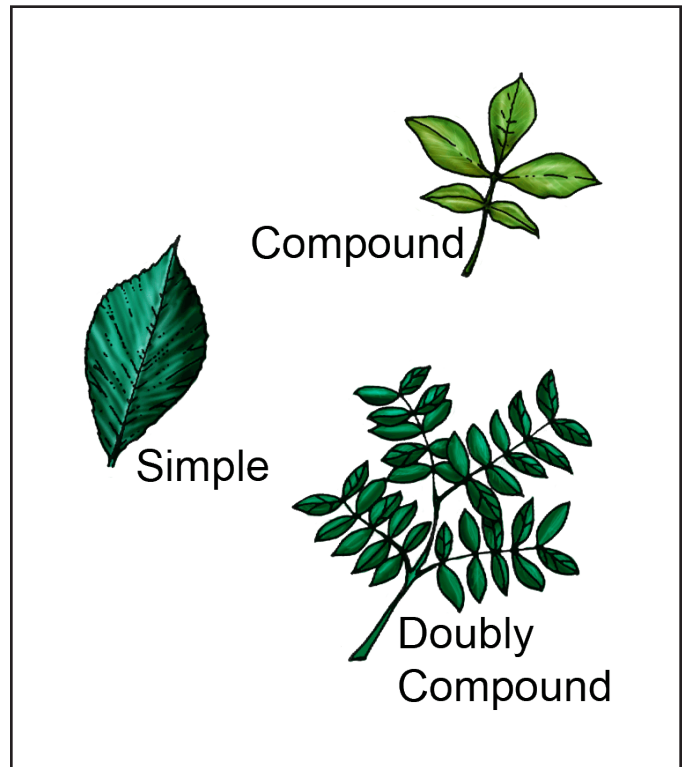


Figure 2.3 – Lobes

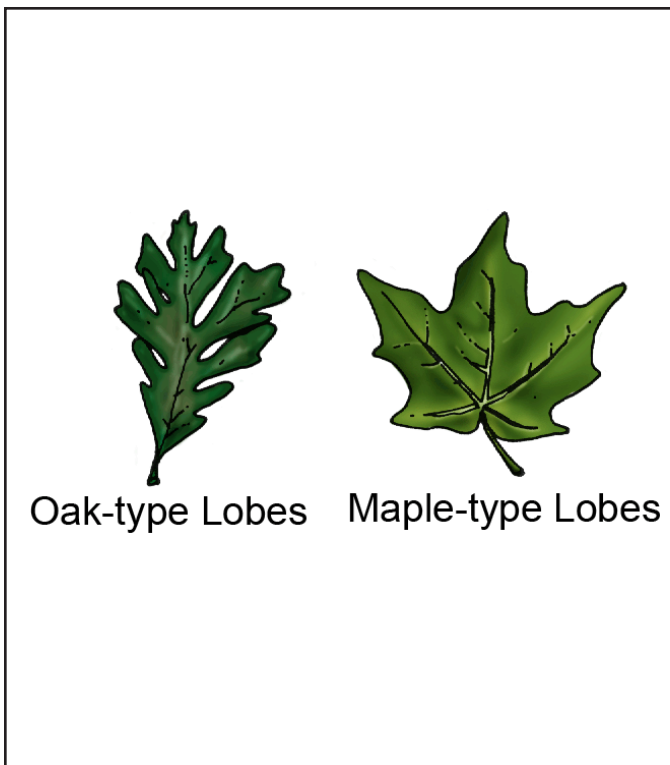
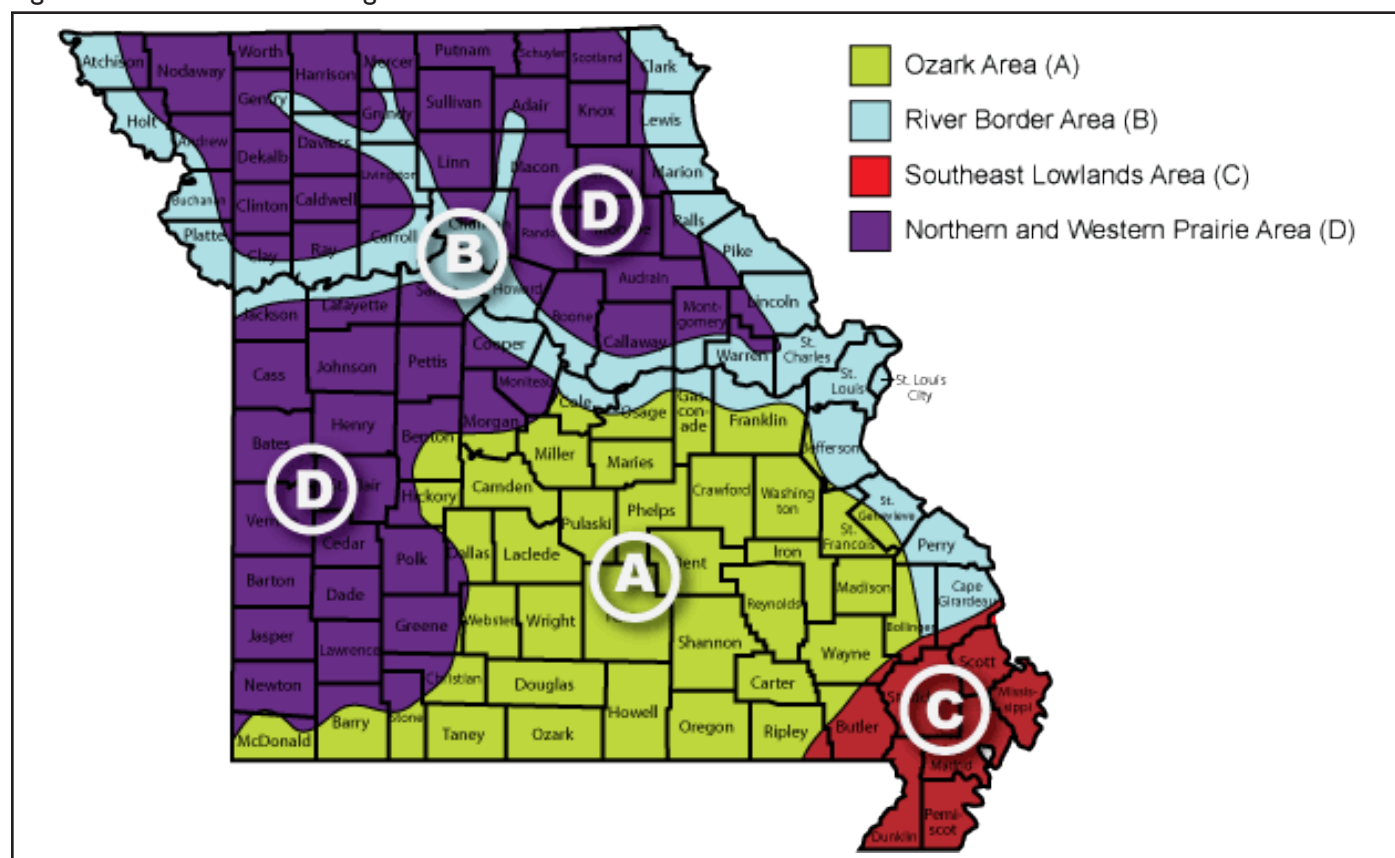


Figure 2.4 – Catkins



Figure 2.5 – The Four Growing Areas of Missouri



Credit: *Before You Order Tree Seedlings*, University of Missouri Extension Guide G5006.

Common Trees of Missouri

Baldcypress

Leaves: Needle-like and delicate, arranged in two ranks in a feather-like fashion, loses needles in winter

Flowers: Male – long drooping clusters
Female – globe-shaped at end of branch

Twigs: Light green at first, becoming reddish brown by winter

Bark: Cinnamon brown; divided by long, loose, shreddy ridges

Area: Area C

General: Baldcypress occurs naturally on deep swamps that are usually flooded for long periods of time. Baldcypress has been successfully planted along lakes and watercourses in central Missouri and has been very successful.

Black Locust

Leaves: Alternate, compound, 9 to 19 oval leaflets, droop at nightfall

Flowers: Large clusters; creamy white, fragrant blooms in late spring

Fruit: Thin, flat pod containing 4 to 8 kidney-shaped seeds

Twigs: Dull brown, slender; some spiny

Bark: Brown with yellow or orange inner bark; inner bark containing poison named “robin” (capable of killing livestock when eaten in large quantities)

Area: Found in areas A, B, and D

General: Primary uses are for posts, erosion control, fuelwood, and, because it is a legume, soil improvement. Branches are armed with pairs of short, sharp spines. Because it spreads easily from root runners, it can become a nuisance.

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Black Oak

- Leaves: Alternate, simple, roughly egg-shaped; 5 to 7 bristle tipped lobes, dark green, shiny
- Flowers: Male and female flowers on same tree
Male – hairy catkins 4 to 6 inches long
Female – red on short, hairy stalks
- Fruit: Acorn 3/4 inch long, bowl shaped, scales forming loose fringe on rim
- Twigs: Moderately stout, dark brown to black, smooth when mature
- Bark: Dark, black, rough, deeply furrowed, blocky on older trees, orange inner bark
- Area: All areas
- General: Black oak is second only to white oak in the amount of net board foot volume of commercial forest area. Black oak is frequently found on dry, rocky ridges and upper slopes. In southern Missouri, black oak competes with and often crowds out shortleaf pines. The wood of black oak is used for flooring, crating, railroad ties, and rough local construction.

Black Walnut

- Leaves: Alternate, compound, 13 to 25 leaflets, spear-shaped, long, pointed tip
- Flowers: Male – catkins 3 to 5 inches long
Female – 3 to 5 on spikes
- Fruit: Large, globe-shaped nut in thick, leathery, rough, green husk; shell hard and bony, rounded; kernel sweet and edible
- Twigs: Stout, brownish
- Bark: Variable; almost black, dark chocolate brown inner bark
- Area: All areas; prefers deep, well-drained, nearly neutral soils
- General: This is one of the best known and the most valuable trees in our state. Since 1899, one-fifth to one-sixth of all black walnut lumber comes from Missouri forests. On an individual tree basis, black walnut is the most valuable commercial lumber species in the United States. Its wood is highly valued for gun stocks, veneer, and fine furniture. Nuts are also sold commercially and the shells are used as an abrasive.

Eastern Cottonwood

- Leaves: Alternate, simple, long, pointed tip, broadly rounded base
- Flowers: Male and female flowers on separate trees
Male – red catkins
Female – green catkins
- Fruit: Long cluster of alternately arranged capsules, each capsule containing many seeds in a cottony mass
- Twigs: Moderately stout, light brown or tan, shiny
- Bark: Greenish yellow and smooth on young stems; thick, dark, and deeply furrowed on old trunks
- Area: All areas except south central portion of A
- General: The cottonwood is a large spreading tree found along streams throughout the state. It is sometimes used as an ornamental tree where large spaces exist because it grows rapidly and requires minimal care. Its leaves turn bright yellow in the fall. It is used for excelsior, crates, and barrel staves. It has also become popular as a source of wood pulp for paper.

Eastern Redcedar

- Leaves: Scale-like or awl-shaped, opposite around a four-angled central stem, dark green
- Flowers: Male and female flowers on separate trees
Male – cone-like with 4 to 6 scales
Female – structure with fleshy scales
- Fruit: A bluish berry, about the size of a pea, with a white frost-like shade
- Twigs: Slender, four-angled, becoming reddish brown
- Bark: Tan to reddish brown, shreddy
- Area: All areas
- General: Eastern red cedar is one of the most versatile trees in Missouri. It is found in every county in the state on nearly all classes and conditions of soil. It seems to thrive on barren soils where few other trees are found. Its heartwood is red, durable, and aromatic and is used in cedar chests, closets, and novelty items. Its dense evergreen foliage makes it a valuable windbreak, screen, or hedge tree. The fruit is a favorite food of birds.

Identifying Missouri Trees

Flowering Dogwood

- Leaves: Opposite, simple, 3 to 5 inches long, egg-shaped, pointed at both ends
- Flowers: Appear before the leaves in small flat-topped clusters, greenish white or yellow with four white petal bracts beneath, occasionally bracts are red or pink
- Fruit: Borne in clusters, egg shaped, bright scarlet
- Twigs: Slender, purple
- Bark: Reddish tan to dark brown; broken in square or round, blocky scales
- Area: All areas around or south of the Missouri River
- General: Missouri's "State Tree" is conspicuous in the early spring by its large, showy, white, petal-like bracts which give the appearance of large spreading flowers. The scarlet fruit is relished by birds, squirrels, and other animals. The Dogwood is a small tree commonly found in the understory of a woodland. It is found naturally south of the Missouri River but can be grown in selected sites.

Green Ash

- Leaves: Opposite, compound, 7 to 9 spear-shaped leaflets
- Flowers: Male and female flowers on separate trees
Male – wooly clusters
Female – greenish red
- Fruit: Seeds with wings, paddle-shaped, narrow
- Twigs: Stout, velvety when mature
- Bark: Gray, the ridges crossing frequently to form a diamond pattern
- Area: All areas
- General: The green ash is often planted as a shade tree because it is rapid in growth. A bottomland species, its wood is used for many of the same purposes in the lumber industry as white ash.

Hackberry

- Leaves: Alternate, simple, narrow egg-shaped, long points, often hooked in a sickle-like fashion
- Flowers: Male and female flowers on the same tree
Male – green, borne in small clusters
Female – green, borne singly

- Twigs: Slender, light brown, becoming gray at maturity (A very common disease of hackberry causes erratic twig growth called "witches broom.")
- Bark: Grayish, rough with warty projections
- Area: A, B, and D
- General: In rich bottomlands where hackberry is commonly found, it may grow 125 feet in height. Many people consider the hackberry a desirable shade tree. Insects may cause galls. The purple berrylike fruit is food for squirrels and birds.

Northern Red Oak

- Leaves: Alternate, simple, 5 to 8 inches long
- Flowers: Male and female flowers on the same tree
Male – 4 to 5 inches long; heavy, yellow catkins
Female – 2 to 3 on short stems
- Fruit: An acorn 1 inch long, oblong, somewhat hairy at the cup end; cup end is saucer shaped, enclosing 1/4 to 1/3 of the nut
- Twigs: Slender, reddish-brown
- Bark: Dark brown or black, smooth on young trees, deeply furrowed on older trunks
- Area: All areas
- General: Northern red oak is a favorite wood for cross ties, rough lumber, flooring, and for certain types of barrels. The brilliant red color of its autumn leaves and the symmetrical form of the tree make the species a widely used shade tree where space is not limited.

Osage Orange (Hedge Apple)

- Leaves: Alternate, simple, long pointed tip, dark green and lustrous
- Flowers: Male and female flowers born on separate trees
Male – small, greenish cluster
Female – globe-shaped, many-flowered head
- Fruit: A large globe-shaped, fleshy fruit resembling a rough, green orange; commonly called a hedge apple
- Twigs: Slender, orange-brown or tan in color
- Bark: Greenish, fissured when young with orange inner bark, shreddy, orange and brown when mature

Forestry

Area: D, B, parts of C and A
General: In the past, Osage orange has been used as a “living fence.” The dense, compact, thorny branches and short trunk provide an excellent barrier to livestock. The wood of this species has properties which are ideal for making archery bows. In addition, its hardness and durability make this an excellent wood for fence posts and telephone pole insulator pins.

Pecan

Leaves: Alternate, compound, spear-like leaflets, lower leaflet hooks back toward the stem
Flowers: Male – catkins in threes, 3 to 5 inches long
Female flowers – in several flowered spikes on the tips of branches
Fruit: In clusters of 3 to 12 oblong-shaped nuts in a thin husk, nut smooth with thin shell and sweet kernel
Twigs: Stout, reddish-brown with large orange-brown lenticels
Bark: Thick, light to dark reddish-brown, deeply furrowed to scaly on very old trees
Area: B, D (southwestern), A (western)
General: Pecan is a favorite nut, timber, and shade tree of Missouri. It occurs naturally in areas along certain large streams and rivers throughout the state. It is most common on well-drained loam soils not subject to prolonged overflow. It also occurs on certain heavy textured bottomland soils and some cool protected slopes. Although once used a great deal for flooring, the lack of adequate amounts of marketable pecan has prevented this use in recent years.

Persimmon

Leaves: Alternate, simple, oval-shaped, 4 to 6 inches long with pointed tips
Flowers: Male and female flowers on separate trees
Female flowers – solitary, yellow or creamy white, bell shaped
Fruit: Large fleshy berry 1 to 1-1/2 inches in diameter, orange and wrinkled when ripe in autumn, edible but often astringent

Twigs: Slender, brown becoming gray
Bark: Dark, broken into thick blocks, with the inner block on young trees showing orange between blocks
Area: A, B, D (mainly below Missouri River), and C
General: The wood of the persimmon tree, closely related to the tropical ebony, is very hard and heavy. It is often used for golf club heads and in weaving shutters where a resistance to splitting is necessary.

Pin Oak

Leaves: Alternate, simple, broadly oval in outline with 5 to 7 narrow lobes, forked lobes
Flowers: Male and female flowers on the same tree
Male – hairy catkins 2 to 3 inches long
Female – on short, hairy stalks; reddish
Fruit: Acorn, small 1/2 inch long; often striped with dark lines; enclosed 1/3 of the way with thin saucer-shaped cups
Twigs: Slender, green at first becoming red-brown
Bark: Thin and smooth when young, shallowly fissured and rough when mature
Area: Parts of A, B, C, and D
General: The pin oak is a wetland tree, growing in the bottomlands and borders of swamps (but also occurring in poorly-drained soils and along draws in nearly every county of the state). Because it is one of the fastest growing oaks, it is used extensively as a windbreak and as an ornamental tree. Pin oak has a single, upright stem with numerous long, tough branches. The lower branches usually droop. It produces very knotty, low-grade lumber. Acorns are a favorite food of waterfowl.

Red Bud

Leaves: Alternate, simple, heart-shaped, dark green in summer, yellow in fall
Flowers: Purplish-red clusters along the stem, appear before leaves in early spring
Fruit: A legume; oblong, flattened, multi-seeded pod; reddish color
Twigs: Slender, brown, turning darker with maturity
Bark: Covered with small, dark, loose scales; underbark reddish-brown

Identifying Missouri Trees

Area: All areas

General: This understory tree is probably found in every county of our state. It is a small, flat-topped tree which grows in the shade of the larger oaks and hickories. This tree is valued for its beauty. The flowers and heart shaped leaves, as well as growth habits, make redbuds a desirable ornamental tree.

River Birch

Leaves: Alternate, simple, egg-shaped, 1-1/2 to 3 inches long, dark green and shiny

Flowers: Male catkins – clustered 2 to 3 inches long
Female catkins – short, 1/3 inch long

Fruit: Cone-like in appearance, small winged seeds

Twigs: Slender, dark red

Bark: Thick and dark brown on old trunks, thin and papery on young trees, light pink to tan on outer surface

Area: A (except south central), B (except extreme north), C, and D

General: A medium-sized tree (rarely as tall as 8 feet or greater than 2 to 3 feet in diameter); more commonly found in clumps of several trunks.

Shagbark Hickory

Leaves: Alternate, compound, 5 leaflets, elliptical (broadest near pointed tip), dark yellowish-green crown turning rusty golden yellow in the fall

Flowers: Male catkins – in threes, green, hairy
Female flowers – on short spikes

Fruit: 1 to 2-1/2 inches in diameter, nut in husk, nut flattened with 4 prominent ridges, pale tan in color, sweet kernel

Twigs: Stout, reddish-brown

Bark: Gray, smooth when young, shredding later into strips or shaggy plates, ends curving away from the tree

Area: All areas except south central A

General: The shagbark often becomes a nuisance around agricultural land since it is quick to invade open fields. The wood is heavy, strong, and flexible. It was once used for the spokes, hubs, and rims of wagon wheels. Its principal

uses today are for handles for hammers, axes, picks, and hatchets. A great deal of this wood is also made into charcoal for barbecue grills. Nuts are excellent wildlife food.

Shortleaf Pine

Leaves: Needles in bundles of 2 or 3 on the same tree

Flowers: Male and female flowers cone-like, borne on the same tree

Fruit: A cone maturing in two seasons; egg shaped; individual scales, each with a minute prickly

Twigs: Moderately stout, purple with white frost-like shade

Bark: Rough and scaly at first, thick and divided into large cinnamon-red plates on old trees

Area: A, planted in C and D (southwest area)

General: The shortleaf pine is the only pine native to Missouri. It is an important timber species, used largely for lumber, paper-pulp, and treated posts. Scattered stands of shortleaf pine furnish valuable wildlife cover. In many cases, large areas may be seeded, under a forester's direction, more economically than they can be planted.

Silver (Soft) Maple

Leaves: Opposite, simple, deeply 5-lobed, pale green above, silvery white beneath

Flowers: Yellow-green to reddish

Fruit: 2 single-winged seeds with wings wide spreading, largest of the native maples

Twigs: Orange-brown to red, have a disagreeable odor when bruised

Bark: Smooth and gray on young trees, scaly or with long thin plates on older trees

Area: All areas

General: Silver maple is the fastest growing of all maples and produces a shade tree in relatively few years. Commercially, this species has great potential. In certain parts of the state, its importance has risen due to its use as a furniture wood. It is also used for windbreaks and streambank protection.

Forestry

Sumac

- Leaves: Alternate, spear-shaped, compound, 9 to 27
Flowers: Small and green in dense clusters at the tip of the branch
Fruit: Dense clusters of globe-shaped berries covered with crimson hair
Twigs: Stout
Bark: Thin, gray
Area: All areas except extreme northwest B and D
General: Sumac is a shrub up to 6 feet in height. Its fruit ripens from June through August and is eaten by many birds, including wild turkey.

Sweetgum

- Leaves: Alternate, simple, star-shaped with 5 pointed lobes, turns brilliant red and yellow in the fall
Flowers: Male and female flowers on the same tree
Male – hairy clusters, 2 to 3 inches long
Female – clustered on swinging globe-shaped head
Fruit: A round globe-shaped cluster of capsules, these ball-like capsules persisting on trees over winter
Twigs: Moderately stout, greenish-yellow with corky lenticels
Bark: Light gray on young trees; dark brown, fissured and rough on older trees
Area: C
General: Sweetgum is restricted in range to the lowlands of the bootheel and scattered occurrences in upland swamps. Sweetgum is an excellent lumber species. Nationally, it is second only to oak on the hardwood market. It is made into veneer, furniture, interior trim, and numerous other products.

Sycamore

- Leaves: Alternate, simple, large with 3 to 5 main lobes, very coarsely toothed, yellow-green
Flowers: Male and female flowers on the same tree
Male – short-stalked dark red clusters
Female – long-stalked, ball-like green and red clusters

- Fruit: A ball-like multiple of many seeds, brown when mature, clusters hanging on tree throughout winter
Twigs: Moderately stout, green
Bark: Dark brown; broken into small, rounded scales; smooth and white with large, loose, olive-green, red, or brown scales on older trees
Area: All areas
General: Sycamores are very tolerant of wet soil conditions and fluctuations in the ground water table. Sycamores make excellent den trees for squirrels, raccoons, and birds and provide food for beavers and squirrels. The wood is hard, tough, and almost impossible to split. Although used in butcher blocks, tobacco boxes, furniture, crates, and barrels, its use in construction is limited due to its warping tendency.

White Oak

- Leaves: Alternate, simple, 4 to 9 inches long, somewhat wider toward the tip end of the leaf, 7 to 9 smooth-edged lobes
Flowers: Male flowers – hairy catkins
Female flowers – inconspicuous
Fruit: 3/4 inch long acorn, short-stalked cup covered with warty scales enclosing about 1/4 of the nut's length
Twigs: Slender, greenish red with white frost-like shade, becoming reddish brown as it matures
Bark: Light, rough with long loose scales, becomes blocky when older
Area: All areas
General: White oak can be found under a diversity of environmental conditions. It often grows in almost pure stands on loamy, well-drained soils in protected coves on cool slopes. Probably the most important use of white oak in Missouri is the cooperage industry for making barrels for distilleries. Nuts of the white oak are a choice food for squirrels. Leaves turn a deep red in autumn and persist on the tree during early winter.

Wild (American) Plum

- Leaves: Alternate, simple, oval in shape with long pointed tip
- Flowers: Clusters of several flowers, individual flowers about 1 inch in diameter, white
- Fruit: Globe-shaped, 1 inch diameter, red or orange colored, sweet and edible
- Twigs: Slender, dark reddish brown, smooth and shiny
- Bark: Thin; dark reddish brown; smooth when young; thin, dark plates when older
- Area: D (southwest), B, A (west), and C
- General: The wild American plum is a small tree commonly occurring in thickets throughout the state. It provides an excellent wildlife cover and erosion control when planted in the heads of washes in area D.

Summary

These are just a few of Missouri's numerous tree species. Being able to identify some of these common species is important to the tree farmer, who needs to know their potential uses and to know what species will grow best under given environmental conditions.

Credits

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Slusher, J.P., and G. Hoss. *Before You Order Tree Seedlings* (Guide G5006). Columbia: University of Missouri Extension, revised 2000. Accessed May 27, 2008, from <http://extension.missouri.edu/explore/agguides/forestry/g05006.htm>.

Lesson 3: Planting Trees

Developing a Tree Planting Plan

Good planting practices include good planting stock, a well selected and properly prepared site, proper planting methods, and adequate protection and care after planting. Failure in any or all of these planting practices usually results in unsatisfactory survival or growth or even in complete failure.

Factors to consider in developing a planting plan include:

- ◇ What trees grow well in the area? (Refer to Lesson 2.)
- ◇ What species will best fit the landowner's needs? (wildlife purposes, wood products, wind breaks, erosion control, ornamental, or shade)
- ◇ What species will grow in my soil type? (claypans or poorly drained soils restrict growth of most species)
- ◇ What are the growth rates of selected species?
- ◇ How much time and funds are available to be spent on tree planting and maintenance each year?
- ◇ What financial returns are needed on initial investment?
- ◇ How many trees should be planted in a given area?

A long-range forest management plan is the basis for determining the most economical use of forest resources, prevents spur-of-the-moment decisions, and allows scheduling and planning of management practices.

Obtaining Trees

Good tree stock is essential for successful planting practices. Choosing the right species for your forest plan and your given site is the first step. Refer to Lesson 2 for a description of common Missouri trees and the areas where they will grow. If planting a cleared area, you will also need to figure the number of trees needed. Figure 3.1 shows the number of trees needed for a given spacing.

Having decided the number and types of trees you wish to plant, you can order trees from a number of sources. Several private nurseries carry seedling trees and shrubs for planting. A partial list of these nurseries may be obtained by writing to: Extension Forester, School of

Natural Resources, Room 203 Anheuser-Busch Natural Resources Bldg., University of Missouri, Columbia, MO 65211-7270. Also your vocational agriculture instructor may have forms available to obtain trees.

Trees may also be purchased from the state nursery at Licking, Missouri. If you are interested in purchasing trees and shrubs from the state nursery, contact your county extension center, or write to: State Forester, Missouri Department of Conservation, P.O. Box 180, Jefferson City, MO 65102. Either agency will provide a list of seedlings available and a nursery stock application form.

Care of Seedlings Before Planting

Best success is obtained when the seedlings are planted as soon as possible after arriving from the nursery. If planting will be delayed, the packing material around the roots should be kept moist and the following procedure should be carried out.

To store seedlings for one week or less:

- ◇ Put the bales in a cool, shaded place.
- ◇ Separate the bales (to avoid overheating and molding) and elevate one end slightly.
- ◇ Pour cold water into the elevated ends of the bales often enough to keep seedling roots moist.
- ◇ Do not store trees in water because roots may be damaged.
- ◇ Protect from severe freezing.

To store for more than a week:

1. Method 1: Hold bales in cold storage at 35° to 37° F.
2. Method 2: Put trees in a heeling-in trench.
 - a. Dig trench in a shaded protected place. Adjust depth to fit roots. Avoid areas with high rodent populations.
 - b. Cut bundle strings and spread trees.
 - c. Pour water on roots as trench is being refilled with soil.
 - d. Water as often as necessary thereafter to keep soil moist, but avoid overwatering.
 - e. A mulch placed on soil close to trees will help hold moisture.

Forestry

Figure 3.1 – Tree and Shrub Planting Guide

Tree		Rows Apart (feet)	Spacing in Rows (feet)
Pine: Shortleaf, Loblolly, Scotch, White, Jack, Austrian (wildlife)		10	10
Pine: Scotch, White (Christmas tree)		– variable –	
Black Cherry Cottonwood Cypress Green Ash Northern Red Oak	Pecan Pin Oak Silver Maple Walnut Yellow Poplar	15	15
Black Alder Black Locust	Hackberry Mulberry	14	12
Osage Orange		(hedgerow)	4

Number of Trees/Acre for a Given Spacing	
6 x 6 = 1,210	10 x 10 = 436
7 x 7 = 889	12 x 12 = 302
8 x 8 = 681	15 x 15 = 194
9 x 9 = 538	20 x 20 = 108

Never leave open bales of seedlings exposed to the sun and wind. During planting operations, take out a few bundles of trees at a time. Cover the others and keep them moist until they are needed. Be careful to avoid damaging the terminal buds.

Planting Tree Seedlings

In planting tree seedlings, it is essential to keep seedling roots moist. A good method for accomplishing this is to carry seedlings in a bucket half full of water or wet moss. Planting by hand may be done by one person; however, two-person crews are much easier since they can change positions and make the job less tiring. In two-man crews, one person is responsible for carrying the trees in the bucket, placing it in the hole, and holding it straight, while

the second person fills in the hole. The second person is also responsible for opening and closing the hole and for proper spacing.

There are several general rules to bear in mind when planting tree seedlings:

- ◇ Plant seedling at the same level that it was in the nursery.
- ◇ Make sure the seedling is upright and roots are not doubled over. Trees that have roots doubled up grow slowly.
- ◇ Pack the soil around the roots in order that the tree will remain in an upright position.
- ◇ Plant only one tree per space.

There are several procedures for hand planting seedling trees. The following are step-by-step procedures for the center hole method using a grubbing hoe and the slit method using a tree planting bar.

Center hole method using a grubbing hoe. See Figure 3.2.

1. Dig a hole to fit the root system of the seedling.
2. Set at the same depth trees grown in the nursery.
3. Fill hole half full of soil and tamp well.
4. Finish filling hole and tamp with feet.

Slit method using a tree planting bar. See Figure 3.3.

1. Hold bar vertically and drive blade full length into soil.
 - a. Pull handle toward you 4 to 5 inches.
 - b. Make a similar thrust in the opposite direction.
2. Remove the planting bar, insert the seedling, and shake the root out straight in slit.
3. Drive blade in at a 30° angle, 3 inches behind seedling.
 - a. Pull the bar toward you.
 - b. Push the bar forward to close the bottom and top slit.
 - c. Remove the bar and tamp with heel.

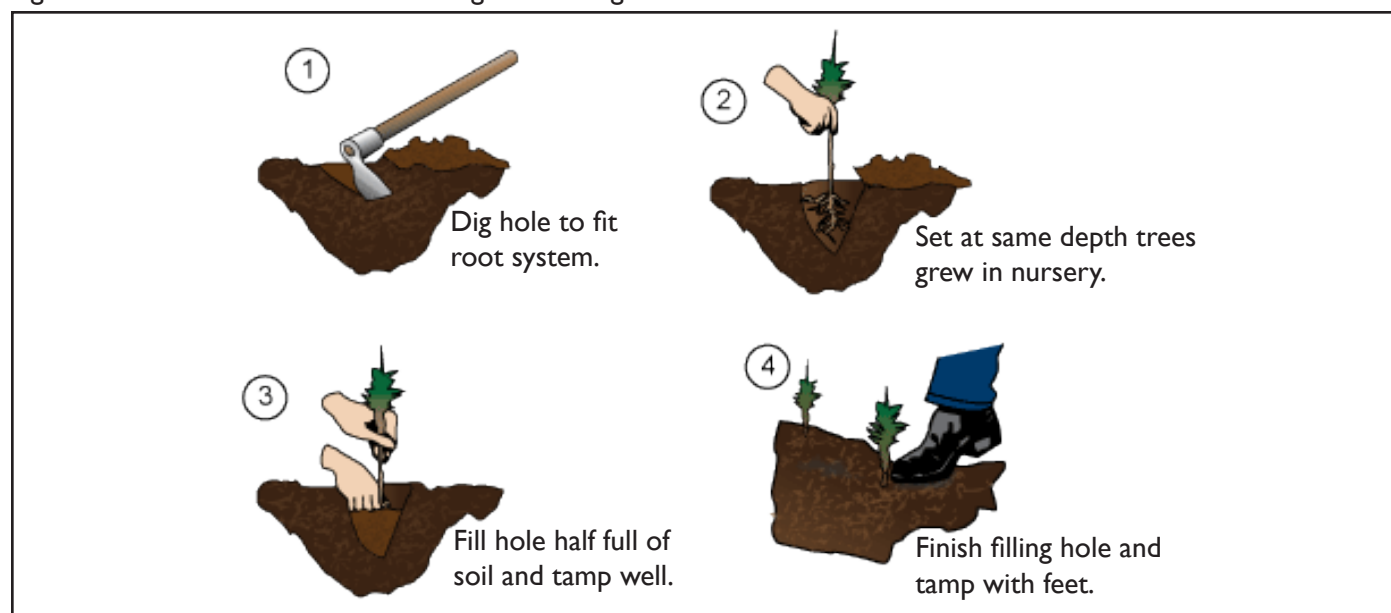
Care of Seedlings After Planting

There are several general rules which will ensure the success of your trees after incurring the time and expense of planting. First and foremost, protect your trees from their number one enemy – fire. Plow or disk a fire break if necessary and maintain it during the fire season.

Trees need to also be protected from livestock. They may damage trees of all ages and should be kept from plantations. Rank growth of weeds and grasses represent another enemy and can be prevented by light disking, using proper chemicals, mowing, or hoeing as often as necessary during the first 2 or 3 years. On poor soils, a light growth of vegetation such as broom sedge or ragweed provides some protection and may be beneficial. Inspect plantations regularly for evidence of attacks by insects and disease.

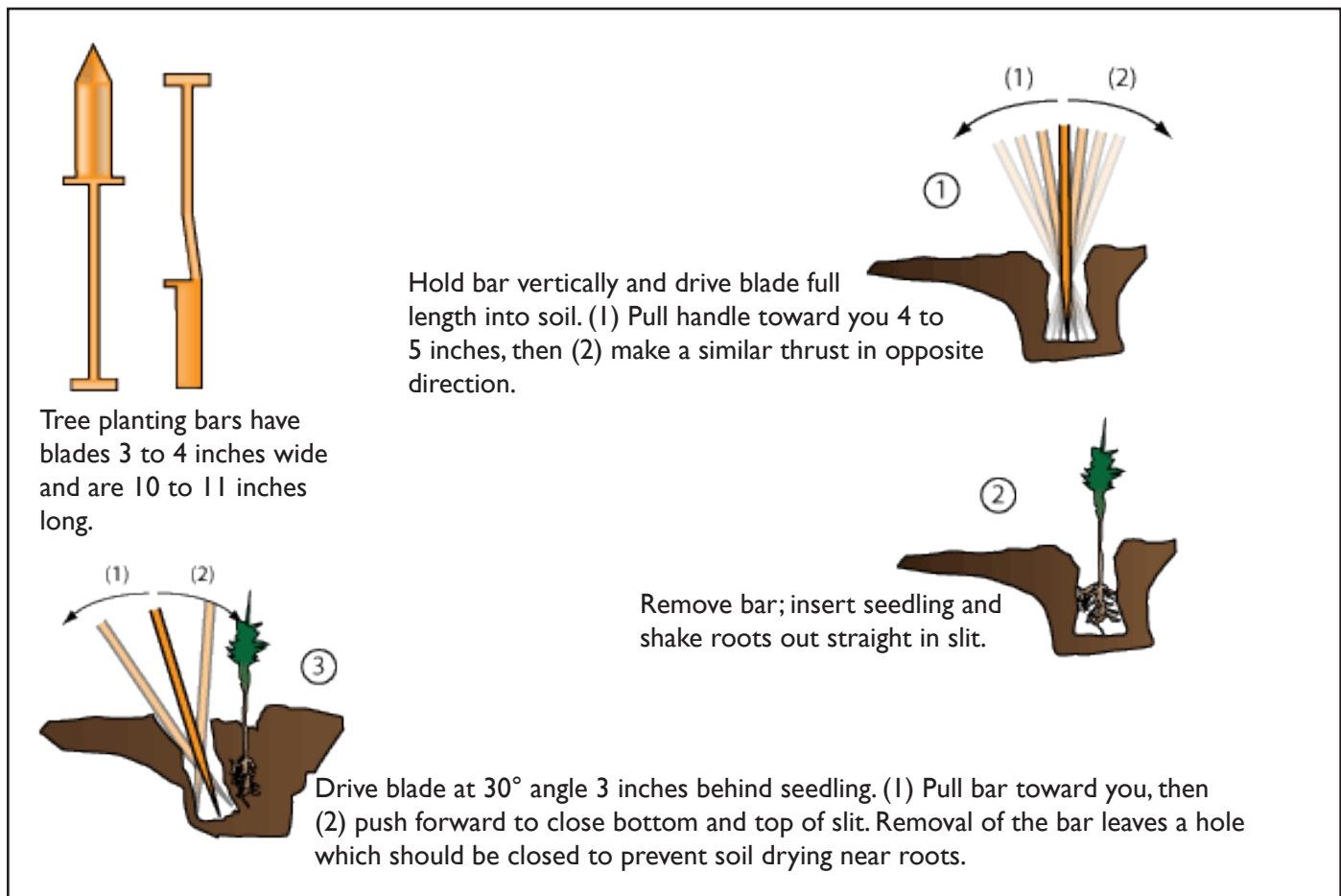
The careful use of fertilizer, when needed, can be an important part of caring for seedlings. Fertilization is usually not necessary for evergreens unless serious nutrient deficiencies exist. Hardwood (deciduous) trees sometimes benefit from fertilization. Fertility needs should be determined by soil test or foliar analysis. To avoid damaging seedlings' roots, do not apply fertilizers directly in the planting holes unless they have been specifically formulated for use in that manner.

Figure 3.2 – Center Hole Method Using a Grubbing Hoe



Forestry

Figure 3.3 – Slit Method Using a Tree Planting Bar



Summary

Seedlings planted today will be around for many years before they yield a return. It is very important, therefore, to have success. Success will depend on:

- ◇ Obtaining good seedling stock
- ◇ Properly storing that stock before planting
- ◇ Planting the stock correctly
- ◇ Caring for the seedlings after planting

Credits

Slusher, J.P., and G. Hoss. *Before You Order Tree Seedlings* (Guide G5006). Columbia: University of Missouri Extension, revised 2000. Accessed May 27, 2008, from <http://extension.missouri.edu/explore/agguides/forestry/g05006.htm>.

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Lesson 4: Forestry Tools and Equipment

If you use forest tools properly with safety in mind, they are valuable to your success in the forest industry. Safety is the key. A careless mistake could mean serious injury to you or your co-workers.

Tools for Pruning and Planting

See Figure 4.1 for an illustration of the following tools.

Tree saw: This hand saw with its curved blade is maneuverable to aid in making smooth, flush cuts on small branches. It is used in pruning trees such as black walnuts.

Hedge shears and hand pruners: These tools are commonly used to shape plantations of Christmas trees. Always keep tools sharp to facilitate clean cuts.

Planting tools: There are two commonly used tools for planting forest seedlings – the planting machine and the tree planting bar. The planting bar is one of the best tools. It is inexpensive, allows for speed in planting, and can be used to compact soil around roots.

Tools for Harvesting Trees

Axe: Many a felling and bucking crew now go into the woods without the once all important tool of the wood-cutter – the axe. Its absence is a testimonial to the utility and versatility of the chain saw.

Nevertheless, a light single-bit axe is still a highly useful tool for felling and bucking. Such an axe with a 2-1/2 to 3-pound head and a 24 inch handle can be a useful tool in cutting small brush and limbs that interfere with the job. It is safer to use an axe rather than a chain saw to clear such obstructions. The poll (back) of the axe can be used to drive wedges and the blade can chop out a chain saw that gets stuck.

The axe blade should be kept sharp and properly tapered for both efficiency and safety. A dull axe is an unsafe tool because it requires harder blows and is more likely to glance off the material being cut.

The poll end of an axe should never be used to drive a steel wedge. Steel splinters can break off and be projected into the eyes.

Wedges: Wedges may be used to keep chain saws from being pinched in the cut and to start the tree falling in the right direction. Steel wedges should never be used in a chain saw cut. Even slight contact with the running chain will ruin the chain and possibly the bar of the saw. Plastic, wood, or soft metal wedges should be used.

Woodchoppers maul: Another commonly used tool, particularly for hand splitting fuelwood, is the splitting maul. For short pieces of wood that are relatively easy to split, it is the only tool needed. Such woods would include clear pieces of practically all softwoods except hemlock and a vast majority of hardwoods such as oak, ash, maple, cherry, and beech. A few hardwoods such as elm, sycamore, and blackgum, have an “interlocked grain,” which makes them difficult to split. Also, the presence of knots makes the splitting of almost all woods difficult. In such cases, the splitting maul can be embedded in the piece of wood with a sharp blow and then pounded in further with a wooden headed maul.

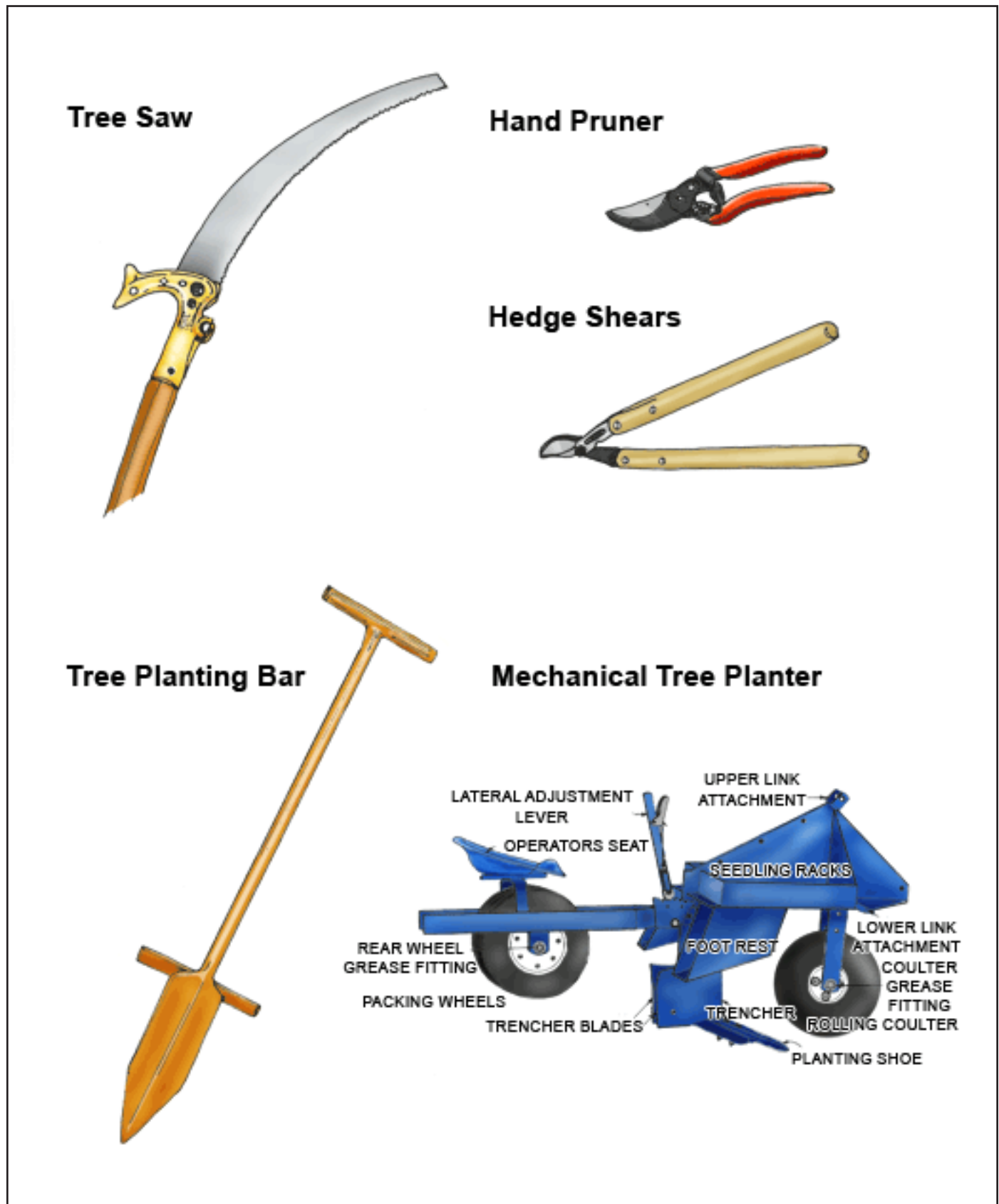
Peavey or cant hook: The cant hook is used to pry or roll logs. When using the cant hook, logs should be rolled away from the user to avoid logs rolling onto the feet. See Figure 4.2.

The cant hook is also used as a lever in lifting logs and is handy for prying logs onto blocks to keep the saw from pinching in bucking. Also, fallen trees can be pried away from stumps with a cant hook.

Chain saw: The gasoline-powered chain saw has become the most widely used and indispensable tool in today's logging operation. Probably 90 percent of the wood-cutting jobs, including timber felling, limbing, and bucking, are done with the chain saw. However, in the hands of a careless or inexperienced operator, chain saws can be dangerous. If you want to get the best out of your chain saw, always treat it with respect.

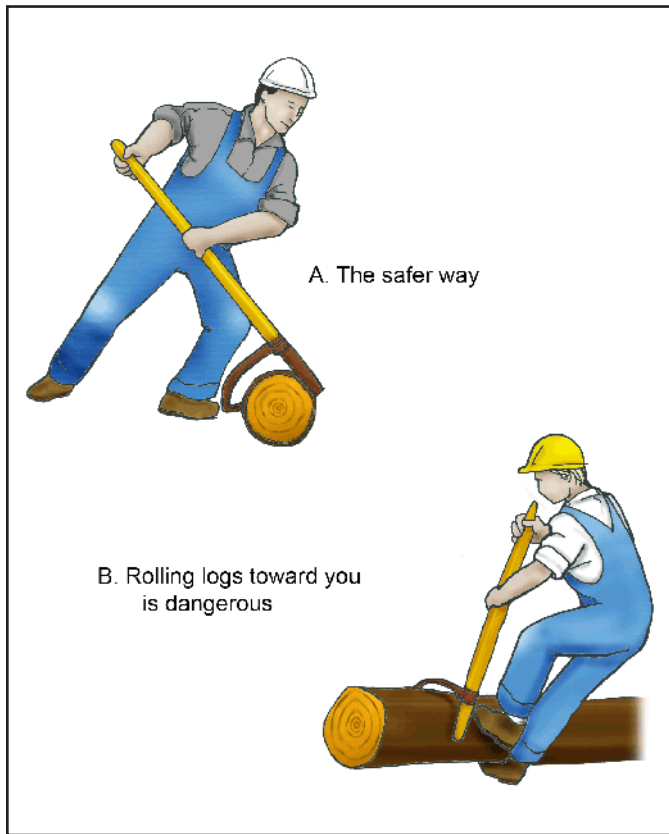
Forestry

Figure 4.1 – Tools for Pruning and Planting



Forestry Tools and Equipment

Figure 4.2 – Using the Cant Hook



Before you cut firewood or timber, outfit yourself with proper clothing and protective equipment that will reduce the possibility of serious injury. See Figure 4.3.

- ◇ Clothing should be well-fitted and free of dangling or ragged edges which could become tangled in the saw. Avoid scarves and be sure to tie back long hair. For additional protection, the use of nylon mesh protective leg chaps and/or knee pads can provide increased protection for your legs.
- ◇ A hard hat protects your head from falling limbs or branches. A properly fitted hat is cool, comfortable, and provides important protection from serious head injury.
- ◇ Safety goggles or safety eye glasses with side shields prevent injury from flying wood chips, twigs, and sawdust.
- ◇ Comfortable ear muffs or ear plugs protect your ears from the 95+ decibel noise level from the saw.
- ◇ Light-weight, non-slip gloves protect hands from abrasions and wood cuts.
- ◇ Safety boots with good gripping soles to prevent falls, high tops to protect ankles, and steel toes to protect feet are necessary equipment.

Using Chain Saws With Safety in Mind

In the hands of a careless or inexperienced operator, chain saws can be deadly. The U.S. Product Safety Commission, in a recent survey, estimated approximately 50,000 people required hospital treatment for injuries associated with chain saws. In these accidents, the operator made a careless move such as reaching across the saw or losing saw control. Loss of balance due to loss of footing accounts for one out of every six accidents with kickback being another major chain saw hazard. Safety awareness can sharply reduce the incidence of injury.

Safety begins before actual saw operation begins. First, in preparing to operate a saw safely, read and study the owner's manual. Even if you are an experienced operator, you should periodically review safe operational procedures. If you buy a used saw, ask the previous owner for the operator's manual or write the saw manufacturer for a copy.

Figure 4.3 – Chain Saw Safety



Forestry

A saw in good condition is safer and easier to operate. Preventative maintenance will allow you to cut more wood quickly and safely. Maintenance includes sharp teeth, correct chain tension, proper lubrication, and a properly turned engine. Check your operator's manual for this maintenance information.

If you notice that the chain tends to walk sideways while cutting, the cut shows fine powder instead of chips, you find yourself pressing down hard to keep cutting, or you smell burnt wood, your saw needs sharpening. Follow the instructions outlined in your manual when sharpening the chain. If you do your own sharpening, use the proper tools. Wear gloves or use a rag over the sharpened cutters.

To assure good cutting action and a long chain life, check the chain tension. If it is too loose, the chain will derail; if it is too tight, the chain will bind. All chains stretch with use. Most of the stretch occurs during the first half hour of operation. Follow the manufacturer's recommendation of chain tension. Most manufacturers recommend that a cold chain be tightened to where the chain tie straps stand away from the bar rail about 1/32 inch at the center bar. A warm chain should be adjusted to 1/8 inch gap.

Lubrication will prolong a chain's useful life. On saws with automatic oilers, be sure the oiler is properly adjusted so it doesn't over oil and run dry during operation. Remember that automatic oilers need an extra squirt of oil occasionally.

At times the bar-oiling mechanism might plug up and serious damage to the saw can result if not corrected. If the chain smokes while operating, there is not enough lubrication.

Every owner should have a good tool kit to help assure continued safe operation of the saw. The kit should contain the following:

1. A few extra labeled cans of chain oil
2. Wrenches to fit all nuts and lugs on the saw
3. Screwdriver
4. Round file and guide for touching up chain
5. Flat file and depth gauge to file the depth guides

6. Small brush to clean away the sawdust and wood chips from around the gas cap and cooling fins
7. Extra spark-plug
8. Owner's manual (wrapped in a plastic bag)
9. Cleaning rags
10. Sharp axe (2-1/2 to 3 pound head, 24-inch handle)
11. Wooden maul and wedges
12. Multipurpose fire extinguisher
13. Shovel
14. Supply of fuel in a UL listed and/or FM approved safety can
15. First aid kit

Safe Operating Techniques

Since the chain saw engine is a two-cycle engine, use the manufacturer's recommended fuel mixture. When refueling the engine, use a funnel or flexible nozzle to avoid spillage on the engine.

Only refuel the engine when it is **cool**. If fuel is spilled, thoroughly clean the engine with the saw on the ground and in an area cleared of combustible materials.

Under **no** circumstances should you smoke during refueling.

Each time you refuel, refill the oiler, and check the air filter, chain tension, and all nuts and bolts for tightness.

The saw should be started on a firm base with the cutting teeth up away from stones, sticks, or other obstacles. With one foot placed in the bracket to the rear of the unit, set the starting controls. Grip the top handle of the saw firmly with one hand and use the other hand to pull the starting rope.

Never start the saw by letting it drop with one hand while the end of the starter cord is held with the other. This process, though commonly used, is an invitation to disaster.

Firm footing should be maintained by the operator while the saw is running. Turn off the saw while moving from tree to tree.

Forestry Tools and Equipment

The saw should be carried with the engine off, at the operator's side, and the bar to the rear.

While cutting, the saw should be held with **both** hands, the thumb firmly locked around the front handle, while the operator is standing with feet well apart and the body well-balanced. The operator stands to the side of the saw while cutting, **never behind it**.

The operator should keep clear of the work. Never cut above shoulder level. While bucking, work on the uphill side of logs. Always be aware of helpers and bystanders when using a chain saw.

Felling Trees With a Chain saw

Felling is probably the most difficult and dangerous part of the logger's job. The required skills and judgment cannot be attained solely by reading a few pages in a handbook. Working with an experienced woodsman plus knowing the general rules of felling is a good combination to have before attempting to fell trees.

Before you attempt to fell any tree, consider its characteristics. One tree may lean, while another tree might be unbalanced because of uneven top growth or breakage even though the trunk doesn't lean. Large diameter branches are also a good indicator of unbalance. Also, consider wind conditions, which can have a dramatic effect on the direction of fall.

Once the direction in which the tree is to be put down is decided, the working space around the tree should be cleared of low or dead limbs, underbrush, and other obstructions. Small wisps of brush are cleared by pulling on the stem with one hand while slicing the stem area closest to the trunk with the axe.

Small saplings are cut by a controlled one-handed chop on the strained fiber, cutting first on one side of the base as the sapling is bent over and then on the other side.

In advance, plan your escape route to either the rear or the side depending on the likely direction of the fall. Plan in advance what to do with the saw when the tree starts

to go. Shut the saw off and drop it in a safe place allowing an unhampered escape.

When you have determined a felling and safety plan, proceed as follows:

1. Hold the saw firmly in both hands; take a well-balanced stance.
2. Make the cut close to the base of the tree but high enough to conveniently avoid running the saw into the ground.
3. Cut through trees up to 8 inches thick using one cut.
4. On larger trees, notch (undercut) at least 1/3 of the trunk diameter on the fall side of the trunk. Make the lower cut first to avoid pinching the saw in the cut.
5. Make a felling or back cut on the opposite side of the trunk 2 inches above and parallel to the horizontal notch. Leave wood fibers to act as a hinge to keep the tree from twisting and falling in the wrong direction or kicking back on the stump.
6. Guide saw into the tree. Do not force it. The rate of feed will depend on the type of timber being cut.
7. Remove the saw from the cut and shut it off before the tree falls.
8. Cutting completely through the hinge may allow the tree to fall in any direction, possibly on the retreating operator. Move away from the tree at a 45° angle through the cleared retreat lane.

A well balanced tree may have to be wedged to fall in the right direction. Use two wedges rather than one to ensure that the tree falls forward. Use a sledge mallet or the poll of the axe to drive the wedge. Strike squarely with firm but not excessive blows. Careless blows may pop the wedge out, swinging the tree backward. Remember to use only wood, plastic, or soft metal wedges – never steel.

Limbing Using a Chain saw

Limbing is removing branches from felled trees. After the tree is on the ground, take a look at each limb before making the cut to be sure that cutting the limb off will not bind the guide bar or cause the trunk to roll toward the operator.

Figure 4.4 – Safe Bucking Procedures

Use these bucking procedures for safety.

A. Log Lying Flat

Cut from top (overbuck)
Avoid cutting into the earth



B. Work Supported at One End

First, cut underbuck
(1/3 of the diameter) to
avoid splintering



Second, cut overbuck (2/3 of the diameter)
to meet the first cut (to avoid pinching)

C. Work Supported on Both Ends

First, cut overbuck



Second, cut underbuck

Do not face the limb squarely. Stand at approximately a 45° angle so that if the saw slips or completes the cut sooner than expected, the chain will not strike your leg.

Sawing with the point of the guide bar (nose sawing) greatly increases the chance of chain saw kickback. If the chain suddenly hits a solid object or takes too large of a cut, then the saw may be forced backward and result in a serious accident. Do not saw with the point of the guide bar.

Bucking Logs Safely Using a Chain Saw

Bucking is the process of cutting the trunk into desired lengths. Special hazards of bucking that must be recognized are log roll, kickback, and backstrain.

The general procedure for bucking logs is as follows. See Figure 4.4.

- ◇ When log is supported along entire length:
 1. Cut from top.
 2. Roll over and cut from opposite side until free.
 3. Use care to avoid getting saw into ground.
- ◇ When log is supported from one end:
 1. Cut 1/3 of diameter from one side.
 2. Cut 2/3 of diameter from top, meeting first cut.
- ◇ When log is supported at both ends:
 1. Make first cut from top 1/3 diameter.
 2. Then cut 2/3 from underside, meeting first cut.

- ◇ Cutting firewood lying on the ground:

1. Make cuts on side 3/4 of the way through log for each length.
2. Roll log over and cut through to first cut for each length.
3. A three-legged sawhorse is effective in steadying wood and making cutting easier and safer.

Summary

Know the right tools for planting, pruning, and harvesting forest trees. Always use them with safety in mind as they are valuable to your success in the forest industry.

Credits

Baker, D.E., and B.E. Cutter. *Basic Chain Saw Safety and Use*. (Guide G1959). Columbia: University of Missouri Extension, reviewed 1998. Accessed May 30, 2008, from <http://extension.missouri.edu/xplor/agguides/agengin/g01959.htm>.

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Slusher, J.P., and T. Robison. *How to Plant Forest Trees* (Guide G5008). Columbia: University of Missouri Extension, reviewed 1993. Accessed May 30, 2008, from <http://extension.missouri.edu/xplor/agguides/forestry/g05008.htm>.

Measuring Standing Timber and Logs

Lesson 5: Measuring Standing Timber and Logs

Measuring timber is an essential skill for individuals involved in the forest industry. As a buyer or seller of forest products, proper measurements will ensure fair and equitable transactions between you and your patrons. Just as grain crop farmers must know the bushels they produce and sell, tree farmers need an accurate measure of their woodlot production and sales.

There are two common ways of measuring Missouri forest products – by the cord and by board feet. Generally, fuelwood and pulpwood are measured in cords while timber used for lumber is measured in board feet.

Measuring Logs for Fuelwood or Pulpwood

The standard cord is a pile of wood 4 feet high, 4 feet wide, and 8 feet long. It occupies 128 cubic feet of space but actually does not contain 128 cubic feet of wood due to air space.

Since fuelwood is not always so conveniently stacked into standard cords, a formula can be used to calculate the number of standard cords in a stack of wood.

$$\frac{\text{Number of Standard Cords} = \frac{\text{length (feet)} \times \text{width (feet)} \times \text{height (feet)}}{128 \text{ cubic feet}}}$$

For example, the number of standard cords in a stack of wood 10 feet long, 6 feet wide, and 3 feet high is 1.41 cords.

$$\frac{10 \text{ feet} \times 6 \text{ feet} \times 3 \text{ feet}}{128 \text{ cubic feet}} = 1.41 \text{ standard cords}$$

A rick is not a standard measurement. It is customarily 1/3 to 1/2 cord, but these amounts can vary within different localities.

Measuring Logs for Sawlogs and Lumber

Logs used for sawlogs and lumber are measured in board feet. One board foot is 144 cubic inches. Scaling of logs

is the normal basis for determining the number of board feet in logs. Although not as accurate as the actual lumber tally after sawing, it permits prompt settlement for timber. It also eliminates the need for separating logs on the yard by ownership. By measuring the log diameter and length and using a log rule, the number of board feet may be determined.

Diameter Measurement

The first step in scaling logs is measuring the diameter of the log. The diameter is measured at the small end of the log inside the bark to the nearest inch. For logs that are not round, two measurements should be taken at right angles to each other and the average of the two will determine the diameter.

For example, a round log measuring 10.4 inches has a diameter of 10. An oblong log having an average diameter of 10 one way and 12.4 the other has an average diameter of 11.

Length Measurement

The length of logs is measured in even feet (8, 10, 12, etc.). If logs are cut in lengths between these even numbers, the length is scaled to the smaller even number rather than the nearest even number. For example, a log measuring 15 feet 7 inches would be scaled to 14 feet rather than 16 feet.

Once the diameter and length have been measured, the log rule is used to determine the board foot volume. There are over 50 log rules in the United States. The International 1/4-Inch Log Rule is the one commonly used in Missouri and will provide a good estimate of board feet volume.

To use the log rule, find the diameter of the log down the left hand column and then find the length of the log in the top horizontal row. The intersection of this row and column gives the board foot volume of the log. See Figure 5.1.

For example, a log with a diameter of 11 inches and length of 12 feet would have 55 board feet of lumber.

Forestry

Figure 5.1 – International 1/4-Inch Log Rule Table

Diameter of Log Small Ends, Inside Bark (inches)	Length of Logs (feet)				
	8	10	12	14	16
	← board feet →				
6.....	10	10	15	15	20
7.....	10	15	20	25	30
8.....	15	20	25	35	40
9.....	20	30	35	45	50
10.....	30	35	45	55	65
11.....	35	45	55	70	80
12.....	45	55	70	85	95
13.....	55	70	85	100	115
14.....	65	80	100	115	135
15.....	75	95	115	135	160
16.....	85	110	130	155	180
17.....	95	125	150	180	205
18.....	110	140	170	200	230
19.....	125	155	190	225	260
20.....	135	175	210	250	290
21.....	155	195	235	280	320
22.....	170	215	260	305	355
23.....	185	235	285	335	390
24.....	205	255	310	370	425
25.....	220	280	340	400	460
26.....	240	305	370	435	500
27.....	260	330	400	470	540
28.....	280	365	430	505	585
29.....	305	385	465	545	630
30.....	325	410	495	585	675

Credit: *How to Measure Trees and Logs*, University of Missouri Extension Guide G5050.

Figure 5.2 – Cruising Stick

Diameter Measurement and Tree Height Side

Diameters•Inches•25 Inches from Eye to Tree	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70
Prevent Woods Fires•Don't Graze Your Woodlands Harvest Your Tree Crop Wisely	Missouri Conservation Department																For Woodland Management Assistance or Advice See Your Farm Forester or Write the State Forester, Jefferson City, Missouri																
16 Foot Logs•50 Feet from Tree•Hold Stick Plumb 25 Inches from Eye	—										2										3												

International 1/4-Inch Log Rule Side

Diameter•Small End Log• Inside Bark•Inches		6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
Inter- national Log Rule	LOG LENGTH IN FEET	8	10	10	15	20	30	35	45	55	65	75	85	95	110	125	135	155	170	185	205	220	240	260	280	305	325	350	375	400	425	450	475
	10	10	15	20	30	35	45	55	70	80	95	110	125	140	155	175	195	215	235	255	280	305	330	365	385	410	440	470	500	535	565	600	
	12	15	20	25	35	45	55	70	85	100	115	130	150	170	190	210	235	260	285	310	340	370	400	430	465	495	540	570	605	645	685		
	14	15	25	35	45	55	70	85	100	115	135	155	180	200	225	250	280	305	335	370	400	435	470	505	545	585	630	670	715	760	800		
	16	20	30	40	50	65	80	95	115	135	160	180	205	230	260	290	320	355	390	425	460	500	540	585	630	675	720	770	820	870	930		

Measuring Standing Timber and Logs

Measuring Standing Timber

Often timber is sold on a stumpage basis (selling timber in standing trees rather than cut products such as logs). To determine the volume of a standing tree, its diameter at breast height (d.b.h.) and merchantable (usable) height must be determined. When these two measurements are known, the volume of the tree can be determined directly from a tree volume table.

Measuring Diameter at Breast Height (d.b.h.)

Diameter measurements of standing timber are made at breast height which is 4-1/2 feet above the ground. One tool used to measure diameter is the cruising stick. Cruising sticks are a quick, easy way to estimate tree volumes and they can be obtained free from local farm foresters or the Missouri Department of Conservation district forestry office. See Figure 5.2.

To use the cruising stick for measuring a tree's diameter, hold it horizontally 25 inches from your eye against the tree at breast height (4-1/2 feet above the ground). (One arm's length for the average person is 25 inches. Try measuring yours and see.) Be sure you have the "diameter measurement" side of the stick towards you.

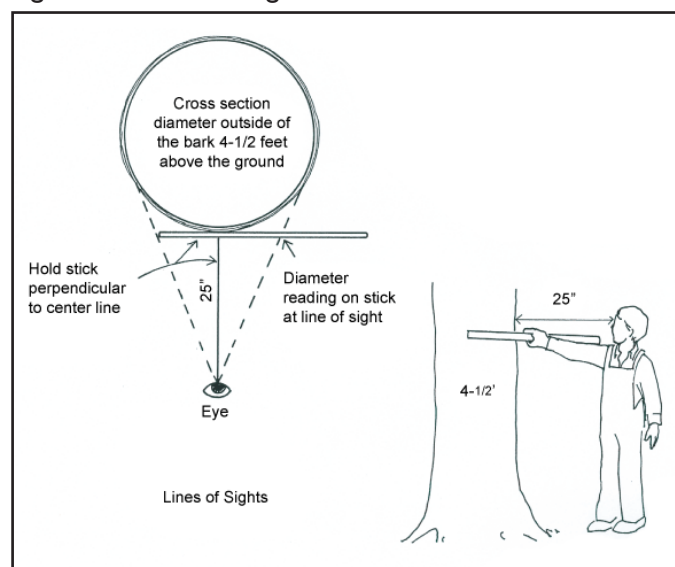
Line up the zero end with the outside of the tree. Then without moving your head and using only one eye, look at the other side of the tree. Read the figure nearest to where your line of sight crossed the stick and this side of the tree. The number you see is the estimate of the tree's diameter at breast height. It is important to move your eye instead of your head, or the reading will not be correct. If the tree is not round, take another reading at a right angle to the first reading and average the two. See Figure 5.3.

Measuring Merchantable (Usable) Height

Individual tree height is normally measured from 12-inch stump height to a point on the tree beyond which salable sawlogs or other products cannot be cut.

For sawlogs, the merchantable height is the point on the tree where the diameter is less than 8 inches. It is

Figure 5.3 – Measuring Diameter



important to note that merchantable height may occur at a height lower on the tree if there are large branch forks or deformities.

To measure the height of a tree, the same side of the cruising stick is used as for diameter. The procedure is as follows. See Figure 5.4.

1. Starting with your heel against the base of the tree, pace out a distance of 50 feet. (Pace toward an opening that will allow you to see the tree you are measuring.) Try to pace out to a point level with the base of the tree.
2. Turn around and look at the tree and determine the point the last cut will be made (merchantable height).
3. Hold the stick **vertically** 25 inches from your eye.
4. Move the stick up or down until the lower end is even with your line of sight to the stump height (12 inches above ground).
5. **Without moving your head** shift your vision upward to the point which you decided was the last cut of the tree. The point where your line of sight crosses the stick gives a reading in terms of 16 foot logs. Make sure the stick is vertical (not tilted forward or backward) when you make this reading. Your reading should be to the nearest 1/2 log.

If it is necessary to go past 50 feet to get a clear view of the tree, you may pace 100 feet (twice the distance) and then double the reading obtained from the stick.

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Figure 5.4 – Measuring Tree Height

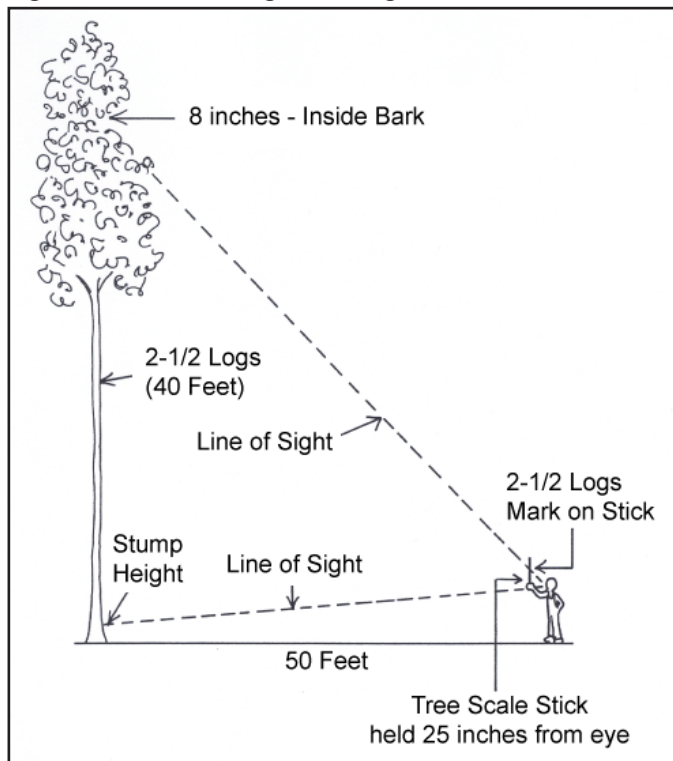


Figure 5.5 – Board Foot Volume of Trees* by Diameter and Height Classes

International Rule – Form Class 76

D.B.H. (inches)	Number of 16-Foot Logs in Trees						
	1/2	1	1-1/2	2	2-1/2	3	3-1/2
	← volume in board feet →						
10	21	34	44	55			
12	30	52	68	85	98		
14	42	74	99	124	143	162	
16	59	100	134	169	198	226	246
18	74	129	175	221	259	297	325
20	92	162	220	279	328	377	413
22	112	198	271	344	406	467	514
24	133	237	326	415	491	567	622
26	158	284	392	500	592	684	755
28	187	331	458	585	696	806	888
30	220	381	529	677	805	933	1,029
32	254	435	606	776	926	1,077	1,192
34	291	493	687	881	1,054	1,227	1,359
36	333	559	782	1,006	1,205	1,404	1,557
38	374	624	874	1,125	1,354	1,582	1,754
40	415	693	974	1,256	1,510	1,764	1,962

*For estimating board feet in standing trees.

Credit: *How to Measure Trees and Logs*, University of Missouri Extension Guide G5050.

Computing Volume of Standing Trees

With the d.b.h., the merchantable height of the tree, and a tree volume table, an estimate of the board feet in that tree may be determined. See Figure 5.5.

The table is read exactly like the one for logs. Find the d.b.h. down the left column and the number of 16-foot logs across the top. The point where these intersect is the volume in board feet of the tree. For example, if the d.b.h. of a tree is 22 inches and the number of 16-foot logs is 1-1/2, then there are 271 board feet.

Use the cord volume table to determine volume in cords. See Figure 5.6.

Summary

Whether measuring trees or logs for sawlogs or cordwood, a fast estimation of the volumes of wood products may be obtained by finding the diameter, the length, and using the appropriate log rule or volume table.

Credits

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Slusher, J.P. *How to Measure Trees and Logs* (Guide G5050). Columbia: University of Missouri Extension, reviewed 1993. Accessed June 4, 2008, from <http://extension.missouri.edu/xplor/agguides/forestry/g05050.htm>.

Figure 5.6 – Cord Volume Table

D.B.H. (inches)	Height in Number of 8-Foot Bolts					
	1	2	3	4	5	6
	← volume in cords – unpeeled →					
6	.02	.03	.04	.06	—	—
8	.03	.05	.07	.09	.12	.14
10	.05	.07	.10	.13	.17	.20
12	.07	.10	.14	.18	.22	.27
14	.10	.13	.18	.23	.29	.35
16	.12	.17	.22	.29	.36	.44
18	—	.20	.27	.35	.44	.53
20	—	.25	.32	.42	.52	.63

Taken from Technical Note 202, Lake States Forest Experiment Station, University Farm, St. Paul, Minnesota, 1943. Volume is stem volume above 1 foot stump in standard unpeeled cords (standard cord is 4' x 4' x 8'). Height is number of usable 8-foot bolts to a variable top diameter; not less than 4 inches inside the bark.

Timber Stand Improvement (TSI) Principles

Lesson 6: Timber Stand Improvement

Timber Stand Improvement Practices

Timber stand improvement (TSI) denotes management practices that improve the vigor, productivity, and quality of stands of trees. Many options are open to woodland owners. They may use a TSI program to increase the woodland's value for timber products, water, recreation, forage, wildlife, or natural beauty. In most cases, work done for one use usually benefits other uses.

There are various practices used in timber stand improvement. The combination of practices used and tree species selected should fit the chosen emphasis for the woodland. Professional foresters are available to help determine a woodland's potential as well as its limitations, and to help develop and carry out a suitable management plan. The following practices are among those used in TSI.

Site Preparation for Natural Reproduction in Understocked Stands

"Site preparation for natural reproduction in understocked stands" means preparing a site to allow the natural seeding or resprouting of desirable species. This also might include underplanting seedling stock to fully use the available growing space. This practice is used in poorly stocked stands to fill large openings and increase stand density or to improve the type of trees found in the stand.

Thinning

Thinning is cutting trees from a stand to increase the rate of growth and improve the form of remaining trees. Competition between trees in a stand of timber for such things as soil moisture, light, and nutrients become so intense that the growth rate is reduced. After thinning, the better trees are left so that growth factors such as moisture, light, and nutrients are concentrated on the more valuable trees. See Figure 6.1.

When a stand of trees is very young, there may be 4,000 or 5,000 seedlings growing on a single acre. This stand will have fewer than 100 trees remaining when it is mature and

ready to harvest. Nature will thin out the surplus trees, but this unaided natural process may take the stand 150 to 200 years to reach marketable size. Periodic thinning can improve tree quality and reduce the time span to less than 100 years. See Figure 6.2.

Deciding on the proper spacing when thinning depends on the species, purpose of management, and the quality of the location (site). Figure 6.3 gives a range of spacing for trees of various diameters. For example, a tree with a d.b.h. of 8 inches would require 13 to 17 feet between it and the bordering trees.

Release

Release is removing or deadening undesirable older overtopping trees to encourage fast growth and better quality of vigorous young desirable trees.

Literally millions of worthless trees are in our woods. Poor trees take away light, water, and nutrients from good trees. Types of trees usually removed are:

- ◇ Cull trees, such as rotten, diseased, or fire-scarred trees in addition to wide-spreading "wolf" trees
- ◇ Inferior species of trees, which interfere with the growth and development of selected desirable trees

Certainly, release should be a practice in which goals for the woodlot must be defined. For example, if your plans for a woodland area include hunting, removal of rotten or fire-scarred trees and brushy growth will result in the removal of wildlife habitat.

Pruning

Pruning is removing limbs from trees to produce knot-free lumber. Research has shown that pruning can improve lumber grades by 60 percent. However, due to the expense involved in pruning, prune only selected hardwood trees where high value species are grown on good sites. This TSI practice is primarily recommended in managing black walnuts.

When pruning limbs of young trees, don't remove too much of the leaf surface of the tree. At least half of

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Figure 6.1 – Examine Trees Before Cutting to Improve the Timber Stand

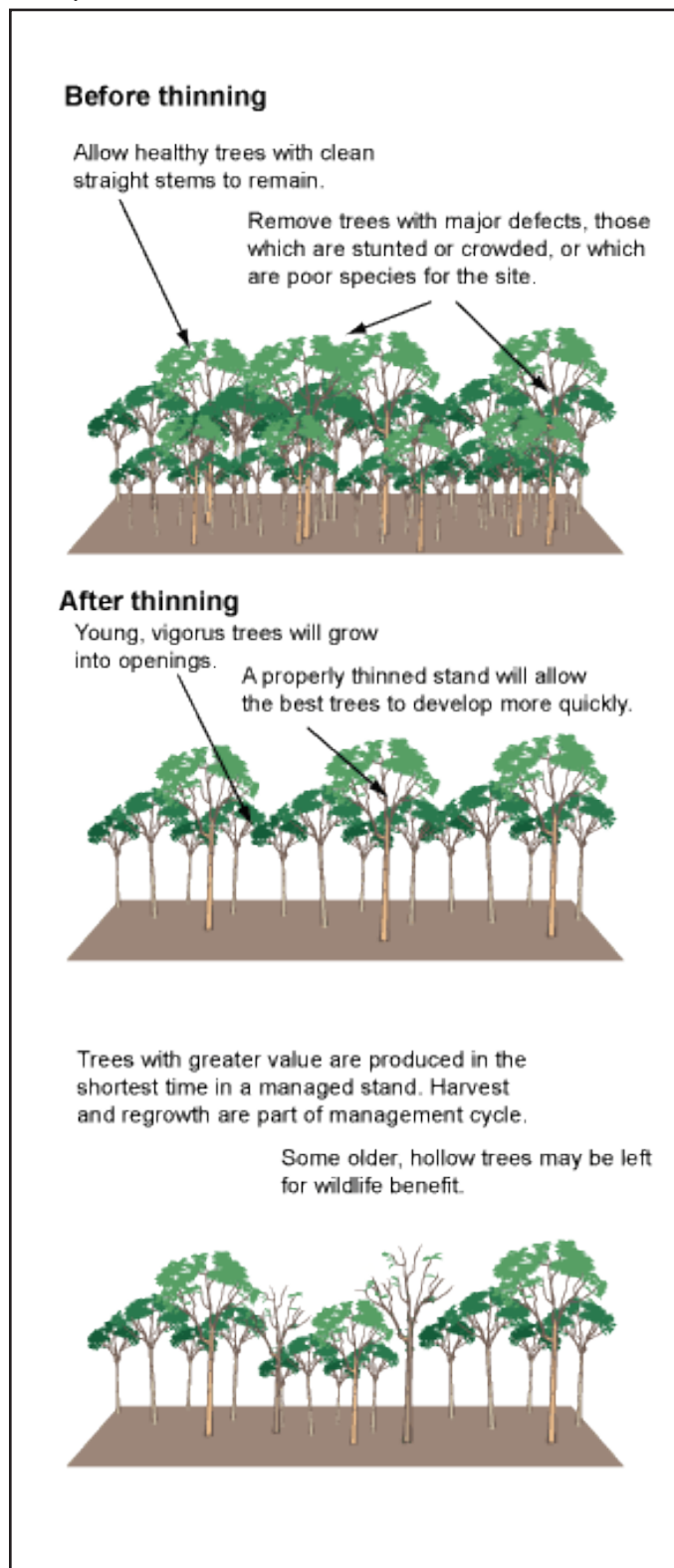
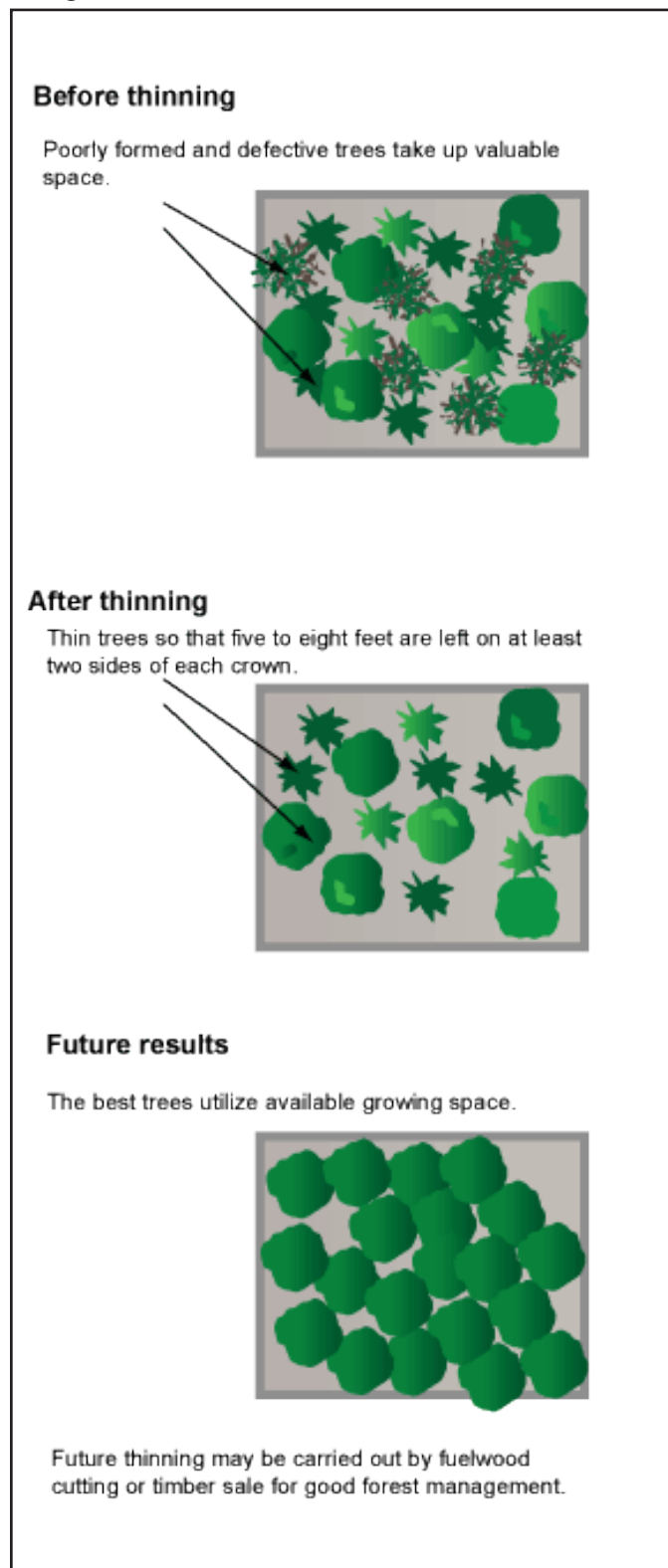


Figure 6.2 – Tree Crowns Compete for Sunlight and Room to Grow



Timber Stand Improvement (TSI) Principles

the food-producing leaf surface should be left intact. Generally, trees should be pruned before they reach 8 inches in diameter. Limbs which are to be removed should be pruned before they reach 2 inches in diameter. This reduces wound size, ensures proper closing, and lessens the impact of disease and insect entry.

Vine Removal

In some areas, vines do considerable damage to trees. Vines not retained because of wildlife food value and fall color should be killed at the same time other stand improvement work is done. Remove vines by cutting them as low to the ground as possible and immediately treat the stump with a herbicide.

Figure 6.3 – Tree Spacing by Diameter

Tree Diameter (inches)	Spacing Range (feet)
2	4.6 – 6.5
3	6.1 – 8.2
4	7.6 – 9.9
5	9.0 – 11.6
6	10.3 – 13.4
7	11.6 – 15.0
8	13.0 – 17.0
9	14.3 – 18.7
10	15.6 – 20.4
11	17.0 – 22.1
12	18.1 – 23.8
13	19.4 – 25.6
14	20.8 – 27.2
15	21.9 – 29.0

Certain species or management purposes may require other spacing. In any thinning, the tallest desirable trees are usually favored.

Source: *Even-Aged Silviculture for Upland Central Hardwoods*, by B.A. Roach and S.F. Gingrich, Agriculture Handbook 355. Upper Darby, PA: USDA, Forest Service, Northeastern Forest Experiment Station, 1968.

Sprouts

A very important aspect in preparing a site for natural reproduction is proper treatment of sprouts. Many Missouri hardwood species sprout heavily from stumps of cut trees. Sprouts grow rapidly and form multi-stemmed clumps. These sprouts can be used economically if handled properly.

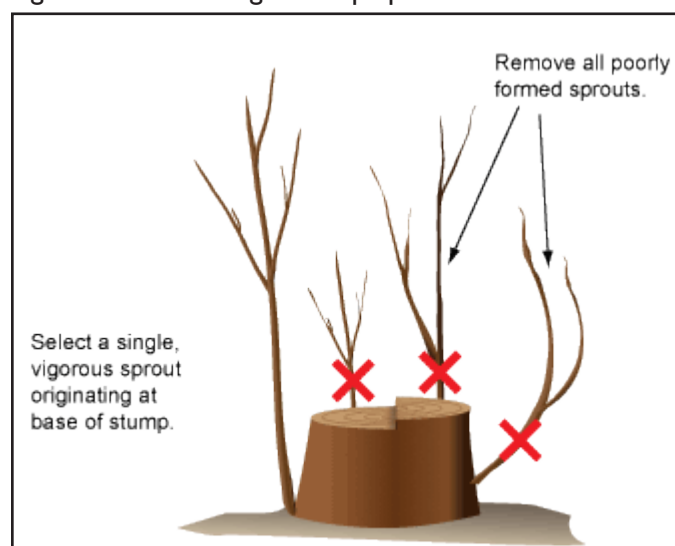
Seedling sprouts are sprouts originating from several seedlings. These are as good as seedling trees if the clumps are thinned to one stem.

Tree stump sprouts are sprouts originating from older trees. Although less desirable than seedling sprouts, they may develop into good quality trees depending on the size of the stump and the origin point of the sprout. See Figure 6.4.

Sprout stands are best managed before they reach 20 years of age. Early treatment permits better selection of trees from the standpoint of attachment to and the size of the parent stump. It also greatly lessens the danger of decay from wounds left in cutting companion sprouts.

Some general rules in managing sprouts under 20 years old or less than 3 inches in diameter at breast height are as follows:

Figure 6.4 – Selecting a Stump Sprout



Forestry

- ◇ Favor the lower sprout, cut the high sprout.
- ◇ Preserve the sprout from the small stump rather than the large stump.
- ◇ Remove the attached sprout with a flush cut.
- ◇ Cut well-separated surplus sprouts at any convenient height.

Use the following guidelines when treating sprouts that are over 20 years old or more than 3 inches in diameter:

- ◇ Companion sprouts joined at the base with a V-shaped crotch, should not be cut. It is usually difficult to remove one without leaving a large wound.
- ◇ When sprouts have a low U-shaped crotch between them or are entirely separated from each other above the ground, one or more can be removed.

Methods of Removing Trees From Competition

There are several methods for removing trees when using the TSI practices of thinning or release. In many cases, a well-planned timber sale (improvement harvest) can accomplish a great amount of TSI where merchantable trees that are too closely spaced may be removed and sold. Also, in release some culled trees may be used for firewood sites.

Undesirable trees that are not marketable may be removed by cutting, dozing, brush hogging, girdling, or chemical control. Chemically treating large trees is often more economical than felling and is more certain to kill trees than girdling. Also, if resprouting control is desired, chemicals are more effective. When using chemical controls, it is important to remember they can injure sensitive trees, crops, or ornamental plants if not used properly according to the label directions.

Silvicides and herbicides can be applied using the following methods:

1. When frilling or using mechanical injection, cuts are made through the bark and into the growing tissue completely around the tree. A suitable chemical is then applied to the fresh cuts. Mechanical injectors can be purchased or rented which apply the chemical at the time they make the cut. Hard-to-kill species such as ash and hickory should have a complete, continuous cut well into the sapwood. Many species may be killed with cuts spaced at intervals several inches apart.
2. Basal spraying may be used effectively on trees which are less than 4 inches in diameter. Spray the chemical oil mixture on the lower 12 inches of the trunk, wetting the bark thoroughly.

Summary

You can increase the financial return from a stand of Missouri forest land by improving tree quality and woodland composition. Timber stand improvement (TSI) includes a broad range of practices: site preparation, thinning, release, pruning, and vine removal. Free technical service is available to help you with your timber stand improvement plan through local district foresters of the Missouri Department of Conservation.

Credits

Slusher, J.P., H.E. Garrett, C. Solomon, and I.L. Sander. *Increase Woodland Products Through Timber Stand Improvement* (Guide G5150). Columbia: University of Missouri Extension, reviewed 1993. Accessed June 4, 2008, from <http://extension.missouri.edu/xplor/agguides/forestry/g05150.htm>.

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Growing and Marketing Christmas Trees

Lesson 7: Growing and Marketing Christmas Trees

Considerations for Growing Christmas Trees

Christmas trees can be grown on suitable sites in all parts of Missouri. Each prospective grower should weigh the outlook in terms of his own set of circumstances. The following questions will need to be answered:

1. Noting the seasonal nature of the work, can the grower spare the time required to produce high quality trees?
2. Is labor available for planting, weed control, pruning, shearing, and harvest?
3. Where and how large are potential markets?
4. What species and varieties are best?
5. Is the planting site suitable for Christmas tree species?

Basic considerations and procedures will be discussed below, but the beginner must also learn that the plantation production of Christmas trees is a young and dynamic business. New materials, equipment, methods, and problems continue to evolve. One can keep up-to-date through the Christmas Tree Association and professional personnel in forestry and related fields.

Seasonal Nature of Christmas Tree Production

Activity peaks for Christmas tree growers occur during planting season (March until mid-April for most of Missouri), in June to mid-July when the pines are shaped by pruning and shearing, and during the fall harvest. The most laborious and time-demanding operations are the pruning, shearing, and harvesting.

Growers of Christmas trees must stay alert at all times. Mowing or other measures to reduce a competitive stress on trees by other vegetation must be administered as needed. Year-long vigilance is required to promptly discover and deal with any of the various protection problems. Sales opportunities also arise at all times of the year. A new grower should begin developing a sales program at least 1 year prior to the first harvest. Well-established wholesalers commonly make their major marketing efforts early in the calendar year. Regardless

of how trees will be sold, harvesting and marketing procedures for the crop of any one year should be firmed up by August.

Marketing Christmas Trees

Where and how a particular grower will market depends upon such variables as the grower's sales personality, personnel available, quality of the crop, size of the harvest, and plantation location relative to population centers.

The highest profits per tree can be realized when the grower sells directly to the consumer, but retailing is very demanding in time and sales imagination.

Success will hinge on improved services, better trees, good display of merchandise, convenient and adequate parking, customer comfort, and a prompt and courteous sales procedure.

Grower-retailers often elect to operate well located sales lots in or near cities. An alternative method to the sales lot is "choose and cut" selling. Customers select, cut, and carry trees from the plantation. For this privilege, Christmas tree buyers are often willing to pay prices commanded at city retail lots.

Growers may wholesale their trees. Trees are normally harvested and delivered by the grower to individuals or organizations who operate retail lots. Wholesale transactions mean many trees can be sold. Sometimes, when sufficient acquaintance and trust exists between parties, trees are sold under consignment agreements. When growers consign their trees they assume less risk and are entitled to a lower share of the returns.

Growers can sell stands of trees. Under this arrangement, wholesale lots of trees are sold while they are still standing in the plantation. This is termed a "stumpage sale." Cutting and transportation are usually done by the buyer; likewise the seller's gross return is less.

Quality counts. Regardless of marketing method, one point needs emphasis: the Christmas tree market is a quality market. Annually, there is an abundance of trees, but good trees are always in short supply.

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Maintain consistent production. One secret to marketing success is the ability to supply an established market on a yearly basis. This requires a balance in age classes of trees. For example, if final harvest is anticipated 8 years after planting a species, the farm should eventually include eight planting ages for that species or 40,000 trees with eight blocks of 5,000 trees which are 1 to 8 years old.

Christmas Tree Species

Scotch pine: The leading Christmas tree nationally, Scotch pine is excellent for Missouri Christmas tree production. Beginning with 2-year-old seedlings, Scotch pines attain popular Christmas tree sizes in 5 to 10 years.

Eastern white pine: A straight, symmetrical, beautiful tree, this species has potential second only to Scotch pine in Missouri plantations. Unfortunately, a good survival rate in the first year after planting is difficult to obtain. Christmas tree sizes are reached in 6 to 10 seasons after planting.

Jack pine: When survival, growth rate, and consumer acceptance are all considered, Jack pine ranks second to Scotch pine as a good yielder in Missouri plantations. However, it has a high proportion of poorly formed trees and winter yellowing. Until genetically better Jack pine stock is available, growers should test the species sparingly. Jack pines reach Christmas tree size in 4 to 6 years.

Douglas fir: Some excellent Douglas fir Christmas trees have been produced in Missouri, but there are several serious drawbacks to use of the species. First, Douglas fir varies greatly within the species. Second, Douglas fir requires deeper and better aerated soils than the previous species. Again, test this type of Christmas tree sparingly. Under favorable conditions, Douglas fir reaches Christmas tree size in 8 to 12 years.

Seedlings of Scotch pine, Eastern white pine, and Jack pine are grown at the State Forestry Nursery in Licking, Missouri, and in commercial nurseries.

Cultural Requirements of Christmas Trees

Christmas tree species survive and grow better in deep soils with good internal drainage. Favorable lands can range from fine sands to silty clays. Avoid areas that are constantly wet or subject to flooding. Planting in droughty sites can be equally futile. The wet winter and dry summer conditions caused by shallow claypans less than 2 feet deep are harmful to Christmas tree species. High fertility increases weed problems. Christmas tree species, especially pines, usually perform adequately at fairly low nutrient levels.

Planting should be done on open ground, staying 30 or 40 feet away from tree borders. Whenever possible, select open areas because conversion of brushy land is expensive and difficult. If conversion is necessary, completely clear the areas of vines, brush, and stumps. One effective measure is to rip freshly cleared ground with a heavy subsoil plow to remove hardwood root systems. Before and after planting, sprouting can be discouraged with a common chemical brush killer. In sparse or shallow-rooted stands of grasses, little or no control work will be necessary. Contour plow in bands about 3 feet wide along rows where trees will be planted. Follow deep plowing with disking to remove air pockets; then level the ground. As an alternative to plowing, a post-emergent herbicide can be applied in strips during late summer prior to spring planting. Site preparation should be completed about 1 year prior to planting.

Christmas trees are commonly grown at spacings ranging from 5 feet x 9 feet (968 trees/acre) to 6 feet x 10 feet (726 trees/acre). Ample space should be left at the ends of rows for turning mowers and other equipment.

Competing vegetation must be controlled. Most experienced growers routinely mow their plantations. Advantages are more light, moisture, and nutrients available to the tree, less fire hazard and rodent damage, easier control of sprouts, and more pleasant working conditions.

Vegetation near trees can be removed by hand tools or chemically. Pre-emergent herbicides can be effective

Growing and Marketing Christmas Trees

with timely applications. Plowing after planting is not recommended. Shallow disking between rows can be useful when combating heavy herbaceous growth.

In addition to control of competing vegetation, other protection problems arise sporadically. Livestock must be kept from the planting. Deer can be a serious and difficult problem to control where their populations are high. Rodents must be controlled with field applications of rodenticides or tree guards.

Insect and disease injuries include damage from tip moths, sawflies, mites, and needlecast disease. Resource foresters can provide the latest recommendations for dealing with pest or disease problems.

Of all hazards, fire can cause the most dramatic and sudden losses. This problem should be considered when locating

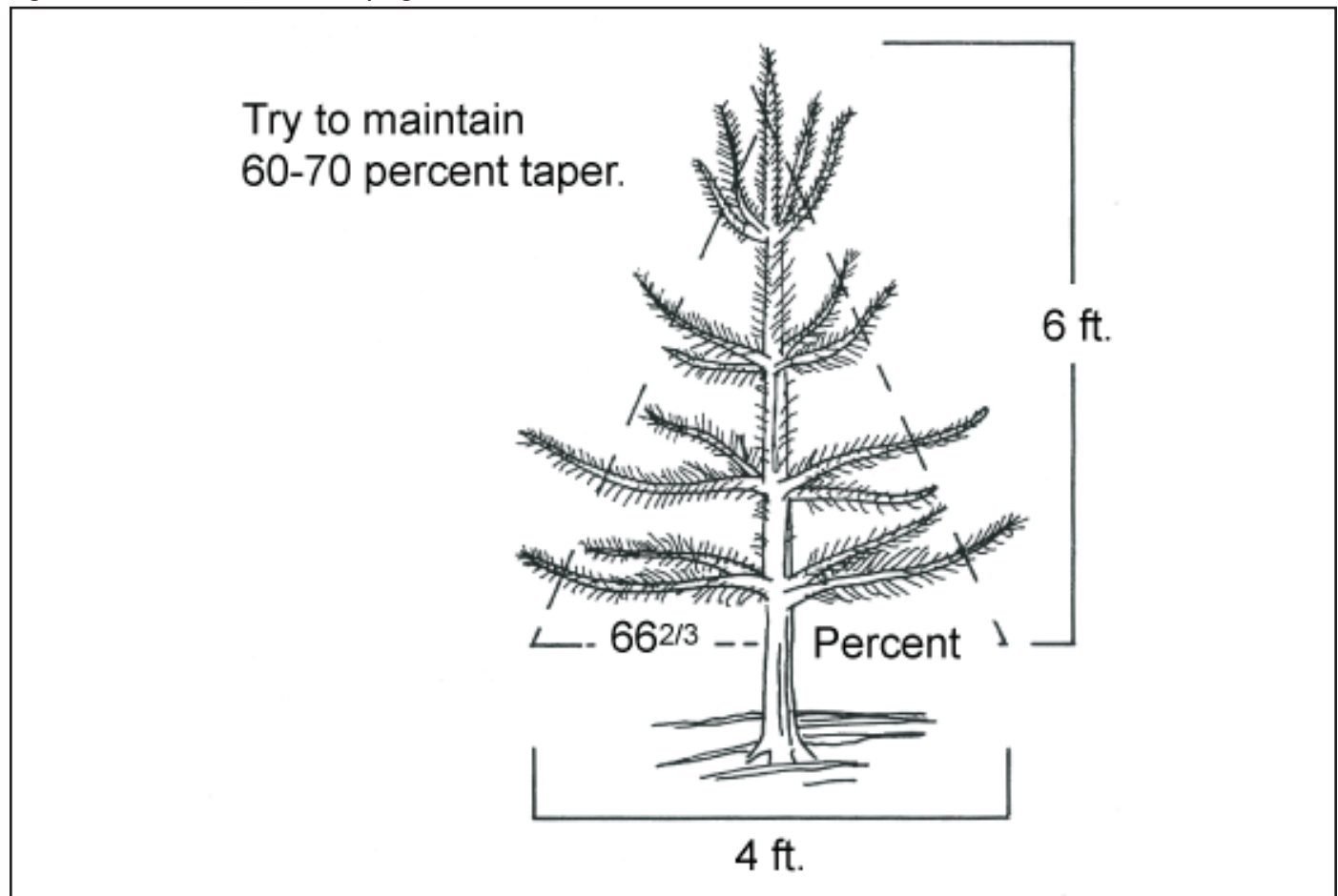
plantations. A system of access roads and plantation borders can be designed to serve as fire breaks. Mowing prevents the buildup of dry organic matter and minimizes the effects of fire.

Shaping Christmas Trees

Shaping and shearing are essential practices in Christmas tree production. The ideal tree should resemble a cone about $\frac{2}{3}$ as wide as it is high. For example, a 6-foot tree should have a 4-foot-wide base. See Figure 7.1.

Many growers prefer the combination of a pair of hedge shears with 8- or 10-inch blades and a pair of anvil type hand pruners such as those used on shrubs and fruit trees. The hedge shears are used for overall shaping, and the hand pruners for making interior cuts or thinning whorls of limbs. See Figure 7.2.

Figure 7.1 – Christmas Tree Shaping



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Begin shaping operations when the trees are 2 to 3 feet tall. Developing a main terminal and creating some balance in the tree at this early stage is important. Trees should be shaped every year from the time they are first shaped until the year they are sold.

Shaping should be done early in the growing season when the new growth (candles) has completed elongation and started to harden off. Jack pine makes its growth early and should be shaped from mid-May to mid-June. Scotch and white pines should be shaped between June 15 and July 15.

There are no hard and fast rules for shaping that apply to every tree. See Figure 7.3. The objectives, however, for shearing and pruning are as follows:

- ◇ Control height growth: Cut the terminal leader back to 12 to 14 inches; make this cut at a 45° angle rather than a straight cut. Cut the lateral branches of the terminal whorl to about half the length of the leader.
- ◇ Eliminate extra leaders: Leave the leader that is straight and best and remove the others. This is especially important during the first shearing.
- ◇ Remove or conceal branch deformities: Crooked, crossed, or otherwise deformed branches should

be removed while trees are young. “Tree trainers” (manufactured commercially) or tape, which will disintegrate within 1 or 2 years, can hold unruly leaders or branches in position until they assume better growth habits.

- ◇ Develop uniform taper and density: After the leader and terminal whorl are shaped, work around each tree and shear as many lateral limbs as necessary to bring the tree to the desired form and taper. Confine shearing primarily to the current year’s growth when possible.

Summary

Growing Christmas trees can be a profitable enterprise, but many considerations go into the decision to grow trees. Understanding considerations such as delayed returns, marketing potential, site suitability, labor needs, species, and cultural requirements are important before becoming a Christmas tree grower.

Credits

Growing and Marketing Christmas Trees (Guide G5700). Columbia: University of Missouri Extension, 1981.

Shaping Pine Christmas Trees (Guide G5706). Columbia: University of Missouri Extension, 1981.

Figure 7.2 – Shearing and Pruning Tools

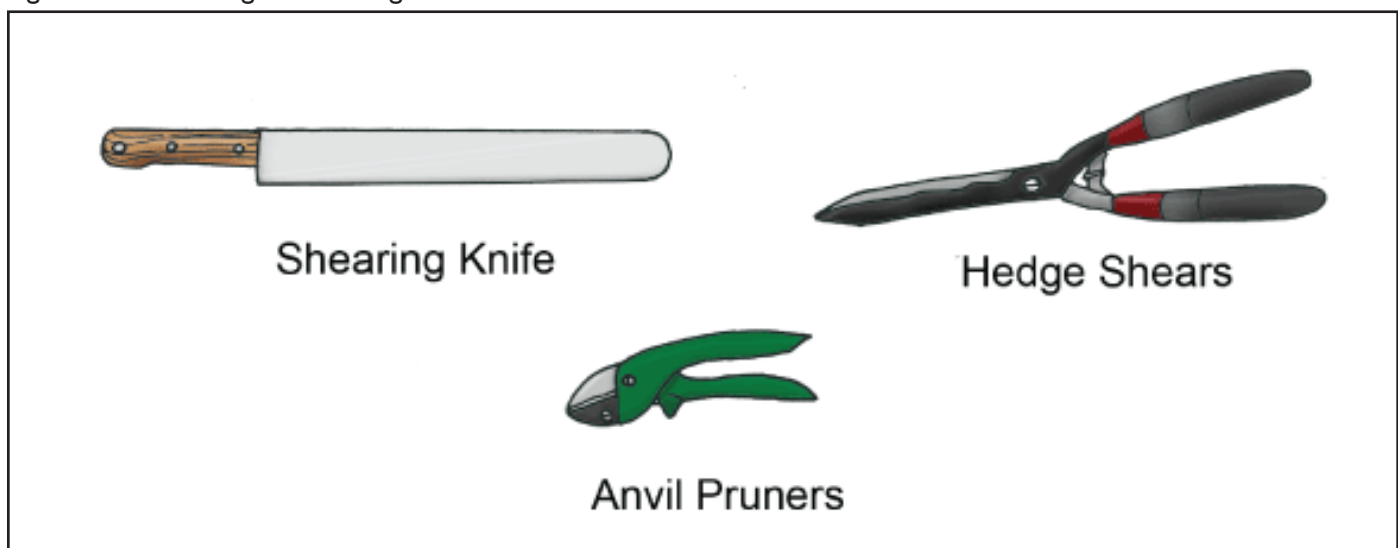
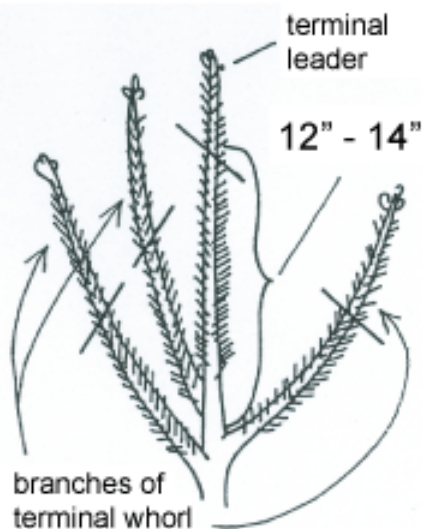


Figure 7.3 – Shearing Christmas Trees

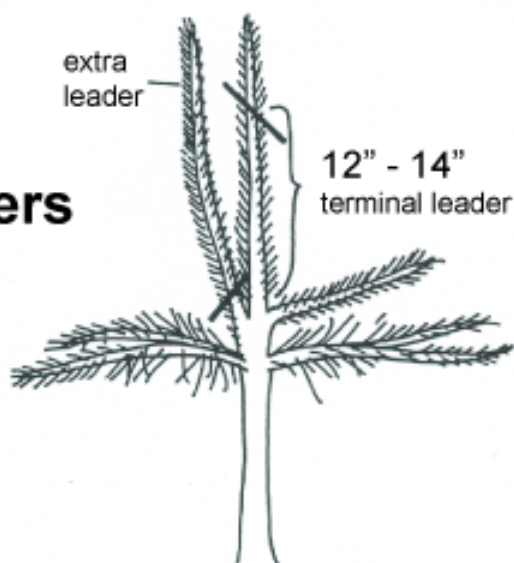
Controlling Height



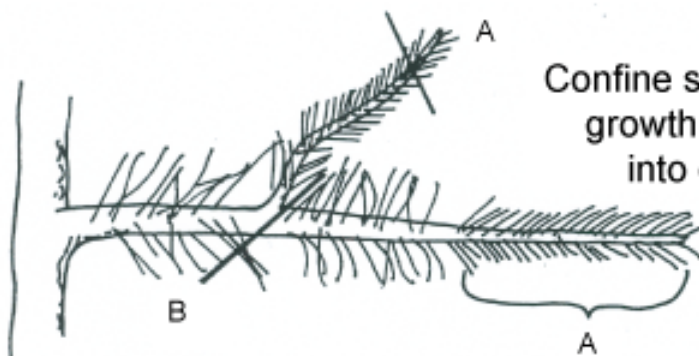
Cut terminal leader to 12" - 14".
Cut branches of terminal whorl
to about 1/2 length of leader.

Eliminating Extra Leaders

Eliminate extra leaders
while trees are young.



Developing Uniform Taper and Density



Confine shearing primarily to new
growth (A). If necessary to go back
into old growth, cut at
junction of side limb (B).

Lesson 8: Producing Walnut Timber

Producing Walnuts in Missouri

Missouri is one of the leading states in walnut production. Many of its soils are ideal for growing walnuts. The importance of walnut timber can be attributed to its outstanding physical properties along with the unparalleled beauty of its grain. The many uses for interior woodwork, paneling, furniture, gunstocks, and novelties attest to its popularity. Timber growers have found it profitable to manage walnuts for timber for many reasons, including the following:

- ◇ Walnut logs have brought consistently higher returns per thousand board feet than any other timber.
- ◇ Marketable quantities can be grown on a small area. One truckload and occasionally one tree, depending on its quality, makes a salable volume.
- ◇ While growing to timber size, walnuts produce crops of nuts that are valuable for home and commercial use.
- ◇ A walnut orchard, if it is protected and pruned, can produce a timber crop within the lifetime of the grower.
- ◇ On good ground, walnut is among the faster growing native hardwoods.
- ◇ Walnut trees on a farm add to its capital value, and make it a more attractive place to live.

Landowners who are fortunate to have existing stands of walnuts can find walnut production to be a profitable enterprise. Walnut production can also be profitable to those with suitable sites for planting and who are willing to wait for returns when trees mature.

TSI Practices Beneficial to Walnut Production

Walnuts require and deserve attention if maximum returns are to be realized. For this reason, walnut producers will find that their stands of timber will benefit from all TSI practices.

Particular attention should be paid to the practice of pruning young walnuts. Some general tips to follow are:

- ◇ Prune no more than 1/3 of the live crown each year. Prune all dead limbs.
- ◇ Try to start the pruning program early enough in the life of the tree to remove side limbs before they reach 1 inch in diameter.
- ◇ Be careful not to tear long strips of bark down the tree. To prevent this, double-cut the heavier limbs. That is, cut the heavy limbs off a foot or so from the trunk with the first cut. Then remove the remaining stubs flush with the second cut.
- ◇ Pruning is best done during the dormant season, winter or early spring. This reduces the incidence of disease and insects.
- ◇ Continue to prune until at least a 9-foot, clear stem has been developed.
- ◇ Always use a sharpened hand pruning saw.

Additionally, it is important to protect trees from the threat of fire and pasturing. Plow a fire lane around timber where it adjoins railroads, highways, and grasslands. Livestock grazing compacts the soil and retards the growth by upsetting the moisture balance of the root system. Livestock browsing will damage young trees, impairing good form and satisfactory development of the seedling.

It is also important to keep these high value trees free of metal. Use posts rather than valuable trees to support fences. Walnut buyers usually refuse to purchase trees to which fences were once fastened. Nails, staples, or other metal objects in logs damage saws and can cause serious accidents.

Planting Walnut Seedlings

Planting walnut seedlings is like a good savings account which can be withdrawn years down the road. Along with this, planting is important in existing stands to replace trees harvested or to fully utilize forest areas.

Plant walnut seedlings only in good ground. Walnut seedlings grow best in deep, well-drained, fertile soils. Walnut seedlings may grow on poorer sites, but growth will be slow and have poor quality. Soils and general growing conditions on north and east slopes are better suited than sites on south and west slopes. Sandy loam, loam,

Forestry

or silty loam soils are most desirable, but silty clay loam soils are also well-suited. Soils that are drab or gray with tight subsoils are poor places for walnuts. Neither poorly drained ground where water stands for considerable periods, nor barren, dry, sun-baked hillsides with heavy clay are good sites.

Along with replacement planting in existing stands of walnuts, there are many areas suitable for planting new stands. Unused ground along the lane or isolated areas that are too small to farm, such as sections of property cut off by highway streams, may be used. Choose rough or hilly areas, which are not suitable for agronomic crops, but which have deep, fertile, well-drained soils. Also, stream terraces or coves and lower north- and east-facing slopes can be utilized.

Walnut seedlings can be planted with one or more of the following species: white ash, red oak, white oak, and sugar maple.

To plant walnut seedlings refer to Lesson 3. It is important to pay particular attention to the weed control and fertility in walnut stands.

Defects Which Degrade Walnut Logs

The quality of walnut timber is essential to its value. A poor-quality log may have no value for veneer or lumber, while a high-quality log may be worth hundreds of dollars. A woodlot owner has a great deal of control in avoiding defects that degrade lumber quality.

It pays to harvest your trees at the right time, while keeping new crops coming on. The highest values are for trees 20 inches or larger in diameter. To be salable in markets as a sawlog, a tree should contain a log that is at least 8-1/2 feet long.

Defects are caused, they do not just happen. You can prevent many defects. Some common defects are:

- ◇ Insect damage – Prevent anything that might wound the trunk, including fire damage, pasturing, and careless logging. Areas containing heavy infestations may require control measures.

- ◇ Crooked logs – Prevent by removing competition that is causing walnut trees to grow out of shape.
- ◇ Dote or rot – Dote works down from the top of the tree and may extend its full length. Dead and dying branches in tree tops, butt scars, other large wounds, and large rotten stubs on the trunk often indicate dote. Prevention is the same as for insect damage. Sell trees as soon as possible upon discovery without sacrificing profit.
- ◇ Cat-faced knots – These concealed knots are generally more damaging to lumber than a knot from a sound live limb. Prevent by pruning walnut limbs when small.
- ◇ Lightning cracks – Sell tree immediately following lightning damage.
- ◇ Splits – Prevent by properly felling trees.

Selling Walnut Timber

Two general types of sale are usually open to the timber owner – a “lump sum sale” offer or a “price per board foot sale.”

The “lump sum,” or a price for all the trees to be sold, is most often used to sell walnuts. It causes the least trouble for the seller, who does not have to check any measuring, but simply takes the amount offered. However, unless the trees for sale have been marked, the buyer can take any tree he or she wants and the woodland may not receive maximum management benefits.

A “lump sum sale” allows the seller to receive the money before the trees have been harvested. It also encourages the buyer to make maximum use of the tree. The disadvantage of a “lump sum sale” is that the buyer has more risk involved and might bid conservatively where doubt about the tree quality exists.

Walnuts should be sold by bid, regardless of the method used. Where only a few trees are for sale, or quality is low, the seller may be able to attract only local buyers. Where tree numbers and quality are high enough to keep the cost of appraisal from being prohibitive, bidders may be attracted from greater distances.

Producing Walnut Timber

There are two types of buyers. Independent buyers work for themselves, buy timber, cut the trees, then resell the logs to one or more mills. The second type of buyer is a company employee who is on the company payroll. The employee's job is to buy a continual supply of timber to keep the mill operating.

Although it would appear that sellers could make more money by cutting and selling their own walnut trees, this is rarely the case. Few landowners have the skill or product knowledge to make proper judgments in harvesting walnut trees. They are also at a selling disadvantage once the trees are cut.

A bid notice should include the following:

1. Seller's name, address, and telephone number
2. Location of trees (legal description and directions from the nearest town)
3. Number of trees to be sold, average diameter, and how they are marked
4. Any special sale instructions (cleanup requirements, special periods of time that logging is to be excluded to prevent crop damage, etc.)
5. Latest date bids will be accepted (A minimum of one month should be allowed after mailing the bid notice for buyers to examine the sale area.)

The bid notice should state a definite date, time, and place when bids will be open and accepted. Only sealed bids should be accepted. The seller has the right to refuse all bids, but under no circumstances should verbal or late bids be accepted. All bidders should be notified as soon as the decision has been made.

All sales of timber should be covered by a timber sale contract. This should not be taken as a sign of distrust but as a good business practice. If all terms are set down on paper, it helps prevent misunderstandings.

The contract may be prepared by the seller with the advice of an attorney or forester, or it may be prepared by the buyer and an attorney. Standard contract forms are often used by buyers, or they may be obtained from professional foresters. No standard contract for selling

stumpage adequately covers all circumstances, but there are certain basic things that should be included:

1. Names and addresses of buyers and sellers
2. An accurate legal description of the location of the timber
3. The number of trees marked and how they are marked
4. The amount of the purchase price and how it is to be paid
5. Expiration date of the contract
6. Other responsibilities of the buyer such as: preventing fire, preventing excessive damage to young timber, and leaving roads, fields, and fences in good repair
7. Other responsibilities of the seller such as: guaranteeing to the buyer the right to sell the timber and granting right of way and entry into the land for the purpose of harvesting trees

Two copies of the contract should be dated and signed by both the buyer and seller with a copy going to each. Some contracts are signed in the presence of a notary public.

The seller should check the site for violations of contract provisions. This should be done several times while the operation is in progress. After the job is completed to the seller's satisfaction, the following items should be checked:

1. No unmarked trees were cut.
2. Fences, roads, and culverts were repaired to as good or better condition than before the sale.
3. There is no excessive or abnormal damage to the sale area.
4. Full payment has been received.

Summary

Walnuts have the highest return per board foot of any Missouri tree. Using good timber stand improvement practices, careful planting practices, and proper marketing techniques can make walnut production a profitable agricultural enterprise. Free technical assistance is available from foresters from the Missouri Department of Conservation and Extension.

Forestry

Credits

Schlesinger, R.C., and D.T. Funk. *Manager's Handbook for Black Walnut*. St. Paul, MN: USDA Forest Service, North Central Forest Experiment Station, 1977.

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