MISSISSIPPI STATE UNIVERSITY EXTENSION

Welcome to 4-H Forestry

Figure 1. Forests provide many uses and amenities. A feller-buncher harvests trees. Wood from the tree trunk will be processed into a variety of wood products (top left). Forests provide opportunities for recreation (top right). Forests protect soil from erosion and filter sediments to keep water clean. Forests also provide many other ecosystem services, such as producing oxygen and storing carbon (bottom left). Wildlife, like these white-tailed deer, use forests to find food and cover (bottom right).

Why 4-H Forestry?

For thousands of years, people have depended on one of the most valuable natural resources for food and shelter—the forest. By becoming involved with 4-H Forestry, you can learn about this great natural resource and how to care for it. You will have the opportunity to learn many interesting facts about forests and put them to good use. 4-H Forestry projects offer exciting activities for everyone, whether you live in the city or the country.

You will learn and be able to explain to others why trees are important for the many products that people need, as well as recreation, natural beauty, wildlife, and the environment (Figure 1). You will be able to identify trees by recognizing leaf, bark, and other species' characteristics, and you will discover why forests are known as the most renewable natural resource we have. 4-H Forestry is your ticket to adventure. Your involvement is limited only by your imagination.

Mississippi's forests are very productive. Our state has fertile soils, a long growing season, and precipitation well distributed throughout the year. Forests comprise about 62 percent of the state's land area—19.2 million acres. Hardwood timber is most common in Mississippi, but pine volume and area are significant. Forests and forest products provide more than 61,000 jobs in the state. With value-added processing of timber, wages paid, and ancillary spending, the forest industry contributes more than $13 billion to the state economy every year. Depending on market prices, forestry and soybeans are the second- or third-ranked agricultural commodities behind poultry production.

This publication introduces 4-H members to forestry and natural resource management. The information provided will be helpful when preparing for the forestry knowledge section of 4-H Forestry judging contests and in choosing 4-H projects of interest.

How Trees Grow

All trees have roots, a trunk, and a crown (Figure 2). Roots serve to anchor a tree in the soil and keep it from falling over. Root hairs on fine feeder roots take up water and nutrients from the soil so the tree can make food and grow. The trunk or stem supports the crown.

The crown is made up of branches, twigs, and leaves. Leaves use sunlight, carbon dioxide from the air, and water transported from tree roots to produce oxygen and sugars through a process known as photosynthesis. Trees play a crucial role in supporting life on Earth by supplying oxygen and storing excess carbon from the atmosphere in the form of wood.

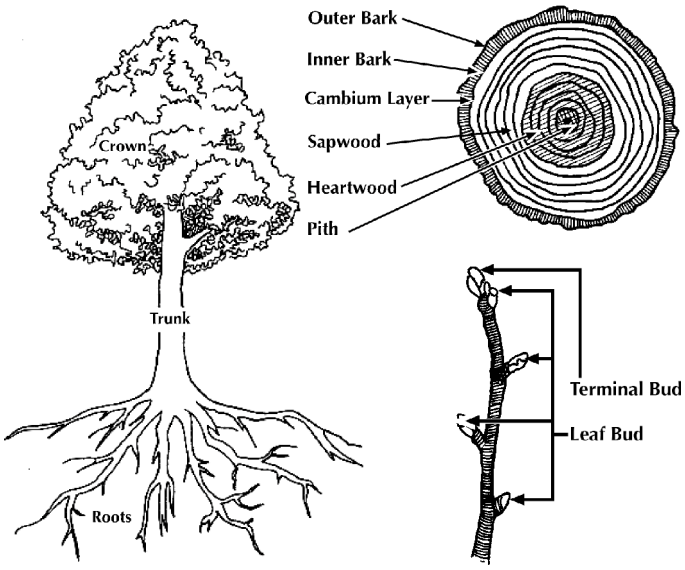

Figure 2. Anatomy of a tree.

The trunk is the part of the tree that provides most of the wood products we use. It holds up the crown and acts as a passageway for nutrients that flow up and down the tree. The trunk is made of xylem tissue, which transports water and nutrients from roots to the crown. Active xylem tissue is called sapwood. Inactive xylem tissue no longer transports water and is called heartwood. It helps support the tree as it grows.

The parts of a tree that grow include the root tips, the cambium, and the buds. Root tips grow into the soil to absorb water and nutrients. The cambium is a layer of cells just inside the bark of the roots, trunk, and branches. You can't see this cell layer with just your eye, but it makes the tree increase in diameter. New wood cells are produced on the inside of the cambium, forming annual rings. Depending on the tree species, wood produced by the cambium differs in spring and summer. So, on these species, each annual ring is comprised of early or spring wood and late or summer wood.

The cambium also produces new bark cells on the outside. This is why the bark of older trees is rough, furrowed, and sometimes scaly. Old bark does not grow, so it cracks and breaks apart as new bark is produced beneath it. Just beneath the bark, other cells move food that is made in the leaves back down to the other parts of the tree. This innermost layer of bark is called phloem tissue.

The buds are the most visible growth area of a tree. The main stem of the tree and branches grow in height and length through the terminal bud. Leaf buds grow into leaves, and flower buds develop into flowers, which in turn produce fruit and seeds.

Forests and Forest Succession

A forest is more than just a group of trees. A forest is a living community of trees, animals, and other plants (Figure 3). A forest is a place of endless activity, but you may have to look closely to see it. Trees, plants, birds, mammals, fish, reptiles, and insects live and die in the forest. It is a cycle of life. Forests will vary according to the soils and climate across the country. In the western United States, there are forest types in the Rocky Mountain, Sierra Nevada, Cascade, and Pacific Coast regions. In the eastern United States, there are northern, Central Hardwood, and southern forest regions.

At smaller scales, forests will differ according to topography and drainage. Trees have adapted to particular environmental conditions. For instance, forests in southern Mississippi have adapted to different disturbance events, such as hurricanes and tropical storms. These tree species have evolved to survive occasional high winds and saltwater intrusion.

Figure 3. Forests are communities of many plants and animals interacting with the environment and living together, ecologically supporting one another.

Figure 4. Periodic prescribed fire helps maintain early successional stages dominated by low-growing vegetation such as grasses and forbs (top left). Pioneer trees and shrubs become established in open areas, gradually dominating the ground vegetation (top right). As pioneer tree species mature, other tree species become established in their shade, gradually changing the nature of the forest. Shown here (bottom) is a later successional stage of bottomland hardwoods containing multiple species of oak, hickory, maple, and gum.

Forests gradually change over time, primarily in response to the changing amount of light. Open ground becomes seeded with grasses, forbs, bushes, and trees. At first, grasses and forbs dominate the vegetation (Figure 4). However, this vegetation gives way to shrubs and trees as they grow. Trees that grow in open ground are adapted to full sunlight. They are known as pioneer species, such as pines, sweetgum, and yellow poplar.

As these trees mature, their shade may prevent their own seed from surviving germination. Instead, other species having more shade tolerance (adapted to more shade) will grow, including oaks and maples. Again, as these species mature, their shade may prevent their own seed from surviving germination. So other tree species adapted to growing in even greater shade will germinate and grow, including beech, hickories, dogwood, and hornbeam. This gradual process of forest communities changing over time is known as succession.

With different forest communities, different wildlife will occupy those forests. Bobwhite quails prefer open habitat dominated by grasses and forbs. As bushes and trees grow, turkeys and rabbits tend to occupy this habitat. As forest cover increases, deer and squirrels find food and cover. In other words, succession of forest communities affects wildlife living in the forest as much as the trees.

Southern Forests and Fire

Southern forests evolved with fire. Frequent, low-intensity fires were historically common, and many tree species evolved to survive these fires, including southern yellow pines and upland oaks. The southern yellow pines evolved thick bark. Longleaf pine, in particular, is very well adapted to frequent, low-intensity fire even as a seedling. Many upland oaks can sprout back after a fire, developing an extensive root system before making substantial stem growth.

Prescribed burning in southern forests has many beneficial uses (Figure 5). Periodic burning reduces the fuel load on the forest floor, lowering the risk of wildfire. As Native Americans understood, fire improves access through the woods by managing vegetation. Low-growing species are easier to walk through than thick, midstory vegetation. Prescribed burning can encourage regeneration of southern yellow pines and upland oaks. Finally, prescribed fire promotes wildlife habitat by setting back successional stages to ground vegetation. Having more low-growing vegetation provides food and cover to a variety of wildlife, including deer, rabbits, and turkeys (Figure 6).

Figure 5. Southern pine forests are adapted to periodic, low-intensity fire. Here, a Mississippi Forestry Commission technician sets a prescribed backing fire in strips.

Figure 6. Proper vegetation management in a pine forest includes the use of selective herbicides and prescribed fire to encourage ground vegetation to grow. This type of low-growing vegetation could support deer through the summer.

Forestry and Foresters

Forestry is the science, art, and practice of managing and using forests, woodlands, and other natural resources to benefit people and the environment. Professional foresters manage trees, soils, watersheds, rangelands, wildlife, and recreation. Forestry includes activities such as:

- identifying, measuring, and cutting the "proper" trees
- protecting trees from wildfire, insects, and diseases
- promoting ecosystem function for environmental benefits

Forestry involves all of the above and more. People go to college to study forestry, then work for years in that field and never stop learning new things. Forestry is a subject you can enjoy while you learn.

Foresters work in many types of jobs and are employed by many different organizations. One forester may be concerned with harvesting trees, while another plans and supervises replanting the forest. Others become administrators, resource managers, researchers, or educators to teach others proper forest stewardship.

As you work in 4-H Forestry, you will become more familiar with a forester's role. You will probably meet and talk with several professional foresters about their responsibilities. One thing that foresters share is a deep, personal connection to the forest. You may also develop this passion by becoming involved in 4-H Forestry.

Figure 7. In uneven-aged forest management, periodic partial harvests maintain a forest structure with all age and size classes.

Figure 8. Herbicides are sprayed during site preparation to kill all unwanted vegetation on a site before planting trees.

Sustainable Forestry

Properly managed forests are sustainable and a renewable natural resource. Cutting trees and using the forest are part of sustainable forestry. Sustainable forestry standards require that harvest sites are reforested and that annual harvest volume is exceeded by the timber growth rate. Other aspects of sustainable forestry include promoting forest health, wildlife biodiversity, protecting special sites, managing forest aesthetics, and using qualified professionals while conducting forest operations.

Another vital part of sustainable forestry is having a written forest management plan. This plan should include guidelines for the implementation of sustainable forestry standards and best management practices (BMPs) that protect the environment. Periodic third-party inspections will verify compliance with the plan.

Harvesting and Forest Regeneration

How forests are harvested determines how they will be regenerated. In uneven-aged forest management, partial harvests remove trees of varying sizes and ages, leaving behind trees of multiple ages (Figure 7). Harvests are made generally every 10 years or so. Trees are cut from every age class in an attempt to leave a sufficient number of good-quality trees to maintain a profitable future harvest and provide adequate space for natural regeneration. Using uneven-aged management with loblolly and shortleaf pines requires periodically spraying selective herbicides to control encroaching hardwoods. Meanwhile, prescribed fire is often used in all-aged management of longleaf pine.

With even-aged management, the forest is completely removed, and new trees are planted. There are several methods available to do this, but the most common is called clearcutting. Site preparation after harvesting removes unwanted vegetation (Figure 8). After the site is ready, artificial regeneration (or natural regeneration in some special scenarios) is conducted to plant trees on the site to establish the next forest (Figure 9). Artificial regeneration is used for planting sites where desirable tree species are lacking. Other advantages of artificial regeneration are the ability to control initial tree spacing and the opportunity to plant genetically improved tree seedlings.

Other options for even-aged management use natural regeneration through seed tree (Figure 10) and shelterwood systems. With these methods, most of the timber is harvested, but some uniformly spaced trees are left behind as a seed source from which to regenerate the stand. The difference between seed tree and shelterwood is the number of seed trees retained. With seed tree regeneration, about 4 to 15 trees per acre are left. With shelterwood, a greater number of seed trees is left, depending on management goals. The tree species to be regenerated determines which method is more appropriate. For instance, seed tree is adequate for loblolly pine, and shelterwood is better for oak species.

Figure 9. In artificial regeneration, trees are planted after the site has been prepared.

Figure 10. A seed tree harvest leaves regularly spaced trees to provide seed for growing the next forest.

Seed trees should have good form and be healthy, wind-firm, and prolific seed producers. These trees not only provide the seed for the next generation but also continue to grow and increase in value. After a good stand of young trees has established, the seed trees are harvested for wood, and room is made for the new stand.

Forest Improvements

Partial harvests are conducted in forests with even-aged management. Such cutting is an important part of managing a forest during its life cycle.

Timber stand improvement (TSI) is sometimes prescribed to help improve the health of a timber stand. One common TSI operation is removing low-quality, diseased, or other undesirable tree species in preparation for natural regeneration in hardwood management. Herbicides are used to kill unwanted hardwoods individually through stem injection (Figure 11). With hardwood management, TSI is done throughout the rotation, since unwanted hardwoods may seed-in at different ages of the stand. In older hardwood stands, TSI is done as part of thinning.

Insect pests and diseases annually destroy more timber than fire. Often, we don't realize they are present in the forest until the damage has been done. Foresters must constantly be on alert for signs of a problem.

As pine plantations mature, trees compete with each other, and weaker trees die. This process is known as self-thinning. When stands reach this condition, all the trees are under stress from competition for site resources: sunlight, water, and soil nutrients. Thinning to relieve overcrowding (Figure 12) and promote tree growth and forest health can prevent insect attack (Figure 13). The ability to select which trees to remove in thinning improves timber quality and forest health by allowing more site resources for the remaining, better trees to grow.

Chemical release is another forest improvement activity used in pine forest management when hardwoods encroach and lower the productivity of the plantation. Selective herbicides are used to kill unwanted hardwoods while not harming the pines (Figure 14). Sometimes, pine release is done early in the age of the plantation because site preparation may not have been adequate. Otherwise, pine release from competition is often done after the first thinning, when ground equipment can get into the stand to spray herbicides. Scheduling a prescribed burn after release is part of quality vegetation management to improve wildlife habitat.

Other types of forest improvement activities include:

- prescribed burning to reduce fuel loads, improve access, and enhance wildlife habitat
- pruning lower limbs on crop trees to produce high-quality timber with minimal knots
- applying herbicides in newly planted stands to control herbaceous weeds and improve seedling survival
- applying fertilizer to promote tree growth (Some industrial ownerships do this to shorten the rotation age for harvest.)

Figure 11. Timber stand improvement includes tree injection to remove undesirable hardwood species on an individual basis.

Figure 12. Thinning in a pine forest improves stand growth, forest health, and overall stand quality by retaining the best trees for final harvest.

Figure 13. Overcrowding of pine trees can stress the stand, leading to insect attack by bark beetles (left) or deodar weevils (right).

Figure 14. Selective herbicides sprayed in a plantation after its first thinning killed these midstory hardwoods, releasing the pines to fully use site resources.

Best Management Practices

When conducting operations in forests, following certain guidelines will protect the environment. Most soils in Mississippi are highly erodible, so comprehensive best management practices (BMPs) are necessary to protect the soil resource and prevent sedimentation in streams, lakes, and rivers. Practices to prevent erosion during road construction include using water bars and turnouts to control water flow. Stream banks can be protected by installing culverts, bridges, and by establishing stream crossings for harvesting equipment perpendicular to the water flow.

In addition, buffer strips along streams and water bodies allow filtration of potential sediments before they reach the water. These are known as streamside management zones (SMZs). Besides protecting water resources, SMZs provide corridors of cover across forest landscapes for movement of many wildlife species.

The Professional Logging Manager (PLM) Program provides training about sustainable forestry, Mississippi BMPs, logging and transportation safety, and business management. The PLM qualification is required for loggers to haul wood to Sustainable Forestry Initiative-certified mills. This ensures

that logging professionals understand sustainable forestry practices and know how to implement environmental protections by using Mississippi BMPs.

BMPs cover proper management practices not just for timber roads and harvesting, but also for site preparation, tree planting, and operations in disturbed areas. It is important to note that Mississippi BMPs are voluntary. Voluntarily following BMPs has prevented government regulation at the state and federal levels. Periodic audits conducted by the Mississippi Forestry Commission (MFC) have shown that compliance with Mississippi BMPs exceeds 90 percent in all categories.

Multiple-Use Forestry

Forests are unique because they can be used in more ways than any other resource. A forest can provide timber, recreation, wildlife habitat, soil conservation, carbon storage, and water conservation—all at the same time and on the same land. We do not have to set aside areas for specific purposes, although forest managers sometimes do. Forests benefit people in many ways, so it is important to manage them for future generations to achieve multiple objectives. This is the goal of sustainable forestry.

4-H Forestry Opportunities

Involvement in 4-H Forestry can provide opportunities to increase forestry knowledge, improve leadership skills, make new friends, and have fun! Youth can participate in judging contests and multiple project areas.

4-H forestry judging contests are held at the local, statewide, and national levels for multiple age groups. Local contests are held as part of 4-H district project achievement days for members between the ages of eight and thirteen. Statewide contests are held at the annual Mississippi 4-H Congress for members between the ages of fourteen and eighteen. The winning team at the statewide 4-H Forestry contest earns the right to compete at the National 4-H Forestry Invitational at Jackson's Mill State 4-H Conference Center in Weston, West Virginia. For contest rules and training resources, refer to Mississippi State University Extension Publication 1991, *4-H Forestry Competition Handbook* online at extension.msstate.edu/publications.

There are a variety of 4-H Forestry topic areas related to the broad field of forestry. These projects can be used to add to the content of your 4-H record book, increase experience and knowledge, and provide opportunities for awards and recognition. As you explore 4-H Forestry, consider customizing your experience to match your unique interests.

4-H Forestry Projects

There are many forestry topics that you can develop into a project. Check with your 4-H leader to find out which project/record sheets are currently available and get copies of any reference publications listed for each project.

- Big Tree Contest
- Careers in Forestry
- Christmas Tree Production
- Collecting and Identifying Tree Leaves
- Collecting and Identifying Tree Seed
- Economic Benefits of Forests
- Firewood Production
- Forest Diseases
- Forest Fire Prevention
- Forest Insects
- Forest Mapping
- Forest Measurements
- Forest Recreation
- Nature Trails
- Orienteering: Navigating in the Woods
- Papermaking
- Products from Wood
- Reading Annual Rings
- Soil and Water Conservation
- Surviving in the Forest: Edible Plants
- Tree Identification
- Tree Planting
- Urban Forestry
- Wildlife Habitat
- Wood Identification

Additional Reading

MSU Extension publications are online at extension.msstate.edu/publications.

- P146 *Know Your Trees*
- P0160 *Tree Planting Is Easy*
- P1203 *4-H Forestry Project No.1 - Tree Planting*
- P1228 *4-H Forestry Project No.2 Big Tree Contest*
- P1250 *Forestry Terms for Mississippi Landowners*
- P1281 *Timber Stand Improvement*
- P1422 *4-H Forestry Project No. 3: Collecting and Identifying Tree Seeds*
- P1473 *4-H Forestry Project No. 7 - Measuring Standing Sawtimber*
- P1612 *Forestry/Wildlife Myths and Misconceptions*
- P1686 *4-H Forestry: Making a Tree Scale Stick*
- P1687 *4-H Forestry Project No. 8: Identifying Forest Insects and Diseases*
- P1991 *4-H Forestry Competition Handbook*
- P2179 *Ecology and Management of the Northern Bobwhite*
- P2233 *Streamside Management Zones and Forest Landowners*
- P2260 *Are My Pine Trees Ready to Thin?*
- P2283 *Prescribed Burning in Southern Pine Forests: Fire Ecology, Techniques, and Uses for Wildlife Management*
- P2466 *Ecology and Management of Squirrels in Mississippi*
- P2467 *Ecology and Management of Rabbits in Mississippi*
- P2470 *Managing the Family Forest in Mississippi*
- P2822 *Forest Soils of Mississippi*
- P3406 *Wild Turkey Ecology and Management for Mississippi and the Southeastern U.S.*
- P3508 *Geocaching in Natural Resources: Fun with Forests around Us*
- P3562 *The Economic Contributions of Forestry and Forest Products – Mississippi*
- P3597 *Wildlife Find Food in Pine Trees, Too*

References

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Notes

Notes

The information given here is for educational purposes only. References to commercial products, trade names, or suppliers are made with the understanding that no endorsement is implied and that no discrimination against other products or suppliers is intended.

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Revised by **James Shannon**, PhD, Extension Specialist I, North Mississippi Research and Extension Center, from an earlier revision by **Brady Self**, PhD, Associate Extension Professor, Forestry, and **James Henderson**, PhD, Professor and Head, Coastal Research and Extension Center. Written by John Kushla, PhD, Extension/Research Professor (retired), Andrew Londo, former Extension Professor, and Thomas Monaghan, Extension Professor (retired).

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