Timber Management
Cooperators:
Delta Wildlife, Inc.

Forest and Wildlife Research Center,
Mississippi State University

Mississippi Department of Wildlife,
Fisheries and Parks

Mississippi Fish and Wildlife Foundation

Mississippi Forestry Commission

USDA, Natural Resources Conservation Service

USDA, Farm Service Agency

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With forethought and planning, forest landowners can increase wildlife populations in their forests. But creation and maintenance of high quality habitat requires active management. There are a number of management practices that forest owners can use to increase and improve forestland wildlife habitat. Habitat management practices, such as thinning, that benefit quail, deer, turkey, and songbirds can also improve timber stand quality. Forest management is absolutely essential for maintaining populations of wildlife species like quail and rabbits that depend on early successional habitats. These species are not highly mobile, and forest-dominated properties that lack grassy habitats will not support species that require a diversity of native grasses and forbs.

Closed-canopy pine plantation
Notice the absence of grasses and forbs in the understory to provide food or cover resources for quail and other grassland wildlife. These stands are also devoid of high quality foods for other wildlife like deer or turkey.
Reducing tree density is the first step in developing the grass and forb ground cover so valuable to quail and other grassland species. Thinning reduces stem density and opens the forest canopy, allowing more sunlight to reach the ground and stimulating growth of ground-layer vegetation. In Mississippi, most species of pines can be commercially thinned for the first time at 13-18 years of age, depending on the site. Typical timber thins reduce basal area to about 70 ft²/acre, but thinning stands to a basal area of 60 ft²/acre or less produces better grassland wildlife habitat. If grassland wildlife habitat is a greater priority than timber production, a basal area as low as 30 ft²/acre will produce optimal habitat. In most cases, periodic thins will be necessary to maintain lower basal areas as trees continue to grow after each thin. Individual landowner objectives will vary, so consultation with a registered forester and a wildlife biologist can help you find the best balance that meets both your wildlife and timber objectives.
Established Stands

Just as thinning stimulates growth of grasses and forbs, it also releases understory hardwood brush and trees that will shade out desirable grasses and forbs if left unmanaged. Some form of periodic disturbance will be necessary to control brush invasion. Prescribed fire and diskng are two disturbance tools. When fuel conditions are appropriate for burning, thinned pine stands should be prescribe-burned during winter to early-spring. Prescribed burning should always be conducted by a certified prescribed burn manager, who will develop a written burn plan and obtain appropriate permits before burning. Check with your county Mississippi Forestry Commission office for more information about prescribed burning regulations. If prescribed fire is not an option, light diskng between thinned trees during fall or winter is an alternative for relatively clean sites. Always be especially cautious when diskng in woodlands to avoid damaging tree trunks and roots and to avoid personal injury or equipment damage. Soil disturbance, such as prescribed fire or diskng, enhances habitat quality for quail and other grassland birds because it inhibits woody brush growth, promotes favored seed producing plants, reduces plant residue, increases bare ground, and increases insect abundance. The plant communities that develop following fire or diskng also provide highly nutritious forage for deer, rabbits, and turkeys.

In the absence of soil disturbance, the plant community composition changes over several years, and annual plants are replaced by perennial forbs and grasses and eventually, woody plants. This change in plant communities is called succession. By planning soil disturbances on a 2– to 3–year rotation, you can manage succession and develop a complex of different habitats that meet the seasonal habitat requirements of a number of wildlife species. For example, first-year burn areas typically produce good quail brood cover, whereas second- and third-year burn areas provide better nesting cover. A rotational burning plan can be developed by creating 60-acre or smaller burn units and burning half to a third of these units one year, another half to a third the next year, and so on. Thus, a given unit is only burned every 2-3 years, but some portion of the property is burned each year. A rotational disking plan can be developed similarly. Disk a half to a third of suitable area each year in a rotational fashion so that all suitable areas are disked every 2-3 years.
Often, fire has been excluded from pine stands for so long that invasive hardwood species can no longer be controlled by low-intensity prescribed fires or disking. After thinning, if hardwood sprouts are abundant in the understory or midstory, it may be necessary to treat these stands with a selective herbicide such as imazapyr (e.g. Chopper®). Chemical control of invasive hardwoods is enhanced when prescribed fire is used during the dormant season following herbicide application (wait at least 6 months after application before burning to maximize herbicide effectiveness). Once these hardwood species are controlled with herbicide, future fire or disking treatments on a 2- to 3-year rotation should provide better control of hardwood invasions.

With some planning, you can protect some mast/fruit producing hardwoods and shrubs from prescribed fire and herbicide treatments. These scattered hard and soft mast producing trees and shrubs can provide food and cover resources for a diversity of wildlife. Invasive, exotic vegetation (e.g. kudzu, cogongrass) should also be controlled by herbicide treatment. Cogongrass, especially, is extremely invasive and seriously detrimental to native plants and wildlife habitat. Herbicidal control of all types of invasive vegetation will be more economical and effective if invasive species are treated when they first appear. Contact a forester or wildlife biologist to develop a plan for controlling invasive vegetation.
Established Stands

A good way to produce more grassland wildlife habitat in forestland is to create forest openings. For quail, 10% or more of forested acreage should be maintained in openings. These can be created in established woodlands by clear cutting 1– to 5–acre patches throughout forest stands. Openings can easily be created during commercial thinning of pine stands. Plan ahead and have your forester mark out forest openings when marking timber for thinning. For mid-rotation pine plantations, a better approach to developing openings is to create interconnected forest openings in a hub-and-spoke design. The hub-and-spoke opening consists of a central opening (hub) from which open lanes (spokes) radiate through the pine stand as if simulating a wagon wheel. Hub-and-spoke openings can be created by removing several adjacent rows of trees during thinning of a pine plantation. Hub-and-spoke lanes should be at least 30 feet wide to maintain grassy cover, and the maximum width of lanes will depend on how much timber acreage you are willing to remove from production (generally, the wider the lanes, the better). Hub-and-spokes can also be used as fire breaks for prescribed burning of mid-rotation pine stands. Forest openings can also be developed by widening or heavily thinning woodland roadsides and maintaining log-decks or skid trails used during timber harvests. Forest openings may also be used for permanent or rotational food plots planted to appropriate supplemental food crops and log-decks during timber harvests. Prescribed fire or disking on a 2- to 3-year rotation (described above) should be used to manage forest openings.
Clearcuts, and the subsequent plant communities that colonize a clearcut, typically provide good grassland wildlife habitat for 3-5 years after harvest. Replanting will typically be preceded by some form of site preparation. Use of prescribed fire and mechanical site preparation methods will stimulate a suite of annual weeds, legumes, and grasses that will benefit quail and other early successional wildlife species. Increasingly, herbicides are an important component of site preparation. Selective hardwood herbicides, like imazapyr, can increase pine growth and survival and inhibit development of a dense brush layer, thereby increasing the window of grass/forb plant communities early in the rotation. Use of herbicides for herbaceous control after planting should be restricted to banded applications along the tree rows. When regenerating a harvested stand with planted pine loblolly, slash, or longleaf pine seedlings, replant trees on an 8- by 10-foot spacing if quail and other grassland wildlife is your objective. Planting trees on a wider spacing allows maintenance of grassland habitat for a greater period of time before canopy closure of plantations. Rotational disking between planted rows in relatively clean sites can be utilized during the first few years after planting to maintain grassland habitat structure. Always be especially cautious when disking in regeneration sites to avoid damaging trees and to avoid personal injury or equipment damage. Where appropriate for the site, longleaf pine is much more conducive to grassland wildlife habitat management than other pines because longleaf can be burned at a younger age. Also, limb and leaf characteristics of longleaf pines generally allow more sunlight to reach the ground, thereby creating a more favorable environment for grasses and forbs. Longleaf pine seedlings can be prescribed-burned the year after establishment, but do not burn once seedlings begin height growth. After trees are greater than 6 feet in height, prescribed burning may be resumed (in well managed longleaf stands, these heights have been documented by the end of the third or fourth growing season). Consultation with a registered forester is recommended before burning young longleaf pine stands. As with other pine species, rotational disking between planted rows may be utilized to maintain grassland habitat structure when prescribed fire is not feasible.
As in established stands, a good way to produce grassland wildlife habitat in regenerated forest stands is to create forest openings. You can create forest openings by simply leaving some well distributed 1– to 5-acre unplanted patches of land when regenerating with planted seedlings. A better approach to developing openings in pine plantations is to create interconnected openings in a hub-and-spoke design. With the hub and spoke design, grassland habitat corridors can be maintained throughout the stand after the forest canopy closes. Without interconnecting forest openings, grassy openings within young pine plantations will become isolated and generally unusable for quail as the pine canopy closes. Hub-and-spoke openings can also serve as fire breaks to protect young plantations from wild fire and for prescribed burning in later years. These openings are also useful for log-decks during future timber harvests.
Converting former agricultural fields or pastures to pine forestland and managing for grassland wildlife habitat is accomplished in the same general way as regeneration of recently harvested forests. However, pine plantings at these sites should be preceded by site preparation to control herbaceous competition. This is especially true when sod-forming, exotic grasses are present at the planting site. The most common of these invasive, exotic grasses include fescue, bahiagrass, bermudagrass, and johnsongrass (cogongrass is less common but extremely invasive and seriously detrimental to native plants and wildlife habitat). These exotic grasses provide poor wildlife habitat and compete with growing seedling trees. Longleaf pine seedlings are especially sensitive to competition with invasive, exotic grasses. Eradication of these grasses will significantly improve longleaf seedling survival. Exotic grasses should be eradicated with an appropriate herbicide treatment, but the appropriate treatment differs depending on which exotic grass or grasses are present. Consult with your forester to develop an appropriate herbicide prescription for pine establishment in former agricultural fields. Once invasive grasses are controlled, these sites can be managed as recommended for forest regeneration sites. Wildlife habitat in these old field pine plantings may be further enhanced by planting native grasses and forbs between seedling rows after exotic grasses have been eliminated.

Longleaf pine seedling in an old bahiagrass pasture. Habitat in this former pasture could be improved by eradicating bahiagrass and allowing native grasses and forbs to recolonize the site.
Developing an integrated forest-wildlife management plan with a wildlife biologist and a registered forester can provide valuable assistance in the implementation of these practices for both wildlife habitat and timber management. A number of cost-share programs exist that can help with implementation costs associated with forest management practices. In order to successfully achieve management goals, clearly established objectives (forest-wildlife management plan) should be in place before consulting with agencies that administer cost-share programs. By planning ahead, programs and practices that accomplish management objectives and are financially sound may be selected.

Following is a brief summary of a few financial assistance programs available for private landowners.

The Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP), and Conservation Securities Program (CSP) are available for landowners with eligible production agriculture land. CRP provides conservation practices for field-level management, whereas EQIP and CSP are more oriented toward whole-farm management. While many of the same goals can be accomplished with each program, there are differences in eligibility and financial incentives under each.
program. If acreage is enrolled in an existing CRP pine woodland conservation cover, mid-contract management cost-shares are available for prescribed fire, herbicide application, and disking. Contact the county Farm Service Agency office for more information regarding CRP. If a whole-farm management program is applicable to the property, contact the county Natural Resources Conservation Service (NRCS) office for more information on EQIP or CSP. Forest management practices available through EQIP will depend on the county in which the property is located. Depending on land uses, multiple farm programs may be applied to optimize conservation and financial benefits.

The Wildlife Habitat Incentives Program (WHIP), Forest Land Enhancement Program (FLEP), and Forest Resource Development Program (FRDP) are available to any non-industrial private forestland owners. Contact the county NRCS office about WHIP or the county Mississippi Forestry Commission office for more information about FLEP and FRDP. These three programs provide cost-shares for forest management practices such as prescribed fire, herbicide application, and disking. The Mississippi Fish and Wildlife Foundation (MFWF) has a longleaf pine restoration program available. Contact MFWF for more information about their longleaf restoration program.
Landowner Assistance

The following agencies are available to provide wildlife and forest management planning or technical assistance:

Mississippi Department of Wildlife, Fisheries and Parks
www.mdwfp.com
Dave Godwin, 662.325.5119
State Office, 601.432.2400

Mississippi State University
www.cfr.msstate.edu
Wes Burger, 662.325.8782
Rick Hamrick, 662.325.5470

Mississippi State University Extension Office
msucares.com
www.naturalresources.msstate.edu
662.325.3176

Delta Wildlife, Inc.
www.deltawildlife.org
Trey Cooke, 662.686.3372

Mississippi Fish and Wildlife Foundation
www.wildlifemiss.org
Daniel Coggin, 662.256.4486 (Northeast Miss.)
Randy Browning, 601.296.1173 (South Miss.)

Mississippi Forestry Commission
www.mfc.state.ms.us
601.359.1386

Natural Resources Conservation Service
www.ms.nrcs.usda.gov

Area 1 (Northeast Mississippi)
Biologist: John DeFazio, 662.534.7651
Forester: Lynn Ellison, 662.844.2341

Area 2 (Central Mississippi)
Biologist: Jeffrey Lee, 601.965.4559
Forester: Ramsey Russell, 601.965.4559

Area 3 (South Mississippi)
Biologist: Barry Pessoney, 601.296.1173

Area 4 (Delta)
Biologist: Kevin Nelms, 662.453.7841

State Office
Biologist: Glynda Clardy, 601.965.4339
Forester: Alan Holditch, 601.965.4339

Photographs courtesy of:
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Andy Ezell
Rick Hamrick
Bobby Watkins
Shane Wellendorf
The 18.5 million acres of forestland in Mississippi are valuable lands that produce many renewable natural resource benefits, including timber, recreation, watershed, erosion protection, and wildlife.

Unfortunately, too many landowners are unaware of the many values their forestlands can provide them. For example, many people believe that unmanaged “natural” forests are best for game. Consequently, the average acre of Mississippi forestland produces less than its timber potential. Properly managed forests not only yield greater amounts of wood products, but they can provide high-quality habitat for many of the state’s most valuable wildlife species.

Always consider timber management and wildlife management together. In fact, many landowners today receive additional income from recreational leases as a result of their more diverse timber and wildlife management programs.

Timber companies have leased lands for hunting and related recreational access for many years, but only recently have private landowners begun to make money on the wildlife values their forestlands can produce. Managing forestlands for wildlife can be financially rewarding and personally satisfying.

Where To Start?
A common reason for unmanaged forestland is the landowner’s idea that it is too costly to begin a forest management program. The essential first steps are planning and making decisions to keep costs low.

Professional help is as near as your telephone and is often free. Many agencies, such as the Mississippi Forestry Commission, stand ready to help you identify your management goals and to help you plan activities to reach those goals. Timber companies and private consultants also offer these services. In this phase, you will write a management plan that states your goals for the property and a schedule of management practices you will need to help you meet them.

Once you recognize the need to put the plan into action, the practices you use can be whatever you desire or can afford. For example, if turkeys are a management objective, you will need to provide forest openings for nesting and brood-rearing habitat. You can do this by harvesting small areas, making fire lanes and access roads, or improving and maintaining existing forest openings. See the end of this publication for a list of professional contacts.

Wildlife Needs
Many of Mississippi’s wildlife species depend on the forest to live. Some, such as deer, turkeys, and squirrels, spend most of their lives in the forest. All wildlife have four basic needs: food, water, space, and cover. Generally speaking, wildlife will prosper in an area with many habitat types. A diverse forest habitat combines different timber types, age classes, and stand conditions in one area.

Some forest habitats already provide the diversity; but if your forestland does not, you can supply it in many ways, often with only minor efforts. Even-aged timber
management can provide diversity by locating different age stands of pine close to one another. For example, research has shown that properly managed clear-cut areas close to young and mature pine timber stands provide excellent quail habitat for a few years.

However, when developing a wildlife management program, it is important to look closely at nearby properties and consider how they will influence your wildlife program. This is a key element of forest stewardship and is especially true when managing small ownerships. For example, in a turkey management program it would be pointless to create openings in a small forest that is next to an existing excellent opening, such as an unimproved pasture.

Management Techniques
For many years foresters and wildlife managers have noted the value of forest openings for wildlife. Timber harvesting creates openings that may be large, as with clear-cutting, or small, as with selective harvests. Other disturbances, such as prescribed burning, can greatly improve wildlife habitat for many species and benefit timber production. By combining forest management practices in a management plan, you can aid wildlife while producing and improving valuable timber crops.

Cutting Methods for Regeneration
Forest regeneration cutting is the removal of all trees from an area to allow a new forest to grow. In clear-cutting, all trees are harvested at the same time, whereas in seed tree and shelterwood harvests, many high-quality trees are kept until the forest reestablishes naturally. These cutting techniques are used to harvest marketable crops of timber and to create the best environment for young trees to grow. Following a regeneration harvest, many sun-loving plants begin to grow in the opening. Animals like to eat these tasty, nutritious plants, and many of the plants make large amounts of fruit and seed for wildlife food.

Many landowners are concerned with the negative impacts of regeneration harvests on wildlife. However, negative effects can be reduced if you will consider the size, shape, and distribution of harvested areas in the harvest plan. Small (20 to 100 acres), irregularly shaped regeneration cuts next to larger stands of different ages will provide a diverse habitat for many wildlife species. You can use these methods to regenerate pine and hardwood stands.

Improvement Cuttings
During the natural development of a forest, young trees compete for all elements needed for growth. Some species or individual trees compete better than others and become dominant in the forest. The dominant trees in an even-aged forest are large and fast growing.

The purpose of improvement cuttings is to remove small, slow-growing trees in favor of fast-growing, high-quality crop trees. Foresters use improvement cuttings to upgrade the quality of a forest by harvesting crooked, diseased, insect-damaged, and slow-growing trees. Such harvesting creates space for crop trees to grow and allows more sunlight to reach the forest floor. The light aids the growth of many low-growing plants valuable for wildlife.

These wildlife benefits do not last, however, because in a few years the remaining trees will close the forest canopy again and shade out many of the forage plants that were established after the harvest. Later improvement cuts can be made to help wildlife and increase the stand’s timber value.

Remember, though, that some wildlife species need “den trees” for nesting and shelter. Therefore, when getting ready for improvement cuttings, it is wise to mark and keep several good den trees per acre. Den trees are food-producing species, such as oak, hickory, blackgum, beech, or persimmon. These will be useful to many wildlife species without a large decrease in timber production.

Prescribed Burning
Controlled fire is a useful tool in pine timber management. Pine trees taller than 20 feet will tolerate low-intensity fires that will top-kill small hardwood stems. Foresters use prescribed burning to control hardwood competition in pine stands. When fire is combined with thinning (improvement cutting), it increases the wildlife habitat value of pine plantations.

Hardwood stems sprout from the roots after prescribed burning, increasing the food supply for wildlife. Thinning increases sunlight and allows other forage plants to become established. The result is an increase in available food for deer, turkey, rabbits, and quail.

This improved environment is temporary. In 3 or 4 years the sprouting hardwood stems will be too tall to be valuable for food, and most forage plants will be shaded out as the forest canopy closes again. Repeat prescribed burning and thinning in pine stands from time to time to benefit deer, turkey, rabbit, and quail populations.

Prescribed burning is a valuable technique for wildlife and forest management, but you must use it properly and at the right time. Contact a forester and plan a prescribed burning program to meet your specific land management goals. Remember, fire can destroy a forest if used carelessly. Wisely used, however, prescribed burning is an effective, low-cost management tool that benefits both timber and wildlife resources.
**Forest Herbicides**
In recent years, forest herbicides have become a valuable forest management tool. Today’s forest herbicides are safe and economical to use in a forest management program. They are used in site preparation, stand improvement, vegetation control, and wildlife habitat improvement. Herbicides often are used in southern pine timber management.

Compounds have been developed that can be applied over the top of southern pines to control unwanted vegetation without hurting the pines. This has given new management possibilities. Forest herbicides also can help in managing hardwood stands.

**Firebreaks and Access Roads**
The foundation of a good forest management plan is a complete network of firebreaks and access roads. Foresters recommend these to landowners for forest protection, but because fire lanes and roads are openings, they also are important areas for wildlife.

Turkey, quail, and other wildlife will use fire lanes and roads for feeding, nesting, and brood-rearing, while deer will be attracted to them for food. Establishment of favorite wildlife foods, such as orchard grass and clover or other perennials, in fire lanes and along roadsides will improve wildlife benefits in these areas. Entry to roads and fire lanes, however, must be controlled with gates or chains so wildlife can use them safely.

**An Example**
Mr. Anderson works for a manufacturing company in a small city and in the next county has 85 acres of forestland he inherited from his grandfather. He wants to make some income from the timber but doesn’t want to sell any trees for fear of ruining his hunting opportunities. Turkey and white-tailed deer are his preferred species, but hunting gray squirrels is important, too.

His land has a 20-acre stand of young hardwood sawtimber along a stream on the east boundary and 45 acres of 25-year-old oak-pine timber. The remaining 20 acres are a 15-year-old pine plantation that has never been managed.

Mr. Anderson consulted a forester and developed a management plan to establish a few roads and firebreaks to provide access and fire protection for his property. These will also serve as wildlife openings, valuable for turkey brood-rearing areas, and as a food source for deer and rabbits.

An improvement cut in the hardwood stand that favors oak will help acorn production, and the oak crop trees will increase in size and value. He will take care to mark and leave several den trees per acre for gray squirrels.

He plans to thin the pine plantation for pulpwood to remove the poorest trees so more valuable trees will have space for further development. When the thinning is finished, he will use prescribed burning every third year to maintain the deer food supply and to provide areas for turkey nesting and brood rearing. He will do prescribed burning in late winter (February or March) to avoid turkey-nesting season. He also plans to thin his plantation again as soon as is practical, probably 6 to 8 years after the first thinning.

Mr. Anderson decided to manage the oak-pine for pine timber production, since his hardwood bottomland is a good source of mast for wildlife. However, on 1 acre near the pine plantation, he decided to keep some large oak and hickory trees as another food source.

The remaining oak-pine stand needed an improvement cut to remove the large hardwood trees and the inferior pines. After the harvest, he will use prescribed burning on this stand at the same time as the pine plantation, except for the wildlife food area previously marked.

As a result of this management plan, Mr. Anderson will receive extra income from his forestland and can expect more profits from future harvests. The forest he has created will increase in value each year, while providing high-quality habitat for deer, turkey, rabbits, and squirrels.

Forest management improves the forest environment for people, animals, and trees. Your forestland is valuable for the wildlife, timber, and other products and benefits produced there. Forest management will add to your pleasure and satisfaction from forest ownership as it increases your income.

**Glossary**

**Age class** - A group of trees about the same age, such as a 20-year or 7-year age class.

**Clear-cutting** - A harvesting and regeneration method that removes all the trees (regardless of size) on an area. Clear-cutting is often used with sun-loving species, such as pine. Clear-cutting produces an even-aged forest.

**Crop tree** - A tree identified to be grown to maturity and for final harvest. It is usually selected based on its location relative to other trees, quality, and species.

**Den tree** - Usually a mature tree used by wildlife as a home. Den trees are used by animals that need cavities to reproduce, such as woodpeckers, raccoons, and squirrels.

**Even-aged timber** - A forest of trees about the same age (usually within 10 years). An even-aged forest may be a natural or an artificially regenerated stand.
Firebreak (fire lane) - A natural or man-made corridor used to prevent the spread of fire. Firebreaks are created by the removal of trees, brush, and other vegetation.

Forest canopy - The layer of tree crowns in a forest.

Habitat - The natural environment of a specific plant or animal. An area containing all the necessary resources for the plant or animal to live, grow, and reproduce.

Management Plan - A written plan identifying short- and long-term management goals for timber and wildlife maintenance on a certain property.

Mast - The fruit of forest trees and plants (e.g., acorns, hickory and beech nuts, persimmons, and berries).

Plantation - An artificially forested area established by planting or direct seeding. It is usually made up of a single species.

Prescribed burning program - The consistent, periodic use of prescribed burning to achieve a management goal. A prescribed burning program may require burning every 3 years.

Pulpwood - Wood cut primarily to be converted into wood pulp to make paper or other wood-fiber products.

Renewable natural resources - Resources that can be restored over time through regeneration and improved management. Examples include forests, wildlife, water, and soil.

Sawtimber - Trees large enough to be sawed into lumber.

Seed tree harvest - Removing all trees from an area, except for 5 to 10 carefully selected seed trees. The seed trees are left to provide seeds to establish a new forest and are then harvested at a later time.

Selective harvest - Harvesting individually marked trees or small groups of trees based on their physical conditions or degree of maturity.

Shelterwood harvest - Removing trees on the harvest area by a series of two or more cuttings, so new seedlings can grow in the protection of older trees.

Stand - A group of trees with similar characteristics, such as a pine or hardwood stand or a sawtimber-size stand.

Thinning - Cutting in an immature stand to reduce the number of trees per acre. The remaining trees will grow faster and produce higher quality wood.

Timber type - A description of the main tree species in the forest, such as the oak-pine type or the slash-longleaf pine type.

Contacts

- Mississippi Forestry Commission - See telephone listing for county forester.
- Mississippi Department of Wildlife, Fisheries & Parks - P.O. Box 451, Jackson, MS 39205.
- Mississippi State University Extension Service - Contact your county Extension agent.
- Natural Resources Conservation Service - Contact local district conservationist.
- Private Consultants - Listings are available through the Mississippi Forestry Commission or Mississippi State University Extension Service.
- Board of Registration for Foresters - Roster available, Box 9681, Mississippi State, MS 39762.
- Forest Industry Landowner Assistance Programs - Contact nearest office of desired firm.
Prescribed burning is an important wildlife management tool used in our southern pine forests. Because these forests regularly experienced burns in the past, vegetation and wildlife have adapted to occasional fire and actually benefit from the effects of prescribed burning. Unfortunately, because of new pine management techniques and concerns about fire, many landowners are reluctant to use fire on their property. If done correctly, though, prescribed fire can be an effective, safe, and affordable management tool.

Benefits to Wildlife
If used properly, fire is one of the most beneficial and cost-effective wildlife habitat management tools available. For example, annual burning maintains early stages of plant succession that bobwhites require. Fire reduces leaves/needles (litter) on the forest floor and exposes soil so bobwhites can easily find seeds. It creates open foraging and travel areas for hens with young chicks, and it encourages plants that provide food (insects and seeds) and cover for bobwhite. Fire also acts as fertilizer by removing vegetation and litter, returning many nutrients to the soil.

For bobwhites, patchy burns are best. Some “ring-arounds” (circular areas plowed around and protected from burns) provide nesting and escape cover across burned areas. It is generally best to burn in late winter before the bobwhite nesting begins in April.

The wild turkey enjoys many of the same benefits from fire that bobwhites do. Burn before April to avoid nesting season, but burn less frequently (every two to four years). Fire produces nesting cover and maintains forest openings in quality brood-rearing habitat.

Burning every three to five years increases white-tailed deer forage production and quality. It also maintains forage close to the ground, well within a deer’s reach. Burning top-kills hardwood brush and promotes sprouting of browse species. Winter burns are normally best for deer management.

A partial list of species suffering from the declining use of fire includes the bobwhite, wild turkey, white-tailed deer, gopher tortoise, and red-cockaded woodpecker. Populations of other birds, mammals, reptiles, and amphibians also have declined in the absence of fire.

Important Prescribed Burn Techniques
Backfire - A backfire is set at a 90-degree angle to the wind direction so the fire burns directly against the wind. This is one of the safest methods of prescribed burning and is recommended for beginning wildlife managers or where there are fire hazards, such as adjacent lands with high danger fuels. Wind speed should be no more than 6 to 10 mph. At night, backfires normally move about 1 chain (66 feet) per hour. If the wind speed is 20 miles/hour, the fire will back twice as fast (132 feet/hour).
Head fire - Head fires are set with the wind direction and should only be used by experienced professionals under ideal fuel conditions. Often set after a rain, head fires are the most economical and the most dangerous type of prescribed fire. Head fires burn quickly, have a taller flame, and can kill even large pines if used improperly. If used properly, they are very effective at maintaining early successional wildlife habitat.

Flank fire - Flank fires are often used when the fuel is relatively light. These fires are set by an individual or individuals walking into the wind and are relatively safe.

Spot fire - Ideally, spot fires are set at equidistant locations throughout the forest. These fires gradually expand until they join.

Expense and Equipment
Prescribed fire is one of the most economical wildlife management tools available. Burning costs vary with tract size, application method, manpower needed, equipment used, and timber/fuel conditions.

Never burn without either a bulldozer equipped with a fire plow, or a tractor and disk. Other required equipment includes drip torches, fuel (a 3:1 mix of diesel and gasoline), fire rakes, flappers, and water. Costs range from $5 to $25 per acre. Consulting foresters and the Mississippi Forestry Commission (MFC) will conduct burns for a fee.

Burn Permits and Applicator Certification
Currently, the Mississippi Forestry Commission (MFC) requires you to get a permit before burning. Contact your county MFC office for permit information. If conditions to burn are not favorable, the burn permit will not be granted. Also, burn applicators should be certified by the MFC. You also can be certified by completing the prescribed burning short course conducted by Mississippi State University’s Continuing Education program, located in the College of Forest Resources. Under the current Mississippi Prescribed Burning Law, all who satisfactorily complete the course will have reduced liability.

Steps to Conducting a Prescribed Burn:
- Get burn applicator certification.
- Map and develop a plan for the area to be burned. Have the plan notarized at least 10 days before the burning date.
- Arrange for equipment and personnel.
- Build fire lanes around the tract within 1 month of the burn.
- Determine wind speed and direction, humidity, temperature, and firing technique.
- Notify neighbors of your plan.
- Recheck fire lanes, and recondition them if necessary.
- On the burn day, get a permit from the MFC.
- Conduct the burn.
- After the burn, check all boundaries for "breakovers" (escaped fire).
Overview of Silvicultural Practices and Wildlife Habitat

Most woodlands, or forests, are composed of forest stands that may vary in size from a few acres to 100 acres or more but are sufficiently uniform in age, composition, and site to be recognized as a separate unit. When discussing wildlife management on forest or woodland areas, we often speak of the influence of forest management practices and these are important at a large-scale level, but it is imperative we understand that the real influence of forest practices is accomplished by modifications at the stand level; these modifications are collectively called “silvicultural” practices. They involve practices such as stand regeneration, thinning, improvement cuts, burning, and fertilization. Forest management on the other hand involves planning and scheduling for all the stands, which involves economic and biological considerations. It should also be realized that silvicultural practices are simply tools used to modify stands to meet the objectives of the owner and are just as valid for wildlife habitat improvement as for timber management. The basic requirements for wildlife are food, cover water, and space. In a forested environment, silvicultural practices are used to enhance or modify one or more of these requirements and therefore enhance the habitat for selected species.

When managing a forest for a variety of wildlife species, habitat diversity is the key. While silvicultural practices can and should be used to create or maintain diversity at the stand level, the emphasis for most owners should be on diversity at the forest level by manipulating individual stand conditions to create a mosaic of habitats across the landscape. Creating or maintaining variation in structure (height differences) of the vegetation is one of the most important aspects of habitat management for a variety of wildlife species. Number of wildlife species and individuals tends to increase with structural diversity. Within-stand structure, even in plantations, can be obtained by practices such as leaving of snags and legacy trees, proper use of streamside management zones (SMZs), and use of wildlife habitat zones or corridors. Landscape diversity is assured by using natural features of the property to create or maintain stands in a mosaic across the property that differ in age, size, and species composition.

In discussions of the relationship between silvicultural practices and effects on wildlife habitat, one important point that is often overlooked is that a given practice does not always affect habitat, even for a given wildlife species, in the same way. Effects of the practice will vary depending on such variables as site, timing of application, location in relation to other stand treatments, arrangement or layout of the stand, and intensity of the operation (e.g. completeness of the clear cut or severity of a thinning). For example, small clear cuts or heavy thinnings in the interior of a large forest may be very desirable for wildlife species needing open or early successional types, and may have little or no effect on species requiring closed canopy or late successional forest types. On the other hand, these same type harvests applied at the edge of the forest may not benefit or even be harmful to some of the same wildlife species benefiting from the harvests in the forest interior. This could happen, for example, to some bird species because of nest predation in areas near the edge of the forest.

Perhaps the most important point to be made is that management of a forest for forest products and for wildlife habitat are very compatible and, in fact, are
inseparable. Furthermore, managing for wildlife habitat most often can be done at little or no reduction in returns for timber management. Silvicultural practices used for timber management are also effective for wildlife habitat management in that they may manipulate such things as landscape diversity, stand structure, plant succession and diversity, and edge effects. However, when managing for both, the choice, timing, and intensity of a silvicultural practice must be based on an understanding of the requirements of the targeted wildlife species as well as a knowledge of the effects on stand ecology and development.

The purpose of this chapter is to describe various silvicultural practices and stand conditions, their relationship to wildlife habitat, and how they can be used to maintain or create desirable wildlife habitat.

The Importance of Planning

As previously stated, silvicultural practices are the tools used for wildlife habitat management in forested landscapes. All silvicultural practices benefit some wildlife species but can be detrimental to others. Furthermore, silvicultural practices can be designed to benefit or improve the habitat for any wildlife species. The do this, one must understand the effects of silvicultural practices on the environment and when and how they should be used to accomplish the desired objective.

If a landowner wishes to manage a forest area for wildlife or for a combination of timber and wildlife, they must be prepared to do a considerable amount of planning and preparation. They must first: (1) establish their objectives as to the wildlife species they wish to favor, (2) know or establish the habitat requirements of those species as to cover, food, and water in local and landscape areas, (3) determine if these requirements are present or can be established on the property by silvicultural manipulations, and (4) determine if these habitat requirements are compatible with requirements or goals for timber production. The best way to assure that this type of preparation and planning is done in a way to accomplish the desired objectives is to prepare a forestry/wildlife habitat management plan. Such a plan is nothing more than a process of using maps and a knowledge of the existing forests and property to develop a planning and scheduling process that is tied to the land, i.e., it will allow you to document the exact type habitat you want to create, where you want it created, and when it will be created. For small holdings, grid or topo maps may be adequate for the planning process, but a geographic information system (GIS) greatly improves the planning process on large holdings.

Even with the best planning and implementation, unexpected results can sometimes occur. For that reason, it is important that the management plan provide provisions for monitoring the results of practices used on the forest. Monitoring will provide landowners or managers with information on how successful they have been in their management practices and will indicate where modifications may be needed in the future. Landowners can obtain assistance in developing management plans from state agencies such as Fish and Game Departments, Forestry Commissions or Departments, and State Extension Services.

Management plans are usually developed for periods of 5-10 years and specify the timing, spatial location, and type of silvicultural operations to be used to maintain or create the desired habitats. The following sections give information on commonly used silvicultural techniques and how they can be used to improve wildlife habitat as well as timber production.

Common Silvicultural Practices

Mississippi has approximately 19 million acres of forest land of which 6 million is classified as pine type, 3 million acres as
oak/pine, and 10 million as hardwood type. Silvicultural practices normally used for hardwood stands are very different than those used for pine stands – the major difference being in the regeneration methods used. Most pine stands are now regenerated using artificial methods, i.e., planting of seedlings, while hardwoods are regenerated by natural means, i.e. seed or sprouts from trees on the site. The silvicultural practices discussed below may be appropriate for both pine and hardwood stands, but the way they are used and the effects on the resulting stands may be quite different.

Forest Type Conversion

Of all forest practices, the one that has the most influence on biodiversity and therefore on wildlife habitat is conversion of natural pine stands, mixed pine-hardwood, and hardwood stands to pine plantations or agricultural crops. It is worth noting that Mississippi now has more acreage in pine plantations than in natural pine stands, and most of the conversion currently occurring is from natural pine or mixed pine-hardwood to pine plantations. Extensive conversion of bottomland hardwood stands to farm land occurred in the past, primarily in the Delta, but the trend is now reversed. As a result of Federal programs such as the Conservation Reserve Program (CRP) and Wildlife Reserve Program (WRP), the acreage in bottomland hardwoods is now increasing.

On a landscape basis, conversion of a limited amount of upland area to pine plantations may be beneficial to wildlife habitat, especially in the early stages of stand development. However, if widespread and done on large areas it will reduce both within stand and landscape diversity. This is especially true if accomplished by intensive site preparation as discussed below.

Clearcutting/Site Preparation/Planting

Clearcutting with site preparation and planting of pine seedlings is the most common form of stand regeneration on upland sites. It is a form of artificial regeneration as opposed to natural regeneration that depends on seed or sprouts from an existing stand rather than nursery-grown seedlings. The thing that really makes it so different from other regeneration methods, in terms of effects on wildlife habitat, is the use of site preparation methods to modify the site and control vegetation that may compete with the planted seedlings.

A variety of methods are commonly used alone or in combination for site preparation. These methods include, in order of increasing intensity, burning, herbicides, chopping, disk ing, shearing and piling, and bedding. If the objective is to favor a variety of wildlife species, less intensive methods of site preparation such as burning are probably more favorable than more intensive methods such as piling and burning or bedding. The less intensive methods may kill much of the existing shrubs and ground cover, but they often just hold it in check by top kill, allowing plants of an earlier stage of succession to become establish and flourish at least for a time. The more intensive methods not only destroy more of the ground flora and understory species and their ability to regenerate but they also reduce structural diversity and hasten development of the pine stand and crown closure which further reduces the growth of subordinate vegetation. However, even the most intensive forms of site preparation may be beneficial, at least in the early stages of stand development, to some wildlife species such as white-tailed deer, quail, rabbits, and turkey that require open conditions and early successional stage plant species.
Clearcutting With Natural Regeneration

Southern hardwoods, both upland and bottomland, are commonly regenerated by clearcutting. The method is very successful in regenerating hardwood stands, but the problem is in controlling composition and obtaining the desired species in the next stand. For wildlife habitat and timber production it is usually desirable to obtain the hard mast species such as oaks. Successful oak regeneration usually depends on the presence of advance regeneration (seedlings) at the time of harvest, and the larger the seedlings the greater is the probability of success. If advance regeneration is not present, the harvest should be delayed until it can be obtained.

If a sufficient number of oak seed trees are present, light is most often the limiting factor to establishment of advance oak regeneration beneath a stand. With a good acorn crop, thousands of seedlings per acre may be produced but with insufficient light they will survive only one or two years. Light to the forest floor can be restricted in very dense stands by the main tree canopy, but in most stands light is restricted by thick midstory and understory canopies. Establishment of advance oak regeneration can often be obtained by control of the lower canopies, either by harvesting or injection with herbicide. However, this operation should be timed with a good acorn crop and can be done before or soon after the acorns have germinated.

Used properly, clearcutting can be an excellent tool for hardwood management and for improving wildlife habitat. Control of large woody material by cutting or injection may be necessary in some cases but site preparation usually is not needed. Herbaceous and woody plants are quickly re-established on the site, thus providing browse for white-tailed deer and food and cover for many other wildlife species. For regenerating most desirable hardwood species, the key to success of the clearcutting method is a thorough evaluation to determine if the regeneration potential is adequate. This usually means presence of adequate advanced regeneration (seedlings/saplings) of the desirable species. If the advanced regeneration is not present in sufficient numbers, steps must be taken to secure it before the final harvest is made.

Clearcutting with natural regeneration is not often used for pine regeneration, although it can be very effective and was used extensively in the past. The method is used in several ways. One way is to clearcut small patches or strips, use controlled fire to reduce the logging residue and prepare a seedbed, and allow seeding from adjacent uncut stands. Another use of the clearcutting method is the “seed in place” technique where a prescribed fire is used to prepare a seedbed, pine seed are allowed to disperser from the trees to be cut, and the trees are then removed. A variation of the seed in place method is the “seedling in place” method where the seedbed is first prepared by burning, seed are dispersed from the trees and germinate to produce small seedlings, and the trees are then removed.

The major advantage of this type of regeneration over those using intensive site preparation is that the native herbaceous and woody vegetation is quickly re-established to produce food and cover for many wildlife species. Also, stands produced in this way are much more likely to be a mixture of pine and hardwoods. For timber production, the disadvantage may be that it will not produce the maximum product value.

Shelterwood/Seed Tree Regeneration

These are regeneration methods generally using natural regeneration in which the stand is removed in two or more harvest cuts. The two methods are similar except that far fewer trees are left in the seed tree method and it is always done in two harvest
cuts whereas the shelterwood method may be done in two or more cuts. The major advantage of these two methods as compared to clearcutting is that the establishment of regeneration can be assured before the final harvest that removes the seed trees.

The shelterwood method is very often the most dependable way to regenerate hardwood stands, especially if sufficient advance regeneration is not present to justify a clearcut. Normally, the first step in the shelterwood method is a seed tree cut, which is similar to a heavy thinning, to open up the stand for seedling establishment. If there is a midstory/understory of shade tolerant species that are undesirable, it will probably be necessary to cut or inject that material before or soon after the new seedlings germinate. Furthermore, the seed cut and midstory control should be timed with a good acorn or seedling crop. If the acorns or seedlings are not present at the time these operations are done the probability of success is greatly diminished. Once the new seedlings are well established, two-to-five years after the seed cut, the residual stand can be removed in one or more harvest cuts.

For heavy-seeded species such as the oaks, the seed tree method of regeneration is not appropriate in that seed distribution may not be sufficient to cover the area. For hardwoods with wind-blown seed the method may have some use but they can generally be regenerated just as well by clearcutting and there is no danger of losing the valuable seed trees to wind or lightning.

Southern pines can be regenerated by both the shelterwood and seed tree methods, but the shelterwood method is preferred for longleaf pine while the seed tree method is used most often for the other pine species. The first step in initiation of the seed tree method is a harvest that removes all except 3-to-10 trees per acre, depending on tree size and history of seed production and expected competition for the newly germinated seedlings. The second step is some form of site preparation, usually burning although mechanical and chemical site preparation can be used, to control competition, reduce logging slash, and prepare a seedbed. If feasible, the seed trees can be removed 1-to-3 years after the new seedlings are established. The shelterwood method differs from the seed tree method in that more seed trees, often 20 or more, are left after the first harvest and the seed trees may be removed in more than one harvest after the seedlings are established.

With shelterwood/seed tree methods and natural regeneration, less emphasis is placed on intensive site preparation than with clearcutting and planting so there is a greater probability of maintaining native ground cover. With pines it is also likely that the new stand will contain a higher proportion of hardwood species. These differences may make the natural regeneration methods more attractive for some wildlife species. Also, regeneration costs may be far less with the natural methods, but production of commercially valuable material may be slightly reduced.

A variation of the shelterwood method, called irregular shelterwood or two-aged management, is gaining increased use across the south especially for hardwoods. After regeneration is established, a few of the more vigorous shelterwood trees, possibly 10-20 per acre are selected for retention and the remainder are harvested. These retained trees can be harvested at the first entry into the new stand or can be allowed to grow for the full rotation. A similar technique can also be used with clearcutting when adequate advanced regeneration is present. In this case vigorous trees of a desirable species, usually in the smaller age/size class, are picked for retention and all other trees are harvested. This technique can be very beneficial for many wildlife species in that structure is retained in the stand throughout the rotation and if mast producing trees are left seed
production will occur much sooner. The technique is also financially attractive in that the trees that are left may be relatively small and have very little value, but at the next entrance into the stand they may be of much higher value for sawtimber.

The shelterwood method, particularly when used for hardwoods, may have some wildlife habitat advantages over clearcutting, especially for deer. The shelterwood method may involve two or more harvests, and each time a removal cut is made understory plant succession is retarded, an environment for early-successional plants is created, and availability of browse plants is extended.

Uneven-Aged Silviculture

Uneven-aged stands contain mixtures of at least three age classes (cohorts) that are in competition with each other throughout the stand. These stands are created or maintained by removing single mature trees (single-tree selection) or groups of trees (group selection) usually covering one-half acre or less in size, and thinning if necessary in the remainder of the stand to maintain the proper size class distribution. The uneven-aged method of silviculture is best suited for use in forest types that contain at least one tolerant species that is highly desirable for management, e.g., sugar maple in northern hardwood forests. However, the method can be, and has been, used for both southern pine and southern hardwood forests, but management efforts tend to be far greater than for even-aged silviculture, especially in regards to obtaining adequate regeneration of the desirable species since pines and most desirable hardwoods are relatively intolerant.

For pines, successful use of the uneven-aged method often requires intensive control of more tolerant competing hardwoods and the control will most often have to be done with herbicides. Fire can be used at certain times in uneven-aged stands but not as frequently as in even-aged stands because of the presence of younger age classes that can be destroyed by the fire. It will take several cutting cycles to convert an even-aged stand to an uneven-aged stand, but once converted it has the advantage of giving a relatively even flow of forest products over time. There is some evidence that the products produced may be more valuable than from even-aged stands.

Most bottomland hardwoods that are desirable for timber or wildlife are fairly intolerant of shade, so use of the uneven-aged method is difficult in these stands because it creates conditions that are more favorable to tolerant competitors. Regeneration must be obtained in a similar manner as for even-aged stands, and once established it must be released as needed to assure survival and a competitive growth rate.

Uneven-aged stands, because of the multi-layered canopy, have often been recommended as providing the very best wildlife habitat and that may be true for species such as squirrels and some native and migrant songbirds, but that type of habitat may not be best for game species such as deer and turkey.

Thinning/Improvement Cuts

Thinnings are harvests made to reduce the density of the growing stock and promote the growth of the remaining trees. Improvement cuts are designed to upgrade the residual stand by removing trees of less desirable species and trees of poor form or vigor. Harvests in hardwood stands before the final harvest are almost always a combination of thinning and improvement cuts and the two are often combined in pine stands. Thinings improve wildlife habitat by maintaining or increasing plant diversity in the understory and ground flora. Opening of the canopy permits more light to reach the forest floor and allows pioneer species to be maintained or to re-invade while
promoting the growth of those species and late successional species.

Numerous techniques have been developed for thinning in forest stands. The two most common techniques are row or strip thinning and selective thinning. Row thinnings are often used as a first thinning method in pine plantations with good row integrity, and strip thinnings are used in natural stands and plantations where rows are not easily determined. A common practice for row thinning in pine plantations is to remove every third or fifth rows and selectively thin within the leave rows to remove the less desirable stems and those likely to be lost to natural competition. Row thinnings are generally not used in older pine stands where future crop trees have already been determined by natural developmental processes within the stand. Row thinnings and strip thinnings are generally not used in hardwood stands.

**Prescribed Fire**

Fire, either wildfire or intentional burning by native Americans or European settlers, has always been a part of the ecology of southern upland forests. Native Americans used fire as a wildlife management tool and European settlers used it to improve grazing for domestic livestock. Prescribed fires enhance wildlife habitat primarily by controlling plant succession. Many plant and animal species in the South have evolved as a result of frequent burning, and they can not persist when the environment is altered by natural plant succession. Prescribed fires control woody vegetation, release nutrients, produce sprout growth that is more palatable and digestible, and increase seed germination of many desirable plant species, including legumes, forbes and grasses. In addition, the vegetation produced as a result of the fires attract an abundance of insects that are an important food source for quail, turkeys and other birds.

A distinction should be made between fires used for site preparation and site clean up following harvest and prescribed fires used underneath a stand of trees. Site preparation fires are usually very severe (hot) and may consume 80% or more of the available organic fuel. Site preparation burns may be done at any time of the year but are typically used in the summer or fall before planting in the winter. Prescribed fires are far cooler and typically consume less than 50% of the available fuel. They are usually employed in the winter months when fuel and soil moisture levels are moderate to high. Prescribed burning is most effective for establishment and maintenance of wildlife plants when combined with a thinning program that provides more light to the forest floor.

Prescribed burning can be a valuable tool for forest and wildlife management, but it must be used at the right time of the year and under the proper weather conditions to obtain the desired results and not damage the resource. If you are not familiar with the use of fire you should seek the advise of a professional forester or biologist who is experienced in the use of fire. Burns are normally conducted in the winter months and are done within a few days after a rain to insure proper fuel and soil moisture conditions. Provided fuel moisture is desirable, the best days for a burn occur when there is a slow steady wind from the same direction. These conditions will assure that the surface layer of pine needles, grass, and low shrubs fuel the fire but the lower organic layer is not destroyed. The burn should be initiated by starting a “back fire” on the downwind side of the property that burns slowly into the wind. Once the back fire has burned a sufficient distance to establish an adequate fire break, a “head fire” can be started from the opposite side of the property.

Burning schedules can be tailored to create or maintain a favorable habitat for the desired wildlife species. For example, a winter burning schedule of one-to-two years
will maintain a habitat favorable for quail and turkeys whereas a schedule of three-to-five years may provide more browse and cover for deer. Summer or growing season burns may be beneficial in some cases, for example where it is desirable to kill much of the woody vegetation rather than simply killing the top and allowing it to sprout. By converting the understory from primarily woody vegetation to grasses and herbs, an excellent habitat can be created for early successional wildlife species such as quail. Regardless of the wildlife species to be favored, a burning schedule should be developed for the entire property that specifies areas to be burned each year and the timing of the burn. Assistance in preparing such a plan can be obtained from State Forestry and State Wildlife agencies or from consulting foresters and wildlife biologists.

In the past, fire was considered to be detrimental to production of quality hardwoods and great efforts were made to keep it out of hardwood stands, both upland and bottomland, primarily by use of plowed fire breaks that are expensive to maintain and often lead to undesirable environmental effects such as erosion and deposition of sediment into streams. We now know that prescribed fire can be used effectively in mixed pine-hardwood stands and in upland hardwoods for forestry and wildlife management purposes. With upland hardwoods fire has proven to be a useful tool for maintaining or increasing the oak component of the stand. Fire will top kill oak seedlings and saplings, but oaks tend to have a very vigorous root system and will sprout more vigorously than many of their woody competitors.

Bottomland (floodplain) hardwood sites and upland wet sites supporting hardwoods have generally been protected from prescribed fires by use of plowed fire breaks. However, except under extremely dry conditions, these sites will not support a fire because of the high soil and fuel moisture levels and the nature of the hardwood litter and ground cover. Most foresters and wildlife biologists now believe there is no need for the fire breaks and that it is best environmentally and ecologically to simply let the fire burn into the wet hardwood areas until the fuels will no longer support a fire.

**Fertilization**

Trees on most forest soils in the south will respond to addition of nutrients, primarily nitrogen, but some soils are lacking in other nutrients especially phosphorous. Fertilization is now a common practice in pine plantations especially for short rotations on industry lands. However, it should only be used after soil testing to determine if there is a sufficient deficiency and to obtain a recommendation for nutrients to add.

If fertilization is used, timing of application is important. If added when the trees are too young and do not have a large root system, the nutrients may be captured mostly by competing vegetation. Most recommendations for fertilization call for application at about age 3-to-4 and/or in connection with thinnings, primarily the first thinning in the stand.

Soils lacking in nutrients produce poor quality deer browse and the deer produced will have low body weights and be in generally poor condition. Fertilization of these soils before crown closure and at time of thinning will produce ground flora and understory plants of superior browse quality for deer and food and cover for other wildlife species. In general, most wildlife species will benefit from fertilization of forest stands on nutrient deficient soils.

**Integration of Wildlife and Forest Management**

The above section gives brief information on common silvicultural methods and techniques used in the south. All can have benefit for management of wildlife habitat,
depending on circumstances. It should also be noted that all can be modified and tailored to be more specific in addressing wildlife management needs, and that most often this can be done at little or no cost to timber production. These modifications are implemented at both the stand and forest (landscape) level and are based on a consideration of stand and forest conditions, such as stand size, stand age arrangement, edge effects, plant succession, stand structure, and plant diversity that are known to influence habitat for most wildlife species. The following section presents some more common examples of how these modifications can be done.

**Modifications For Pine Plantations And Natural Stands Of “Pure” Pine**

*Size, shape, and arrangement of regeneration areas:* This discussion primarily concerns forest game species and most other native wildlife species occurring in the south; larger areas larger areas with less edge effect may be preferred for some wildlife species such as some neotropical birds.

The size and shape of clearcuts or regeneration areas determine their usage by wildlife. The center portion of very large regeneration areas may be relatively unused by wildlife. Even the very mobile animals such as deer may use only the outer portions near wooded areas. In addition to providing greater usage of the food resources, use of smaller clearcuts provides more edge effect and therefore more plant diversity than use of large clearcuts. In general, long narrow or irregular shaped regeneration areas offer better habit than square or circular areas.

If regeneration areas are established in the form of square blocks or circles, it is probably best to limit their size to about 40 acres. Elongated regeneration areas can be much larger in size, perhaps 100 acres or more, and still provide good usage of the food resource and create better edge effects. Also, the long narrow areas may provide more territories and home ranges for animals and allow them to benefit from the food resource and proximity to cover.

Although there is disagreement among wildlife biologist about placement or arrangement of regeneration areas, it is probably best for most game species in the south to stagger or disperse the regeneration areas so that you do not have large areas of the same or nearly the same age class. One practical way that this has been done is to assure that adjacent regeneration areas differ in age by at least five years. This practice assures proximity of areas of different successional stage and provides great diversity across the landscape. However, it may result in a somewhat fragmented landscape that may not be desirable for some wildlife species.

*Planting at lower densities:* Ideas and recommendations for plantation spacing have varied greatly over the years and there is still wide variation in the spacing used. A spacing of 6’ X 6’ was very common at one time and plantings of 8’ X 8’ are still used, although wider spacings seem to be preferred. For timber production, the choice of spacing is best determined by the products to be grown and the markets for products such as pulpwood. Present market conditions may dictate wider spacings since pulpwood supplies exceed demand. Generally, wider spacings (lower densities) are best for wildlife because of greater light penetration through the canopy that permits better growth of desirable plants for food and cover.

*Buffer zones, streamside management zones (SMZs), and wildlife corridors:* Separation of regeneration areas, even though they may differ somewhat in age, by buffer strips of uncut timber (100 feet or so in width) greatly enhances diversity of habitat and provides travel corridors between fragmented habitats. Some timber harvesting can be done in these corridors at the time of the regeneration cut to remove
mature timber or high value trees likely to be lost before the next harvest in the younger stands. However, efforts should be made to minimize equipment travel in the corridors and damage to the ground flora and understory vegetation since they are so important as a food source and for protection of smaller animals.

SMZs are strips of vegetation left adjacent to streams or other bodies of water primarily as filter strips for the protection of water quality. However, they may also serve a very useful purpose in enhancing wildlife habitat. As with buffer strips, they provide travel corridors and enhance plant diversity, but they may, because of the water source, also provide the unique habitat needed for many smaller animals with limited home ranges. State Best Management Practices (BMPs) specify the minimum size of SMZs based on stream size and topography, and the type of harvest activities permitted in the SMZs. Some harvesting is permitted in the SMZs, but for protection of both water quality and wildlife habitat, equipment use and crossing of the SMZ should be limited. For wildlife habitat improvement, it may be desirable to increase the size of the SMZ over that specified by State BMPs and/or to limit the amount of harvesting in the SMZ.

In larger regeneration areas where refugia or travel corridors are not provided by SMZs, it is highly desirable to leave strips of relatively undisturbed vegetation across the area. These strips are sometimes referred to as Habitat Management Zones (HMZs) and should be on the order of 50-to-100 feet wide. Some harvesting can be done in the strips but again it is important to create as little disturbance as possible. One very good use of HMZs is to extend SMZs or connect SMZs so that there is a continuous corridor across the regeneration area.

Seedling of disturbed areas: Timber harvesting almost always results in soil disturbance and exposure of mineral soil along roads, logging or skid trails, and on loading decks. Compliance with state BMPs requires that these areas be treated, including establishment of ground cover, to minimize erosion and maintain water quality. Seeding and establishment recommendations vary widely, but some involve the seeding of non-native material and/or material that has no value for wildlife. Establishment of native ground cover, including native warm season grasses, will be most beneficial to wildlife. A wildlife biologist or other natural resource professional should be consulted for the best mixture for seeding in your area.

Woody debris/logging residue: For purposes of nutrient cycling and site improvement, it is generally best to leave woody debris and logging residue scattered uniformly over the site rather than concentrated at the logging deck or other places on the site. Leaving the material, especially some of the larger material, on the area is beneficial to many animals, especially salamanders and small mammals that use it for dens, nests, foraging, and cover. However, leaving some piles of tops and larger material will provide cover for species such as rabbits, quail, and other birds and will not decay as rapidly as the scattered material. The piles can be left anywhere in the harvest area but are best left near edges, bodies of water, or food sources.

Modifications For Bottomland Hardwood Stands

Most bottomland hardwood stands are managed using natural regeneration methods and long rotations for the production quality sawlogs, so fewer modifications for wildlife habitat may be needed than in pine stands.

Preparation For And Supervision Of Harvest Operations

Most logging contractors can conduct the silvicultural operations described above effectively for timber production, but are generally not aware of modifications that
may be desired for improving wildlife habitat. It is therefore imperative that the landowner or manager take the necessary steps to assure that the operation accomplishes the desired objectives for wildlife habitat and timber production. These steps in preparation and supervision of the operation should begin long before the harvest contract is awarded and continue even after the harvest until all objectives are accomplished.

Landowners not familiar with preparation and supervision of timber sales would be well advised to secure the services of a consultant forester and wildlife biologist. These professionals can handle, in cooperation with the landowner, all details of the sale from initial inventory/marking, to layout of the sale area, preparation of the sales contract, advertisement of the sale, supervision of harvest operations, and close out of the tract after harvest. Consultants can receive payment for their services in different ways but the most common is to charge a percentage of the revenue from the sale. As an alternative to using a consultant, the landowner may obtain advice for conducting the sale from their state forestry agency.

Pre-Harvest Preparation

If a Forestry/Wildlife Habitat Management Plan has been prepared it will specify the areas to receive treatment each year and the type of treatment to be applied. Once the area is determined, the following steps should be taken before the harvest or other operation begins.

**Inventory/assessment of treatment area.** The need for an inventory and the type of inventory will be determined by the type of sale used. For regeneration harvests, a timber cruise is normally done to determine volume of timber to be sold by species, product class, and size class. For partial harvests (thinnings), this information is obtained in conjunction with marking of the trees to be removed. An alternative to sales based on inventory is one where the contractor pays based on the timber actually cut and delivered to a processing facility.

Other assessments that should be done before harvest begins include: (1) location and marking or SMZs, (2) layout and marking of skid trails and stream crossings if necessary, (3) marking of special areas to be protected, (4) location of logging decks, (5) marking of HMZs or wildlife corridors, and (6) location of any special wildlife habitat improvements such as openings and small slash piles. This information should be indicated on a detailed map of the area and a copy of the map given to the logging contractor.

**Marking/delineation of trees to be removed.** The need for marking of trees and how it is done is determined by the type of harvest to be made. For regeneration harvests using artificial regeneration, the trees to be removed are generally not marked since virtually all trees will be cut. The exception to this occurs when some trees are to be removed from areas such as SMZs and HMZs. Also, trees to be left for wildlife purposes within the harvest zones should be marked with a distinctive colored paint. When natural regeneration methods such as shelterwood or seed tree are used, the usual practice is to mark the trees to be retained rather than those to be removed.

For partial harvests (e.g., thinnings) the most common practice is to mark the trees to be removed. A paint spot is placed on the tree at eye level and another at stump level. This permits a check to insure that only marked trees are removed. If row thinning is used, the trees to be removed are not marked, and if trees are removed in the leave rows the logger makes the selection. In the "logger select" method of thinning in older stands, the trees for removal are not marked and the logger makes the selection after thorough training by a professional forester or someone with experience in how the stand should be thinned.
Preparation of a timber sale agreement and map: The timber sale agreement and accompanying map are extremely important documents from a legal, financial, and environmental standpoint, but they are also the landowner’s primary vehicle for assuring that the result will meet their specific goals for timber production and wildlife habitat. An example of a timber sale agreement is given in Figure ___, but it should be realized that there is no “standard” sale agreement. The agreement should be tailored to fit a particular harvest unit and the specific outcome desired by the owner.

The map accompanying the sale agreement should be drawn at a scale that permits easy recognition of all features discussed in the agreement. Attachment of aerial photographs to the agreement is also highly desirable. These photographs can often permit easier recognition of property boundaries and features such as streams and trails.

In addition to the sale agreement, it is common practice to require the logging contractor to sign a performance bond and establish an account from which funds can be withdrawn by the landowner in case terms of the agreement are not met.

Sale advertisement. If a consultant is employed they will know the loggers, timber buyers, and mills that may be interested in purchasing the timber and will handle this aspect of the sale. If the landowner handles the sale, a list of companies and individuals that may be interested in purchasing the timber can be obtained from the state forestry agency. The sales contract/bid forms can be sent to the full list of possible bidders or a sales announcement can be sent with a form expressing interest in the sale to be returned by the possible bidder.

Tour of treatment site with contractor. Once the sales agreement has been signed and the logging contractor has been identified, the landowner, and consultant if one is involved, should meet with the logging contractor on the tract to be harvested. This is a very critical time to insure that the landowner and contractor fully understand what is expected of each and what is to be accomplished. The landowner should tour the entire tract with the logging contractor using the map prepared with the sales agreement, making sure that all information on the map and in the sales agreement is fully understood. Most failures in compliance on the part of logging contractors occur because of a lack of complete understanding of what is expected by the landowner.

Supervision of Operation

The landowner, or their representative, should visit the harvest site on a regular basis, daily if possible. These visits offer a possibility for establishing good working relationships with the logging contractors and to impress on them the importance you attach to satisfactory completion of all aspects of the harvest agreement. If mistakes or a non-compliance are noted, repairs or corrections can be made immediately. Good supervision is the key to accomplishing your desired objectives.

Post-Operation Activities

Near the end of the harvest, and before the contractor leaves the site, the landowner should visit the site and do a complete inspection with the contractor. If repair work, wildlife habitat work, or other work necessary to meet the terms of the agreement are found, it should be noted at this time and plans made to complete the work before the contractor leaves the site.

After all work is complete on the site, the landowner should again make an inspection to see that all terms of the agreement have been met. It is also the time to make any desirable wildlife habitat changes, such as addition of additional wildlife openings, before site preparation or planting begins.
Summary

Silvicultural practices such as regeneration harvests, thinning, improvement cuts, burning, and fertilization are used to improve product quality and production in forest stands, but the same methods may be essential for improving or maintaining wildlife habitat. In many cases the silvicultural practices can be used without modification, but if needed slight modifications can be made to make them more favorable for creating desirable wildlife habitat. If landowners wish to manage a forest area for a combination of timber and wildlife, they must (1) establish their objectives as to the wildlife species they wish to favor, (2) know or establish the habitat requirements of those species as to cover, food, and water in local and landscape areas, (3) determine if these requirements are present or can be established on the property by silvicultural manipulations, and (4) determine if these habitat requirements are compatible with requirements or goals for timber production.

Once the above criteria are met, a forestry/wildlife management plan can be developed that specifies the location, type, and timing of each operation on the forest to best meet the desired objectives for wildlife habitat and timber production.
19. Integrating Wildlife Considerations With Hardwood Forest Management

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INTRODUCTION

Because of their great variety, hardwoods have exceptional value as wildlife habitat. The habitats associated with them can be very diverse and develop a high degree of permanence especially as compared to southern pines, which tend to be replaced by hardwoods as years go by and forests mature. This summary describes some of the ways to help desired wildlife in hardwood forests as well as ways to reduce damage done to hardwood habitat by timber harvest.

The term hardwoods in the South refers to a couple hundred or so species of broad-leaved trees. Wildlife in its broadest sense means all that is wild -- plants and animals. For this article, wildlife means a thousand or so species of birds, mammals, reptiles, and amphibians.

Forest Succession and Wildlife Management

A forest is always changing. Change is most rapid when the forest is young, such as after a wildfire or clearcut. Young seedlings and sprouts compete for light, water and essential elements. There are winners and losers -- some kinds of trees and other plants increase while others decline. Because wild animals directly or indirectly depend on habitat, the numbers and kinds of animals using the land will change as well. This process of change through time, where one living community replaces another, is called ecological succession. Animals that roam widely may visit all forest growth stages that are within their home range. In general, however, undisturbed, mature forests with well-developed understory vegetation and midstory shrubs and trees, as well as occasional openings, offer the greatest diversity of wildlife. In a Louisiana study, for example, 13 species of songbirds were most abundant in early regeneration, 5 were most abundant in seedlings, 1 in pole-size trees, 1 in sawtimber and 31 in mature forests.

Timber Site Quality vs. Wildlife Habitat Quality

Stands of timber and the sites occupied by these stands are evaluated based on how well trees produce wood and the value of the wood in the trees. All variables can be measured in terms of how much wood a stand can produce. Generally, the quality of wildlife habitats is not as easily measured--one does not normally equate wildlife to meat the way trees are equated to wood. Poor habitats for some animals may be excellent for others. Excellent stands of timber may be poor habitat for certain wildlife species, while poor stands of timber may be excellent for other species. Deep sands, for example, may make poor soil for timber but they are excellent for gopher tortoises and other animals associated with sand hill habitat.
In general, forest habitats that are wetter tend to be more productive. That is, they contain more total living material or "biomass." Likewise, forests that produce more wildlife food in the form of browse, nuts or fruits tend to be considered "better" than those that do not. Mature forests and maintained forest clearings generally tend to be "better" wildlife habitat for many favorite game species. However, certain "poor" habitats may be ideal for some kinds of wildlife. Intermediate successional stages may be preferred for relatively fewer favorite game animals and fewer species of nongame birds.

Animals can also be classified according to their habitat needs as edge species, interior species, specialists, and those that need large areas of generalized habitat. Quail in forest habitat are edge species. They tend to be common in diverse forest habitats featuring lots of edge. A black-throated blue warbler is an interior species. R lives in the interior of large blocks of forest. A gopher tortoise is a specialist. It needs special sandhill habitat. Bears are one of those species that need large areas of almost any kind of forested habitat.

**Values of Hardwoods for Wildlife**

Food production is the most obvious way to value trees as supporters of wildlife. All trees have food value for wildlife. Some food values of trees such as oaks are well known. The value of elms is less known. If you see a squirrel or a flock of goldfinches feeding on elm seeds in the spring then you will know two of the values of elms for wildlife. Table 19-1 shows some commonly known wildlife food values of selected trees.

Sometimes the value of trees as food support for wildlife is indirect. For example, in some years, red mulberry leaves support a good crop of caterpillars in September. Summer tanagers, tufted titmice and migratory warblers feed on these caterpillars. Likewise, the leaf litter under hawthorns provides a valuable foraging habitat for white-throated sparrows and towhees in winter. These little birds need little leaves to scratch in. Large coarse leaves such as those of sycamore offer little scratching habitat for small birds.

A bird watcher might value a certain grove of hardwoods because every spring it attracts a high number of migrating warblers. The warblers follow leaf opening as the season advances northward, providing opportunities to feed on insects. Another place in the forest may be a traditional roost for wild turkeys during the spring -- a fact which only a landowner might know.

**APPROACHES TO WILDLIFE HABITAT MANAGEMENT IN FORESTS**

Four general approaches are commonly used to manage forest habitat:

1. Protect and maintain habitats as they occur naturally: Let nature take its course and maintain plant and animal communities in more or less intact ecosystems.
2. Coordinate timber management activities to also achieve wildlife habitat enhancement.
3. Manage for timber and accept whatever wildlife is adapted to that habitat. Keeping these approaches in mind, consider your forest as a painting. Do you like the way it looks? Is it full of interesting habitats and animals? If so, you can leave it just the way it is. There is no need to try to improve on nature. However, if you wish to make some changes in the "painting," the main tools at your disposal are chainsaws, fire, plows, seeds and seedlings.
4. Manage a forest for wildlife as a primary goal. If wildlife management is a primary goal you can:
   a. Manage featured species.
   b. Enhance diversity.
   c. Protect and maintain natural communities.

**Manage Featured Species**

This approach to habitat management is to emphasize a particular species. Suppose you have a uniform stand of old trees and you want more ruffed grouse and rabbits. You can
Table 19-1. Some wildlife food values of common trees.

_Trees do not necessarily have high or low value for wildlife. A stand of any kind of tree has wildlife value--especially if the trees are mature._

<table>
<thead>
<tr>
<th>Species</th>
<th>Remarks on Value of Wildlife</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple, Crab</td>
<td>Fruits eaten by many game species. Sprouts preferred by deer.</td>
</tr>
<tr>
<td>Beech, American</td>
<td>Highly ranked as a food source (nuts, buds, catkins). Nut production in south is inconsistent and unreliable. Manage to increase crown development. Often a good cavity tree.</td>
</tr>
<tr>
<td>Cherry, black</td>
<td>Important because of the long fruit-ripening period and frequency of good seed years. Needs full sun or dominant position to thrive.</td>
</tr>
<tr>
<td>Dogwood</td>
<td>Because it is widespread, with fruit that persists on the tree into the early winter, it is very important for many game species, especially turkeys and squirrels, as well as songbirds and mice.</td>
</tr>
<tr>
<td>Elm, American winged</td>
<td>Produces seeds relished by squirrels, goldfinches, and certain birds in early spring when other tree seeds are scarce. Seedlings and half cut trees make good deer browse.</td>
</tr>
<tr>
<td>Gum, black (tupelo)</td>
<td>Fruit is important, but remains on the tree for only a short period after ripening. Good fall color.</td>
</tr>
<tr>
<td>Hickory, bitternut</td>
<td>Shagbark and mockernut are considered preferred mast producers for wildlife, especially squirrels. Bitternut is the least preferred. Hickory nuts provide a food source from late summer to the spring. Favor shagbark and mockernut over bitternut when thinning hickories.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Hornbeam, American</td>
<td>Seeds eaten by squirrels.</td>
</tr>
<tr>
<td>Hophornbeam, eastern</td>
<td>Valued as a seed producer in midstory.</td>
</tr>
<tr>
<td>Maple, red</td>
<td>Produces seeds preferred by squirrels and quail in early spring. Important because of its widespread occurrence.</td>
</tr>
<tr>
<td>Mulberry, red</td>
<td>A good food source in midspring. Fruit is available for only a few weeks.</td>
</tr>
</tbody>
</table>
Table 19-1. Some wildlife food values of common trees. (continued)

<table>
<thead>
<tr>
<th>Species</th>
<th>Remarks on Value of Wildlife</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oak</td>
<td>Oaks rate high as producers of wildlife food because many animals eat acorns. Water, willow and cherrybark oaks near streams and ponds are important as a food source for ducks. On drier sites, a good balance of species in the white and red oak groups will help maintain a consistent level of mast production. Cherrybark, swamp chestnut, and white oaks are top timber species.</td>
</tr>
<tr>
<td>black</td>
<td></td>
</tr>
<tr>
<td>post</td>
<td></td>
</tr>
<tr>
<td>southern red</td>
<td></td>
</tr>
<tr>
<td>swamp chestnut</td>
<td></td>
</tr>
<tr>
<td>water</td>
<td></td>
</tr>
<tr>
<td>white</td>
<td></td>
</tr>
<tr>
<td>willow</td>
<td></td>
</tr>
<tr>
<td>Persimmon, common</td>
<td>Favorite fall fruit for many game animals. Fruit is persistent on tree during years of early frost.</td>
</tr>
<tr>
<td>Pine, loblolly</td>
<td>Seeds of southern pines are an important food source for quail, turkey, songbirds and squirrels. Pine hardwood forest provides a great variety of wildlife food.</td>
</tr>
<tr>
<td>shortleaf</td>
<td></td>
</tr>
<tr>
<td>Virginia</td>
<td></td>
</tr>
<tr>
<td>Sugarberry</td>
<td>Fruits are an important food for turkey and many summer and wintering songbirds. An important seed producer. Thrives on moist sites.</td>
</tr>
<tr>
<td>Sweetgum</td>
<td>Songbirds and quail eat seeds; some birds eat buds. Deer, sweetgum sprouts. A preferred food of beaver. In some areas, sweetgum may outcompete more desirable trees.</td>
</tr>
<tr>
<td>Yellow-poplar</td>
<td>A prolific seed bearer. Seed will persist in cone and can be used by many birds and some mammals in winter. Deer browse seedlings.</td>
</tr>
<tr>
<td>Locust, honey,</td>
<td>Fallen honeylocust pods are a favorite deer food. Birds and rodents also feed on pods. Seedlings and sprouts are preferred deer browse.</td>
</tr>
<tr>
<td>black</td>
<td></td>
</tr>
<tr>
<td>Walnut, black</td>
<td>Nuts are favorite food of squirrels. Fallen nuts keep well. Some last 2 or 3 years.</td>
</tr>
<tr>
<td>Ash</td>
<td>Seeds are eaten by a variety of wildlife.</td>
</tr>
<tr>
<td>white pumpkin</td>
<td></td>
</tr>
</tbody>
</table>
temporarily increase the carrying capacity for these animals by harvesting patches of woods. Thickets that develop in these man-made openings will make the forest better for grouse and rabbits than a forest having only large well spaced trees. The effects would be temporary as the trees grow large. Over time, the thickets, rabbits and ground cover plants will disappear or change. On the other hand, don't cut the forest if gray squirrels are the target species. Gray squirrels prefer mature forests with large oak trees.

Enhance Diversity
A second approach to habitat management is to enhance diversity. This often appeals to small landowners in love with their land and who do not have a favorite species. The greater the variety of trees and plants, the greater the variety of animals that will live there. When removing trees the "scarcity factor" is a major consideration. For example, on land where oaks are common and magnolias are rare, favor the magnolia. Rare species may be particularly important components of the forest ecosystem, and indicators of overall forest health.

Protect and Maintain Natural Communities
A third approach to habitat management is to maintain and protect outstanding natural communities already present on the land. For example, if there is a spectacular stand of a particular forest type, or a grove of picturesque trees, try to maintain them, especially if they harbor desired wildlife populations. Scarce habitats such as sandhills, Carolina bays, streamside forests or forested wetlands can be kept as they are with minimum interference.

THINNING A FOREST FOR WILDLIFE
Thinning means cutting out some trees so the remaining ones can thrive. Many trees must die as a forest develops from seedlings to saplings and then on toward maturity. Thinning will take place naturally if no one interferes. Numbers of trees will decline from perhaps tens of thousands of seedlings per acre down to perhaps a few hundred large trees, in a century or so. This is the normal course of plant succession.

During the decline in numbers of trees, landowners can steer plant succession by removing the less desirable trees to favor those that support preferred wildlife. What is less desirable or more desirable depends on the person's point of view and knowledge. Making decisions as to which trees to remove is relatively easy in a young, managed forest. As a young forest grows, wildlife management considerations can help guide the thinning process. For example, in a mixed forest, removing sweetgums while leaving oaks would favor deer and squirrels. Deer and squirrels dislike sweetgum as a food source, but both animals relish acorns. Beavers and goldfinches on the other hand, prefer sweetgum. Beavers like the bark and goldfinches eat the flowers and seeds.

Even age stand management for timber can reduce habitat layering. As thinning takes place, the timber producer tends to try to channel as much sun energy and elements into timber producing trees. This tends to reduce vertical layering and habitat variety. This layering is often best developed in old wild, unmanaged forests which have the most diverse wildlife, especially bird life. A natural forest tends to have diverse ground cover, shrub layer, midstory layer of small to medium sized trees with an overstory of dominant trees.

Flowering dogwoods, shadbush, red mulberry, rusty blackhaw, and sparkleberry are examples of small midstory trees that are especially valuable for wildlife.

In general, when thinning a forest with wildlife in mind, look at each tree and ask yourself what is its future as a part of a wildlife habitat. You can cut the tree or leave it, according to your judgement.

When thinning a forest to enhance wildlife and aesthetic values there are no simple rules. The greater the knowledge of the wildlife manager, the more things there are to complicate decisions on what trees to remove. Consider all the potential wildlife values when you look at a tree—seeds, fruit, forage, insects that live on the tree, and the potential for nests and dens. Also consider a tree's individual beauty of form and color changes during the season.
especially the edges of the forest and how the finished job will look from a distance. When thinning for wildlife and aesthetics consider that the forest need not be cut down when it is "finished", but rather, it may remain for lifetimes.

A thinning can be accomplished by selling timber, which removes a tree completely, or half cutting. Half cutting involves partly severing a trunk and then pushing a tree over. Some half cut trees will live for years and provide good ground-cover. Trees can also be cut and left to rot there, providing habitat for animals that need dead wood.

**CONFLICTS AND TRADE-OFFS BETWEEN MANAGING WILDLIFE AND TIMBER**

Does a young, healthy forest mean healthy wildlife? Modern forest management for timber tends to favor young, vigorously growing trees. Large trees are usually cut when they are economically mature and the land is "rotated" back to the seedling and sprout stages. Such young forests contain abundant wildlife of certain kinds.

Forests of old decadent, diseased trees with their rots and holes, on the other hand, do not mean poor wildlife habitat. Old forests make better habitat for certain wildlife than do young healthy trees. Old forests in a wild condition are becoming rare because they are being replaced by younger, managed forests. If you have an old hardwood forest, you may find management decisions are difficult. This can be especially true if a forest has developed without management. Large, old "decadent" trees may have cavities suitable for squirrels, raccoons, owls, or wood ducks, but the tree likely has little timber value. Old trees use space that productive young timber trees could use. A beautiful, old forest may be crowded with trees that are unproductive economically and yet be a paradise for a diversity of wildlife. Aesthetic qualities, in addition to wildlife benefits, may make timber harvest unthinkable to the landowner even though a forester might recommend harvest to meet economic goals and improve the timber quality of the forest. The conflict is between preserving something culturally or aesthetically valuable versus exploitation for commodities. Therefore, some landowners choose to protect rather than manage their forest for optimum economic return. Even in an intensively managed forest, a few acres of old, unmanaged forest makes an interesting island in time to serve as a reference point and comparison with young forests managed for timber.

**ROADS AND WILDLIFE HABITAT**

Many kinds of favorite wildlife may be common in forests with roads. However, roads usually do not improve wildlife habitat. Roads tend to facilitate access for vehicles and removal of forest commodities while they can damage wildlife habitat. Making roads is generally the first step in the habitat fragmentation process. Fragmenting habitat into smaller pieces by roads and development can reduce or eliminate wildlife species that uses large blocks of forest. Roads change rainfall run-off patterns and increase the speed of run-off and erosion. Roads along stream tend to be particularly undesirable, due to potential increased sedimentation of stream . Roads can encourage casual visitors, littering, and hunting from vehicles. In general roads decrease wildness.

Roads maintained with broad borders can mitigate some losses by functioning as forest clearings. Roads for occasional use by light vehicles can be made simply by removing enough trees and shrubs to make a passageway. Such roads will last indefinitely without disturbing the earth if they are used only by light vehicles during dry weather when the soil is firm.

**DEER AND FOREST MANAGEMENT**

Whitetail deer are popular animals with hunters and wildlife watchers. They are adapted to all Southern forest environments. Likewise, deer are compatible with most timber production practices. Almost any timber harvest can be argued as being beneficial for deer because deer use forests at all stages of succession- Early forest stages can provide browse, intermediate stages provide cover for hiding; mature forests can provide preferred foods such as acorns. All harvests,
including clearcuts, create more browse, although this benefit is temporary. Harvest of oaks and other fruit and nut trees may hurt food production. Only when deer management becomes intense do trade-offs with wood production normally create conflicts. In general mature hardwood forests with abundant oaks provide plenty of food for deer in fall. This food declines during the winter. Mature forest habitat is often fair to poor for deer in spring and summer.

NEST BOXES

Timber management emphasizes sound, healthy trees that have commodity value. In such forests, lack of nest and den sites may limit certain wildlife populations, so the use of nest boxes will likely be beneficial. Table 19-2 gives specifications for wildlife nest boxes. If nest sites are a limiting factor, nest boxes can increase populations of raccoons, squirrels, certain owls, and some hole nesting songbirds.

MAKE A MANAGEMENT PLAN FOR WELDLIFE AND TIMBER

Most landowners have diverse goals for their forests which include both protection and integrated wildlife and timber plans, depending on the habitat. If you are an experienced forest manager and you spend a lot of time on your land, you can keep your management plan in your head. But because there are so many possibilities for managing a forest to favor wildlife and timber, it pays to make a written plan. Basically, a forest management plan for wildlife, timber and other values includes identifying the features of the land and the plans to protect or manage each part.

What Does a Management Plan Do?

A management plan considers all aspects of land management. It helps you achieve goals, avoid losses and helps keep you from falling behind in your work. It can be simple or complex. The more care and thought you put into your plan, the more you will get out of it. Working on a Plan makes you think about your forest. Planning helps you enjoy your forest more.

A management plan is an inventory. It is a summary of the current condition of the land and all its resources of interest to the landowner. An inventory can include geographic, recreational and wildlife features. It should include more than trees. An inventory is a kind of snapshot of a changing condition. It serves as a reference point against which you can view change and measure success.

A management plan predicts changes and includes predictions based upon past growth rates and estimates of site indices, for example. Also, it includes your own personal plans.

A management plan schedules tasks to achieve goals. Goals might be to improve timber stands, regenerate new trees, preserve special areas, cut firewood or timber, or establish food plots for wildlife. To make a management plan you need knowledge and skills. If you are short of skills, get information and help from the Extension Service, or state forest or wildlife agencies, private consultants or other professionals. As time goes by, experience will increase your capabilities.

Tips for Making Your Management Plan

1. Inventory Your Resources

Start management plan by making notes as you roam around your forest. Identify boundaries. Get a topographic map, a soil map and an aerial photograph. These may be available from U.S. Geological Survey, ASCS office or Soil Conservation Service offices. Next make a map that shows details of the land: roads, trails, fences, power lines, buildings, and stands of trees according to species and size.

Also make note of streams, marshes, ponds, rocky outcrops, sandhills, animal burrows, den trees, nesting sites of unusual birds, rare plants, old house sites, Indian artifact sites and anything else that interests you. Identify features on the map with names or numbers. Make notes on the
Table 19-2. Summary of specifications for some wildlife nest boxes. Nest boxes can substitute for tree cavities for many birds and mammals. Note - entrance holes do not need to be round - square or triangular holes are ok.

<table>
<thead>
<tr>
<th>Birds</th>
<th>Hole size diameter</th>
<th>Approximate box dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>House wren</td>
<td>1</td>
<td>5 x 5 x 10 high</td>
</tr>
<tr>
<td>Prothonotary warbler</td>
<td>1 1/4</td>
<td>5 x 5 x 10 high</td>
</tr>
<tr>
<td>White breaded nuthatch</td>
<td>1 1/4</td>
<td>5 x 5 x 10 high</td>
</tr>
<tr>
<td>Chickadee</td>
<td>1 1/8</td>
<td>6 x 6 x 12 high</td>
</tr>
<tr>
<td>Eastern bluebird</td>
<td>1 1/2</td>
<td>6 x 6 x 12 high</td>
</tr>
<tr>
<td>Crested flycatcher</td>
<td>1 3/4</td>
<td>6 x 6 x 12 high</td>
</tr>
<tr>
<td>Flicker</td>
<td>2 1/2</td>
<td>7 X 7 X 24 high</td>
</tr>
<tr>
<td>Screech owl</td>
<td>3</td>
<td>9 X 9 X 16 high</td>
</tr>
<tr>
<td>Wood duck</td>
<td>3&quot; high, 4&quot; wide (oval hole)</td>
<td>11 x 11 x 24 high</td>
</tr>
<tr>
<td>Barred owl</td>
<td>8</td>
<td>13 x 13 x 24 high</td>
</tr>
</tbody>
</table>

Mammals

| Gray and fox squirrel      | 3                  | 8 x 8 x 15 high           |
| Flying squirrel            | 2                  | 8 x 8 x 15 high           |
| Raccoon                    | 5 high x 9 wide    | 13 x 13 x 24 high         |
ecological development of your stands or habitats. For example, you might note dates and locations of previous fires or grazing, beaver damage, soil erosion, soil type, timber harvest, and areas of young seedlings. List wildlife species that are likely to occur on the land, with notes on where these animals occur. The greater your appreciation and knowledge of wildlife the more decisions you need to make. If you need help, hire a qualified wildlife biologist.

After your map is complete, make a cruise of each stand of trees. A timber cruise details the number of trees of each kind and size class bearing the name or number of the section of the map to which it applies. The cruise gives the volume and value of your wood products. It enables you to show a timber basis value so you can deduct the cost of your timber at the time of land purchase from future sales. Hire a professional forester if you are uncertain about your ability to cruise timber.

2. **Predict Changes and Make Plans**

   After your inventory is complete, determine your goals for each forest stand, habitat type or special area. These are your management units. Consider these factors when you choose your management goals for each management unit.

   a) How rare is the habitat?
   b) What is the present timber value?
   c) What is the timber potential?
   d) What present and potential wildlife does it support?
   e) What are your recreational interests on this property?
   f) What is its value for subdividing and building?
   g) How long will you own the land?
   h) What are likely to be the goals of children, future owners, or buyers?

   Some management units may be for income production, while others may be for recreation, preservation, or other goals.

3. **Schedule Tasks to Achieve Goals**

   Make a list of jobs for each management unit. For example, a stand of young hardwoods might need thinning. Estimate how many years will elapse before a stand needs cutting, based on current growth. Plan for access roads. Plant groves of mast-bearing trees, or thin an existing forest to make a grove by taking out all but the desired species. Plan for nest boxes if den trees are scarce. Schedule regular seasonal jobs such as planting wildlife food patches, hay mowing, and equipment maintenance.

   Some places in your forest don’t need work. They need protection. Streamsides and water edges need special care. A rocky outcrop surrounded by picturesque oaks and wildflowers might be such a place. Do you have a favorite swimming hole or picnic spot? Plan to exclude logging equipment from favorite spots during timber harvests.

   After you select management practices for a stand, write them down. Update the management plan every 5 to 10 years. A complete management plan for a diverse tract of land might be a large complex document. On the other hand, an informal management plan could be as simple as an annotated sketch map.

**PRACTICES THAT MAY FAVOR WILDLIFE**

No simple wildlife management practices will work in all situations. Here are some suggestions to consider, depending on your wildlife habitat management goals.

1. **Design timber harvest to favor wildlife diversity.** Identify what wildlife communities you wish to perpetuate.
   a) Harvest, thin, or protect certain areas from timber harvest, depending on wildlife to favor.
   b) Plan edges of cuts to be wavy and irregular to increase the amount of habitat edge.
c) Leave forests uncut along stream and drains to maintain corridors of undamaged streamside habitat. Keep logging equipment away from streams to protect stream banks and maintain water quality.

d) Leave forest corridors for wildlife travel lanes between patches of woods and along roadsides.

e) Leave a few clumps of large trees in clearcuts.

f) Leave den trees. Large den trees are much more rare and valuable than small ones.

g) Spare some good seed- and mast-producing trees such as persimmons, crabapples, dogwoods and oaks during harvest.

h) Pile logging slash to make brush piles.

2. Use prescribed fire in openings. Set back plant succession and maintain browse plants.

3. Plant roads, clearings, odd areas, and log loading decks to wildlife foods.
   a) Plant clovers, ryegrass or wheat or other cool season crops in late summer to produce fall, winter, and spring forage.
   b) Plant browntop millet or sorghum or other warm season crops for summer and fall wildlife food.
   c) Plant field borders or clearings to bicolor lespedeza, to make thickets and feeding areas for quail.
   d) Plant nut and fruit trees in permanent wildlife food patches and clearings. Oaks, persimmons, pears, chestnuts, and crabapples are good choices. Pick trees adapted to your area. Protect seedlings with a wire mesh cylinder when young or deer and rabbits will eat them.

4. Use good harvest systems.
   a) After harvest or thinning, leave piles of logging slash unburned. Bobcat, fox, raccoon, rabbits, and other small game will den in those places.
   b) Protect fragile or rare groundcovers. Consider natural regeneration in such areas. In hardwood forests, ground covers of Lycopodium, certain wild flowers, or rare plants may be damaged by logging.
   c) Avoid site preparation or other soil disturbance near stream, gullies or other erosion-prone sites.

5. Install artificial nest boxes for owls, songbirds, wood ducks, squirrels, raccoons, and other cavity-nesters. Nest boxes can increase populations in areas where den trees are scarce. Get plans from your county agent. Don't put nails into trees with timber potential. Attach nest boxes to branches, not main stems.

6. Inventory and protect rare animals or plants and their habitats.

7. Protect grapevine and other fruit-producing plants useful to wildlife.

8. Harvest deer during the hunting season to maintain deer populations at a level where they won't harm the habitat.

9. Ask a qualified wildlife biologist for advice on specialized management problems. "Certified wildlife biologist" is the professional designation for qualified wildlife managers.

10. Read books and articles on wildlife management.

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REFERENCES


Jackson, Jeff. 1984. Wildlife and timber -- can we help small landowners manage them together? Tops. 17(1):26-35.