ALABAMA A&M AND AUBURN UNIVERSITIES

ALABAMA COOPERATIVE Extension SYSTEM

ANR-331

Prescribed Burning in Alabama Forests

Early settlers in Alabama found that Indians used fire in the virgin pine stands and learned that they too could use fire to improve hunting, to keep down brush for improved access to the forest, and to clear land for farming.

Eventually, however, the use of fire got out of hand, and the increasing wildfire problems caused many foresters to advocate the prevention of all fires in the forest. Effective educational campaigns and increased public awareness of the destructive nature of wildfire resulted in the near elimination of fire from thousands of acres of pine timberland.

The absence of fire in pine forests brought about a new set of problems. Hazardous fuels began to build up in pine stands, making wildfires that did occur much more destructive. At the same time, poor-quality hardwoods began to grow under the pines and threatened to dominate the sites.

Research and experimental burnings were begun in the 1930s. It was found that, because pines are more resistant to fire damage than hardwoods, fires could be particularly important in the perpetuation of pine stands. Although wildfires can completely destroy timber stands, the deliberate use of fire by professional foresters under controlled conditions can help accomplish several of the objectives of multiple-use forest management. This deliberate use of fire is called "prescribed burning."

Benefits and Effects of Prescribed Burning

Hazard Reduction

Fuels such as pine needles and fallen branches, hardwood leaves, dried grasses, and weeds accumulate rapidly in pine stands of all ages. They increase the threat of destruction of young stands by wildfire and hinder regeneration in older ones. Prescribed burning is a swift, effective, and inexpensive means of reducing this hazard.

Hardwood Control

Hardwoods are sensitive to fire because of their relatively thin bark, but low-intensity prescribed fires normally will not injure pine trees 4 inches in diameter and larger, because their thick bark is good insulation. Low-value, poor-quality hardwoods often encroach upon pine stands at an early age and, if not treated, become increasingly bothersome. They persist because they can grow in the shade. They compete with pines for moisture and nutrients, hinder visibility and access through the stand, and interfere with regeneration. A vigorous, persistent burning program is the most economical way to deal with this problem.

Site Preparation

Pines cannot be regenerated in the shade or on seedbeds covered with forest litter. Natural and artificial pine regeneration depends on full overhead light and freedom from hardwood competition for establishment and growth. Burning to reduce hardwoods and expose mineral soil just before harvest cutting is desirable for natural seeding. Fire can also be used to remove logging slash and undesirable hardwoods to prepare sites for direct seeding or planting of seedlings.

Wildlife Habitat Improvement and Forage Production

Prescribed burning can benefit wildlife, including deer, turkey, quail, and doves where southern pines are the primary timber species. Whether done specifically for wildlife management objectives or for timber production, burning will increase the yield and quality of herbage, legumes, and browse from hardwood sprouts and create openings for feeding, travel, and dusting. For example, burns to control hardwoods in immature stands bring on succulent sprout growth that is within the reach of browsing deer. Quail and turkey benefit from fuel-reduction burns that encourage the growth of annual plants. While some insect populations are reduced immediately following a burn, population levels generally return quickly to pre-burn levels.

Similarly, productivity of annual grasses and other forage plants can be enhanced in pine stands managed for cattle grazing. These species have higher nutritive value and palatability than other plants available in forests. Burning removes dead material that is low in nutrient value and promotes new growth, which in the spring is high in protein, phosphorus, and calcium.

Disease Control

Brown spot needle blight infects the needles of longleaf pine seedlings in the grass stage. Unchecked, it delays growth and kills seedlings. Prescribed burning in winter will scorch the needles and kill the fungus without killing the seedlings. Infestations of Annosus root rot occur less frequently in areas where periodic burning reduces litter, probably destroying some of the fungal fruiting bodies.

Accessibility and Appearance

Reduction of the understory before harvest cutting improves visibility and makes timber marking and cutting much easier. This, in turn, often lowers harvesting costs substantially. Prescribed burning is an ideal tool for this purpose. Controlling the size of understory growth improves accessibility for hunting or other recreational uses. It also helps maintain a variety of plants, including many flowering annuals.

Air Quality

One of the biggest public concerns about the use of prescribed fire has been its effect on air quality. In reality, prescribed fire provides one of the best and most economical means of reducing air pollution resulting from forest fires.

The potential for the release of air pollutants by prescribed fire is lower than for wildfire, since prescribed fire burns less fuel. On the average, prescribed fires in the South burn about 3 tons of fuel per acre and produce 17 pounds of particulate matter per ton of fuel burned. In contrast, wildfires consume 7.5 tons of fuel per acre and produce 58 pounds of particulates per ton.

Prescribed fires do not continue to burn for many days, as wildfires can. They ordinarily burn only a few hours during the day when atmospheric conditions favor good smoke dispersal. When smoke-management guidelines are followed and smoke-sensitive areas (highways, residential areas, etc.) are identified, burns can be planned so that the smoke is carried away from these areas.

Soil and Water Quality

Physical and chemical properties of forest soils, which determine site productivity and influence water infiltration and runoff rates, are largely unchanged in the long run by prescribed fires. Changes in soil pore space and infiltration rates are small as long as the organic layer is not completely consumed. A properly applied prescribed fire will not burn all of the litter layer, nor will it kill the roots of understory plants as wildfires often do. The remaining litter and plants protect the soil and help control runoff and erosion. As a result, neither water quality nor quantity is harmed by most prescribed burning. There is usually a small temporary increase in soil nutrient levels after burning.

Conditions for Prescribed Burning

Burning Interval

The first fuel-reduction burn in a young pine stand should not be made until the trees are at least 15 feet tall. Thereafter, winter burns can be used as needed (every 2 to 5 years) to keep fuel accumulation low. Burning to improve wildlife habitat or forage for grazing should fit this cycle also.

For hardwood control, some pine needle fuel is essential. Winter burns at 5-year intervals will control, but not kill, hardwoods under 1 inch in diameter. As a stand approaches harvest age, a series of summer burns every other year can kill hardwoods less than 4 inches in diameter and get sites ready for regeneration.

The first brown-spot control burn in longleaf pine is usually made the second or third winter after seeds germinate. In areas of heavy infection a second burn may be needed 2 years later. These burns will kill the fungus disease but not the seedlings, since longleaf pines in the "grass stage" are resistant to fire.

Season of Year

It may be desirable to burn in either summer or winter, depending on the objectives of the burn. Winter burns (November through March) are preferable for fuel reduction, hardwood control in young pine stands, and brown spot control in longleaf pine stands. For hardwood control in mature pine stands, summer burning (June through October) may be more effective. Site preparation burns are best done in hot, dry weather, preferably late summer or early fall.

Time of Day

Most prescribed burning is done in the daytime (from 10 a.m. to 6 p.m.) when weather and working conditions are favorable. Night burning may be required in very young stands, stands where draped fuel is a problem, or where there is slash on the ground, as from a thinning. There is a risk, however, of smoke accumulating near the ground during night burning.

Fuel Conditions

Pine needle fuel is needed to successfully carry fire through a forested area. This requires an overstory dominated by pines, because hardwood leaves carry fire poorly. In order to properly burn over a mixed pine-hardwood stand, more extreme fire conditions (drier fuel and higher wind velocity) are necessary. An exception would be an open stand with scattered waxmyrtle and considerable grass on the ground. Fire will move readily through this fuel.

Weather Conditions

Days Since Last Rain. For most purposes, the surface fuels should be relatively dry, while the soil should be moist to prevent injury to roots. It is desirable to have ½ to 1 inch of rain several days before burning, and burning may generally be done from 1 to 10 days following a rain. Ordinarily, after a week to 10 days without rain, most fuel types are too dry to burn without excessive damage to the standing pines. A wet-site fuel type, may take 3 weeks to dry out.

Relative Humidity. The safe and effective range for relative humidity is from 30 to 50 percent. Occasionally, when a hot burn is mandatory, a reading as low as 20 percent may be acceptable, but burning is dangerous at this level. On the other hand, a safe burn may not be possible in a young plantation unless the humidity is above 50 percent. When the relative humidity is above 60 percent, fire may not burn an area completely or be hot enough to accomplish the desired results.

Air Temperature. Temperatures of 20 to 50 degrees F are desirable for winter burning. When summer burning is used to control hardwoods in mature stands or for site preparation, air temperatures of 80 to 95 degrees F are recommended in order to raise the temperature of unwanted vegetation above 135 degrees F, the average killing temperature for unprotected plant tissue.

Wind Direction and Velocity. The ideal condition is a moderate, steady wind from the north or northwest. This condition most often occurs after a cold front passes. If north or northwest winds are not present, south or southwest winds are the next best. Easterly winds are often erratic and not recommended for prescribed burning. Wind velocities of 2 to 10 miles per hour, at eye height in the stand, serve most burning purposes. This corresponds to a range of 5 to 18 miles per hour in the open. When there is no wind at all, burning should be avoided because fires will not move properly and excessive butt and crown scorch may result.

Prescribed Burning Techniques

Backfire

A backfire is set along a control line such as a road, fire lane, or stream and allowed to back into the wind (Figure 1). Since the rate of backing is approximately one chain (66 feet) per hour, interior firelines must be prepared and fires set along them rapidly to get a large area burned in the available time. Backfiring is not flexible; it requires stable weather conditions. It is relatively easy and safe to do and causes minimum scorch. Backfires are used mainly for fuel reduction and hardwood control.

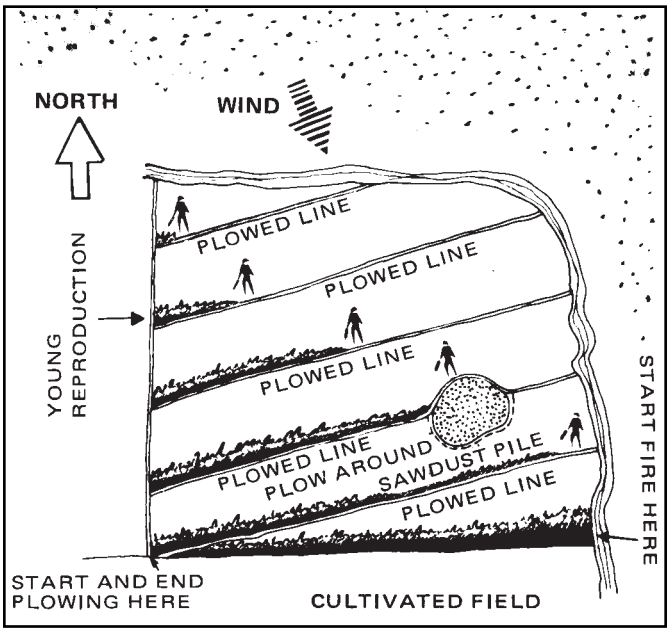

Figure 1. Backfire

Strip Headfire

A downwind control line is secured with a backfire first, then short strips of headfire are allowed to run with the wind (Figure 2). The spacing of the strips of headfire depends on wind, fuel, and desired results. A strip headfire can be used in cool weather when humidity and fuel moisture are relatively high and wind velocity is low. It requires fewer plowed lines and is faster and cheaper to do. It is also flexible, allowing for some change in the direction of firing to meet changes in wind direction. Strip headfires are used in winter for fuel reduction and in winter or summer for hardwood control.

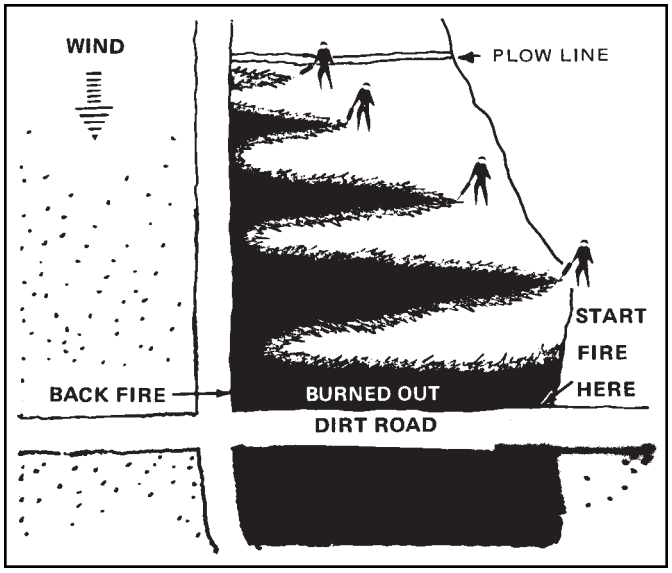

Figure 2. Strip headfire

Flank Fire

A flank fire is set directly into the wind and burns slowly at right angles to the wind (Figure 3). It may also be used on the flanks of any fire to secure them as the fire progresses. Flank fires burn hotter than backfires and cooler than headfires. This method requires a constant wind direction, but no interior fire lines are needed. It requires experienced personnel and good crew coordination. It is used in medium fuels or in larger timber, usually in winter, to speed up the job or to supplement some other burning method.

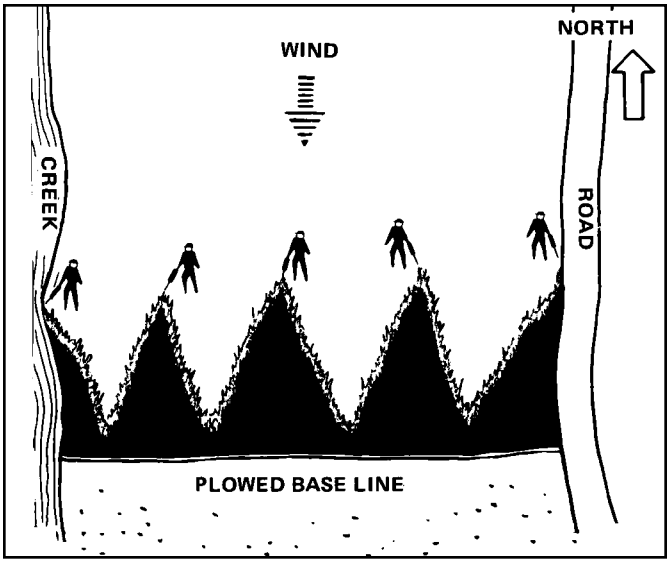

Figure 3. Flank fire

Ring Fire

With this method, after a downwind control line has been secured with a backfire, the entire area is circled with fire and allowed to burn toward the center (Figure 4). Care should be taken with this technique because it can produce strong, often violent, convection columns and cause spot fires as far as 1 mile away. Ring firing should only be used for site preparation where a hot fire can be beneficial.

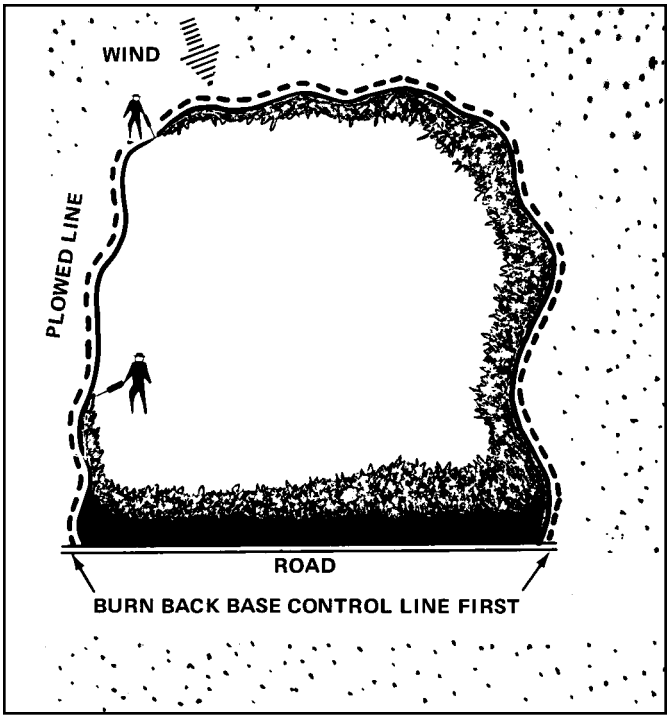

Figure 4. Ring fire

Preparing to Burn

Prescribed burning is a highly technical job requiring a knowledge of fire behavior, suppression techniques, and the environmental effects of fire. Preparation should be thorough, including a written plan; site, material, and manpower preparation; weather monitoring; and legal considerations.

The Written Plan

You should have a written prescribed-burning plan, prepared by a professional forester for each area to be burned. Have your plan drawn up before the burning season, then carry out the burning plan when the correct weather occurs. Some plans may be quite short and simple, while others will be complex. The area covered by a plan can vary from a few to more than 1,000 acres. Large areas should be divided into units with similar topography and amounts and types of fuel, which can be burned in one day.

For best results, use a prepared form with space for all the information needed. Such a form serves as a checklist to assure that no requirements or dangers have been overlooked.

The written plan should include the purpose or reason for prescribing a treatment using fire; for example, brown spot control, hazard reduction, wildlife habitat, etc. In addition, the needed weather conditions, the burning technique to be used, the season for burning, and time of day should be included; and the equipment and manpower needs should be listed. Also, a concise explanation of fire behavior expected (how high and how intense the flames should be) should be given. This will enable the person in charge of the burning to vary the technique and still accomplish the burning objectives if the prescribed weather conditions are not met precisely. Such information will also be useful in determining the success of the burn.

As a part of the written plan, the following information should be indicated on a map (Figure 5) or aerial photograph:

- Location of the area and number of acres to be burned
- Exterior boundaries and adjacent landowners
- Existing firebreaks
- Firelines to be plowed
- Interior areas to be excluded from the burn

Site, Material, and Manpower Preparation

Line location is important and has much to do with the success of the burn. Have an experienced person do it, one who knows fuel types and fire behavior, who can read maps or aerial photos, and

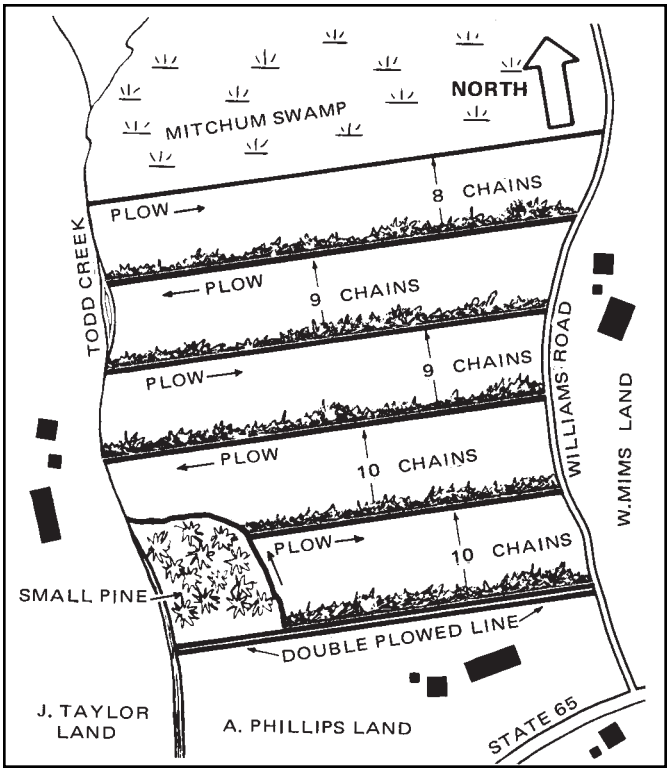

Figure 5. Burning unit map

who can adapt the written plan to actual fuel and terrain conditions. It is important to make use of existing features, to keep plowed lines mostly straight, and to avoid obstacles that would create burning and mop-up problems. Plowing should be done just far enough ahead to leave clean lines, perhaps even on the day of the burn.

Equipment needed will include several drip torches in good working order and a generous supply of drip-torch fuel. A tractor-plow unit may be needed in some situations. In any case, the crew should have with them a few basic hand fire-fighting tools (fire rake, flap, and, if possible, a backpack pump), a power saw, and first aid equipment.

Manpower usually consists of a crew leader and from two to five helpers to fire and patrol the

lines. The leader should be an experienced prescribed burner, preferably the same person who located and plowed the lines. All personnel should be thoroughly trained beforehand. Previous experience on other prescribed burns and also on wildfire suppression is the best kind of training.

Weather becomes of prime importance once the season for the planned burn has arrived. Watch daily forecasts closely, because successful prescribed burning depends heavily on the weather matching the prescription. Detailed forecasts are available between 8:00 a.m. and 5:00 p.m. daily from the Forestry Meteorologist at the National Weather Service office in Birmingham (telephone: 205-664-3010).

Legal Requirements

According to Alabama law and regulations, a permit is required for burning any woodland, grassland, field, or new ground. This means you must have a permit for all types of prescribed burning, with the possible exception of small trash piles. Violations could result in a fine of up to $1,000 and up to 6 months in jail.

Obtain a permit by calling the Alabama Forestry Commission's toll-free number for the county in which the burning will take place (a list of numbers for individual counties is found in the back of this publication). In order to receive a permit, a landowner must provide the following information:

- Location of the burning site, including section, township, and range.
- The time of burning, type of burning, and number of acres.
- Tools, equipment, and personnel to be used to control the fire and prevent it from escaping. If, after a permit is issued, the fire escapes and it is discovered the planning, supervision, and/or equipment were inadequate, a case may be brought against the offender.

As a matter of common courtesy and professionalism, every effort should be made to notify adjacent landowners at least 5 days in advance of burning.

Smoke Management

One of the inevitable results of any fire is air pollution. Even though prescribed burning produces much less smoke and particulate matter than wildfires, the smoke produced from prescribed burning can be a problem under certain conditions. Problems associated with smoke are creating more and more friction between the public and those who use fire as a management tool. Smoke management defines potential smoke-related problems and develops a strategy to minimize them. Smoke management should be included in the burn planning process.

The first step in smoke management is to locate smoke-sensitive areas downwind of or adjacent to the burn which may be affected by smoke. Examples of smoke-sensitive areas are highways, airports, hospitals, farms with livestock or poultry, and populated areas. These areas should be located on a map before burning is begun. The fire should not be set if a smoke-sensitive area is within a half mile downwind of the proposed burn. Burning should certainly be curtailed when done near an urban area that is under an air-pollution alert, warning, or emergency.

The degree of smoke impact on sensitive areas will be determined by weather and fuel conditions at the time of the burn. The ideal atmospheric conditions for smoke dispersal occur when unstable atmospheric conditions exist and smoke quickly rises and is carried away by high altitude transport winds. Fuel moisture also influences smoke production, with increasing moisture producing more smoke. The more intense the fire, the less smoke is produced because combustion is more complete. Windows and large piles with dirt in them are by far the worst type of smoke-producing fires. Special precaution is necessary when burning "dirty" fuels.

One of the most dangerous smoke-related conditions exists when smoldering fires burn on during the night and produce smoke that hugs the ground and moves down drainage patterns. When the relative humidity is above 80 percent, which can readily occur at night, smoke can mix with fog

to produce a smog. As this smog moves down drainage patterns, it can settle across roads or bridges, reducing visibility to near zero.

The Alabama Forestry Commission uses a Smoke Dispersion Index to indicate how well smoke will disperse into the atmosphere. The Index was developed by the U.S. Forest Service and has been adopted by the Commission to classify atmospheric conditions relative to smoke dispersal. The Dispersion Index incorporates measurements of atmospheric stability, mixing height, transport wind, and radiant heat, into an equation that produces a numerical value. The higher the value, the better the smoke dispersion.

Executing the Burn

Ideal conditions for prescribed burning occur on only a few days each year. When a good day arrives, it is time to drop all other tasks and set the prescribed burning plan into motion. The best available weather information should be obtained in the morning. If conditions appear favorable for burning, a burning permit should be obtained from the Alabama Forestry Commission. Then, follow these procedures to have a safe and effective burn:

1. Check the weather and fuel conditions at the burn site.

2. Review the day's plan with the crew to make sure each person knows exactly what to do.

3. Set a test fire and then watch carefully to see if it behaves exactly as called for in the prescription. If it does not, put out the fire and postpone the burn.

4. If needed, establish a downwind safety strip, usually by backfiring. Watch it carefully to prevent breakovers.

5. If all is going well, activate the main burning plan. It may call for a backing fire, strip headfire, or something else, but the crew should rapidly proceed to the task, following the order and sequence prescribed.

6. While this is occurring, have one or more persons carrying hand tools patrol the base and flanks to prevent breakovers and check progress of the burn.

7. All during the burn, watch for changes in the weather, especially in wind direction and velocity. If dangerous or just unsuitable conditions arise, stop the firing and prepare to control or put out the fire.

8. When firing has ended, take whatever actions are needed to secure the boundary lines and safeguard the burn.

Evaluating the Burn

A few weeks after the burn, check results in relation to objectives sought. Things to look for are the following:

- Amount of fuel consumed.
- Probable hardwood kill, as indicated by bark cracking at ground line.
- Probable damage to pines, as shown by the height tree boles are blackened or the percentage of crown foliage discolored. A bole scorch less than 3 feet in height indicates little or no damage, as does a crown scorch less than one-third of crown length. Bole scorch over about eye height or more than one-third crown scorch shows the fire was probably too hot and the burning technique faulty. Occasionally, under large pines and where hardwood kill is the chief aim, more severe conditions may be tolerated.

Make final evaluation of the results from 3 months to a year after the burn. By that time, actual hardwood kill (or dieback to ground) and the extent of damage to standing pines are revealed. Only then can you know fully what has been accomplished. Plan future burns with this experience in mind.

Key Points to Remember

1. Fire is part of the natural environment, and, if used carefully by professionals, it can be a desirable and economical tool for management of Alabama's pine forests.

2. For each area to be burned, have a written plan prepared by a professional forester.

3. Prepare in advance for burning by having firelines plowed, necessary equipment on hand, and trained personnel available.

4. Advance planning should consider smoke management as part of preparation for the burn.

5. Get a Permit to Burn and notify adjacent landowners of your intention to burn.

6. Watch the weather, and when the proper conditions exist, execute the burn according to your written plan.

7. If conditions change or any undesirable condition exists, be prepared to control the fire and put it out.

8. Sometime after the burn, evaluate the results to determine if your objectives have been met.

References

Wade, D. D., and James D. Lunsford. 1988. A Guide for Prescribed Fire in Southern Forests. Technical Publication RB-TP11. USDA Forest Service, Fire Management, Southern Region, Atlanta, GA.

Crow, A. B. 1975. Prescribed Burning in Louisiana Pinelands, Louisiana Cooperative Extension Service, Publication No. 1618. 19p.

To request a burning permit or to report a wildfire, call the Alabama Forestry Commission at the following toll free numbers:

Southeast Region

Montgomery
1-800-392-5679 Butler, Crenshaw, Bullock, Elmore, Lee, Lowndes, Macon, Montgomery, Russell

Ozark
1-800-922-7688 Coffee, Dale, Geneva, Henry, Houston, Pike, Covington

Southwest Region

Bay Minette
1-800-672-6912 Choctaw, Clarke, Mobile, Washington

Selma
1-800-242-2504 Autauga, Chilton, Dallas, Marengo, Perry, Wilcox, Sumter, Greene, Hale

Brewton
1-800-672-3076 Conecuh, Escambia, Baldwin, Monroe

Northwest Region

Gardendale
1-800-292-6653 Walker, Jefferson, Shelby

Tuscaloosa
1-800-452-5923 Fayette, Lamar, Pickens, Tuscaloosa, Bibb

Florence
1-800-942-3107 Colbert, Franklin, Lauderdale, Lawrence, Limestone, Marion, Morgan, Cullman, Winston

Northeast Region

Brownsboro
1-800-572-2017 Calhoun, Cherokee, DeKalb, Etowah, Jackson, Blount, Madison, Marshall

Dadeville
1-800-492-3711 Chambers, Clay, Cleburne, Coosa, Randolph, Talladega, Tallapoosa, St. Clair

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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