

Prescribed Burning In Arkansas Forest

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Use of Fire – Then and Now

Early settlers in Arkansas 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 problem 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 of Prescribed Burning

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

Hardwood Control – 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 depend on full overhead light, bare mineral soil 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 – Prescribed burning can benefit deer, turkey, quail and doves where southern pines are the primary timber species. Burning can increase the yield and quality of herbage, legumes and browse from hardwood sprouts and create openings for feeding, travel and dusting. Many of the burns prescribed for other purposes benefit wildlife as well. For example, burns to control hardwoods in immature stands bring on succulent sprout growth which is within the reach of browsing deer. Quail and turkey benefit from fuel reduction burns that encourage the growth of annual plants.

Disease Control – Infestations of annosus root rot occur less frequently in areas where periodic burning reduces litter, probably destroying some of the fungal fruiting bodies.

Forage Production – In pine stands of the Coastal Plain, prescribed burning increases the quantity of grasses and other plants which may be used for grazing. These species have higher nutritive value and palatability than plants otherwise 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.

Improving 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. It also helps to maintain a park-like appearance in the forest, which contributes to recreational and aesthetic benefits.

Environmental Effects of Prescribed Burning

Vegetation – Low-intensity prescribed fires normally will not injure pine trees 4 inches in diameter and larger, because their thick bark is good insulation. However, hardwoods have thinner bark and prescribed fires can be used to control these species in the understory, thereby economically maintaining the more timber-productive pine stands. In addition, forest fuels are reduced, minimizing potential losses from wildfire.

Soil – Physical and chemical properties of forest soils, which determine site productivity, are largely unchanged by prescribed fires in the long run, even though small increases in some plant nutrients may occur just after burning. Changes in soil pore space and infiltration rates are small as long as the organic layer is not completely consumed. While some insect populations are reduced immediately following a burn, population levels generally return quickly to pre-burn levels.

Water – A properly applied prescribed fire will not burn off all of the litter layer, nor will it kill the roots of many 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.

Air – One of the biggest public concerns about the use of prescribed fire has been its effect on air quality. The truth is that prescribed fire provides one of the best and most economical means of reducing air pollution resulting from forest fires.

The potential for air pollutant release 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 last 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.

Wildlife – Prescribed burns usually improve food and cover conditions for wildlife, including both game and non-game species. Since prescribed fires are usually slow-moving and limited in size, animals in the area to be burned are not trapped. However, prescribed fires should not be used in the spring when they may harm the young of many wildlife species.

Aesthetics and Recreation – Prescribed fire controls the size of understory growth to improve accessibility for hunting or other recreational uses. It also helps maintain a variety of plants, including many flowering annuals.

Conditions for Prescribed Burning

Season of Year – It may be desirable to burn in either summer or winter, depending on the objectives of the burn. Winter burns 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 may be more effective. Site preparation burns are best done in hot, dry weather, preferably late summer or early fall.

Suitable winter burning conditions generally occur from November through March and summer burning conditions from June through October.

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 burn over a mixed pine-hardwood stand properly, 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. For most purposes, the surface fuels should be relatively dry, while the soil should be moist to prevent injury to roots.

Weather Conditions – A number of different weather measurements are important.

- **Days Since Last Rain.** It is desirable to have 1/2 to 1 inch of rain several days before burning. Generally, burning may be done from 1 to 10 days after 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. However, a wet-site fuel type may take three 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 all right, 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 20E to 50EF are desirable for winter burning. When summer burning is used to control hardwoods in mature stands or for site preparation, air temperatures of 80E to 95EF are recommended in order to raise the temperature of unwanted vegetation above 135EF, the average killing temperature for unprotected plant tissue.

- **Wind Direction and Velocity** 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 . The ideal condition is a moderate, steady southwest winds are the next best. Easterly winds are not recommended for prescribed burning. Wind velocities of from 2 to 10 miles per hour, at eye height in the stand, serve most burning purposes. This corresponds to a range of from 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.

Time of Day – Most prescribed burning is done in the daytime (between 10 a.m. and 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 real problem, or where there is slash on the ground, as from a thinning. However, there is a risk of smoke accumulating near the ground during night 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 will kill hardwoods less than 4 inches in diameter and get sites ready for regeneration.

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 normally between 60 to 200 feet per hour, interior fire lines must be prepared and fires set along them rapidly to get a large area burned over in the available burning period. 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.

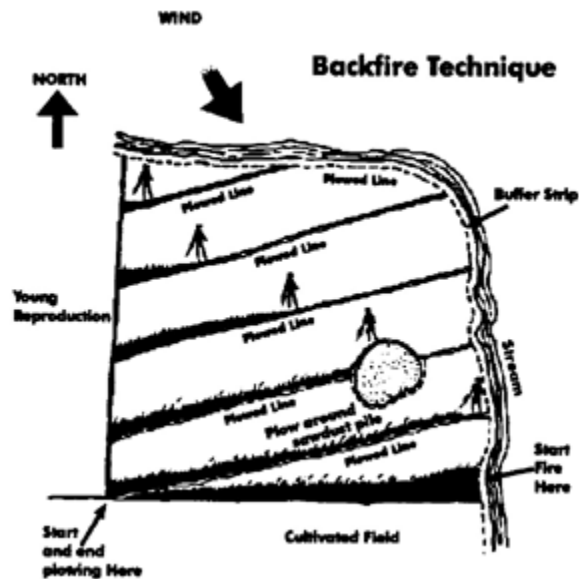


Figure 1. Backfire Technique

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). Spacing of the strips of headfire depends on wind, fuel and desired results. 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 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.

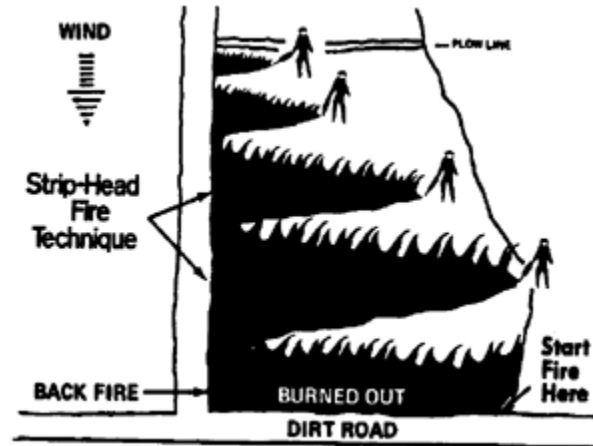


Figure 2. Strip Headfire Technique

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.

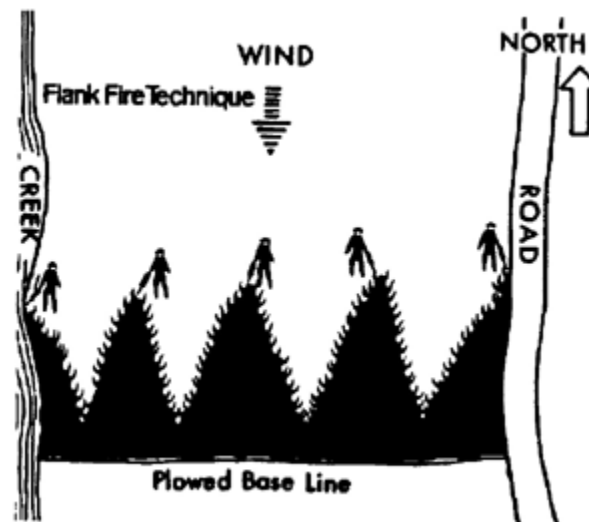


Figure 3. Flank Fire Technique

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). This technique can generally be used in any season and is particularly useful in slash disposal and site preparation, where a hot fire is needed. However, care should be taken with this technique because it can produce strong, often violent, convection columns and cause spot fires as far as one mile away.

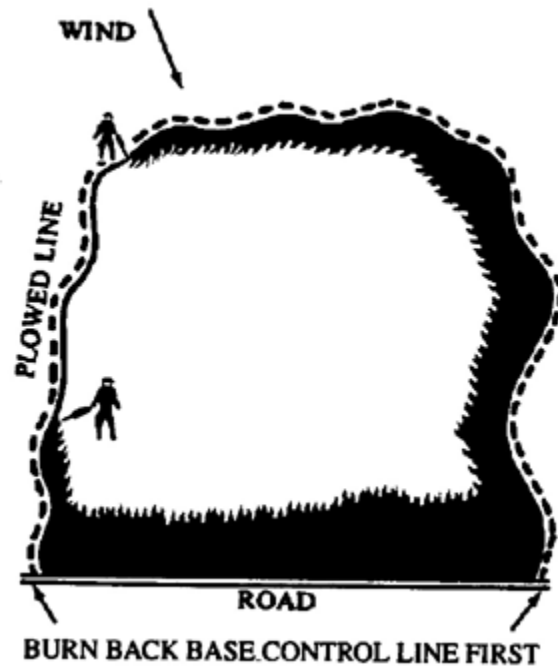


Figure 4. Ring Fire Technique

Planning the Burn

Prescribed burning is a highly technical job requiring a knowledge of fire behavior, suppression techniques and the environmental effects of fire. 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 over 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. Existing barriers such as roads and creeks should be used as much as possible. It is important to make certain the barriers are still effective at the time of the burn.

The Written Plan – 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 risking fire; for example, brush control, hazard reduction, wildlife habitat improvement, 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 should the flames be and how intense) 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: (1) location of the area and number of acres to be burned, (2) exterior boundaries and adjacent landowners, (3) existing firebreaks, (4) fire lines to be plowed and (5) interior areas to be excluded from the burn.

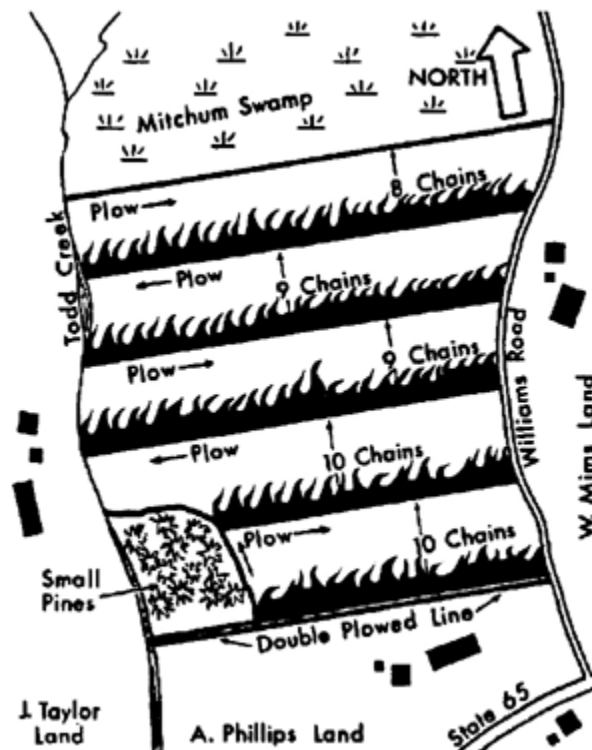


Figure 5. Burning Unit Map

Advance 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 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 firefighting tools (fire rake, flap and, if possible, a back pack 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 for them.

Weather becomes of prime importance once the month for the planned burn has arrived. Watch daily forecasts closely, because successful prescribed burning depends heavily on the weather matching the prescription.

Burning Notification – It's a good idea to call the Arkansas Forestry Commission and the local volunteer fire department and let them know the date you are going to burn. This may prevent them from needlessly dispatching a unit to the site of your burn. You should tell them the location of the burning site, including section, township and range, the time of burning, type of burning and number of acres. It is a matter of courtesy to notify all adjacent landowners of your intention to burn several days in advance.

Smoke Management – Prescribed fires produce much less smoke and particulate matter than wildfires. However, under some atmospheric conditions smoke caused by prescribed burning can be a problem. If possible, burn when the wind will carry smoke away from heavily traveled roads, interstate highways, airports, hospitals and populated areas. If smoke is allowed to drift across lightly traveled roads, use signs and personnel to control traffic.

Generally, you should avoid burning during periods of high "Air Stagnation." The Arkansas Forestry Commission and the National Weather Service can give you information on the "Air Stagnation Index."

Air Stagnation Index and Interpretation	
0 - 6	Excellent to good dispersion of smoke
7 - 10	Marginal, care should be taken
11 - 14	Poor smoke dispersion, pollution potential
15 - 17	High pollution potential

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 in motion the prescribed burning plan. The best available weather information should be obtained in the morning. If conditions appear favorable for burning, notify the Arkansas Forestry Commission, the local volunteer fire department and neighboring landowners. 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 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 (1) amount of fuel consumed, (2) probable hardwood kill, as indicated by bark cracking at ground line and (3) 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 three months to a year after the burn. By that time actual hardwood kill (or dieback to ground) and 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

- For each area to be burned, have a written plan prepared by a professional forester.
- Prepare in advance for burning by having firelines plowed, necessary equipment on hand and trained personnel available.

- Get a Permit to Burn and notify adjacent landowners of your intention to burn.
- Watch the weather, and when the proper conditions exist, execute the burn according to your written plan.
- Follow smoke management guidelines.
- If conditions change or any undesirable condition exists, be prepared to control the fire and put it out.
- Sometime after the burn, evaluate the results to determine if your objectives have been met.

Remember, fire is part of the natural environment; and if used carefully by professionals, it can be a desirable and economical tool for management of Arkansas' pine forests.

References

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