

Prescribed Burning

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Fire

Fire can be a great tool that benefits a number of natural resources. Prescribed burning is defined as the intentional use of fire, under prescribed conditions and with adequate supervision and preparations, to accomplish one or more specific objectives.

The prescribed conditions include a number of weather and fuel conditions that can affect the success of the burn. Some of the more common uses for prescribed burning in Mississippi are listed below:

- Site preparation in advance of planting
- Hazard reduction by removing fuel that could endanger property if ignited
- Reduce above-ground vegetation, generally hardwoods, in pine stands by burning in spring
- Obtain a “root kill” of competing vegetation, generally by conducting a burn in late spring or summer
- Promote or retain diverse herbaceous plants by killing woody plants
- When managing for longleaf pine, fire kills young loblolly pine trees that are competing with the desired longleaf and reduces the occurrence of brown spot disease.
- Improve wildlife habitat by shifting species composition and by removing the forest floor layer so that wildlife can more easily find seeds.

- Burn some types of fruit-producing vegetation, such as blueberries and blackberries, to stimulate berry production.

As you can see, prescribed burning has many positive benefits. In addition, it can be a relatively inexpensive tool since in many cases, burning only costs \$25 to \$30 per acre. There are some negative aspects about prescribed burning, however. It can be unpredictable if the weather abruptly changes; it can be difficult for the untrained person to control; and it can require unanticipated down-time or the need for special equipment. It also does not respect property lines if fire lines are inadequate or nonexistent.

Smoke is the greatest problem with prescribed burning. Smoke released into the atmosphere and settling onto a major highway or interstate has caused traffic accidents. These accidents have led to lawsuits, which is the main reason fewer people use prescribed burning today than in the past. Insurance rates to cover potential damage from prescribed burns have increased considerably, causing many people to choose other methods of control.

If you plan to use prescribed fire, you must understand the “fire triangle.” For any fire to burn, it needs three things: fuel, oxygen, and heat. If you remove any of

these three items, or if you “break” the triangle, the fire will go out. In a forest situation, we can often do little about removing oxygen. However, we can put water on a fire to reduce its temperature. With enough water, at some point, the fire will go out. You can also remove fuels. This is often done by plowing a fire line down to mineral soil.

Legal Issues in Mississippi

The 1992 Mississippi Prescribed Burning Act provides the legal framework for prescribed burns in Mississippi. The Act has four mandatory requirements that must be met for a prescribed burner to have the liability protection afforded by the act. These four requirements are listed below:

- A Mississippi Certified Prescribed Burn Manager must be on site on the day of the burn.
- A permit must be obtained from the Mississippi Forestry Commission for the day of the burn.
- The burn plan must be written and notarized at least one day before the burn.
- The burn must be in the public interest.

There are three ways to become a certified prescribed burn manager in Mississippi:

- Complete and pass the prescribed burning short course offered through the Office of Academic Outreach and Continuing Education at Mississippi State University. The short course is normally offered twice a year, once in the spring, and again in the fall. For more information, contact the Mississippi State University Department of Academic Outreach and Continuing Education.
- Enroll in Forest Fire Laboratory and Lecture (FO 3201 and 3202) in the Department of Forestry at Mississippi State University and pass both accordingly.
- The Mississippi Forestry Commission may recognize certification from other states.

The Mississippi Forestry Commission will issue a permit to conduct prescribed burns when environmental conditions provide adequate smoke dispersal. Two conditions must be met:

- A transport wind speed of 3.5 m/s (approximately 8 miles per hour)
- A mixing height of 500m (approximately 1,750 feet)

When preparing your burn plan, it is important to remember to use these values as the minimum in their respective categories. When calling for a permit, you will be asked to provide your name and the location of your property, including the county. You will also be asked to provide (to the best of your ability) a legal description of the property being burned.

The burn plan must be notarized at least one day before the burn to ensure that you have done some planning for the burn. This is primarily to ensure the public safety as well as make you aware of any special conditions on the property being burned.

Liability

Liability for damages under the Mississippi Prescribed Burning Act falls upon the burner. If the four mandatory requirements listed above are followed, and someone is hurt by your fire or the smoke it produces, the burner can be found guilty of simple negligence. This means that the burner can be held liable for actual damages and up to \$150 in punitive damages.

If the four mandatory requirements listed in the previous section are not followed, and someone is hurt by your fire or the smoke it produces, the burner can be found guilty of gross negligence. This means that the burner can be held liable for actual damages, punitive damages up to \$500, as well as being guilty of a misdemeanor. The misdemeanor carries a maximum 3-month sentence in county jail. It is important to remember that negligence, either simple or gross, can be determined by a jury.

Burn Plan Preparation

The first step to a successful prescribed burn is advance planning. It is very important to determine the conditions of the area you want to burn, the reason for the burn, and the proper actions to take to meet your goals. You will need a written prescribed burn plan for each area to be burned. Some plans may be short and simple. Others are long and complex. In either case, it is essential that the plans are concise and that they include all necessary information.

Plan Components

Many different forms can be used for a prescribed burn plan. The form provided here is an example of the minimum information necessary to conduct a prescribed burn legally in Mississippi (adapted from Londo, et al. 2005):

• Legal Description of Property

The complete legal description of the property must be on the form, including the section, township, and range. Also include the county and state.

• Name of Owner

The name and address of the property owner, as well as the name of the person who prepared the plan, should be included. Mississippi requires that a burn plan be notarized, at least one day before the day of the burn. The notary's signature and number should be on the prescribed burn plan. In addition, Mississippi requires that a burn permit be obtained. The permit number should be recorded on the burn plan as well as the date the burn is conducted.

• Stand Description

Describe the stand characteristics, including a description of the overstory and understory. Also describe fuels. Fuels are typically considered to be those on the soil surface. Fuel loadings and models can be easily determined by using the fuel model and loading descriptions found in National Interagency Fire Center (NIFC) Publication 1981- S 390 Fire Behavior Field Guide.

These publications are available through the National Interagency Fire Center in Boise, Idaho (www.nife.gov). You should also include the topography of the site because it can have a significant effect on fire behavior, microclimatic conditions, and fuel loading. It is important to note what soils are present on the site. This is especially true if there are organic soils present. Take special precautions to keep fire away from organic soils.

• Purpose of the Burn

There are many reasons for conducting a prescribed burn, including timber management, wildlife habitat management, and hazardous fuel reduction. These topics, as well as other reasons, were discussed earlier in this chapter.

• Pre-Burn Information

Maps: You need at least three maps: a large scale area map; a site-specific map outlining the burn area; and another site-specific map of the burn area with burning methods and escape routes marked. Highlight the burn area on the large scale area map, along with evidence of smoke-management screening. The site-specific maps focus on the area being burned. These two maps will be used exclusively for the rest of the pre-burn information section.

Fire lanes: On the site-specific map, the corners of the area to be burned should be labeled, usually with capital letters. When installing fire lanes, label the fire lane placement based on the letters. This is done for simplicity and safety. Everyone can see where the fire lanes are based on the map. If the crews are using radios for communication, it is easy to let everyone know where they are, or where the jump in the fire lane has occurred, etc. Interior fire lanes may be needed. These can be installed and labeled in the same way as those on the exterior. It is also useful to put in the burn plan any natural or other man-made fire breaks present. These can include streams, ponds, roads, skid trails, etc.

Acres to be burned, crew size, equipment needed: It is important to document how many acres are to be burned, as well as the crew size and equipment needed. In Mississippi, once the burn plan is notarized, it becomes a legally binding document. Therefore, if you are conducting the burn with a smaller crew size than you initially specified, your liability could increase if something goes wrong.

Special precautions: There will usually be something in the vicinity where you are burning that you don't want damaged by your fire. It could be a streamside management zone (SMZ) around a stream, a hunting cabin, etc. You should note anything of this nature on the burn plan and the site-specific maps.

Notify if needed: Emergency contacts must be listed on your burn plan because you won't have the time to look up numbers if something goes wrong with your fire. You can notify these contacts before starting the burn to alert

them that you will be burning that day. Also, it is good to include the names of people who live in the vicinity of the area you are burning. Some may have health concerns or other issues that would make fire and smoke hazardous for them. Notifying them in advance can save you and them a lot of time and trouble later on.

Smoke management: One of the most important things you can do when planning for a prescribed burn is to determine if there are any smoke-sensitive or smoke-critical areas present. This is important for safety and liability concerns. You should take the following steps, adapted from Wade and Lunsford (1989), as part of a smoke management plan for any prescribed burn:

Step 1: Plot the direction of the smoke plume

Using the regional scale map, plot the anticipated downwind smoke movement. Assume the distance the smoke travels based on the following information:

- Grass fuels (regardless of burning method).....5 miles
- Palmetto/gallberry fuels using backing or spot fires.....10 miles
- Palmetto/gallberry fuels using heading fires.....20 miles
- All logging debris fires.....30 miles
- Backing fires in all other fuel types.....5 miles
- Line heading fires in all other fuel types.....10 miles
- Burns of 250 acres or more.....10 miles

Smoke does not travel in straight lines; it disperses horizontally as it moves. To account for this, draw a line starting at the center of your proposed fire, following the prescribed wind direction. Draw two additional lines at 30° from each side of your centerline.

Lastly, follow any drainage for one half the distance determined above. This will account for smoke movement after sundown. It is important to keep in mind the scale of the map you are working with to determine accurate distances. A key concept of smoke management is that if you put smoke in the air, wherever it goes, it is the responsibility of the burner.

Step 2: Identify smoke-sensitive areas

Smoke-sensitive areas are areas where your smoke could have a negative impact. Such places include, but are not limited to the following:

- Towns and Cities
- Airports
- Roads and Highways
- Hospitals
- Nursing Homes
- Schools
- Chicken Houses

It is important to note that you will not necessarily be able to find all the smoke-sensitive areas just from the map. You should do a reconnaissance around the area first to determine if there are any elderly residents, residents with respiratory problems, or farms present. You may need to go door-to-door in some cases to ensure that you have all possibilities covered.

Step 3: Identify smoke-critical areas

Smoke-critical areas are locations that already have an air quality problem or smoke sensitive areas in the path of your smoke. An area identified in step 2 is smoke critical if it is within 1/10 the smoke travel distance listed in step 1. For example:

Fuel Type	Smoke Travels	Critical if within
Grass fuels (regardless of fuel type)	5 miles	0.5 mile
Palmetto/gallberry fuels using backing or spot fires	10 miles	1 mile
Palmetto/gallberry fuels using heading fires	20 miles	2 miles
All logging debris fires	30 miles	3 miles
Backing fires in all other fuel types	5 miles	0.5 mile
Line heading fires in all other fuel types	10 miles	1 mile
Burns of 250 acres or more	10 miles	1 mile

Step 4: What to do if smoke-critical areas are present

If smoke-critical areas are present, you cannot burn under the current prescription. However, you do have the following options:

- Don't burn at all.
- Change the prescription and go through the smoke-management system again.
- Do something other than burning. Use mechanical operations to remove slash, hazardous fuels, and other vegetation. Herbicides can also be used.
- If you are burning windrowed logging debris, and smoke-sensitive or critical areas are present, then don't burn. Windrows produce copious amounts of smoke and take longer than one day to burn.

Firing Techniques

There is more than one way to start a burn. How you start a burn is called the "firing technique," and this can influence your flame characteristics. One of the safest and most widely used firing techniques is a backfire. A backfire is a line of fire set along a firebreak perpendicular to the wind. Because of this, the fire burns slowly back into the wind.

Because the fire is moving into the wind, the flames are low and slowly spreading. Controlling such a fire is relatively easy. However, people often do not realize that this technique generates more heat than most other firing methods. This is because the fire remains in one place longer, burning deeper into the forest floor, and can more easily result in lethal temperatures than other firing techniques. The chief disadvantage of a backfire, however, is the slow rate of spread. It is difficult to use a backfire only to cover even moderate acreage in most of Mississippi, so it is often used in combination with other firing techniques.

The opposite of a backfire is a headfire. With this technique, the fire is set and carried with the wind, stopping once it reaches the far firebreak because you have removed fuel and broken the fire triangle. The flames generated by a headfire are generally higher and travel much faster than a backfire. Hopefully, you will

have no "spotting" once the fire reaches the fire break. Spotting is where hot embers are lifted up and over a firebreak, coming back to ground and starting another fire on the wrong side of the firebreak. Because of this danger, it is important to have people looking out for spotting.

A strip headfire is a modified and somewhat safer version of a headfire. With the strip headfire, you have multiple people setting fire. The first one starts nearest a plowed or burned out fireline and puts in a line of flame perpendicular to the wind. After the first firing line is set, a second line is started some distance upwind of the first line. Once the first set line burns up to where the second fire line was started, it goes out. The second fire line has already burned the available fuel. A third and subsequent lines are set in similar order. This technique allows the burner to burn relatively large acreages quickly and safely.

Range of Desired Weather

The desired weather conditions under which you want to conduct the burn needs to be documented here. This includes surface and transport wind speeds, mixing heights, stagnation indices, relative humidity, temperature, and time of day to start the fire.

Summary of Burn

Once the burn is completed, you should conduct a summary of the burn. The number of acres actually burned, and the techniques used should be the same as what you said you were going to do. Additional information needed includes the time the fire was set, time period for which your permit was valid, and the weather conditions on the day of the burn. Depending on the objectives of the burn, you can include the number of acres burned, number of jump-overs, measures of crown scorch, etc. The following is a sample Prescribed Burning Plan form:

BLANK PRESCRIBED BURNING PLAN*

Legal Description of Property

40: _____ Section: _____ Township: _____ Range: _____
County _____ State _____

Name of Owner

Name: _____ Plan prepared by: _____
Address: _____ Date plan written: _____
Approved by (Notary): _____ Date burn executed: _____
Burn Permit Number: _____

Stand Description

1. Overstory: _____
2. Understory: _____
3. Fuels: _____
4. Topography and soils: _____

Purpose of the Burn

Pre-Burn Information: (See attached maps)

1. Fire Lanes: _____ Exterior: _____ Interior: _____
2. Other Barriers: Natural: _____
Man Made: _____
3. Acres to be Burned: _____ 4. Crew Size: _____ 5. Fire Units: _____
6. Special Precautions: _____
7. Notify (if needed): _____
8. Smoke Management
a. Smoke Sensitive Areas: _____
b. Smoke Critical Areas: _____
9. Firing Techniques: _____

Range of Desired Weather

1. Surface wind speed: _____ 5. Relative Humidity: _____
2. Transport wind speed: > _____ 6. Temperature: High _____ Low _____
3. Mixing Height: > _____ 7. Time of day to start: _____
4. Stagnation Index: 0-2

Summary of Burn

1. Acres burned _____ 2. Firing techniques _____ 3. Date burned _____
4. Time set _____ 5. Time permit in effect _____
6. Actual weather conditions:
Surface wind (Dir and Speed) _____ Transport Wind _____
Mixing Height _____ Stagnation Index _____
Temperature (High) _____ (Low) _____ Relative Humidity _____
Remarks _____

* Adapted from Londo et al. 2005. *Living on the Edge. Wildland Fire Management: A Laboratory Manual. Interactive Training Media, Tallahassee FL. 212p.*

What Weather Characteristics Are Most Critical?

A number of weather measurements are important to consider when determining whether to start or maintain a burn. Generally, for winter burns, you will have a pretty good idea what the weather will be like for a 3-day period. Fronts move in from the north or west in winter, and the weather patterns are predictable. Because of wind instability, never burn when a front is moving through. Once a front blows through, you might be looking for a series of weather characteristics, including the following:

- **Relative Humidity (RH)**—Relative humidity is the amount of water vapor in the air, compared to the maximum amount of water vapor it can hold, and is expressed as a percent. High relative humidity indicates a lot of moisture in the air, and also in the fine fuels that are used to carry the fire. The upper end of RH is 60 to 75 percent, depending on fuel type. A high RH will result in a spotty burn. However, if the temperature is supposed to increase, you can be assured that the RH will drop as the temperature increases, and your patience will

be rewarded. A relative humidity below 25 percent is too low to burn because the fuel becomes too flammable, and you could lose control of the fire.

- **Wind Direction**—If your property is on the south side of a major highway, do not burn when the wind is from the south. Wait for a north or northwest wind that will push smoke away from the highway.

- **Wind Speed**—This will vary depending on the firing technique you use. With a backfire, you burn at higher wind speeds than with a headfire. However, you need some wind. Suitable wind speeds may be from 2-20 mph, depending on firing technique.

Other weather variables might be important with your burn: current and projected temperatures, fuel moisture, or other variables.

You should conduct a “test burn” on a small area to make sure the fire will behave as anticipated. If the fire burns as expected and the smoke behaves as anticipated, you have a good test burn and are ready to start your burn.

References

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