# Bring Fire Back to Oak Forests

## Part 2

**Now that you understand the benefits of using prescribed fire in hardwood stands, learn the steps to prepare for and conduct a safe, effective prescribed burn.**

**By Dr. Craig Harper**

A deer and habitat management program can gain considerable benefits from the use of prescribed fire in hardwood stands, and knowing these benefits is the first step toward bringing fire back to forests that need it. I covered the benefits and how and when to use fire to achieve them in Part 1 of this article in the last issue of *Quality Whitetails*. The second step, and the subject of Part 2, is knowing how and when to safely and effectively implement a burn. This two-part series is excerpted from a chapter I contributed to an upcoming publication by the USDA Natural Resources Conservation Service.

It is beyond the scope of this article to provide a step-by-step prescription for implementing prescribed fire. However, there are several steps that should be highlighted and followed carefully. Before implementing any prescribed fire, it is critical to work with experienced personnel until you have adequate experience to conduct the burn yourself. And then, it is always necessary to have adequate help to complete the burn.

**Preparing The Site**

Before any site can be burned, there must be sufficient firebreaks – cleared lanes of exposed soil designed to stop fire. A creek or road can serve as a firebreak, but usually one has to be established. This is most often accomplished with a dozer and fire-plow. These firebreaks can be made more permanent by dressing them afterwards with a tractor and disk. This will smooth the firebreak, which makes it easier to walk or ride along with an ATV. This can be important when setting backing fires or checking stands after burning. If adequate sunlight is available, firebreaks can be planted if desired. Of course, firebreaks should be established along contours with consideration to prevent erosion. Establishing firebreaks is best done months before the burn is planned. When it is time to burn, it is essential to clear firebreaks of debris to prevent fire from spreading across the firebreak. Any standing dead trees within reach of the firebreak within the area to be burned should be felled to prevent them from falling across or allowing embers to blow across the firebreak. While it is best to establish a firebreak that exposes soil (which doesn't burn), firebreaks along the edges of woods can be created with water trucks that have the capacity to spread enough water that creates a wetline. Volunteer fire departments often have this capability and may

be willing to help implement the prescribed fire.

Mowed strips of vegetation do *not* stop fire and should not be considered a firebreak!

**The Burn Plan**

A burn plan should be prepared prior to every burn. The burn plan should describe the area to be burned, state the objectives, and list preburn factors, such as a description of the fuels present, manpower and equipment needed, nearby smoke management considerations, and ignition procedure. A map of the area to be burned should be included in the plan. The map should clearly show the firebreaks and the planned ignition procedure. The desired, predicted, and actual weather conditions should be included in the plan. Obviously, actual weather conditions will not be known until it is time to burn; thus, the burn plan is a working document that is filled out before, during, and after the burn. Along with actual weather conditions, the desired and actual fire behavior should be recorded as well. Finally, after the burn, a postburn evaluation should be completed. All this information helps ensure you are prepared to implement the fire and helps you understand fire effects after the burn is completed. In summary, this helps make you a more successful and safe prescribed fire manager.

**Notifying Appropriate Contacts**

A critical step prior to burning is notifying the proper contacts. In most states, it is necessary to obtain a burning permit from the state forestry agency prior to burning, at least during certain seasons of the year. In addition to this, you should notify 911 and tell the dispatcher that you have a burn permit and that you intend to burn during the stated time of day. You then should call the area fire department(s) and tell them you have a burn permit and that you intend to burn during the stated time of day. Don't hesitate to ask them to come out and help if they would like. Often, a local volunteer fire department enjoys coming out and helping. Involve everyone you can. Make sure your neighbors know what you are doing! The more contacts you make, the better. No one in the local area should be surprised when they see smoke.

**Firing techniques**

There are five main firing techniques commonly used when lighting a fire. The

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## Red Flag Conditions

You have planned your burn for months. You have everything in order and plenty of people on-site ready to help. Everything has come together, except… In your eagerness to burn, don't overlook a **Red Flag** condition and think, "It'll be alright." This is a recipe for disaster. Don't hesitate to cancel a burn if conditions are not right or if something has been overlooked. There are several **Red Flag** conditions, and you shouldn't burn if any are present.

**DON'T BURN IF…**

- Adequate firebreaks are not in place.
- You have not completed a written burn plan.
- Everyone has not been briefed on the plan and conditions.
- Conditions are too dry or too windy.
- The forecast does not meet the prescription.
- There is inadequate personnel or if experienced personnel are not present.
- Communication (such as hand-held radios) is not available for everyone helping.
- Adequate contacts have not been notified.

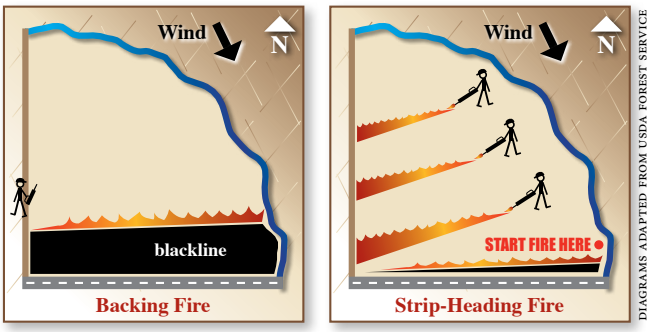
Well-established, clean firebreaks are essential to a safe and effective burn. Disking and smoothing a firebreak makes it easier to walk or drive along the break while monitoring and managing the fire. Having an ATV on site also helps you effectively monitor firebreaks.

recommended firing technique varies with landowner objectives, condition of fuels, topography, and weather. Different firing techniques allow you to adjust fire intensity to the desired level. I will provide a *general description* here to introduce you to firing techniques that may be used. For additional information, contact your state forestry agency and review more detailed publications on using prescribed fire. One such publication, the USDA's "A Guide For Prescribed Fire in Southern Forests," is available free online at:

www.bugwood.org/pfire/

**1. Backing Fire**

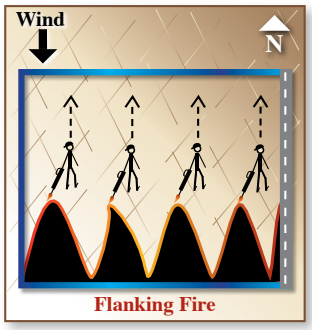
A backing fire moves against the wind. Thus, it is relatively slow moving and generally consumes fuel more completely than fire moving with or parallel to the wind. Backing fires are set along a firebreak (or other barrier, such as a creek or road) on the downwind side of the area to be burned and allowed to back into the wind. A steady wind speed and direction is important for consistent and predictable burning. Backing fire is less intensive with lower flame heights than other firing techniques. This produces less scorch (if any) when burning oak woods. However, the slower moving fire can have a longer residence time and can possibly damage fine feeder roots if the duff layer below the leaf litter is dry. This is another reason to burn when adequate duff moisture is present. Backing fire should be used when considerable fuels are present, especially vertical fuels (dense shrub layer), as they can elevate fire intensity if a heading fire is used (a fire that burns with the wind), which may damage/kill desirable overstory trees. Backing fire is typically the easiest to implement. Although it takes longer to implement a backing fire, it is the recommended firing technique when burning oak woods where damage to overstory trees is not desirable.

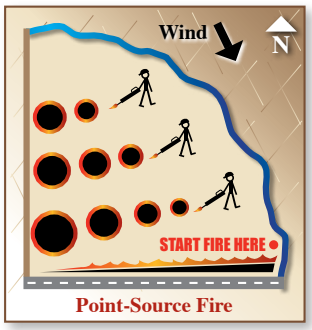



DIAGRAMS ADAPTED FROM USDA FOREST SERVICE

**2. Strip-Heading Fire**

A strip-heading fire involves both backing fire and heading fire. A backing fire is first set along a firebreak, then lines of fire are set sequentially upwind of the backing fire and allowed to move into the backing line of fire. The distance of the strip-heading firelines from the backing fireline is set according to the desired level of fire intensity. Normally, the strip-heading fireline is set 50 to 200 feet upwind of the backing fire. Fuel conditions, windspeed, relative humidity, and landowner objectives determine the distance that should be used. A major advantage of strip-heading fires over backing fires is strip-heading fires require much less time, allowing quick ignition and burnout. A major consideration when using strip-heading fires is to create an adequate blackline (at least twice the distance that will be used between the backing fire and the strip-heading fireline) with the initial backing fire prior to setting the first strip-heading fireline. When burning oak woods,





strip-heading fires are applicable when relatively flat fuels are present. Presence of vertical fuels may demand increased use of backing fires.

**3. Flanking Fire**

Flanking fires are set directly into the wind, allowing the fire to burn at right angles to the wind. Obviously, this can be unpredictable and dangerous if wind direction is inconsistent. Typically, several burners are necessary to implement a flanking fire. Coordination is critical so that all the lines of fire are set at the same time and all the burners know where each other are and move at the same speed. Flanking fire is also used to secure the flanks of backing and strip-heading fires along firebreaks. Flanking fire is usually intermediate in intensity between backing and strip-heading fires. Implementation is more difficult, however, as coordination is critical among burners.

**4. Point-Source Fires**

Point-source fires can be viewed as modified strip-heading fires, where spot ignition is used instead of strip ignition. Spot ignition produces more intensity than the backing fire, but less intensity than strip ignition. This can help speed-up the line-backing fire with less intensity than would be produced with a strip-heading fire. Point-source ignition spots are ignited upwind of the backing fireline. The distance of the point-source ignition spots from the backing fireline are determined just as those in a strip-heading fire. It is important to realize point-source ignition spots are not placed randomly. To safeguard against hot spots, point-source ignition spots should be equidistant along each fireline. If not equidistant, a point-source ignition spot on one fireline may burn between two point-source ignitions spots on the adjacent downwind fireline and produce a heading fire that exceeds desired intensity levels. Firelines may be set by a single burner, or firelines may be set simultaneously by multiple burners. If multiple burners set firelines, it is critical that they are able to communicate (they should be able to see each other and communicate via radio) and are coordinated in setting the firelines.

**5. Ring or Center Fires**

A ringfire is ignited by first igniting the backing fire adjacent to the downwind firebreak. After securing the firebreak, the fire is spread around the perimeter of the area being burned, along the firebreak that surrounds the area. Before the perimeter is complete, a point-source fire is ignited in

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the center of the area. Then, the remainder of the perimeter is ignited. Convection from the center point-source fire creates indrafts that pull the perimeter fire inward, potentially creating a strong convection column, which can cause spot-fires a considerable distance away. Ringfires are normally used only when clearing debris prior to planting trees. It is described here only for informative purposes. I do not recommend ringfires when burning in oak systems. Further, ringfires should not be used whenever wildlife is a consideration as direct mortality is more likely than with other firing techniques.

**Smoke Management Considerations**

The old adage, "where there's smoke, there's fire," can also be flipped—"where there's fire, there's smoke." And when we create smoke, just like fire, we are responsible, and we must consider potential impacts of smoke before implementing a fire. Major considerations include atmospheric stability, wind direction, fuel moisture, weather forecast, and timing.

Controlled burning should not be implemented when the atmosphere is stable and smoke is unable to rise and disperse (your state forestry agency can help alert you to these conditions). It is most desirable for smoke to rise rapidly, disperse, and be transported away from the site relatively quickly. Winds should carry smoke away from sensitive areas, such as major roads, hospitals, airports, and schools. Burning should not be conducted anytime smoke may enter such areas. These considerations do not prevent prescribed fire from being used near sensitive areas. However, wind direction and atmospheric stability must be considered closely so smoke is moved away from those sites and dissipates relatively quickly.

Burning during the growing season (shown here) may produce more smoke than burning during the dormant season because of the moisture in green leaves in the understory.

In addition, adequate moisture should

be available to prevent consuming the duff layer under the leaf litter when burning oak woods. However, excessive moisture can lead to smoke management problems. Trying to burn when relative humidity is above 50 percent can lead to excessive smoke. Burning during the growing season will produce more smoke than burning during the dormant season because of the moisture in the green leaves in the understory. Balancing fuel moisture with smoke management considerations is important.

The amount of smoke produced is increased with higher relative humidity and moister conditions. Thus, burning during the middle of the day produces relatively less smoke than burning during the early morning or evening. Typically, by waiting until 10 to 11 a.m. to initiate burning, relative humidity has decreased and the ambient temperature has increased to allow more complete fuel consumption and less smoke. As temperatures decrease in the evening and relative humidity rises, smoke problems can be accentuated, especially in low-lying areas. This can be particularly problematic if smoke follows drainages and meets a road. It is also at

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## Weather and Fuel Conditions

Wind speed, relative humidity, temperature, rainfall, and atmospheric stability are the primary factors that influence fuel moisture, fire intensity and smoke management. As you learn to burn, you will soon realize it is absolutely critical to follow weather patterns and forecasts when planning to burn. Accurate weather forecasts for planning prescribed fire can be obtained at the National Weather Service website:

**http://weather.gov/**

You may also find detailed weather information relative to prescribed burning at your state forestry agency website.

The importance of monitoring the weather cannot be overstated. This should be a regular activity as the burning season approaches. Weather patterns and forecasts should continue to be monitored in the days leading to burning and right up until burning is initiated. On-site conditions may also be monitored by hand-held instruments that provide temperature, wind speed, and relative humidity readings. These instruments are available through forestry supply dealers, such as Forestry Suppliers and Ben Meadows.

**Predicted wind speeds** of 6 to 20 mph are desirable when burning. However, it is important to note wind speeds are forecasted for open areas 20 feet aboveground. Actual wind speeds 6 feet aboveground in the woods are considerably lower. In-stand wind speeds at eye level should be 1 to 3 mph for safe, predictable burning conditions.

**Relative humidity** is the amount of moisture in the air compared to the total amount of moisture the air is capable of holding at that temperature. The preferred relative humidity for a majority of burning prescriptions is 30 to 50 percent.

**Ambient air temperature** is an important factor when burning as higher temperatures dry fine fuels more quickly than cooler temperatures, and higher temperatures increase the likelihood a fire will reach lethal temperatures to kill plants (145 degrees F at the cambium, or inner bark, layer).

**Rainfall** and **atmospheric stability** are two other critical factors. To learn more about reading all five of these primary weather factors in deciding when and how to burn, contact your state forestry agency.

this time that wind direction is more difficult to predict, and winds often cease completely, allowing smoke to settle and reduce visibility. This is not to say burning should not be conducted during morning, evening, or nighttime. Burning during these times may be most sensible if conditions are best to meet objectives. For example, when dry conditions prevail, burning at mid-day may not be prudent because fire intensity may be too high.

This dormant-season fire burning into the wind should be just right for achieving habitat goals without damaging valuable timber. To fine-tune your future burning skills, always evaluate the immediate and long-term effects and results from the fire.

Small test fires should be set prior to initiating a prescribed fire to confirm predicted fire intensity, wind direction, fuel consumption, and smoke dispersion. Contingency plans should also be in place if conditions change unexpectedly and burning should be halted.

**Post-Burn Evaluation**

Evaluating the results of your management efforts is critical to success. Burning just because someone recommended it doesn't make sense, especially if the desired results or effects are not realized. In many cases, you won't know if the desired results are achieved unless you evaluate your efforts. Post-burn evaluation should be completed immediately or soon after a burn, as well as during the growing season following the burn.

Surveying the area immediately after a burn allows you to record the percentage of the area that burned and evaluate fire intensity. If some areas didn't burn, determine why they didn't burn, and note whether that is desirable or not. If not, what conditions were present that kept that area(s) from burning? Fire intensity can be evaluated by recording how much of the litter layer and understory vegetation was consumed and if any desirable overstory trees were damaged. If there were any damaged, was it because the fire was too intense, or because debris was present around the base of the tree? If a growing-season fire was implemented, was the understory foliage consumed? Did the duff layer remain intact? Recording this information will help you determine the intensity of fire under the present conditions, and if your next burn should be altered depending on the results after burning in those conditions. In your burn plan, there should be a place to record these data, as well as other observations,

such as characteristics of smoke dispersal, flame heights, how long it took to complete the burn, and incidence and timing of smoldering. Incidence of fire escape should also be recorded. If the fire escaped the firebreak, you should know what action should be taken next time to prevent a similar response. Wildlife mortality should be recorded. For those who haven't burned before, they are often interested and pleasantly surprised to find no wildlife harmed by the fire. If you do find some mortality, don't worry. You are managing land for wildlife habitat and populations, not individual animals. Consider the firing technique used and how that might be adapted next time to prevent mortality.

In the growing season following the burn, continue to evaluate the fire by recording the understory vegetation response. Is there an increase in herbaceous plants, or are woody species dominant? What percentage of woody sprouts top-killed by the fire is re-sprouting? Is damage to any overstory trees obvious? Recording this information will help you make any necessary adjustments to burning technique, timing, and intensity.

Here's the potential result of a well-planned, well-run fire in a hardwood stand: valuable and abundant forage species appearing in the growing season immediately following the fire.

**Human Perception: Opportunities and Limitations**

Our society has essentially been "programmed" to believe fire in the woods is bad. The notion that any fire is bad and that it "destroys" the forest is ridiculous. Fire is a natural and necessary phenomenon. Fire causes change. By using prescribed fire accordingly, you can make sure the change is directed toward helping you meet your land management objectives.

The best way to change human perception of using fire in the woods is to use it and show the effects. Invite others to come see the effects of your woods-burning efforts or even to help in your next controlled burn. Always remember to make appropriate contacts before burning, and never allow your neighbors to be surprised when you burn. Over time, do not become too "comfortable" when burning. This leads to laziness, taking risks, and not making sure all precautions are met. Burning should never be conducted outside the recommended prescription.

When the appropriate precautions and procedures are taken, fire is a wonderful tool to help meet management goals and objectives in oak systems, whether they focus on timber production, forest health, aesthetics, or wildlife considerations. Keeping an open mind with regard to possible management practices, and adjusting techniques as necessary to meet your objectives will help you enjoy your forest resources more than ever.

***About the Author***: *Dr. Craig Harper is a professor of wildlife management and the Extension Wildlife Specialist at the University of Tennessee. He is a certified prescribed fire manager, a certified wildlife biologist, and he has studied the effects of fire in oak systems for nearly 20 years.*