Bring Fire Back to Oak Forests

Part 1

Used wisely, fire is a valuable tool for forest and habitat management, no less so in oak stands than in any other forest. Only you can dispel the fear of fire in hardwoods.

By Dr. Craig Harper

Fire was a natural part of the ecology of North American forests for thousands of years. Many habitat managers, however, are still reluctant to light woods on fire, *especially hardwood stands*. This article, published in *Quality Whitetails* in two parts, is excerpted from a chapter I contributed to an upcoming publication by the USDA Natural Resources Conservation Service (NRCS). Part 1 discusses the effects and wildlife benefits of fire in oak systems in the eastern United States. Part 2 will cover the mechanics of implementing fire in oak forests on lands you manage.

Fire Effects on Wildlife Habitat

Fire can be used in oak systems to influence vegetation composition and structure, which can influence regeneration, as well as encourage additional food resources and enhance cover for a wide variety of wildlife species. Fire sets back existing vegetation and stimulates fresh growth from the seedbank and from sprouting. The fresh vegetative growth is more palatable and nutritious for grazers and browsers as plants are typically more digestible and contain higher nutrient levels following burning, especially early in the growing season following fire. Fire consumes the litter layer, which not only stimulates the seedbank, but also makes food resources, such as seed, mast, and invertebrate parts, in the leaf litter more readily available to wildlife.

Fire typically leads to increased herbaceous forage and browse, as well as soft mast, but this is directly related to the amount of sunlight entering the canopy. In closed-canopy stands, the increase in forage and browse may be negligible if additional sunlight is not allowed through canopy reduction. Allowing at least 20 to 30 percent sunlight into the stand through retention cutting or some type of thinning prior to or soon after burning is necessary if increased forage/browse is desired. Light availability is also related to soft mast availability. Burning scarifies seed and encourages germination of some plants that produce soft mast, but if sufficient sunlight is not available, an increase in soft mast may not be realized. Blackberry, pokeweed, and blueberry are often the primary soft mast species responding after canopy reduction and fire in oak systems in the eastern United States. Soft mast production will begin to decline after five years, and by seven years post-disturbance, the regenerating woody stems in the understory will have developed to

the point they are shading out soft mast species. Additional prescribed fire will be needed to set back succession within the stand and stimulate additional soft mast production.

Food availability is important for wildlife, but arguably more important is the structure and cover present. Various wildlife species require different amounts of groundcover, vertical cover (layers of vegetation from the ground up), and horizontal cover through various stem densities. Until the structure is suitable for a particular wildlife species, food availability may be meaningless. Fire can be used to create the desired structure within a stand for various wildlife species. However, just as related to food, light availability is critical to influence the structure within the stand. With sufficient sunlight, groundcover is stimulated by fire. This is desirable for species that forage at ground level, for those that nest among the understory vegetation, and those that require such cover for raising young. Without additional fire, the understory woody response soon grows into the midstory. Within about seven to eight years (in the eastern United States where rainfall is not limiting), the amount of sunlight reaching the forest floor is reduced to that available in a closed-canopy situation (usually zero to 5 percent sunlight). At this point, your management strategy should follow your objectives. If you have considerable acreage and you are concerned with the regenerating stand, it may be desirable to allow the regeneration to develop and begin managing another stand. But if your acreage is limited, and your objective is wildlife that would benefit from increased groundcover, soft mast, and visibility, you should consider additional fire to set back succession and create the desired conditions.

Fire Effects on Soil and Water

Fire intensity is key to how soil and water resources are affected by fire. Low-intensity fires have no negative effect on forest soils or water resources. Organic matter in the upper soil layer is generally unchanged. As plant material is consumed, nutrients are released as rain leaches them back into the soil where they are available for new plant growth. Although nitrogen is lost to the atmosphere when fuels are consumed, nitrogen may actually be increased on the site following fire through nitrogen fixation. Intense fire, however, reduces soil organic material and may reduce soil fertility. Burning when soil and/or fuel moisture conditions are extremely low can lead to reduced soil fertility and also damaged root systems. For these and other reasons, burning should not be conducted when the duff layer under the leaf litter is not relatively moist. When the duff layer remains intact, the concern of surface runoff and sedimentation into adjacent water sources is removed.

Fire Effects On Wildlife

Rarely are wildlife killed when prescribed fire is conducted in a sensible manner. Intense fire, whether wildfire or prescribed, presents more danger for wildlife. Not only does increased fire intensity pose more danger, but the firing technique used (covered in Part 2) must be considered where wildlife is a concern.

Relatively low-intensity prescribed fire rarely poses danger to wildlife. Large and medium-sized mammals – such as deer, bear, foxes and raccoons – leave the site. Small mammals, such as chipmunks or squirrels, hide underground or in trees. Birds fly. Reptiles and amphibians go underground or under large debris and objects, such as logs and rocks. Disturbance of nests and young are often a concern when implementing prescribed fire. These concerns can be alleviated by adjusting the timing of burn to occur outside the nesting or young-rearing seasons.

Fire, just as other disturbance events, should be implemented on a scale that is reasonable and acceptable for a variety of wildlife species. What is good for one species is never good for all species. Providing an appropriate balance of successional stages across the landscape to benefit a

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The author looks at sweetgum saplings re-growing after a dormant-season fire. The tops were killed by the fire, but the root system was able to re-sprout using stored carbohydrates. Fire in the late growing season (September or October) is more effective at killing woody cover and promoting forbs.

Without sunlight, fire can do little to promote plant growth. Allowing at least 20 to 30 percent sunlight into a stand through retention cutting or some type of thinning prior to or soon after burning is necessary if you want to increase forage and browse – as seen in this stand.

diversity of wildlife species should be considered.

Intensity, Timing, and Frequency

Fire intensity, timing, and frequency determine fire effects. Fire intensity is related to fuel loads and environmental conditions. Hotter, more intense fires kill larger trees than cooler, low-intensity fires, which may only kill small woody stems in the understory and some small-diameter stems in the midstory (less than 3 inches at ground level). The cambium layer of shrubs and trees is severely damaged when heated to approximately 145° F, and this normally kills the aboveground stem. For larger trees with thicker bark, a more intense fire is needed to heat the cambium layer to a level that causes damage. Increased heat can also result if debris is lying next to or lodged up against the trunk. As the debris burns, the heat is retained around the trunk longer than if only the surrounding leaf litter was burning.

Low-intensity fire should be prescribed for most applications in oak-dominated systems. Only when a significant reduction in overstory cover is desired and there is no consideration for timber value, would intense fire be recommended in oak systems. Even then, a better approach would be to mechanically remove or kill undesirable trees via girdling and herbicides, and then use low- to moderate-intensity fire at the correct time to help reduce woody competition and encourage more herbaceous groundcover.

Low-intensity fire – which is the goal in most prescribed fire applications in forests – will not harm trees unless there is debris piled against the bottom of the trunk and heat is retained while the debris burns.

Fire intensity is always a concern in stands that have not burned in many years. Litter accumulation is deep and there is usually a considerable amount of debris in the stand. When burning a stand for

the first time, it is critical to make sure there is adequate moisture in the leaf litter. Burning techniques to allow a low-intensity fire will be discussed in Part 2. Another consideration is to burn early in the growing season as opposed to the dormant season. As spring green-up occurs, moisture in the green leaves of the understory helps keep fire intensity relatively low. Nonetheless, it is always critical to burn only under the correct environmental conditions that allow fire intensity to be controlled.

Short fire-return intervals (one to two years) generally increase structure near the ground (under 4 feet) and reduce structure 4 to 12 feet high.

Fire-return intervals of three to five years maintain a diverse vegetation structure from the ground to approximately 10-15 feet. However, structure is highly dependent upon the amount of light entering the stand. More light allows taller and more dense structure.

Long fire-return intervals (over five years) in closed-canopy stands may have no impact on vegetation composition or structure, unless fire intensity is high, which would kill more midstory stems and could kill some overstory trees, breaking the closed canopy and allowing increased light to the forest floor. If dormant-season fire is used, an understory dominated by woody re-sprouts may persist. Carbohydrates are stored in the root systems of woody plants during winter senescence. Dormant-season fire may top-kill the plant, but the root system is not harmed. Upon spring green-up, the root system is able to send up sprouts, which may eventually grow into the midstory if not disturbed again. Early growing-season fire (April/May) generally produces the same effect as dormant-season fire as there are still adequate carbohydrate reserves in the root system to send up sprouts. As the growing season progresses and a majority of carbohydrates are transported from the root system to the aboveground portion of the plant, the shrub or tree is more susceptible to fire. If fire top-kills the plant during this time, it is more likely to die and not re-sprout. In stands where the objective is to reduce woody coverage in the understory and increase herbaceous cover, a late growing-season fire (September/October) will generally produce more favorable results.

Relatively infrequent fire (every four to eight years) will allow woody species to remain dominant in the forest understory. However, according to the timing of fire, fire frequency can be adjusted for various objectives. When using late growing-season fire, it may not be necessary to burn as often to maintain a significant herbaceous component in the understory than if dormant- or early growing-season fire is used.

Developing Your Fire Plan

There are many issues to consider prior to using fire in oak systems, but the first is to clearly define your goals and objectives and prepare a written management plan with a professional forester and wildlife biologist. Is regeneration and/or forest health the primary consideration? Have fuels accumulated to dangerous levels? Is wildlife a primary consideration? If so, which species? There is nothing more ambiguous than to say you want to manage for "wildlife." All species have different habitat requirements, thus management efforts for one species may be completely counter to another. Your goals, objectives to reach your goals, the strategy and meth-

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ods you intend to employ to reach your objectives, and a timeline for your efforts should be clearly stated in a management plan. This is an often overlooked step that can lead to confusion, frustration, and incomplete implementation.

Fire can be used to enhance conditions for many wildlife species. However, because all species have different habitat requirements, fire is not used in the same way to benefit all species.

Whitetails

Fire can be used in oak systems to increase both available nutrition and available cover for white-tailed deer. Burning in closed-canopy forest will do little to improve browse availability or fawning cover. Therefore, it is important to reduce canopy closure and allow at least 20 to 30 percent sunlight into the stand prior to burning. Following a retention cut, thinning, or shelterwood harvest, available forage for white-tailed deer can increase from approximately 25 to 100 pounds of forage available per acre to 700 to 1,000 pounds of forage available. (These are dry forage estimates of plants commonly eaten by white-tailed deer.) Not only can this help increase the nutritional carrying capacity of the area for deer, it can also help increase fawn survival by enhancing available cover. The soft mast response following fire also provides increased nutritional benefits for deer. Interestingly, the species that provide the majority of soft mast in oak systems of the eastern United States (blackberry, blueberry and pokeweed) are also important forage species and can provide excellent fawning cover.

A low-intensity early growing-season fire. The timing of fire – whether dormant season or early or late growing-season – determines the effect on plant species composition following the fire.

Dormant-season fire and growing-season fire can be used to stimulate increased forage, soft mast, and cover for deer. Dormant-season and early growing-season fire on a three- to five-year fire-return interval in oak forests will maintain browse availability before declining. Past five years, browse will become less available as it grows beyond reach of deer. Late growing-season fire may encourage more forbs where grasses account for more than 70 percent of the coverage. Increased forb coverage (at least 30 percent ground-cover) is desirable when managing for

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deer because forbs are preferred forage for deer during the growing season. Woody and/or forb composition may comprise 30 to 70 percent of the groundcover.

It is important to distribute disturbance across the landscape when managing for deer.

Wild Turkeys

Wild turkeys benefit from relatively low woody cover for nesting and more open herbaceous cover for raising broods. Dense cover from the ground up to 2 feet in height is effective cover for poults, while adults desire relatively open cover above 2 feet for enhanced visibility. Both dormant- and growing-season fire in oak forests can be used to establish and maintain desirable cover requirements and provide additional food resources for turkeys.

Where sufficient sunlight is available, dormant-season fire every three to four years will maintain desirable structure for nesting and brood rearing and provide soft mast. When managing oak woodlands and more lightly forested oak "savannas," occasional late-growing season fire should be used to promote additional forb cover and decrease woody composition where needed.

Using fire during the early growing season overlaps with nesting season. This concern can be alleviated by burning during the dormant season, which influences vegetation composition similarly to early growing-season fire.

Early growing-season fires may consume turkey nests (lower right). Dormant or late growing season may be better options.

Northern Bobwhite

Bobwhites depend on disturbance. In fact, they have been called the "fire bird" by many wildlife managers and scientists. Bobwhites require early successional habitat. They are not woods birds, and if found frequenting closed-canopy woods with any regularity, it can be assumed habitat conditions for bobwhites on that property are poor. Thus, oak stands that are going to be maintained in forest should not be considered for bobwhite management.

Fire is the tool of choice to maintain oak savannas and other high-quality early successional habitat for bobwhites. Both dormant-season and growing-season fire should be used to manage oak savannas. Relatively short fire-return intervals (two to three years) should be used. Senescent grass (dead leaves from the previous growing season) is important for nesting structure. Soft mast is also an important food source. Therefore, when managing oak savannas for bobwhites, an annual fire-return interval is not recommended. Where woody stem density needs to be reduced, late growing-season fire should be used instead of a shorter dormant-season fire-return interval. It is critical to prescribe fire on a different area of the property every year, setting back succession and providing diverse structure and composition, both spatially (across the property and landscape) and temporally (different times of the year).

Forest Songbirds

There are many species of songbirds that use oak forests. All fill a different ecological niche and have various habitat requirements. Some nest and forage in the overstory, some in the midstory, and some in the understory. Most nest among vegetation, but some nest on the ground.

Forests with a broken canopy that allow at least 20 to 30 percent sunlight to reach the forest floor may be managed with fire to develop suitable structure for species that use a well-developed understory, such as black-throated blue warbler, hooded warbler, worm-eating warbler, white-eyed vireo, and Kentucky warbler. Low-intensity dormant- and early growing-season fire on a three- to five-year interval will maintain a well-developed understory. Late growing-season fire may be used intermittently with dormant-season fire to decrease woody composition and increase vegetation and structural diversity.

To avoid disrupting nests, burning should be completed by late April where forest songbirds are a consideration.

If you're interested in managing for a combination of these species, or species not mentioned here, guidance can be provided in your management plan by a certified wildlife biologist.

In the next issue of *Quality Whitetails*, we'll look at guidelines and techniques for conducting prescribed fire.

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