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OAK REGENERATION PRACTICES: PRESCRIBED BURNING FOR OAK REGENERATION

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To burn or not to burn for oak regeneration? More burning is conducted in hardwood forests today than at any time since fire suppression policies were implemented in the 1950s. Many people have mixed opinions about burning to regenerate oak. These views are often conflicting, founded on personal perspectives, preferences, experience, or relegated to the local landscape that is being managed and investigated. Frequent cultural burning was certainly one disturbance in combination with others (chestnut blight, grazing, less intensive harvesting) that favored oaks before fire suppression policies. However, replicating those same burning conditions from 70+ years ago to perpetuate oak with today's environment, climate variability and management practices is not possible. In addition, contemporary forest composition and structure differ greatly compared to those in the past, and response to fire will also vary. One burning prescription seldom has application in all environments or situations with stands occurring on a wide variety of site productivities and having different stand structures, compositions, and fuels.

Prescribed fire is a silvicultural tool commonly implemented for site preparation for natural or artificial regeneration, fuel reduction, enhancing wildlife habitat, perpetuating fire-dependent species, improving site access and appearance, and providing early successional vegetation structure. Mineral soil exposed by burning supports the introduction of wind-blown, light-seeded species that often affects oak reproduction. Prescribed burning has environmental impacts on vegetation, soil, water, air, wildlife, and visual appeal. Burning to promote successful oak regeneration remains challenging in facilitating and not harming oaks yet impeding species that compete with oak.

A prescribed burn that killed oak seedlings that sprouted from a burn four years ago. Top-killed oak seedlings will continue to sprout after each burn. Prescribed fire should cease for > 10+ years to allow oak seedlings to become large enough to withstand additional burns. Photo Credit: *Wayne K. Clatterbuck*

Burning for oak regeneration on lower quality, poorer productivity sites (Site Index (SI) < 65 feet tall at 50 years for oak) is not necessary because oak already proliferates in both the overstory and in the understory. Oak competition is sparse on these sites. Prescribed burning may be appropriate for other purposes such as wildlife habitat but not for oak reproduction that is already in place. On the better, more mesic hardwood sites (SI >80 feet), burning is difficult and rarely occurs. These better sites in cove hardwood areas, lower slopes, and near stream valleys and floodplains are usually too moist throughout the year to ignite and carry a fire. Typically, faster-growing species will dominate oak on these sites. Burning for the purpose of regenerating oak on these higher productivity sites is not realistic. The best opportunity for burning to benefit oak regeneration is on the average or mediocre site productivities (SI 65 to 80 feet). Burning for competition control may benefit oak, but oak growth also may be delayed through top kill of seedlings and damaging larger stems. Advance oak reproduction of sufficient number and size must be present to progress oak beyond the competition.

Prescriptions to successfully regenerate oak using prescribed fire are indefinite. An intensive regeneration survey is necessary before the harvest and the burn to evaluate whether oak advance reproduction is present in conjunction with other species. If not present, oak regeneration will not occur. The question remains how oak can be encouraged by burning with the presence of other species. Most all hardwood species resprout. Providing partial sunlight for shade-intermediate oaks and managing oak development on the average productivity sites may give oaks an advantage over other species.

Several factors that influence burning properties and oak resiliency compared to other species include fire duration, residence time, rate of spread, frequency, air temperature, intensity, and season and timing of the burn; as well as type, amount, size and moisture content of the fuels; and individual species tolerances to burning based on size and age. The range of these burning properties and combinations vary across the landscape making prescribed burning results to promote oaks difficult to replicate across stands and sites. A successful prescription that favors oaks selectively at the expense of other species is easier said than done.

Will repeated burning favor oaks compared to other species? Research has indicated that just one burn is not enough to promote oak over other species. In theory, repeated burning would tend to gradually reduce the sprouting ability of some species (progressively reducing root reserves until they no longer sprout) and enhance other species (primarily oaks) that may be better adapted to burning through their re-sprouting ability. Depending on size of oak reproduction (as well as other species), small seedlings (< 1-foot tall) are as likely to be killed as perpetuated by prescribed burning.

Controlling burning intensity can be difficult. Excessive temperatures can injure and kill oak saplings. Photo Credit: *Ray Ward, TN Division of Forestry*

Oak seedlings often resprout vigorously after top kill from a burn.
Photo Credit: *Ray Ward, TN Division of Forestry*

Most hardwood species will continue to sprout after burning, especially small-diameter trees with thinner bark that are more susceptible to stem damage. Repeated burning also increases the risk of bole damage and decay to standing trees that decreases their value.

A program of prescribed burning should not be undertaken without a full appreciation of the purpose, difficulty, and risks/liabilities involved with each burn. The meteorological windows for safe burning are becoming more limited and smoke management is more of an issue. Creating more open canopies with partial light environments to sustain shade-intermediate oaks may be more beneficial. Periodic burning is one practice to maintain partial light conditions. Care should be taken to ensure that prescriptions using fire are successful for both meeting oak regeneration objectives and increasing the probability for oaks to emerge into the overstory in mixed species stands.

FURTHER READING

Arthur, M.A., Alexander, H.D., Dey, D.C. [and others]. 2012. Refining the oak-fire hypothesis for management of oak-dominated forests in the eastern United States. Journal of Forestry 110(5):257-266 (https://www.fs.usda.gov/research/treesearch/40972).

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