

OAK REGENERATION PRACTICES: MIDSTORY REMOVAL

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Natural regeneration of oak is limited during seedling establishment and growth by the amount of sunlight received through the canopy as well as the influence of competitor species. Oaks are both disturbance and advanced growth dependent, that is their slower growth requires a head start when competing with faster-growing species. When sufficient light is lacking, shade-tolerant species such as maples and beech perpetuate in low light while retarding oak seedling growth due to shady understory conditions and competition. Disturbances that reduce tree density and allow increased light to reach the forest floor can stimulate shade-intolerant species like yellow-poplar and suppress slower-growing oak seedlings. Targeted disturbances, such as midstory removal, provide partial sunlight that aids oak growth, development, and recruitment into more competitive size classes. By leaving the overstory intact and removing the midstory canopy level (stratum), the intermediate sunlight received stimulates oaks and discourages the shade intolerant as well as the shade-tolerant species.



With a prominent midstory allowing < 10% of sunlight to reach the ground, growth and survival of 3-year-old white oak advance reproduction is deterred. Photo Credit: Wayne K. Clatterbuck



Small, advance reproduction of white oak from a bumper acorn crop directly after midstory control treatment. Photo Credit: Wayne K. Clatterbuck

Two conditions are necessary to implement a midstory removal to enhance oak regeneration. First, oak advance seedlings must be present so they can be cultured to increase their size and compete with residual species. If advance seedlings are not present, then implementation should be delayed until oak acorns have germinated, usually after a bumper acorn year that occurs every three to five years on average when the number of acorns exceed that consumed by predators. Second, additional time (several years) is necessary to recruit the shade-intermediate oak germinants into larger size classes by adjusting the amount of sunlight received while other species with different light-tolerance requirements are deterred. These two steps should take place well before the anticipated overstory harvest to establish oak seedling reproduction from acorns. By removing the midstory canopy layer, defined as the trees with crowns beneath the overstory trees, more sunlight infiltrates to the ground. Leaving most of the overstory intact provides the partial light conditions required to recruit small oak advance reproduction into more competitive positions as well as to position those oaks to be more competitive once the overstory is removed or harvested.

Once a sufficient number of large oak seedlings (> 4 feet in height) is attained, the overstory can be harvested releasing the seedlings. Regenerating oak is a process involving foresight, patience, and upfront investments when establishing and developing advance reproduction before the overstory is harvested.

Research at the University of Tennessee Forest Resources Research and Education Center at Oak Ridge investigated the growth and survival of natural white oak reproduction that was established from a previous bumper acorn crop. By removing the midstory canopy layer that consisted primarily of maple, beech, and yellow-poplar, ground diameter of oak seedlings was improved and height more than doubled (height from 6 inches to > 30 inches) after three growing seasons compared to controls that did not receive the treatment. Study areas that received the midstory removal treatment average 15 to 25% of full sunlight, while the sunlight in controls was < 10% full sunlight. Response of potential competitor species after midstory release was minimal. Shade-tolerant species such as maples and beech and shade-intolerant species such as yellow-poplar were discouraged with the level of sunlight provided by the midstory removal and leaving the overstory intact. These results confirm that a midstory removal treatment is a viable option for enhancing size and number of oak reproduction.



Released white oak seedlings from a midstory removal after three growing seasons. Photo Credit: *Wayne K. Clatterbuck*

Once oak reproduction becomes 4 to 5 feet tall, they can be released through an overstory harvest or shelterwood operation where the overstory is removed in stages (refer to shelterwood fact sheet) securing a future cohort of oaks in the upper forest canopy. If too many saplings (oaks and other species) are present, then a crop tree release is recommended to increase growing space for selected oaks.

BENEFITS

- Oak reproduction is secured before the overstory harvest. Midstory removal will encourage the partial light conditions to increase size of slower-growing oak seedlings/saplings while constraining growth of other species.

WEAKNESSES

- Cost of implementing midstory removal with little, if any, associated revenue.
- Midstory removal is implemented three to 10 years before the overstory harvest. Small, advance oak reproduction must be cultured and recruited to larger sizes to compete with faster-growing species and successfully allow ascendance of oak to the upper canopy.



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