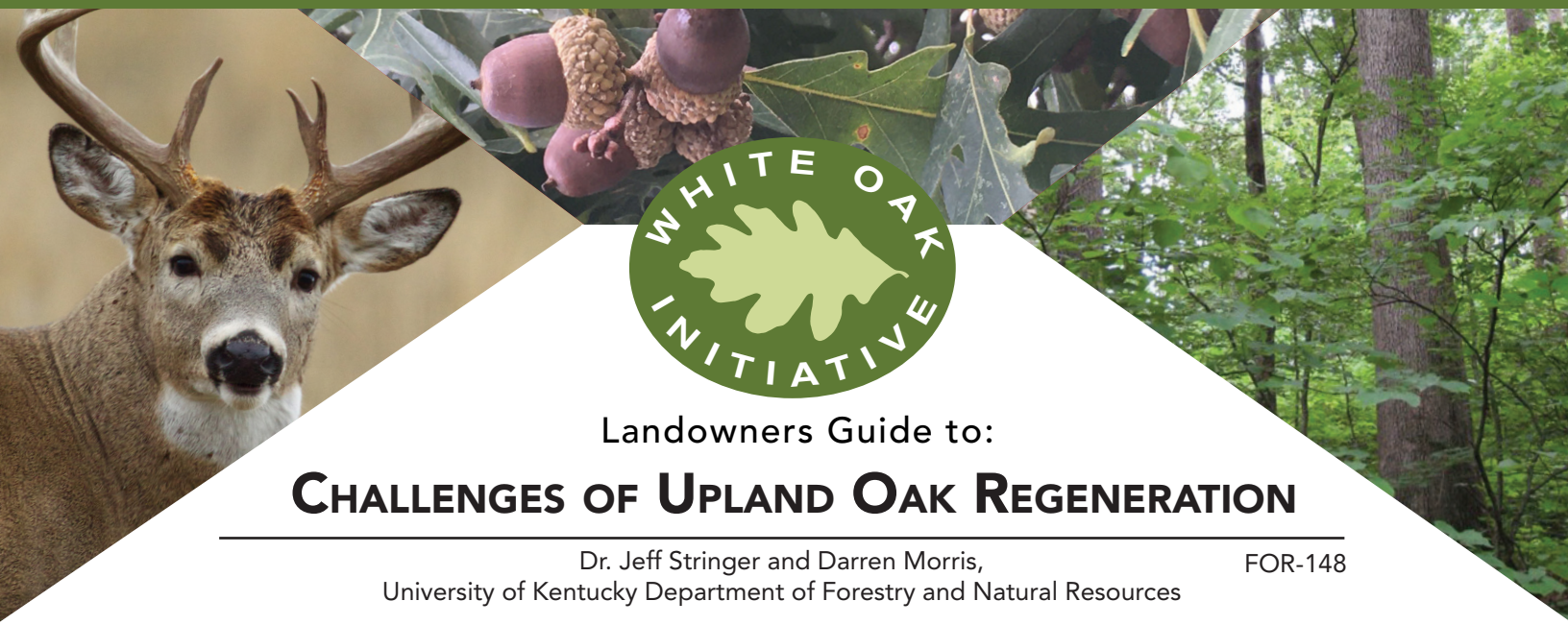

Landowners Guide to:

Challenges of Upland Oak Regeneration

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FOR-148

Introduction

Upland oak forests are one of the most dominant forest types in the eastern United States. These forests commonly contain several species of upland oaks that are classified as either red oaks or white oaks. Red oaks include species such as black, scarlet, southern red, and northern red, and important upland white oaks include chestnut, chinkapin, post, and white oak. Upland oaks are found on a wide variety of soils and topographies, typically on well-drained sites on uplands above the flat bottomlands around streams and rivers. Some upland oak forests contain only scattered oaks while some may be dominated by oaks. The occurrence and abundance of an individual oak species will vary depending upon the characteristics of the site. Some are more prevalent on drier sites and others appear most often on moist sites. While large oak trees are common in upland oak forests, over the last several decades there has been a noticeable decline in the number of young oak seedlings and saplings indicating a problem with oak forests being able to regenerate themselves. To regenerate, oak forests must produce enough acorns that will successfully germinate into small oak seedlings and have the proper conditions so these seedlings can continue to grow into saplings and eventually overstory trees. While this sounds simple, in reality the story is complex.

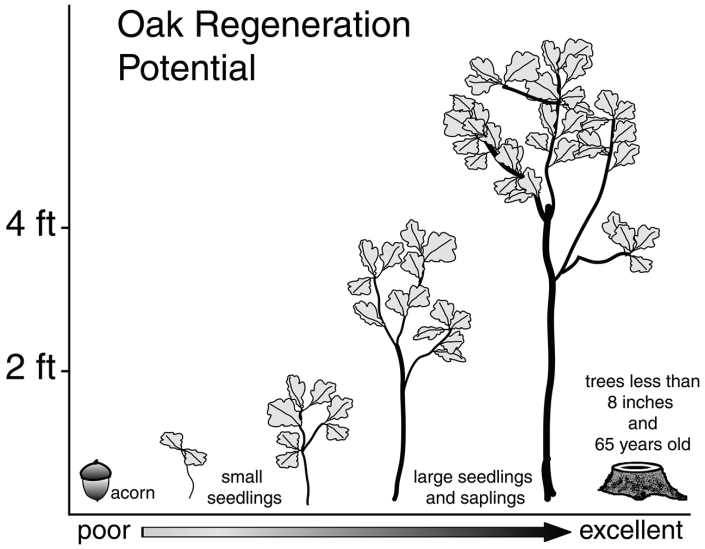

Figure 1: Probability of developing into a large tree after a timber harvest or other disturbance that allows full-sunlight to reach the ground.

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The **Landowners for Oaks Series** is produced by the Cooperative Extension Service, University of Kentucky, Department of Forestry and Natural Resources (http://ukforestry.org) in support of the White Oak Initiative.

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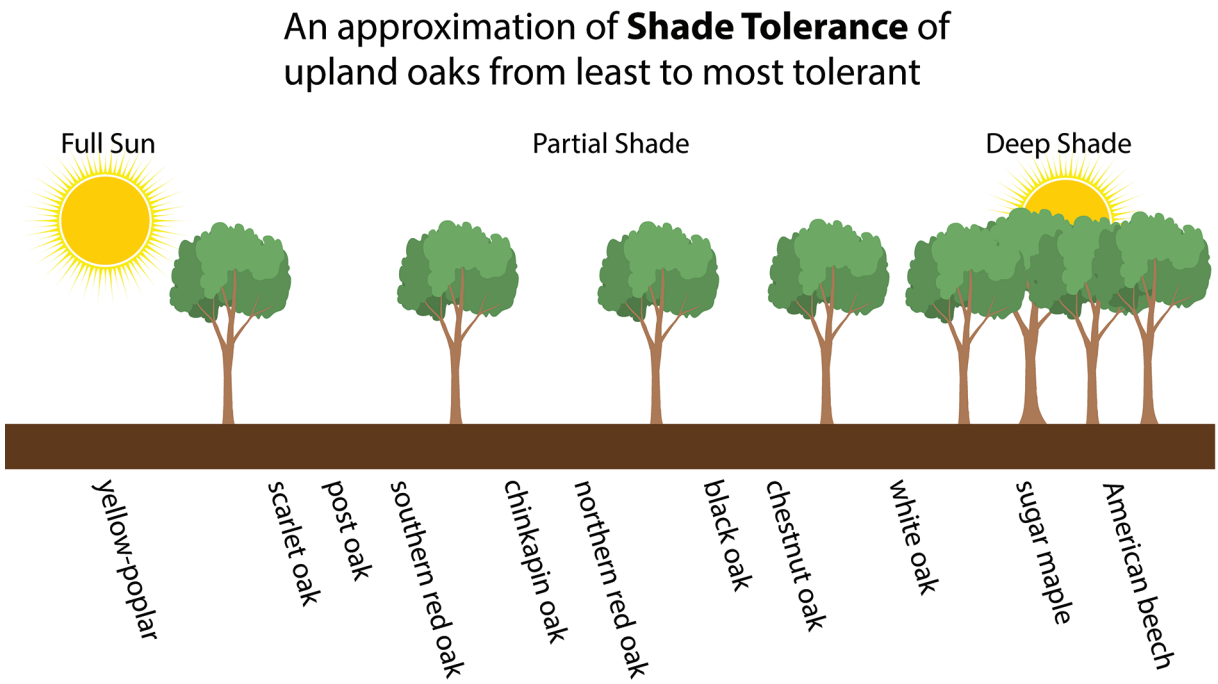

Figure 2: White oak is usually more shade tolerant than other oaks.

Two key factors must be understood to shed light on the complexity of oak regeneration. The first is, in comparison to many species, oaks grow best in a moderate amount of sunlight. Too much shade and they die several years after they germinate. Too much sunlight and competing species that love sunlight can outgrow the oaks. Second, when acorns germinate, the young oak seedlings spend a lot of time and energy establishing a root system and initially do not grow rapidly in height. This is a disadvantage when a harvest occurs and only acorns or small seedlings are present and fast growing species quickly outpace the small oaks. This means that for oaks to regenerate after a harvest there have to be larger seedlings and saplings already present that have enough vigor to grow quickly to stay even or ahead of competing species. These seedlings and saplings that established prior to a harvest are called advance regeneration. Enough large advance regeneration is required for oaks to successfully regenerate after a harvest.

Shade tolerance is the term used to describe the relationship of a species to light. A shade tolerant species can continue to grow in the shade. Examples include species that can eventually grow to a large size such as American beech and red and sugar maples, or ones that remain small such as dogwood or redbud. The other end of the spectrum are shade intolerant species that must have nearly full sunlight to grow. Examples include yellow-poplar, black walnut, black locust, and a host of others. In between are the upland oaks, most of which are classified as intermediate in shade tolerance. Thus providing conditions that create a moderate amount of sunlight at the forest floor is most favorable to growing oak seedlings. Foresters use practices that manipulate forest stands to provide the right amount of sunlight to establish oak advance regeneration, not too much and not too little.

The key to maintaining oak is to ensure that acorns are present and moderate light conditions in the understory are maintained, allowing oak seedlings to develop into waist-to-chest height seedlings or optimistically, into saplings that are at least 1 inch in diameter. Then when a harvest or other forest disturbance occurs, the robust oak advance regeneration can grow rapidly in height and compete with the other tree species that are a part of upland oak forests. This points to a critical concept in oak management: the development of adequate oak regeneration is a process and not an event. This means that oak regeneration development takes years to complete and must be initiated well in advance of a harvest.

Acorn Production and Germination

Upland oaks growing in forests commonly start acorn production when they are 20 to 25 years old. However, significant acorn production does not occur until later; the larger crowned trees having the capacity to produce thousands of acorns.

A large acorn crop, referred to as a bumper crop, is vital to establishing a generous number of new seedlings. However, oaks vary in the number of acorns produced year to year; the variation is based on species and weather. Some, such as

Figure 3: A large white oak can produce hundreds of pounds of acorns during bumper crop years.

chestnut and scarlet oaks, produce relatively high numbers of acorns every year. Others may go several years between bumper crops. In non-bumper crop years, many of the acorns produced fall prey to both insects and wildlife. Oak weevils, a grub that feeds on acorns from the inside during the summer and early fall, ensure that many acorns will not germinate. It is also well known that acorns are a favorite food of many wildlife species such as deer, squirrels, turkeys and bears. These animals and others rely heavily on acorns as a source of nutrients, especially during the winter months when other food sources are scarce. Therefore, it takes a heavy acorn crop for some to survive the insects, birds, and mammals that feed on them. Unfortunately, many oak species do not produce heavy acorn crops every year, which limits the number of seedlings established the following year.

Sunlight and Shade

As indicated above, the right amount of sunlight is important for the growth and survival of newly established oak seedlings. However, competing species that can live in shade, such as beech and maple, often dominate the understories of many upland oak forests. This creates dark conditions at the forest floor where the acorns are germinating. In these conditions, even abundant acorn crops resulting in a large number of seedlings is of little use as the new oak seedlings are starved for light and slowly die over several years. Unless something happens to stop it, this process continues to repeat itself and the forest never develops a significant amount of large oak seedlings and saplings. Using management techniques to improve the light condition is tricky. If too much sunlight reaches the forest floor, oak seedlings are often out competed by other species. The key is to have just enough sunlight for oak seedlings to outgrow the competing tree species that can grow in dark shade, and at the same time, not so much light that competing sun-loving species outgrow the oak seedlings. If oak seedlings can get the right amount of light to reach a competitive height, they have a much better chance of competing with other species after a harvest. This height varies, typically from 3 to 4 feet tall to 1 inch in diameter at breast height. The variation in height required, as an indicator of vigor, is often based on the site. For example, some sites that are inherently dry and of lower productivity have fewer competing species, and the advance regeneration size of a species like white oak can be smaller than would be needed if it were on a highly productive site with more competitors.

Figure 4: There is almost no oak regeneration in this white oak dominated stand. In the back of the photo there appears to be abundant reproduction, however the species are primarily sugar maple and hickories, with no oaks.

Oak Regeneration Management

Unfortunately many landowners harvest without taking into consideration oak regeneration. Often, forests are harvested with few oak seedlings and saplings (advance regeneration) present. When this occurs, both shade-tolerant and intolerant species can out-compete the few small oaks present and the forest changes from an oak dominated forest to one where few oaks are present. These forests often become dominated by competing species such as maple, beech, hickory, and yellow-poplar depending upon how many shade-tolerant tree species are present and how much light the harvests let in. This lack of oak advance regeneration in the face of increasing competition from other tree species has been recognized as a significant concern that often leads to the slow loss of oaks from our forests. To successfully maintain a significant amount of oak in a regenerating forest, it is important to have at a minimum 100 to 200 large seedlings or sapling oaks present per acre. During any activity within a forest such as a timber harvest that involves heavy machinery, many of these

oak seedlings may be damaged. This is acceptable and even desired at times because large seedlings, saplings and pole-sized oaks have the ability to sprout. Oaks commonly sprout from existing stumps from seedling-sized to trees up to 8 to 10 inches in diameter for some species like white oak. Some species have the ability to sprout from larger stumps. Oak sprouts from these stumps that have vigorous root systems as well as undamaged large seedlings, saplings and pole-sized trees will grow fast, giving the oaks the capability of out-competing faster growing competition. However, without the vigorous root systems or large advance regeneration, oak forests cannot successfully regenerate themselves.

The knowledge and understanding of these characteristics have resulted in the development of a number of management techniques to aid oaks. Foresters and landowners now have a number of techniques to help successfully regenerate oaks in our forests. As suggested, many of these techniques involve the manipulation of sunlight by removing specific amounts of undesired trees. This process often involves multiple treatments conducted over several years to establish the advance regeneration needed to maintain oak as a component of the forest. Implementing these techniques can at times be challenging financially and operationally. However the end result is the successful management of a healthy upland oak forest. Without this effort, the future of our upland oak forests is uncertain.

Figure 5: This photo shows a white oak with white oak advance regeneration that has been developed prior to a timber harvest. White oak now has an excellent chance of being a dominant component of this forest for decades.

The photos at the top of page one represent a few of the many benefits and uses of white oak, making it one of the most important tree species in the Eastern United States. Photos and images courtesy of the authors or the University of Kentucky Department of Forestry and Natural Resources unless otherwise noted.

For more information about upland oak forest management, refer to White Oak Initiative – Landowners for Oaks Series publications at www.whiteoakinitiative.org, specifically Landowners Guide to: Sustainable Oak Management Practices, which provides a basic overview of oak management techniques that are necessary management tools for growth, development, and maturity of healthy upland oak forests. Use a professional forester to help guide you in assessing your forest and prescribing oak management practices. Also your state forester or a private consulting forester can visit your property, discuss your goals and objectives, answer questions, develop a management plan and help with planning and implementing practices to meet your objectives and lead to a healthy and sustainable forest. To learn more about the White Oak Initiative and the Assessment & Conversation Plan, visit www.whiteoakinitiative.org/assessment-conservation-plan.

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