

# OAK REGENERATION PRACTICES: TWO-AGE DEFERMENT SYSTEM

Wayne K. Clatterbuck, Professor, Silviculture and Forest Management, School of Natural Resources  
Stephen E. Peairs, Professor, Silviculture and Forest Management, School of Natural Resources

The two-age deferment system maintains two age classes, usually a regenerating class that will grow and develop and an older, mature age class which is retained for another rotation. Pertaining to oak regeneration, if the present, mature oak stand does not contain advance oak reproduction and a harvest is imminent, then the forthcoming stand (rotation) will not be composed of oaks. However, by retaining a few mature oak reserve trees, acorn production continues. Even though oaks will not be a component in the development of the younger age class, oak advance reproduction can develop during the next rotation and build the number and size of seedlings during the 2nd (next) rotation. This oak advance reproduction would be available for regeneration for the 3rd rotation. Thus, if an oak seed source remains, oaks can flourish in successive stands. Otherwise, if all the overstory oaks are harvested now, future rotations will not be composed of oaks because of the absence of a seed source. Refer to the following table for the stepwise process.



*White oak trees retained for another rotation in two-age deferment.*  
Photo Credit: Wayne K. Clatterbuck

Present (1st) Rotation	Next (2nd) Rotation <sup>1</sup>	Future Rotations <sup>1</sup>
Oak advance reproduction (AR) absent	Building AR from acorns of oak reserve trees during rotation	Stand is harvested releasing developed oak AR to regenerate the next stand
Next stand will not contain overstory oaks in regenerating age class w/o AR	Maintain open forests (partial light) with disturbances <sup>2</sup> during rotation for AR growth	No need to retain oak reserve trees unless for other purposes because oak AR is already present
Oak reserve trees retained to provide acorns to develop AR during 2nd rotation	Complete harvest of stand and reserve trees	

<sup>1</sup> Time between harvests ranges from 50 to 100+ years depending on objectives, site productivity, and stand growth

<sup>2</sup> Examples of disturbances include crop tree release, precommercial thinning, timber stand improvement such as cleanings, and careful burning

Dominant and codominant oaks with full vigorous crowns should be chosen as reserve trees. The best, highly-valued trees are harvested, not retained as the risk of stem degrade or damage in more open environments during the second rotation can lower their timber value. Instead, select reserve trees that have the potential to improve in value, size, and grade during the second rotation. These reserve trees will still produce acorns to build oak advance reproduction during the rotation.

Selection of reserve trees is critical. The species should be long-lived and able to flourish through a second rotation. White oaks and hickories are examples of species with long life spans. Vigorous crowns without indication of decline should be chosen. Live crown ratios (length of crown : total height) should be at least 35%. Potential of stems to develop defect-free boles to improve tree grade should be included in the assessment. The topographic position of the tree also should be considered.

Trees on shallow soils such as noses of ridges are more susceptible to windthrow as well as areas in depressions, lower slopes, and stream valleys or bottoms when soils are saturated after excessive rainfall. Usually, 10 to 15 trees per acre should be retained as reserve trees, although a few will probably succumb during the second rotation in the more open, adverse environments.

Mast production by oak reserve trees will vary. Some trees rarely produce acorns; others are irregular with annual production; and some consistently produce acorns every year. If possible, potential reserve trees should be observed several years prior to the harvest for their acorn production, selecting those that are more dependable each year. Intermediate operations are necessary to maintain more open stand conditions to enhance the growth of oak into the overstory and discourage growth of competing species. Such operations would include crop tree release, thinnings, timber stand improvement such as cleanings, and careful burning.



*Two-age deferment provides an array of seedlings of different species. Oaks will not be a component of the next generation, but oak advance reproduction will be present from the seed of the older trees in the future generation. Photo Credit: Wayne K. Clatterbuck*

The two-age system is used to “lifeboat” oak in stands where adequate advance reproduction is not present at the time of harvest. A disadvantage of this system is that several rotations are involved often exceeding the tenure of ownership and managers. Unexpected large-scale disturbances (wind, fire, epidemics, climate) may alter or eliminate the management sequence. However, the two-age management option does keep oak reproduction capacity on the sites for the long-term. For more specific information on the two-age deferment system to regenerate oak, refer to the weblink below.

## **BENEFITS**

- Sexual propagation for oaks is maintained for successive generations.
- Oak regeneration potential remains for future generations if seed sources are continually available even when oak advance reproduction is not present initially.

## **WEAKNESSES**

- Long-lived species should be selected as reserve trees that will survive for 150+ years or two rotation lengths. White oaks are an example of this longevity, while red oaks are shorter-lived and should not be selected as reserve trees.
- Reserve trees, because of their advance age and size, are at risk and are more susceptible to physical damage from harvesting and weather associated with open environments such as ice storms, winds, and lightning as well as environmental influences such as droughts and pathogens. Damaged trees lower tree value.
- The growth of the reproduction located underneath and nearby the crowns of the few reserve trees will be reduced compared to growth of unaffected reproduction in more open areas.
- With the loss of successful oak reproduction in one generation, securing adequate oak advance reproduction in future generations may be problematic because of the longtime element and a changing environment.

## **FURTHER READING**

Stringer, J. 2006. Two-age system and deferment harvests. Extension Publication SP679. Knoxville, TN: University of Tennessee Extension, Institute of Agriculture. 12 p. (<https://utia.tennessee.edu/publications/wp-content/uploads/sites/269/2023/10/SP679.pdf>)



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