

TIMING AND PLANNING FOR HARDWOOD REGENERATION IN THE COASTAL PLAINS

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Foresters generally do a good job of managing hardwood overstories; they upgrade the stand by deadening or cutting decadent and undesirable trees. But eventually they have to cut the overstory, and if they wait until after final harvesting to plan for reproduction, it is too late. Where the overstory has been removed and reproduction is unacceptable, as it is on many acres in the South, the only alternative may be expensive clearing and planting.

This paper, which deals with establishment and early development of natural regeneration, will only be helpful where overstory hardwoods still exist. Here the forester can often arrange for acceptable reproduction cheaply through manipulation of the overstory. In general, the more trees in the overstory, the more control the forester will have. It must be realized, however, that the range of species that can be brought into the new stand is normally relatively narrow. It is folly to think, for example, that a stand of overcup oak can suddenly be replaced with cherrybark oak simply by handling the overstory. The chances of increasing the proportion of a particular species in the new stand depend upon that species' reproductive characteristics and the character of the old stand. Reproductive characteristics of some of our major hardwood species and species groups are given below.

Yellow-Poplar.--Most yellow-poplar reproduction originates from seed. Trees produce large numbers of seeds nearly every year, but only about 5 percent of them on the average are sound. Still, from the thousands of seeds that are produced, good crops of reproduction can be attained under the proper conditions. Needed is a seedbed void of vines, grasses, and other herbaceous plants. Sunlight is also important; established seedlings are relatively intolerant of shade and will not persist under a dense overstory for more than 3 years. In openings of 1/10 acre, seedlings have survived for up to 10 years, until the crowns of surrounding trees closed the opening. Since yellow-poplar seeds will remain viable in the litter for several years, it is not necessary to leave seed trees within a regeneration area (Sander and Clark 1971). But, in openings where there have been no yellow-poplar seed trees, regeneration depends on seed trees within 200 feet of the perimeter of the opening. Yellow-poplar seedlings grow rapidly on sites where they occur naturally and will dominate most competitors.

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Sweetgum.--Most sweetgum reproduction comes from sprouts from the roots and stumps of cut trees. Sprouts from old trees grow rapidly the first year or two and can be very prolific; as many as 150 have been counted from the root system of a single tree. Sweetgum sprouts make acceptable trees if they originate from low stumps or roots (Johnson 1964). Although good seed crops occur nearly every year and not many trees are needed to produce thousands of viable seeds, seedlings seldom are a major source of reproduction. Sweetgum seeds germinate early on the Coastal Plain, from late March to early April, but the seedbed is frequently too wet or too dry for seedling establishment. Seedlings are very sensitive to moisture stress during the first year. Three or four weeks without rain in May or June can result in almost complete mortality.

Oaks.--New stands of oak come from advanced reproduction. Oaks have been and still are the predominant overstory species in southern hardwood forests, but they are not being reproduced in large numbers. One factor is that most acorns are destroyed by birds and rodents. The majority of acorns that reach the germination period undamaged fail to establish seedlings because the seedbed is unsatisfactory. Tests have shown that acorns need to be underground to consistently establish seedlings. Most oak seedlings are moderately tolerant of shade, but tolerance varies by species. Upland oaks usually remain in the understory for only 2 or 3 years, whereas seedlings of bottom land oaks may persist 15 or 20 years. Oaks are not only difficult to establish, but they grow slowly the first few years and become overtopped by competing species. Oak reproduction appears to do best in pure stands and possibly under conditions that are adverse for other species--in dense vine areas, for example.

Ash.--Green and white ash are shade tolerant, very adaptable to extremes in sites, and capable of sprouting from roots and stumps of cut trees. They are among the easiest hardwoods to regenerate. Ash seedlings readily become established under a dense overstory and some will persist for 20 to 30 years. Stump and root sprouts grow rapidly and can rise above seedlings of most other species very early. They will maintain their early dominance in thick stands. In one test on Sharkey clay soil, dominant green ash sprouts were 1-1/2 inches d.b.h. and 15 feet tall after 5 years (Johnson 1961). Ash is very intolerant of vines, which deform the seedlings, reduce their growth, and prevent a single leader from dominating.

PLANNING FOR REGENERATION

The first step in planning for regeneration is to survey understory plants, seedbed conditions, and density and composition of the overstory. Ideally, there should be two surveys, one about 1 or 2 years before and one just before the stand is to be cut and regenerated. The first survey will provide background information far enough in advance to adequately plan for regeneration. The second will provide a check on the first and should reveal the need for any last minute changes in plans. Specifics to look for in these surveys are discussed below.

Understory plants and seedbed conditions.--Understory trees (advanced reproduction) are very important because, in many cases, they will be the next stand. Commercial species commonly found in the understory or in small openings are green ash, hickories, maples, elms, oaks, sugarberry, and American beech. Subcommercial species include boxelder, flowering dogwood, American hornbeam, and eastern hophornbeam. During the survey, the forester should determine the proportion of each species and relationships among species in the understory. For example, it should be known that 5- to 10-foot-tall water hickory and ash trees cover the 2-foot-tall oaks that are present. Information on the distribution and density of reproduction helps to delineate areas that are ready to be regenerated.

Vines are particularly damaging to young trees (Johnson 1970), and their presence in the understory should be noted. In open stands, vines can readily be seen, but where the overstory is dense, they are small and more difficult to find and identify. Vines are most numerous on wet, clay soils, but they can exist on most hardwood sites.

A bare, mineral soil seedbed is most desirable, but where the overstory is not dense many herbaceous plants including grasses and vines may cover the soil surface. Both will practically negate the chance of establishing a new hardwood stand from natural seeding. In such instances, the bulk of the reproduction must originate either from advanced reproduction or from the stumps and roots of cut trees.

Overstory density and composition.--Density and composition of the overstory affects both the seedbed and the survival and growth of advanced reproduction. Presence of species in the overstory that reproduce primarily from seed, such as yellow-poplar and American sycamore, should be noted since the proportion of these species can often be increased in the new stand. Where such species are absent from the overstory, it is unlikely that they will appear as reproduction.

The overstory also indicates the likelihood of regeneration from sprouts. Among the most prolific sprouters are gum, ash, maple, hickory, and basswood. American beech, the oaks, and many other species will occasionally sprout. Important sprouters among the subcommercial species are American hornbeam, eastern hophornbeam, boxelder, and flowering dogwood. If any of the above species are present in the overstory, they can nearly always be counted upon to be part of the next stand.

Other considerations.--Notes on water levels, if the area is subject to flooding, and on evidence of excessive grazing damage by deer or cattle should be included in the stand survey. Any unusual soil or stand conditions should also be recorded (Putnam et al. 1960). I will not attempt to list the many special problems that can appear in individual stands. It is sufficient here to say that they should be recognized.

TREATMENTS TO ENCOURAGE REGENERATION

In considering regeneration treatments it is useful to class hardwood overstories as either open or dense. Open overstories are the most common; they often result from several selective cuttings. These stands often look as though they had been cut by the heavy shelterwood method. Advanced reproduction up to 20 feet tall is present in small openings throughout the stand. Most of the reproduction is of tolerant species of seedling origin with a lesser amount of more intolerant species of sprout origin. Since only scattered trees are still left in the overstory, there is little opportunity to change species composition by cutting large trees. One species may be favored over another in the understory by selectively releasing desirable from undesirable species. For example, American hornbeam and eastern hophornbeam should be eliminated if they are suppressing reproduction of desirable commercial species. Research has shown that if American hornbeam and eastern hophornbeam are not removed they will remain dominant and eventually will result in mortality of the better species. When that occurs, complete species conversion through planting becomes necessary.

The overstory in heavily cutover stands can be cut at one time and probably should be to avoid repeated logging damage to established reproduction. Advanced reproduction will respond to release, even though some trees may have been suppressed for 10 to 15 years and may be only 10 to 15 feet tall. Regardless of when the overstory trees are cut, little change will be made in the composition of the reproduction. Sprouting is probably related to time of cutting, but experience has shown that at least some sprouts will occur regardless of cutting season. One fact is clear: the quicker the overstory is removed, the faster the reproduction will develop.

Size of the reproduction area matters little provided there is adequate stocking. Where vines are numerous, approximately 10 thousand trees per acre are required, if trees are under 2 feet tall. If trees are 5 to 10 feet tall, 5 thousand per acre are needed for the stand to develop rapidly through vines. With appreciable less stocking, reproduction may take 15 to 20 years instead of 4 to 7 years to get above the vines, which usually occurs when trees are about 15 feet tall. Where vines are scarce, 2 or 3 thousand trees per acre may suffice.

The second but less common type of hardwood stand is one in which the overstory is uncut and dense. This type of area holds the most promise for controlling reproduction. Prior to regeneration cuts, the overstory should be kept open enough to grow and yet dense enough to hold back development of very tolerant, undesirable tree species and herbaceous plants. The objective is to preserve the bare mineral soil seedbed that is highly desirable for establishment of yellow-poplar, American sycamore, sweetgum, and other seeding species. Even under a dense overstory, a few trees of tolerant species are likely to become established. Deadening of culls and weed trees, should they develop, is not recommended in such stands except in conjunction with harvesting of the overstory. Removing a large cull when it is surrounded by other trees creates an opening that is too small for development of reproduction of the more intolerant, and usually the more desirable, species.

In small openings, the seedbed frequently becomes covered with herbaceous material and is no longer suitable for reproduction from natural seeding. If the very tolerant subcommercial American hornbeam and eastern hophornbeam develop under a dense overstory, they should not be deadened. Research has shown that these trees only return to the understory in greater numbers than before. In addition, some large trees of subcommercial species may later protect the boles of crop trees around the perimeter of a regeneration area by providing shade that prevents lateral branching of crop trees.

The overstory of areas to be regenerated should be clearcut. All suppressed and intermediate overstory trees must be either cut or deadened. Trees of subcommercial species should be removed if they are 2 inches d.b.h. or larger. If less than 2 inches and scattered, such trees should not pose a major problem since they will soon be overtopped by trees of more desirable species that may have been much smaller when the overstory was removed.

The minimum size of opening to allow development of hardwood reproduction is 1/2 acre. Since the potential for reproduction is not apt to be the same over a large area, harvesting should be restricted to that acreage that appears to be ready for regeneration. Adequacy of the new stand depends upon advance reproduction, sprouts expected from cut trees, seeds lying dormant in the litter, and seeds expected to move in from surrounding seed trees.

Time to harvest the overstory to favor yellow-poplar, sweetgum, and American sycamore is from November through February. This is after the current year's seed crop is mature and is either on the ground or will be scattered over the ground when the trees are dropped. Reproduction from seed must be established during the first year after cutting. Competing vegetation will appear during that period and greatly reduce the chances of establishing seedlings the second year. As mentioned previously, timing of harvest does not appear critical for advanced reproduction or for sprouts from roots and stumps of cut trees. For most species, stumps should be cut as low as possible to assure that originating sprouts are not affected by heart rot from the decaying stumps. Evidently there are exceptions, since DeBell (1971) found that swamp tupelo stumps about 25 inches high sprouted very well, while 6-inch and lower stumps sprouted very little. The situation with tupelo is not typical, however; it probably results from prolonged floods killing suppressed buds near the base of the stump.

Periodically, thousands of seedlings per acre of elm, sugarberry, ash, hickory, and occasionally oak may appear in the understory. Usually over 95 percent of these seedlings die within a year or two. By timing the cut to take advantage of unusually good seedling crops, good new stands--particularly of oaks--can be obtained.

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