

Bottomland Hardwood
Reforestation in the Lower
Mississippi Valley

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BOTTOMLAND HARDWOOD REFORESTATION IN THE LOWER MISSISSIPPI VALLEY

by **James A. Allen**, *National Wetlands
Research Center*, and **Harvey E. Kennedy, Jr.**,
Southern Forest Experiment Station

WHY REFORESTATION?

We prepared this bulletin to assist you--as a farmer or other private landowner--in reestablishing forests on part of your land. It will be most useful to you if your land is in the Lower Mississippi Valley and your main reason for reforestation is to produce wildlife habitat, either for private enjoyment or as a means of obtaining supplemental income. In addition to more wildlife, you can expect numerous other benefits if you reforest part of your land.

Several of the non-wildlife related benefits of reforestation are economic, such as the additional income that you may get from participating in conservation-related agricultural programs or through selling timber. Some benefits are environmental, such as the improvement in water quality that may result if you reforest an area between a field and a waterway. Other benefits are less tangible, but may nevertheless be important to you. One example is the personal satisfaction of watching your forest grow and mature--and realizing that you are producing something of value to yourself, as well as to your community, the Nation, and future generations.



Common egret

Value of Lower Mississippi Valley Forests to Wildlife

The bottomland hardwood forests of the Lower Mississippi Valley provide some of the best wildlife habitat in the entire United States. If you own a tract of forest anywhere in the valley (Figure 1), the chances are very good that it is home to a wide variety of both game and non-game wildlife species.

Studies have shown that, acre for acre, bottomland hardwood forests of

the types found in the Lower Mississippi Valley can support two to five times as many game animals as nearby upland forests (Figure 2). Deer, turkeys, squirrels, rabbits, mallards, and wood ducks are all taken in great numbers from forests throughout the valley each hunting season. Otters, minks, raccoons, nutrias, and other important furbearers are found throughout much of the Lower Mississippi Valley's forests. When flooded, these forests also provide spawning sites and food for several species of game and forage fish. Throughout this bulletin, you will find drawings of some wildlife species that favor bottomland hardwood habitat.

Many types of non-game wildlife also make extensive use of Lower Mississippi Valley forests. Millions of migratory birds move down from the north to spend the winter in the valley, at which time these forests may have 10 times as many birds per acre as upland forests. Several species of non-game wildlife found in these forests are threatened or endangered. For example, it is likely that North America's rarest songbird, the Bachman's warbler, still survives somewhere in the forests of the Lower Mississippi Valley.



Figure 2. *Bottomland hardwood forests can support two to five times as many game animals as nearby upland forests.* (Photo by C.C. Lockwood.©)

Losses of Lower Mississippi Valley Forests

Prior to the arrival of the first European settlers, the Lower Mississippi Valley was almost entirely covered by dense bottomland hardwood forests and cypress-tupelo swamps. In many places, these forests overshadowed vast, nearly impenetrable thickets of cane or palmetto. There were just a few exceptions to this heavy cover of forest. Two of the most notable--the Grand Prairie region of Arkansas and the Macon Ridge area of northeastern Louisiana--were largely devoid of trees because of soil conditions and perhaps in part because of frequent burning by Indians.

The tremendous agricultural potential of the valley, due to its rich alluvial soils and adequate moisture, was realized almost immediately, but the rate of clearing and conversion to agriculture was slow at first because

of the frequent flooding and lack of drainage. Gradually, as the Mississippi River and its tributaries were brought under some control and coordinated drainage projects were established, more and more of the forests were cleared.

By the late 1930's only about half of the original area of forest remained. Clearing continued at a rapid pace right up through the late 1970's, by which time only about 20 percent of the original forested area remained (Figure 3). While the rate of clearing has begun to slow down, it is also apparent that many of the areas that have already been cleared were better suited as forest than as agricultural land; many of these lands can successfully produce a crop only in relatively dry years.

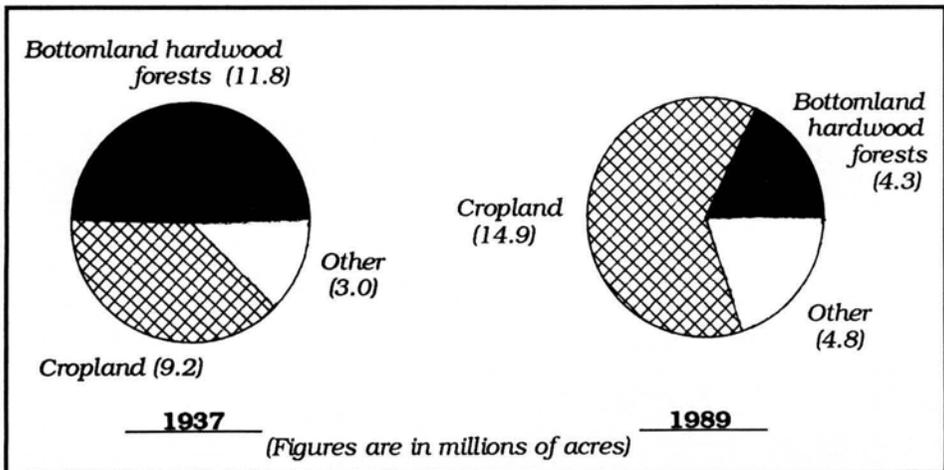


Figure 3. During the last 50 years, over 7 million acres of bottomland hardwood forests have been converted to agricultural crop production and other uses. (1937 data from a U.S. Fish and Wildlife study; 1989 figures based on trends since last study in 1977.)



Otter

PLANNING FOR REFORESTATION

Careful planning is the first, and perhaps the most critical, step in the reforestation process. You will have to choose a planting site and decide whether or not there is a need for site preparation; you will also have to choose which species you will plant and the planting method you will use. You should make these decisions well in advance of the planting date--ideally in the summer or early fall prior to planting--to ensure the availability of labor, equipment, and planting stock.

Choosing the Planting Site

Reforestation should take place primarily on lands least suitable for

agriculture. In general, such sites will be fields on the lower portion of your land which have poor drainage or are subject to frequent flooding. Other recommended planting sites include the edges of rivers, streams, borrow pits, drainage channels, farm ponds, roadsides, and fencerows. You might also want to consider reforesting areas that would join two existing tracts of forest since this can provide valuable travel corridors for wildlife.

Where possible, combining reforestation with other types of wildlife management can be beneficial. For example, if you would like to convert a large, low-lying field to wildlife habitat, you could maintain the very lowest portion as a seasonally flooded shallow water impoundment for wintering waterfowl and plant the surrounding portion of the field with trees. In such a case, the forest may enhance the use of the impoundment by waterfowl (Figure 4), perhaps by sheltering the impoundment from



Figure 4. Combining reforestation with other forms of wildlife management, such as the creation of shallow water impoundments, can increase the overall value of your land as wildlife habitat.

disturbance caused by a nearby road or residential area. Also, the impoundment may increase the value of the forest to wildlife such as deer and turkeys by providing a source of water and additional food.

Once you select the planting site, you should obtain information on its soils and flooding characteristics, since these will affect your selection of the tree species. A good place to start is with the county or parish soil survey, which you can obtain through your county or parish Soil Conservation Service office. Soil surveys contain a wealth of information on the soil characteristics (including degree of flooding and soil saturation) that affect the survival and growth of trees, as well as information on the suitability of the soil type(s) on the site for various tree species.

Another source of information on the characteristics of the planting

site--particularly if you acquired the site only recently--is local expertise. Talk to your neighbors, local Soil Conservation Service and other agricultural extension personnel, and the county or parish forester (Figure 5). These people may know of changes in flooding patterns (due to drainage projects, etc.) that are not covered in the soil survey. They may also have experience with other reforestation projects in the area and can relate any problems that were encountered.

Choosing the Species

Proper tree species selection is critical, since it will greatly affect the chances for successful reforestation. You should base your selection of tree species on several factors, including which species are capable of growing on the site, the availability of planting stock, and your personal objectives for reforestation.



Figure 5. Your county or parish forester and Soil Conservation Service officer can provide valuable assistance as you plan your reforestation project, including information on State and Federal programs that provide cost-sharing.

The soil survey and local experts referred to above can help you with the question of which species will grow on your site. The county or parish forester is often a good source of information on the availability of planting stock and can also provide information on local markets for timber, pulpwood, and other forest products. The final choice of species, however, depends on you and the specific wildlife species you want to favor, and whether you also want to produce a valuable crop of timber. To help get you started, characteristics of some of the most commonly planted tree species are presented in Appendix A.

In most of the reforestation projects that have been carried out in the Lower Mississippi Valley, the

emphasis has been placed on planting hard mast-producing species, particularly oaks and sweet pecan. These species are generally believed to have the greatest value to the most widely desired types of wildlife--deer, turkey, squirrel, and waterfowl. It is also widely believed that the lighter-seeded species, such as ash, elm, sweetgum, and sycamore, will establish themselves on the site on their own, since they are easily dispersed by wind or water. Although this approach to reforestation appears to be successful, you should not depend on the lighter-seeded species to always establish themselves on their own (Figure 6).

A tract of forest that contains many types of both hard and soft



Figure 6. In some cases, such as in this stand of oaks, the planted trees have grown very well, but other tree species have not become established on their own.

mast-producing trees is probably valuable to more species of wildlife than a stand heavily dominated by two or three hard mast-producing species since not all species eat hard mast, and also because it provides a measure of insurance for those years when hard mast production is poor. Therefore, we recommend that you also plant at least one or two species in addition to the hard mast-producers, especially if your planting site does not flood very often and is more than about 100 yards from a stand of mature forest that can act as a seed source.

Choosing the Planting Method

The two major planting methods are direct seeding and planting seedlings. Both can be done either by hand or with machines and are described in detail later in this bulletin. Direct seeding is usually less expensive than planting seedlings, though this will depend on factors such as the price of seed and labor and the availability of suitable machinery. Typical costs of direct seeding in 1989 were about \$40-\$60 per acre, while planting seedlings costs roughly twice as much. On the other hand, planting seedlings may result in faster initial establishment of a forest. You should give each method careful consideration in the planning stage because they will affect the type of planting stock you will need, and you should try to ensure that your desired stock will be available as early as possible.



*Black and
white warbler*

SITE PREPARATION

The main purpose of site preparation is to create suitable growing conditions for tree seed or seedlings. Another purpose in some cases is to create improved conditions that allow for use of mechanical planting equipment. Site preparation is not always necessary, but we do recommend it if the area to be planted has a plowpan or otherwise compacted soils or if the site has extensive weed cover.

Regardless of whether you reforest by direct seeding or planting seedlings, you will probably prepare your site by disking (Figure 7). If the site has a substantial cover of weeds, disking is helpful because it reduces the amount of competing vegetation, and by reducing the amount of weeds, it reduces the number of small rodents. High rodent populations are especially troublesome if direct seeding is planned.

Ideally, you should disk no more than 2 months prior to planting or seeding. However, disking may need to be done somewhat earlier if you plan mid to late winter or early spring planting and if flooding is a



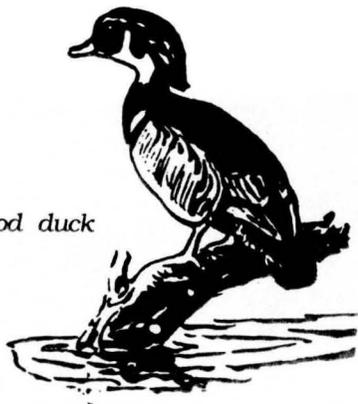
Figure 7. *Disking is the most common form of site preparation on old agricultural fields.*

possibility. Two passes with the disk plow or harrow should be made, and disking should be to a depth of at least 6 inches, but preferably 8-15 inches.

In some cases, you may find burning or sub-soiling useful in preparing your site. Burning alone may be adequate on a field that has been fallow for a couple of years and does not have a plowpan. Sub-soiling may be needed on heavily compacted or otherwise degraded sites, but is rarely necessary on old agricultural fields.

Fertilization may increase the growth of some species planted on old field and other disturbed sites and therefore is occasionally done prior to planting. If you want to maximize growth of your planted trees, we recommend that you first get a soil test done, particularly for nitrogen and phosphorus levels. You should be aware, however, that while fertilization may increase growth, the increase may not be great enough to justify the costs from a timber production perspective.

Wood duck



DIRECT SEEDING

Direct seeding is becoming a widely used method of reforestation in the Lower Mississippi Valley. The primary advantage of direct seeding is its lower cost. Another advantage is that it allows tree roots to develop naturally, without the disturbance caused by cutting roots and removing seedlings growing in a nursery.

A disadvantage of direct seeding is that it usually results in slower initial development of the forest. Also, a major limitation of direct seeding is that it is only reliable for oaks and to a lesser degree other large seeded species such as sweet pecan. The smaller seeds of many other bottomland species are much more susceptible to heat and dry soil conditions and, because they must be planted nearer the surface, are also more susceptible to bird and rodent predation. The procedures described in this section therefore should only be attempted for large-seeded species.

Obtaining Seed

Seed can be obtained either commercially or by collecting it on your own. We have listed a few commercial sources of seed in Appendix B, but your county or

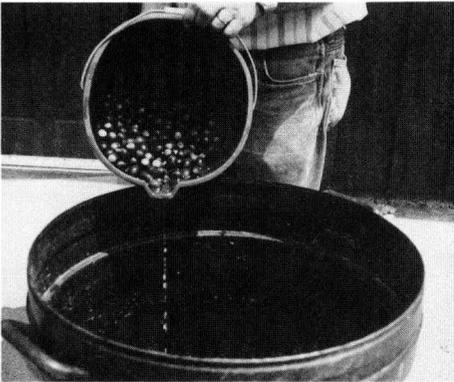
parish forester may be aware of smaller suppliers operating in your vicinity. Seed may be in short supply, so it is important that you place your order as early as possible if you plan to buy it.

If you decide to buy seed from a large supplier, you should request seed collected from sites as close as possible to your land. This seed is likely to be better adapted to your own site than seed collected from more distant areas. Ideally, seed should be obtained from sources no more than 150 miles from where you intend to plant. Also, you should ask the supplier to estimate how much of the seed is viable. Viability should be at least 80 percent; if it is less, you will have to compensate by planting more seed than we recommend in the "Depth of Sowing and Spacing" section.

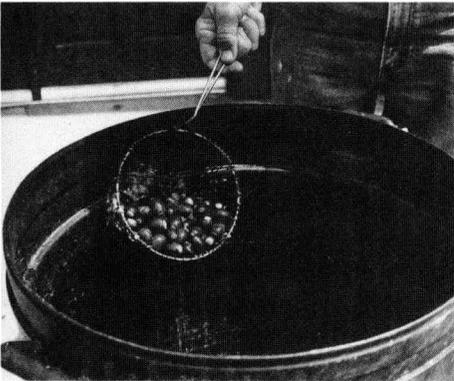
If you are planning to collect your own seed, you should begin as soon as it matures, although you need to be aware that the very first seeds to fall are often not viable. The most common method of seed collection is simply to gather seed that has fallen to the ground and temporarily store it in a bucket, canvas bag, or other container. Plastic bags or other non-permeable containers *should not* be used for collection since they may cause overheating of the seed.

Assuming that there is a fairly good crop of seed on the ground, it is usually possible for one person to pick up from 8 to 10 pounds per hour. It is occasionally possible to speed up collection by shaking large amounts of seed out of trees onto a tarp, or by collecting seed from trees felled in logging operations.

If you are collecting acorns, the next step after collection should be the "float test." The float test helps eliminate unsound (floating) acorns; it works for every species of oak except overcup, which floats even when sound. To test, place the acorns in a large container of water, stir them a couple of times, and skim off the floating acorns and other material (Figure 8). You should then completely drain the water.



a.



b.

Figure 8. The "float test" is a very good way of separating sound acorns from unsound ones. Simply (a) place the acorns in a large container of water, swirl them around a bit, and (b) skim off and discard the floating (unsound) acorns.

Seed Storage

After collection, place red oak acorns (such as Nuttall, cherrybark, water, and willow oaks) and other large seeds in 4-6 mil thick polyethylene bags, tie the bags shut, and put them in cold storage (35 to 40 °F). These species can be stored successfully for at least 3 years. White oak acorns (such as overcup and swamp chestnut oaks) can also be stored in this manner, but only for a few months. You should try to plant white oaks within a month or two after collection rather than store them for an extended period.

If cold storage is unavailable, you can store seed over winter by burying them 1-2 feet underground, either in 4-6 mil polyethylene bags or loose. Under no circumstances should you leave seed in a warm, dry location for more than a couple of hours. If polyethylene bags are unavailable and you do not intend to store seed for longer than one winter, you can use burlap bags.

Timing of Direct Seeding

The most common times for direct seeding are fall, spring, and early summer. Oak acorns (and probably other large seeded species) may also be sown successfully at other times of the year, although the period of July through September is not recommended. The relative flexibility of timing is an important advantage of direct seeding; you can plant when you are not busy with other farm operations or wait until soil conditions are just right.

Depth of Sowing and Spacing

Acorns can be sown successfully at a depth of between 2 and 6 inches. Sowing 2-3 inches deep usually results in better germination and survival than sowing at 4-6 inches, but sowing deeper may pay off in situations where there are many rodents or the soil surface is subject to drying out completely.

Experience has shown that you can expect about 1 out of 4 acorns sown on old fields to produce a tree still growing well after 10 years. If you are sowing only acorns and hope that other types of trees will become established on the site naturally, you should sow as few as 800-1,000, and no more than 1,200-1,800 acorns per acre. This will produce from around 200 to 400 oak trees per acre after 10 years, which should allow some (though not much) growing space for other trees. Even at these densities some thinning of oaks may eventually be required.

Spacing for sowing 1,000 acorns per acre should range from 4.5 by 10 feet to 3 by 15 feet. Spacing for sowing 1,500 acorns per acre should range from 3 by 10 feet to 2 by 15 feet. If you want to avoid the eventual appearance of a plantation, with neat rows of trees, you can plant in wavy lines or even at random, as long as you allow enough growing space around each seed.

Hand Sowing

Direct seeding can be readily accomplished by hand methods. These can be as simple as using a stick or metal bar to make a hole, placing the seed in by hand, and closing the hole with your foot. A

hand tool such as the one in Figure 9 can make the job easier by avoiding the need to bend over to put the acorns in the holes, and also can be constructed so as to ensure a uniform planting depth.

On a relatively clean, flat site, with favorable soil moisture conditions, a single planter should be able to sow around 7 or 8 acres per day using the hand methods described above. This amount can vary substantially,

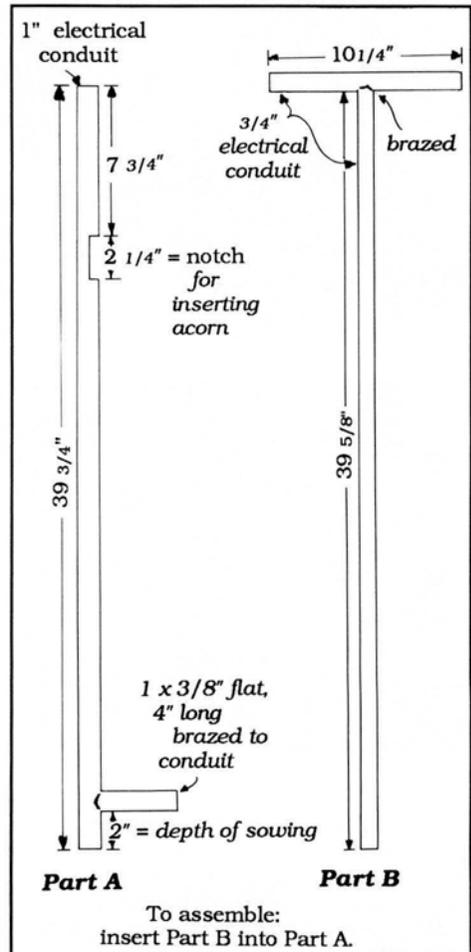
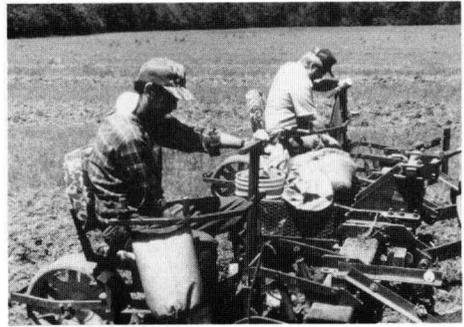


Figure 9. This hand tool, developed by the Forest Service, can make hand sowing acorns much easier.

however, depending on such factors as the experience and physical condition of the planter, the depth of sowing, the distance the planter has to hand carry seed before being able to start planting, and the actual site conditions.

Machine Sowing

On old field sites under proper soil conditions, machine sowing works very well. A soybean or other type of planter can often be modified to allow for sowing acorns (Figure 10). Using the planter depicted in Figure 10a on a prepared site with good soil moisture conditions, three people can sow 40-60 acres per day. Rather than spending time and money modifying a planter on your own, you may be able to rent or borrow one. Your county or parish forester may know of planters available in your general area.



a.



b.

Figure 10. A variety of agricultural planters can be modified for direct seeding. Some require people to ride on the planter and drop acorns in individually (a), and some automatically drop acorns into the planting furrow (b).



*Pileated
woodpecker*

PLANTING SEEDLINGS

Planting tree seedlings is an old, well-established method of reforestation. When it is done correctly, the chances for successful establishment of a forest plantation are very high. If the planting is done incorrectly or carelessly, however, you are likely to end up with an expensive failure. The keys to successful initial establishment of tree seedlings, in addition to selection of the appropriate species for the site, are obtaining good quality seedlings, proper pre-planting care of the seedlings, and proper planting technique.

Obtaining Seedlings

The primary sources of tree seedlings are State forestry organizations and private nurseries (see Appendix B). Growing your own seedlings will rarely be cost effective and is only recommended for commercial operations.

The seedlings you will get from most of these nurseries will be bare-rooted, which means the seedlings have been separated from the soil they were growing in at the nursery. Bare-rooted seedlings are less expensive than seedlings in containers, lighter, easier to transport, and easier to plant.

In contrast to pine seedlings, which are usually planted while quite small, the hardwood or cypress seedlings you select should be good-sized and sturdy (Figure 11). Seedlings should have a top length of at least 18 inches. The diameter of the root collar (the part of the root just below ground level) should be at least 3/8 inch. The roots should be well-developed, and pruned to a length of about 8 inches, since this makes planting easier.

Handling Seedlings

While bare-rooted seedlings have the advantages mentioned above, they require careful handling. The



Figure 11. You should insist on good-sized, sturdy seedlings, with roots pruned to about 8 inches. Since the seedlings are dormant when planted, many will not have any leaves.

most important thing to keep in mind is that the roots are very vulnerable, and if they die the seedling dies.

When you get seedlings from a nursery, they will generally be wrapped up in bundles of 50-200. If you are not going to plant them immediately, you should place the seedlings (still wrapped) in a cool, dark place--ideally in a cold storage unit. A barn, shed, or dense shade will do for a few days, as long as the

roots are not allowed to freeze or dry out.

You should take only as many seedlings to the field as you intend to plant in a day. Take the seedlings out of the nursery-supplied bag and plant them immediately, or transfer small groups of seedlings to a bucket or planting bag containing moist sphagnum or peat moss (Figure 12). You should never carry a group of seedlings in your hand while planting because their roots will be exposed to the air and sun, and they can dry out very quickly.

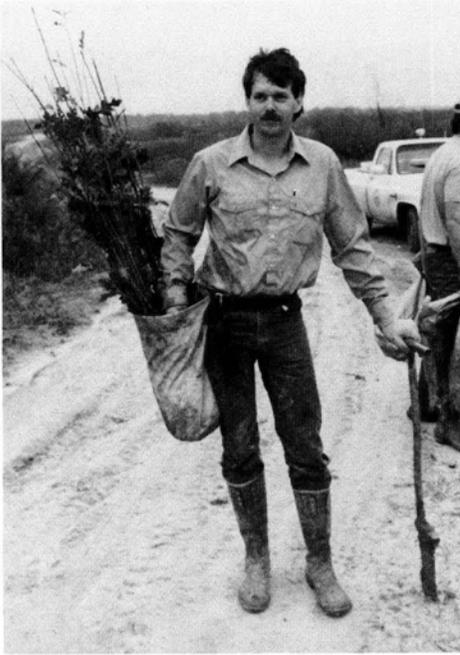


Figure 12. *Tree seedlings should never be allowed to dry out. A good way to protect them in the field is by carrying them in a planting bag.*

Timing of Planting

The best time to plant bare-rooted seedlings is while they are dormant and when the soil is moist. Generally, planting conditions are most suitable in the Lower Mississippi Valley from January through about mid-March. Planting can be done into May if the seedlings are kept in cold storage (and therefore dormant) until planting. The ideal planting weather is cloudy and cool.

The most frequent limitations on planting during this season are excessive cold (planting should not be done in sub-freezing temperatures) and flooding of the site. The more

flood-tolerant species can be planted in shallow water, but the job is much easier if the soil is moist but not flooded.

Spacing

If your goal is reforestation primarily for wildlife, you do not need to plant on spacings of 10 by 10 feet or less, which are frequently used for timber production. Spacings of 12 by 12, 15 by 15, or even 20 by 20 feet may meet your objectives and will do so at less cost. The number of seedlings you need for planting an acre at 10 by 10 foot spacing is 437; at 15 by 15 foot spacing you will need 194; and at 20 by 20 foot spacing you will need only 109.

Hand Planting

You can hand plant tree seedlings using a dibble bar or sharpshooter shovel (Figure 13). The technique for use with these tools is shown in Figure 14. It is important that the roots be placed in the hole so that they can spread out somewhat naturally; they should not be twisted, balled up, or bent. Moist soil should then be packed firmly around the roots.

Planting a tree by hand is a simple task, but nevertheless it is often done incorrectly. If you have a crew of inexperienced tree planters, you should take the time to demonstrate clearly the proper way to plant. Also, you should keep an eye on the crew to make sure they don't get careless as the day wears on and they begin to get tired.

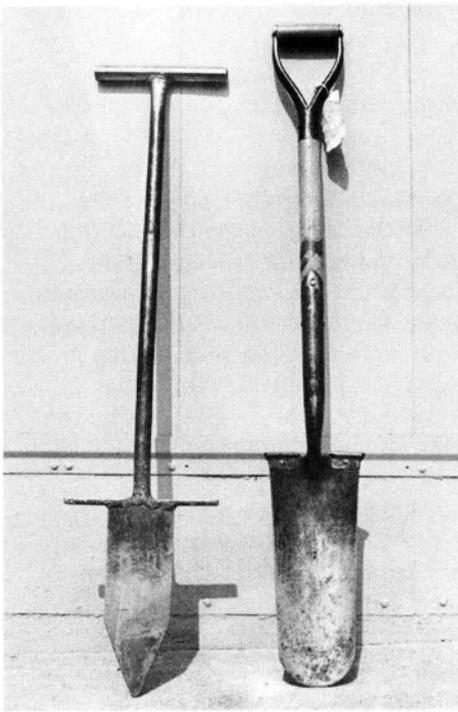


Figure 13. *Dibble bars (left) and sharpshooter shovels (right) are two commonly used tools for planting tree seedlings.*

Seedlings should be planted with their root collars just below the ground surface (Figure 15a). Perhaps the most frequent planting mistake is planting the seedling either too deeply or, more commonly, not deep enough (Figures 15b and c). Another common mistake is digging a hole too shallow for proper placement of the roots. In such a case the roots may become bent upwards, or "J-rooted" (Figure 15d), which can result in the roots not penetrating deeply enough into the soil to protect the tree from windthrow or droughts. A third mistake is leaving an air pocket near the roots after closing the hole (Figure 15e), which may allow the roots to dry out.

You can expect one experienced person to plant roughly 600-800 seedlings per day on a relatively clean, flat site with moist soil. The rate can vary substantially, however, for the same reasons mentioned for direct seeding by hand, as well as

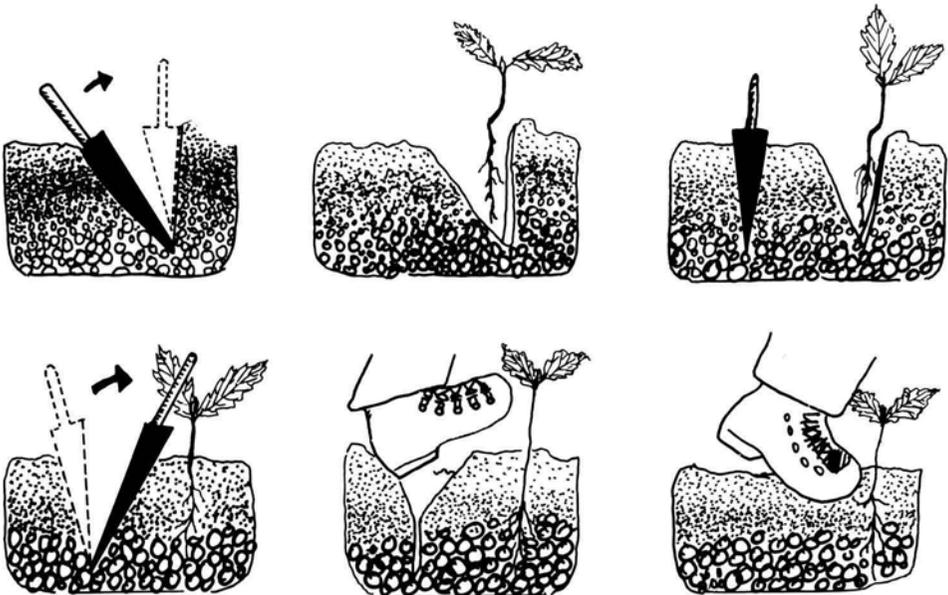
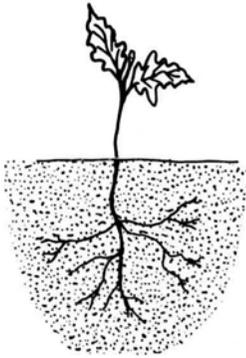
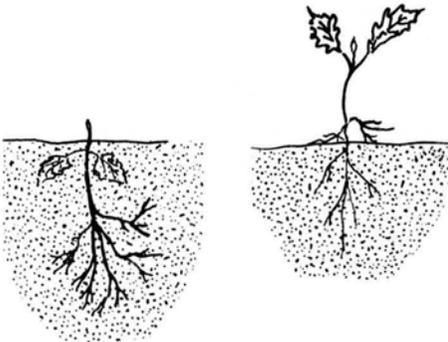


Figure 14. *Planting technique for use with hand tools.*



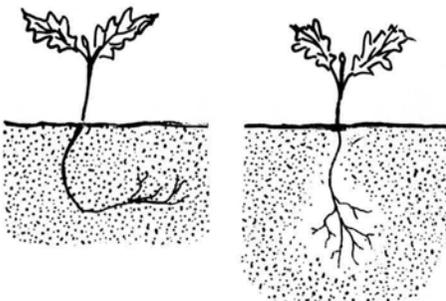
a. Properly planted seedling

Improperly planted seedlings



b. too deep

c. too shallow



d. roots bent

e. air pockets

Figure 15. It is critical that tree seedlings be planted properly (a), not too deep (b), shallow (c), with roots bent upwards (d), or with air pockets (e).

depending on the size of the seedlings being planted.

Machine Planting

Machine planters can speed up the planting job dramatically in soils other than heavy clays when other site conditions are favorable. An experienced crew of two or three can plant 4,000-10,000 seedlings a day with a planting machine, and often survival will be better than that achieved by a large, less-experienced crew of hand planters.

One of the more commonly used types of mechanical planters is shown in Figure 16. The cost of mechanical planters will be prohibitive for most small reforestation projects, but you may be able to rent one or borrow one from someone in the area. We recommend that you ask your county or parish forester about the availability of such planters in your area.



Figure 16. Tree planting machines can be very effective on soils other than heavy clays.



Figure 17. *Young seedlings can often be very difficult to find by the end of the first growing season, but eventually they will overtop the weeds.*

POST-PLANTING OPERATIONS

After planting, you should closely monitor the initial establishment of the seed or seedlings. If there is going to be a problem with the planting project, it will most likely show up in the first couple of years. Outright failures and only partially successful planting projects occur occasionally. They most often result from extended post-planting dry periods, flooding coupled with high temperatures, poor planting practices, residual herbicides or herbicide drift from nearby aerial applications, poor quality seed or seedlings, or animal predation.

During the first few years, you may think that not a single tree survived, but if you look closely, you will probably be able to find many small seedlings nearly hidden in the dense ground cover (Figure 17). If you direct-seeded the site, you should give the seed ample time to germinate before determining the initial success of the project; some seed planted in early summer may not germinate until late summer, fall, or even the following spring.

Post-planting weed control (by disking, mowing, and/or use of herbicides) may speed up growth of the seedlings during the first few years and perhaps slightly increase survival, but the benefits will seldom justify the costs. Post-planting weed control may be most critical where a heavy cover of large grasses (e.g., Johnson grass) or woody vines develops. In general, weed control should be practiced sparingly, since it may actually reduce the short-term value of the site to some types of wildlife, such as rabbits and some songbirds, that use the weeds as food or cover.

If you expect to do some burning near the reforested site, or suspect a neighbor might, you should create a firelane around the site annually in early fall. In most cases, you can make a firelane by disking. Every time that an extended dry period occurs, you should inspect your firelanes and maintain them if necessary.

There is little you can do cost-effectively to protect your newly planted seed or seedlings from animal predation. Domestic animals, birds, deer, rabbits, squirrels, raccoons, beavers, nutrias, and mice may all destroy seed or seedlings. Fencing

can control domestic animals and good site preparation can reduce the number of rodents. The only case where protection of individual seedlings is justified is where there are large populations of beavers or nutrias, in which case a chicken wire or other type of predator guard is essential, especially for cypress plantings. Some loss and damage caused by animals should be expected and tolerated, especially if your main goal is to attract wildlife.

As long as survival remains satisfactory, you shouldn't worry if your trees grow slowly at first. Most species of oak, for example, only grow 1-2 feet per year for the first 5-7 years. After this stage, growth increases to around 2-3 feet per year. By the end of 10 years, your trees should be anywhere from 15 to 25 or more feet tall--and you'll have a valuable, productive forest (Figure 18).



Opossum



Figure 18. *This stand of oaks averages 25 feet in height 10 years after planting and is already good habitat for many wildlife species.*

Appendix A. Characteristics of selected tree species suitable for reforestation.

KEY TO FLOOD TOLERANCE:

T (tolerant)--Species are able to survive and grow on sites where soil is saturated or flooded for long periods during the growing season. Species have special adaptations for flood tolerance.

MT (moderately tolerant)--Species are able to survive saturated or flooded soils for several months during the growing season but mortality is high if flooding persists or reoccurs for several consecutive years. These species may develop some adaptations for flood tolerance.

WT (weakly tolerant)--Species are able to survive saturated or flooded soils for relatively short periods of a few days to a few weeks during the growing season; mortality is high if flooding persists longer. Species do not appear to have special adaptations for flood tolerance.

I (intolerant)--Species are not able to survive even short periods of soil saturation or flooding during the growing season. Species do not show special adaptations for flood tolerance.

KEY TO SUITABILITY: H=high suitability, M=medium suitability, L=low suitability, I=insufficient data to determine suitability or unsuitability.

Common name(s)	Soil type(s) for best growth	Flood tolerance	Time of seed dissemination	Suitability for				Additional information
				Direct seed- ing	Water- fowl food	Deer/ turkey food	Timber pro- duction	
Cherrybark Oak	Well-drained loams	WT-I	Sept.-Nov.	H	H	H	H	Probably the most valuable red oak for those desiring both wildlife and timber.
Live Oak	Well-drained loams and sandy soils	WT-I	Sept.-Nov.	M	H	H	L	Limited to southernmost portions of Lower Mississippi Valley; acorns are reportedly good waterfowl food, but are usually unavailable because Live Oak grows on sites that don't flood for long periods of time.
Nuttall Oak	Heavy, poorly drained clays and clay loams	MT	Sept.-Feb.	H	H	H	M	Best overall direct seeding success obtained with this species; this is an especially valuable species for wildlife since its acorns fall gradually throughout the winter.

Overcup Oak	Heavy, poorly drained clays and clay loams	MT	Sept.-Nov.	M	M	H	L	The only species that produces acorns that float when viable; this is valuable to wildlife in periods of high water. Timber quality is generally low within the Lower Mississippi Valley but is somewhat better in other river bottoms, especially north of Crossett, AR, and Greenwood, MS.
Pin Oak	Heavy, poorly to moderately well-drained clays or clay loams	MT	Sept.-Dec.	H	H	H	L	A fairly consistent mast producer.
Shumard Oak	Well-drained loams	WT	Sept.-Dec.	H	H	H	H	The only oak recommended for soils with a pH greater than 7.5.
Swamp Chestnut Oak, Cow Oak	Moderately well-drained silty clays and loams	WT	Sept.-Oct.	M	M	H	H	
Water Oak	Moderately well-drained silty clays and loams	WT-MT	Sept.-Nov.	H	H	H	M	A fairly consistent mast producer.
White Oak	Well-drained loams	WT-I	Sept.-Nov.	M	H	H	H	Limited to northernmost areas of Lower Mississippi Valley.
Willow Oak	Moderately well-drained silty clays and loams	WT-MT	Oct.-Dec.	H	H	H	M	A good mast producer; the only oak whose foliage is a highly preferred food for deer.
Baldcypress	Very poorly drained organic or clay soils	T	Nov.-Feb.	I	M	L	H	Needs special protection in areas with high beaver or nutria populations.
Bitter Pecan, Water Hickory	Poorly to moderately well-drained clays and loams	MT	Oct.-Dec.	L	I	M	L	A good tree to plant with Overcup or Nuttall Oaks.

(Continued)

Appendix A. Concluded.

Common name(s)	Soil type(s) for best growth	Flood tolerance	Time of seed dissemination	Suitability for				Additional information
				Direct seed- ing	Water- fowl food	Deer/ turkey food	Timber pro- duction	
Blackgum	Well-drained silty and loamy soils	WT	Sept.-Nov.	I	I	M	M	This species is a valuable food source for a wide variety of nongame wildlife.
Green Ash	Poorly to moderately well-drained clays and loams	MT	Oct.-Nov.	I	L	L	H	A good species to plant with Nuttall Oak.
Pecan, Sweet Pecan	Moderately well- drained loams	WT	Sept.-Dec.	M	H	H	H	Although pecans are reportedly eaten by waterfowl, they are seldom avail- able due to the lack of flooding of pecan sites.
Persimmon	Poorly drained clays and heavy loams	MT	Sept.-Dec.	I	L	H	M	A good tree to plant with Nuttall Oak; market for timber is limited mostly for specialty products, such as golf club heads.
Shagbark Hickory	Moderately well- drained loams	WT	Sept.-Dec.	L	I	M	L	
Silver Maple	Moderately well- drained loams	MT	Apr.-June	I	H	H	M	
Sweetgum	Poorly drained clays and loams	MT	Sept.-Nov.	I	M	L	M	A good tree to plant with Cherrybark, Water, or Willow Oaks.
Sycamore	Moderately well- drained loams	MT	Jan.-Apr.	I	M	L	M	Fast-growing, often provides good cavities for Wood Ducks.



Raccoon

APPENDIX B. Partial List of Seed and Seedling Sources

SEED

Alabama

International Forest Seed
Company
P.O. Box 290
Odenville, AL 35120
(800) 231-8079 in Alabama
(800) 633-4506 out of State

Louisiana

K. and S. Jeane Seed Co., Inc.
P.O. Box 21
Quitman, LA 71268
(318) 259-2088

Louisiana Forest Seed
Company
343 Forestry Road
Lecompte, LA 71346
(318) 443-5026

Massachusetts

* F.W. Schumacher Company
36 Spring Hill Road

Sandwich, MA 02563
(508) 888-0659

Missouri

Hicks Seed Company
Route 2, Box 566
Willow Springs, MO 65793
(417) 962-4521

Lovlace Seeds, Inc.
Route 2, Box 13
Elsberry, MO 63343
(314) 898-2103
FAX (314) 898-2855

Montana

* Lawyer Nursery, Inc.
950 Highway 200 W
Plains, MT 59859
(406) 826-3881

New York

* Sheffield Seed Co., Inc.
273 Auburn Road
Locke, NY 13092
(315) 497-1058

SEEDLINGS

STATE FORESTRY AGENCY NURSERIES

Alabama

E.A. Hauss Nursery
Route 3, Box 322
Atmore, AL 36502
(205) 368-4854

John R. Miller Nursery
P.O. Box 236
Autaugaville, AL 36003
(205) 365-8333

Stauffer Nursery
Route 5, Box 142
Opelika, AL 36801
(205) 749-0636

Arkansas

Baucum Nursery
Route 1, Box 515-C
North Little Rock, AR 72117
(501) 945-3345

Illinois

Mason Nursery
Route 1, Box 235
Topeka, IL 61567
(309) 535-2185

Union Nursery
Route 1, Box 1331
Jonesboro, IL 62652
(618) 833-6125

Note: Illinois State nurseries
will not sell out of State.

Kentucky

Morgan County Nursery
Route 1, Box 85-H
West Liberty, KY 41472
(606) 743-3511

John P. Rhody Nursery
P.O. Box 97
Gilbertsville, KY 42044
(504) 362-8331

Louisiana

Beauregard Nursery
P.O. Box 935
DeRidder, LA 70634
(318) 463-5509

Columbia Nursery
P.O. Box 647
Columbia, LA 71418
(318) 649-7463

Mississippi

Winona Nursery
Route 3, Box 83
Winona, MS 38967
(601) 283-1456

Missouri

George O. White Nursery
Route 2, Box 465
Licking, MO 65542
(314) 674-3229
Note: This nursery will not sell out
of State.

Oklahoma

State Tree Nursery
Route 1, Box 44
Washington, OK 73093
(405) 288-2385

Tennessee

Pinson Nursery
P.O. Box 120
Ozier Road
Pinson, TN 38366
(901) 988-5221

Texas

Indian Mound Nursery
P.O. Box 617
Alto, TX 75925-0617
(409) 858-4202

PRIVATE NURSERIES

Alabama

Beck's Nursery
P.O. Box 752
Auburn, AL 36830
(205) 821-0982

Florida

* Central Florida Lands
and Timber
Nursery Division
Route 1, Box 899
Mayo, FL 32066
(904) 294-1211

* Superior Trees, Inc.
P.O. Box 9325
U.S. 90 East

Lee, FL 32059
(904) 971-5159

Iowa

Cascade Forestry Service
Route 1
Cascade, IA 52033
(319) 852-3042

Louisiana

Bosch Nursery, Inc.
Route 2, Box 142A
Jonesboro, LA 71251
(318) 259-9484

Richard's Nursery
Route 1, Box 41
Forest Hill, LA 71430
(318) 748-8587

Mississippi

Delta View Nursery
Route 1, Box 28
Old Highway 61 South
Leland, MS 38756
(800) 227-5750 in Mississippi
(800) 323-7738 out of State

East of Eden Nursery
Route 2, Box 206A
Yazoo City, MS 39194
(601) 746-5577

Thomas Nursery
Route 2, Box 180A
Highway 11
Enterprise, MS 39330
(601) 659-9259

Missouri

Forrest Keeling Nursery
Elsberry, MO 63343
(314) 898-5571

Tom Lett Nursery
Route 2, Box 383C
Cape Girardeau, MO 63701
(314) 335-0909

Oklahoma

Greenleaf Nursery
Route 1, Box 163
Park Hill, OK 74451
(918) 457-5172

Tennessee

Boyd Nursery
P.O. Box 71
McMinnville, TN 37110
(615) 668-4747 or
(615) 668-9898

Greenwood Nursery
202 Bradford Road
McMinnville, TN 37110
(615) 668-3041 in Tennessee
(800) 426-0958 out of State

Hillis Nursery
Route 2, Box 142
Highway 56 S
McMinnville, TN 37110
(615) 668-4364

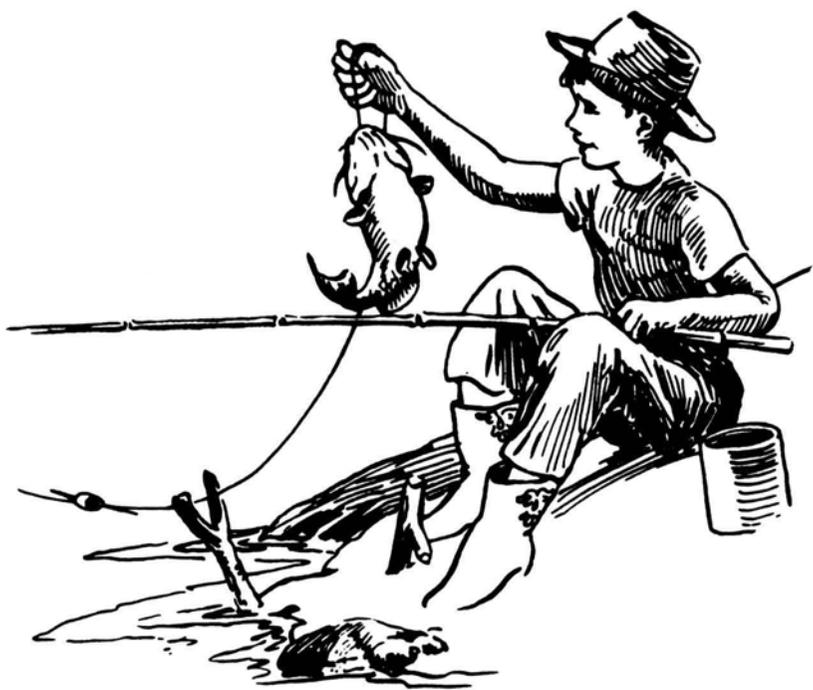
Texas

Greenleaf Nursery
P.O. Box 73
Highway 71 S
El Campa, TX 77437
(409) 543-6891

* These nurseries or seed suppliers, while located well outside of the Lower Mississippi Valley, purchase seed from within the valley and keep it separate from seed collected elsewhere. We invite submissions of additional names of seed and seedling sources for future reprints.

RECOMMENDATIONS FOR FURTHER READING

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- * Reprints of these articles are available from the U.S. Forest Service, Southern Hardwoods Laboratory, P.O. Box 227, Stoneville, MS 38776.**



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