



Planting and Care of Fine Hardwood Seedlings



Hardwood Tree Improvement and
Regeneration Center

Northern Research Station
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Importance of Hardwood Tree Plantings

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Landowners in the Central Hardwood Region have placed increasing demand on forest tree nurseries for production of hardwood seedlings to be used for plantation establishment. Most of these seedlings are planted on former agricultural lands, such as croplands and pastures (Jacobs et al. 2004) (Fig. 1). This increased demand has led to shortages of hardwood seedlings in some regions. For instance, in the Central Hardwood Region it was estimated that demand outpaced supply by 25 to 50 million seedlings in 1999 (Michler and Woeste 2002).

Much of the demand for hardwood seedlings comes from private landowners, who control the majority of forestland in many portions of the Central Hardwood Region. In Indiana, for example, approximately 150,000 non-industrial private forest landowners own 85 percent of the 4.45 million acres of forest (Tormoehlen et al. 2000).

Landowners may qualify to receive financial assistance, education, and professional advice for establishing hardwood tree plantations through governmental conservation programs that seek to protect environmental resources, in part, through planting of hardwood trees (MacGowan et al. 2001; Hoover 2004). Examples can be found at the federal (USDA Forest Service, USDA Farm Service Agency, USDA Natural Resources Conservation Service, USDI Fish and Wildlife Service), state (Division of Forestry, Division of Fish and Wildlife, Cooperative Extension Service), and local (Soil and Water Conservation Districts) levels. These programs may be especially important to help motivate and provide technical assistance to the tree planting efforts of small landowners in the Central Hardwood Region, many of whom are planting trees for the first time (Ross-Davis et al. 2005).

With shifts toward greater conservation pressures being placed on public forests nationwide, private lands must increasingly be relied upon to provide timber resources. However, while landowners in some regions of the United States, for example, the southeast, establish forest plantations primarily for timber production, landowners in the Central Hardwood Region plant trees for many reasons. A recent survey of tree plantations in Indiana found that landowners are planting trees primarily for conservation-related reasons; that is, to provide for future generations, enhance wildlife habitat, and to



Figure 1. Establishment of a hardwood plantation on a former agricultural field.

conserve the natural environment (Ross-Davis et al. 2005) (Fig. 2). The ownership characteristics of many plantation landowners suggest that they place higher priority on aesthetic or conservation values rather than on financial attributes (Ross-Davis et al. 2005) (Fig. 3).

Landowners in the Central Hardwood Region have a diversity of attitudes and manage their land for a wide variety of economic and ecological reasons. Hardwood tree plantations may simultaneously meet many landowner objectives including timber production, provision of wildlife habitat, ecological restoration, watershed protection, and conservation or aesthetic values. This publication provides a brief overview of several key societal and environmental attributes that hardwood plantations provide.

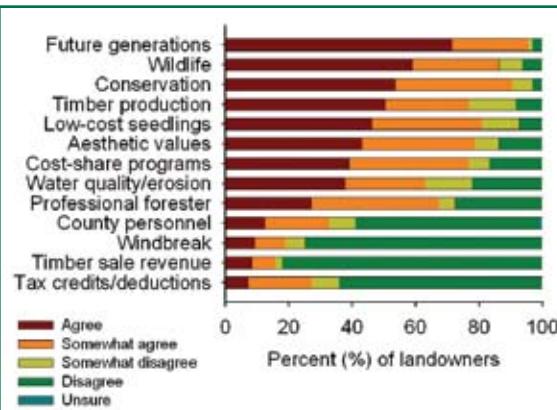


Figure 2. Landowner motivations for tree planting resulting from a survey in Indiana (adapted from Ross-Davis et al. 2005).

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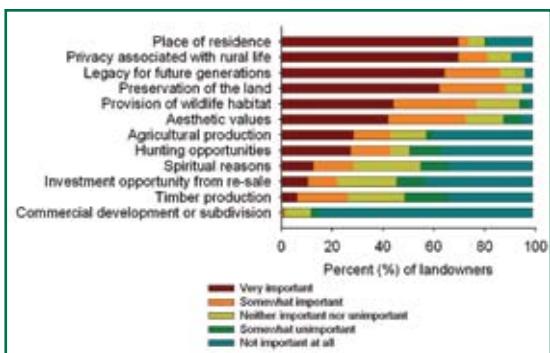


Figure 3. Ownership characteristics of landowners who planted trees resulting from a survey in Indiana (adapted from Ross-Davis et al. 2005).



Figure 4. Black walnut plantation managed predominantly for timber production.

Timber Production

Many of the hardwood tree species native to the Central Hardwood Region, such as oaks, cherry, and walnut, command some of the highest timber prices in the world. This is especially true for highly select trees with excellent form and grain qualities that may be used in veneer production. Hardwood trees of medium or lower quality still attract excellent lumber prices for furniture, flooring, paneling, specialty crafts, etc. As such, some landowners establish and manage hardwood plantations primarily for timber production (Fig. 4).

Hardwood plantations can provide good long-term investment opportunity through timber production, so long as landowners receive expert consultation prior to plantation establishment and apply good silvicultural management throughout the rotation. In particular, it is critical to match the appropriate species to the ecological characteristics of the plantation site and to use stock that is genetically adapted to the site (Jacobs and Davis 2005). Because of the long rotation ages characteristic of hardwood plantations in the Central Hardwood Region (i.e. 50 to 80 years), it is also recommended to plant multiple species on a given site. This allows for reasonable security that a timber investment will be maintained despite the risk for introduction of pests or pathogens specific to a given species. Additional management activities that may enhance timber profitability in a hardwood plantation include fertilization, irrigation, pruning, and thinning.

Wildlife Habitat

Hardwood plantations can provide excellent habitat for many species of wildlife. Wildlife species vary tremendously in terms of their specific habitat and food requirements, but the great diversity of hardwood tree species available for planting in the Central Hardwood Region accommodates these needs well (see Table 2 in MacGowan 2003). Hardwood tree species that



Figure 5. White oak acorns, a preferred food source for many wildlife species, typically begin to develop after 15 to 20 years of age (photo by Sally Weeks).

produce large nuts, including hickory, oak (Fig. 5), and walnut are especially important for wildlife species such as deer, squirrels, and turkey. Other hardwoods that produce berries, such as cherry, are readily consumed by various bird species. Wider spaced plantations typically promote early onset and vigor of fruiting because abundant sunlight helps to stimulate flower production.

Protective cover is another important wildlife benefit that hardwood plantations provide. Many hardwood tree species, such as those producing large nuts, do not begin to produce mast until 20 or more years of age. Thus, prior to reproductive maturity, the greatest benefit from these plantations to wildlife is protective cover, which is related to the structural characteristics of the stand. Just as wildlife species vary in food needs, they also differ in cover requirements. Some early successional wildlife species such as rabbits, woodcocks, and many songbirds prefer relatively dense canopies associated with young stands planted at a close spacing for use in foraging and nesting (Fig. 6) (MacGowan 2003). Relatively tight spacing also helps to encourage good timber form by forcing a dominant terminal leader, while simultaneously minimizing lateral branching that degrades wood quality. Dense plantations also allow the landowner to manipulate the stand later in the rotation by cutting or girdling residual trees, which creates



new opportunities for wildlife habitat options and helps stimulate fruit production.

Other wildlife species prefer cover afforded by mature forest stands with relatively low tree densities. For example, the Indiana bat, an endangered wildlife species, is thought to roost within the peeling bark of shagbark hickory trees. Plantation owners may manage species compositions and tree densities to favor a variety of species throughout stand development of a hardwood plantation. It is probably ideal to maintain a wide range of plantation ages, densities, and species types to meet the diverse habitat and food needs of multiple wildlife species.

Forest Restoration

Planting hardwood trees also affords the land-owner with an opportunity to help restore forest lands or manipulate the composition of forest tree species in existing forest stands. This may be particularly important in portions of the Central Hardwood Region that have been subjected to intensive habitat loss. Indiana and Ohio, for instance, were 87 percent and 95 percent forested, respectively, prior to European settlement, compared to only about 19 percent and 30 percent at present (Smith et al. 1994). Indiana, Illinois, and Iowa ranked lowest among the 50 U.S. states in amount of remaining natural habitat (Klopatek et al. 1979).

Mine reclamation sites provide an excellent example of how degraded lands may be successfully restored through hardwood tree plantings (Fig. 7). Following the completion of coal mining operations, companies are required to restore land to its original cover type, which in the Central Hardwood Region was often comprised of hardwood forests. Mine reclamation sites are a major source of tree plantings in portions of the Central Hardwood Region. About 1 million trees are planted on mine reclamation sites each year in Indiana (roughly 20 percent of total nursery production). Similarly, hardwood plantings may help to restore the ecological character of degraded pasture or agronomic sites.

Existing forest stands can also benefit from hardwood plantings. In many portions of the Central Hardwood Region, logging often involves single-tree selection, which tends to favor the dominance of late-successional, shade-tolerant species (e.g. beech or maple) as opposed to early to mid-successional, shade intolerant species (e.g. oak, hickory, and walnut) in the residual forest stand. There has been a notable shift in tree species composition during the last decade toward later successional species (Schmidt et al. 2000), which is of concern to many landowners. Though

multiple silvicultural options exist to manipulate natural regeneration in stands, planting hardwood seedlings represents an additional means to help promote development of oaks or other preferred species in forest stands (Fig. 8). Clearcutting or creation of harvest gap openings, followed by planting hardwood seedlings can also be used to help restore forest stands that have received poor forest management practices in the past (e.g. “high-graded” stands where only preferred trees of certain high value species were removed).

Watershed Protection

Many portions of the Central Hardwood Region are subjected to intensive agricultural production that threatens groundwater and stream resources. Pesticide and fertilizer runoff can substantially alter ecological characteristics in riparian areas for example, by increasing stream nitrate or pH levels or altering water temperatures). Intensive agriculture often leads to increased sediment deposits in riparian zones through soil erosion. Many riparian areas harbor high diversities of native wildlife, fish, and invertebrate populations. Degradation of these riparian zones can have severe negative ecological consequences for many species that depend on these resources. Runoff from agronomic sources can threaten drinking water supplies through groundwater contamination.



Figure 6. High density hardwood plantations help to promote good timber form, while simultaneously providing habitat for certain wildlife species.



Figure 7. Mine reclamation site planted with oak seedlings (photo by Francis Salifu).

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Figure 8. Northern red oak seedling planted in a harvested forest opening to help encourage oak regeneration in subsequent stand.



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Hardwood plantations can help to mitigate these negative effects by filtering pollutants before they reach water supplies. Tree roots can extract most nutrients applied to agronomic crops, using these to promote their own growth and thereby reducing nutrient leaching into groundwater supplies. Trees planted along riparian corridors are particularly useful for reducing the flow of pollutants into streams. These trees may act as effective filterstrips that help stop the flow of chemicals and sediment into streams.

Conservation and Aesthetics

Hardwood plantings can also serve as an important source for forest conservation purposes and may provide tremendous aesthetic values to landowners. Deciduous hardwood forests of the Central Hardwood Region are cherished by many people for providing aesthetic beauty, plentiful recreational opportunities, and exceptional fall leaf color. Landowners often plant hardwood trees primarily to help maintain the abundance of these forests for current and future generations. Though hardwood plantations established on former open fields are often planted in rows similar to that of agronomic crops, over time these plantations develop forest structure similar to that of natural forests through natural thinning or silvicultural manipulations (Fig. 9). Hardwood plantations are likely to become an increasingly significant source of mature forest stands in the future that will help contribute toward the wide host of values currently derived from natural hardwood stands.

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Figure 9. Thirty-year old mixed hardwood stand, exhibiting complex overstory and understory forest structural development.

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