

A Century of Tree Planting: Wisconsin's Forest Nursery System

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Abstract

This report summarizes the history of the Wisconsin nursery system, including the tenuous beginning in the Wisconsin Conservation Department after the initial cutover of the State's forests, the boom years during the middle of the 20th century, the current challenges, and future projections.

Wisconsin and Its Landscape

Wisconsin Overview

Wisconsin lies in the upper Midwest between Lake Superior, Upper Michigan, Lake Michigan, and the Mississippi and Saint Croix Rivers. Glaciations largely determined the topography and soils of the State with the exception of more than 13,000 mi² (33,670 km²) of a driftless area in southwestern Wisconsin. The various glaciations created rolling terrain, nearly 9,000 lakes, and several large marsh and swamp areas. Elevations range from about 600 ft (180 m) along the Lake Superior and Lake Michigan shores and in the Mississippi flood plain in southwestern Wisconsin, to nearly 1,950 ft (600 m) in the north-central highlands.

The Wisconsin climate is typically continental with some modification by Lakes Michigan and Superior. Mean annual precipitation ranges from 28 to 34 in (70 to 85 cm) annually. The land immediately south of Lake Superior is characterized by rolling to flat topography with heavier clay soils. The northern tier of the State is dominated by rolling topography and silt loam soils. Large areas of sandy outwash are located in the central and far northwest and northeast parts of the State that include some large, scattered wetlands. The west and southwest portions of the State have a mix of silt loam and sandy soils that support oak savanna, open oak woodlands, and prairie. The eastern and southeastern portions of the State have loam, silt loam, and clay soils. Of the State's 34.8 million acres (14.1 million hectares), about 45 percent are currently covered by forests, with most in the northern third of the State. Most of the flat, fertile terrain in the southern portion of the State is agricultural land.

Early Wisconsin Forest Cover

Prior to European settlement, mixed hardwood and conifer forests covered most of northern Wisconsin (figure 1). Hard maple (*Acer saccharum* Marsh.), yellow birch (*Betula alleghaniensis* Britt.), basswood (*Tilia americana* L.), American elm (*Ulmus americana* L.), rock elm (*Ulmus thomasi* Sarg.), and northern red oak (*Quercus rubra* L.) represented the bulk of the species. American beech (*Fagus grandifolia* Ehrh.) occurred along Lake Michigan and Green Bay. Hemlock (*Tsuga canadensis* Carr.) was the principal conifer associated with these hardwoods, but scattered areas of white pine (*Pinus strobus* L.), balsam fir (*Abies balsamea* [L.] P. Mill), and white spruce (*Picea glauca* [Moehn] Voss) could be found as well. Within this mixed hardwood and conifer forest were lowland or swamp areas characterized by white cedar (*Thuja occidentalis* L.), black spruce (*Picea mariana* [P. Mill] B.S.P.), tamarack (*Larix laricina* [Du Roi] K. Koch), balsam fir, black ash (*Fraxinus nigra* Marsh.), and elm. Sandy soils in parts of central and northern Wisconsin supported vast tracts of white pine, red pine (*Pinus resinosa* Soland.), jack pine (*Pinus banksiana* Lamb.), and scrub oak. Oak, hickory (*Carya* sp. Nutt.), hard maple, basswood, black walnut (*Juglans nigra* L.), and white ash (*Fraxinus americana* L.) dominated the southern forest, which also contained extensive prairie openings covered with thick grasses, interspersed with hardwood islands.

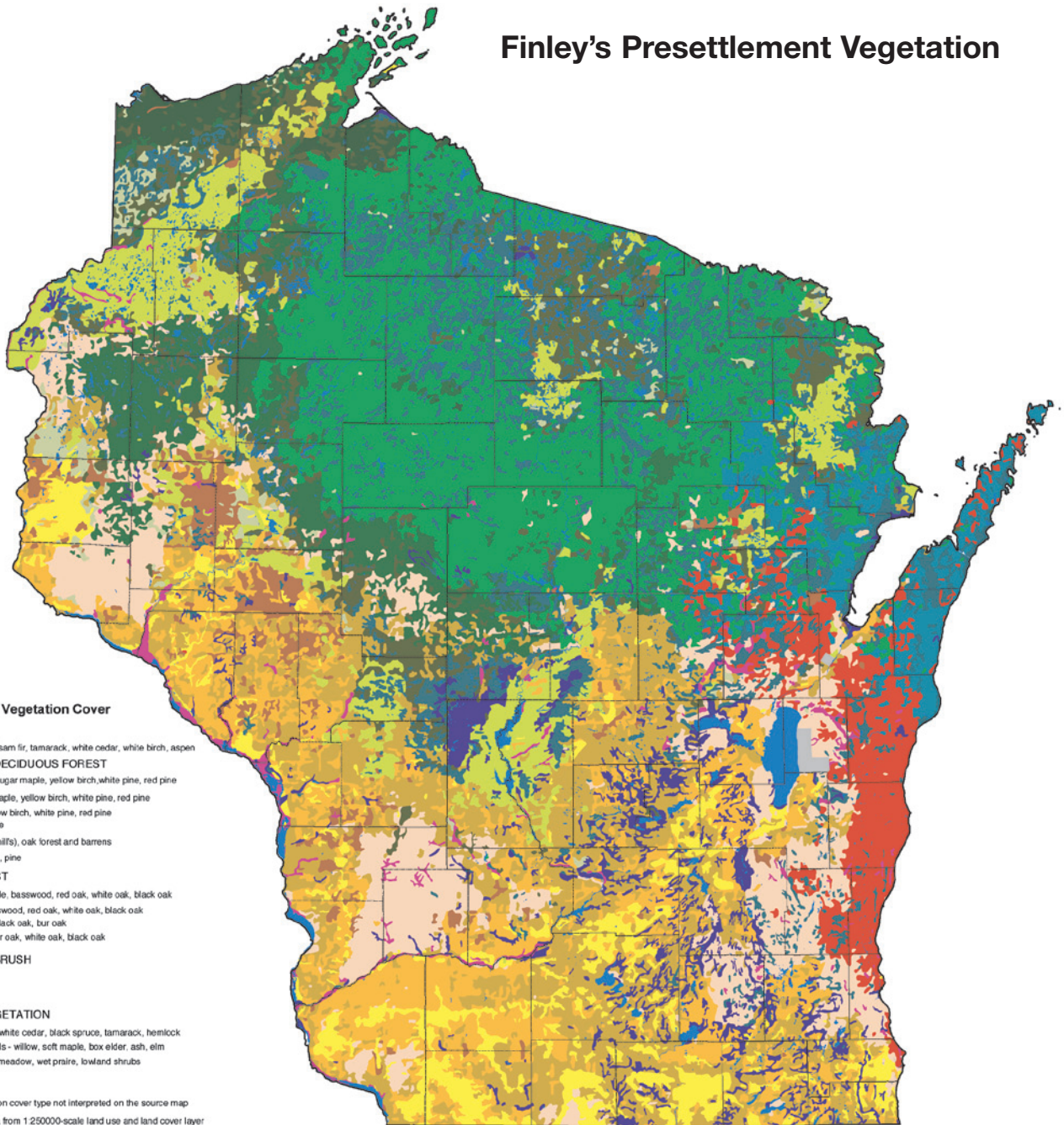
The Lumbering Era

With vast acreages of white pine, a species highly sought by ambitious timber barons, the logging industry started, in earnest, at the end of the Civil War. By 1869, Wisconsin's annual lumber production had reached more than 1 billion board feet (2.3 million m³) and would continue at that level, or higher, until the early 1900s. With such accelerated rates of cutting, the forest was unable to sustain the early logging industry's insatiable appetite for timber. Soon sawmills, lumber companies, and jobs disappeared. Forest lands were abandoned and left to recuperate on their own. Thousands of acres of tax delinquent lands reverted to public ownership by the State or county. The lumber and land companies, in conjunction with well meaning members of the University of Wisconsin

Finley's Presettlement Vegetation

Finley's Original Vegetation Cover

- BOREAL FOREST**
- White Spruce, balsam fir, tamarack, white cedar, white birch, aspen
- MIXED CONIFER—DECIDUOUS FOREST**
- Beech, hemlock, sugar maple, yellow birch, white pine, red pine
- Hemlock, sugar maple, yellow birch, white pine, red pine
- Sugar maple, yellow birch, white pine, red pine
- White pine, red pine
- Jack pine, scrub (hills), oak forest and barrens
- Aspen, white birch, pine
- DECIDUOUS FOREST**
- Beech, sugar maple, basswood, red oak, white oak, black oak
- Sugar maple, basswood, red oak, white oak, black oak
- Oak - white oak, black oak, bur oak
- Oak openings - bur oak, white oak, black oak
- GRASSLAND AND BRUSH**
- Prairie
- Brush
- WETLAND AND VEGETATION**
- Swamp conifers - white cedar, black spruce, tamarack, hemlock
- Lowland hardwoods - willow, soft maple, box elder, ash, elm
- Marsh and sedge meadow, wet prairie, lowland shrubs
- OTHER**
- Area with vegetation cover type not interpreted on the source map
- Hydrographic area from 1:250,000-scale land use and land cover layer



0 12.5 25 50 75 100 Miles

Scale 1:2,750,000
Wisconsin Transverse Mercator NAD83(91)
Map Creator: Nina Janicki

Data created by Robert W. Finley—1976
Professor of Geography Emeritus, University
of Wisconsin Center System.
Digital Data prepared by Maribeth Milner, and Steve Ventura
University of Wisconsin—Madison.
This data layer is included in DVGISlib, a part of the DNRView
extension to ArcView. DNRView makes it easier to use and share
DNR geographic data. Trained ArcView users can obtain
DNRView from the appropriate regional contact listed in the
"GIS" Datasharing" section.
The data on this map are available on a
cost of resources basis from WDNR, GIS Services Section.
See the "GIS Datasharing" section.
Visit <http://www.dnr.state.wi.us/org/et/geo>.

Figure 1. Presettlement vegetation distribution in Wisconsin.

College of Agriculture, encouraged settlement and farming of the recently cutover lands. Unproductive soils, vast stump fields, frequent wildfires, lack of infrastructure, and economic opportunities led to a mass exodus of settlers, however. These vacant lands were the precursors to the national, State, county, and municipal forest reserves that are currently managed throughout the northern half of Wisconsin (Rohe and others 2004).

Current Wisconsin Forest Lands

The composition of Wisconsin forests has changed significantly since early settlement. Conifers, specifically hemlock and white pine, are just remnants of their once vast expanses. The oak savannas and pine barrens are also less prevalent on the landscape. Some forests, specifically the aspen and birch, however, are more important in many areas. Currently, 16 million acres (6.5 million hectares) are covered in forest land and encompass a number of different forest types (figure 2). The hardwood forests are the most abundant forest type, but the oak-hickory and maple-basswood forest type have the largest trees. Significant areas of softwoods, red pine, white pine, and jack pine also occupy large swaths of land in northern and central portions of the State. Private, nonindustrial landowners own nearly 70 percent of this property (figure 3). Large, contiguous acreage of public land is located in the central, northern, and north-western parts of the State. The east and southern portions of the State are dominated by land with agricultural uses.

History of Wisconsin's Reforestation

Early Efforts

The following paragraphs are excerpted from a personal narrative written by William Brener in 1944, reflecting on the history and legacy of reforestation in Wisconsin (Brener 1944). Brener (figure 4) began his career as a forester for the Wisconsin Conservation Department (precursor of the Wisconsin Department of Natural Resources) in 1931 and served as Nursery Supervisor at Central State Nursery (changed in 1940 to Griffith State Nursery) and later as Chief of the State Nursery Program. Brener maintained detailed records of events at the nursery every year, including climate, insect and disease problems, research, working conditions, sales, and correspondence with other members of the nursery community within the State. During his 41 years of distinguished service, he was credited with establishing and developing more than seven State nurseries, which provided 900 million tree seedlings for reforestation of forest land in Wisconsin (figures 5, 6, and 7). He was inducted into the Wisconsin Forestry Hall of Fame on November 3, 1995.

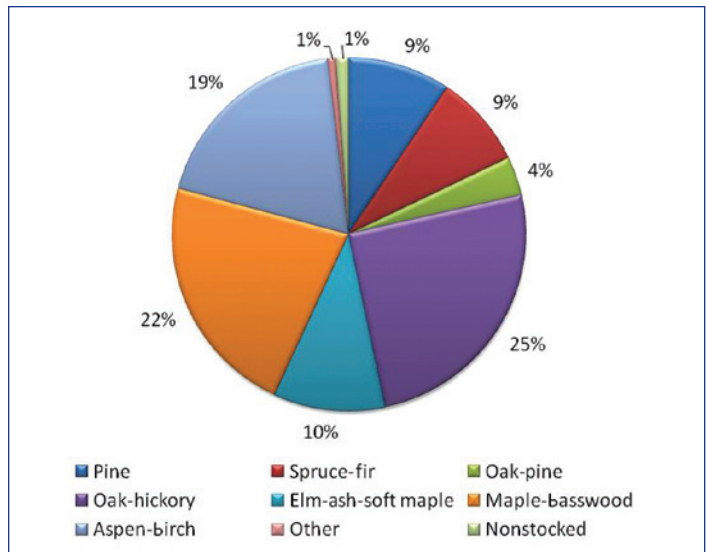


Figure 2. Wisconsin forest cover types.

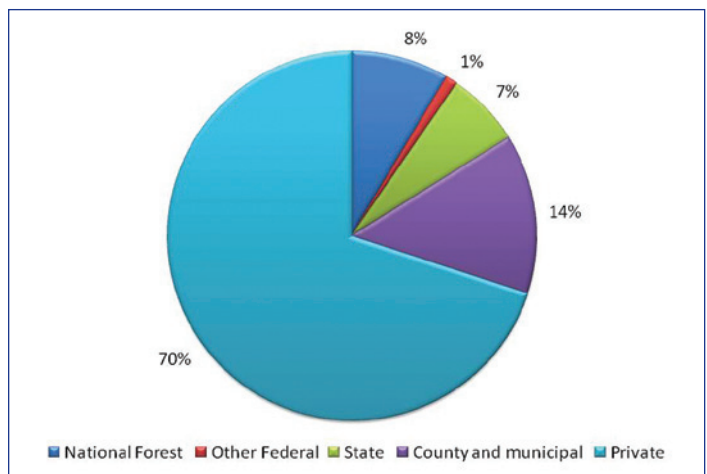


Figure 3. Forest land ownership in Wisconsin as of 2009.

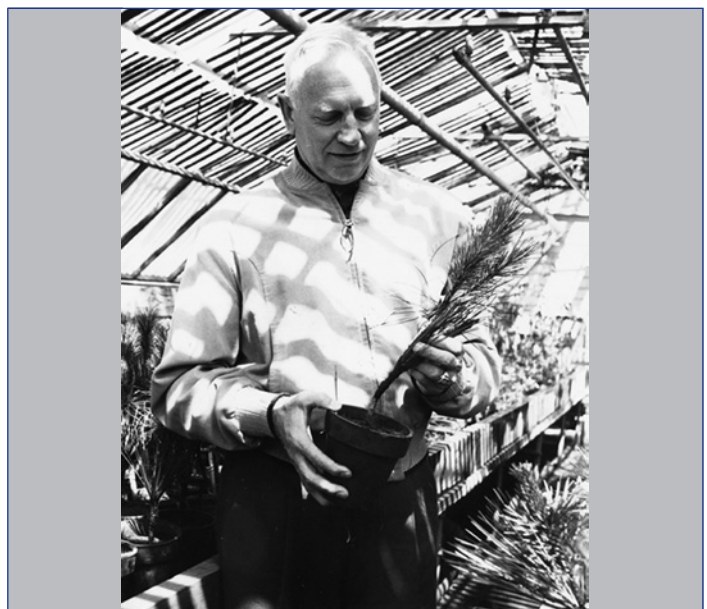


Figure 4. William Brener (shown here in 1960 holding a pine graft seedling) was an early advocate for producing high-quality seedlings to reforest lands in Wisconsin (Photo source: Wisconsin Department of Natural Resources files).



Figure 5. An early view of the nursery beds and facilities at Griffith State Nursery, located in Wisconsin Rapids, WI (Photo source: Ray Amiel, Wisconsin Department of Natural Resources files).



Figure 6. Historical photo of lifting nursery stock in Wisconsin destined for reforestation of publicly owned lands (Photo source: Ray Amiel, Wisconsin Department of Natural Resources files).



Figure 7. Loading bundles of seedlings for distribution (Photo source: Ray Amiel, Wisconsin Department of Natural Resources files).

A Brief History of Tree Planting in Wisconsin

As we look back over the record, the first appreciable amount of tree planting in Wisconsin began in 1911 under the tutelage of the Conservation Department. At that time 192,000 seedlings were planted on State-owned land with stock secured from Michigan State College. The young conifers were planted near Trout Lake in Vilas County and presented a fresh start for long-range sustainability and management of the State's forest resource. An additional 18,000 trees were purchased and planted the following year. Meanwhile, a State-operated nursery was constructed at Trout Lake. In 1913, the nursery's first production of 68,500 trees was added to the State plantations.

Initial Expansion and 1915 Setback

The period from 1911 to 1915 was an active one in forestry work, filled with much hope. Due to favorable legislation and the acquisition of State forest lands, the Trout Lake nursery was expanded and by 1914 had an output of 1/2 million trees. During the pioneer days of forestry and reforestation strides, many recognized this as a significant achievement.

Although the populous supported restoration activities with their votes, opposition began to develop and culminated in 1915. The question of forestry was presented to the State Supreme Court in a friendly suit to determine the exact status of forestry work and the legal structure supporting it.

After an intensive review, the court rendered an opinion declaring forestry work illegal and in conflict with the State constitution on a number of fronts. This decision practically nullified the entire reforestation program that had been growing in intensity. In 1915 only 77,400 trees were distributed from Trout Lake.

Interest in Reforestation Revived

The 1915 decision was a significant milestone in the history and development of reforestation in Wisconsin. It was a great shock to those who were interested in the movement of forestry in the State, and it looked as if the business of forest restoration was out for good. It took nearly 10 years to recover from the setback.

However, the public interest in reforestation was so pronounced that after the close of World War I in 1924, an identical amendment to the State constitution was again submitted to the voters and approved by an overwhelming majority. The Supreme Court reviewed the amendment and found it sufficient. The record shows that over 1 million trees were distributed and planted in 1926 with an ensuing expansion of effort and facilities until entrance into World War II.

1932 Expansion and Establishment of a New Nursery at Wisconsin Rapids

Late in 1931, a special Governor's subcommittee, committed to land use and forestry, was appointed to study the need for accelerated reforestation. The subcommittee's report, presented in early 1932 to the Conservation Commission, readily approved the recommendations that the State should commence at once a forest

planting program on suitable lands. The over-riding goals were to sustain industry, to afford employment, and to keep land best suited for forestry in a productive capacity.

The tremendous expansion of the planting activities necessitated the purchase of planting stock from private nurseries, principally those located in Wisconsin. The enlarged reforestation initiative made it more imperative than ever to construct a new nursery in the central part of the State. Coupled with this was the need to supply seedlings approximately two weeks earlier for planting in the southern and central parts of the State than was possible from the more northern Trout Lake nursery.

A survey to determine suitable sites was conducted, resulting in the selection of an area near Wisconsin Rapids for the new State nursery (the future Griffith State Nursery). Site development started in the fall of 1932 with the first stock becoming available in 1934. That year over 16.5 million trees were distributed and planted.

Nurseries Enlarged and Improved

The tree growing facilities of the department again were materially improved and increased during 1936 and 1937. This work was done in cooperation with the Civilian Conservation Corps and CCC camps. As the work of these camps in truck trail construction was completed, more of their attention was directed to reforestation of publicly owned lands. To furnish the trees needed for this expanding planting program, further facilities were required. Additional land was purchased, and general amplification of all facilities, including buildings, water systems, and other equipment was necessitated. The Wisconsin Rapids facility was trebled, and additional improvements were completed at Trout Lake. A new nursery was established near Gordon in the northwest portion of the State. In the work of the enlarged nursery facilities, the CCC camps and the WPA crews furnished by far the bulk of the labor and shared expenses with the Conservation Department.

County Forest and Private Landowner Planting

While the principal reforestation work was done on lands owned by the State, primarily State forests, much work also was done on county lands. The location of the CCC camps and the enormous acreage of plantable land on county forests were contributing factors. Over 2 million trees were planted on county forests in 1933. In 1940 more than 25 million trees were planted, representing the highest annual distribution to county forest lands in the history of Wisconsin's State nursery program. Today, planting on the county forests has dwindled to less than 4 million trees annually.

The policy under which planting stock was furnished at reasonable prices to private landowners for reforestation purposes in the State continued, but suffered little because of the war. While State and county forest planting decreased drastically during World War II, the demand for trees from farmers and other private landowners held up surprisingly well.

Shelterbelt Project

The hot, dry weather of 1933, and particularly in 1934, the lowering of the water table in various communities, together with the dust storms, focused attention on the need for trees and shelterbelts for windbreak purposes. A well-organized and enthusiastic demand arose in the central counties for an extensive tree planting program. Through the county agricultural agents and other interested parties, surveys were conducted to determine the tree requirements for shelterbelts. As a result, the Conservation Department was called upon to furnish over 14 million trees, mostly transplants, during the 10-year period of 1934 to 1944. The Conservation Department entered into cooperative agreements with the County Board Agricultural Committees of the counties concerned, and each farmer signed an agreement to plant the trees as instructed and to give proper care to the plantation. The trees were planted in three row shelterbelts, and a total of 5,942 miles of plantings were completed by 1944.

Research Studies and Industrial Forests

The Conservation Commission, in cooperation with the University of Wisconsin, began investigating depletion of soil fertility at all State nurseries. This led to a soil rejuvenation program, especially important due to a general decline in vitality and size of nursery stock.

Studies were also initiated to control damaging soil and tree diseases, and a separate experimental nursery was established in conjunction with the College of Agriculture and the U.S. Department of Agriculture, where investigations were carried out to possibly propagate disease-resistant varieties.

During these years, several industrial corporations, mainly paper companies, also conducted extensive forest plantings as an integral part of their forestry programs. While several of the corporations operated their own nurseries, the Conservation Department continued to provide them with a goodly portion of forest planting stock at nominal prices.

Effects of World War II

Even before the United States' entry into the war, the loss of the CCC camps caused a decided drop in tree planting activities on public lands in Wisconsin. From an all-time high of over 38 million trees planted in the year 1940, there was a drop to 18 million in the year 1942, the first full year of active participation in the war. In succeeding years, the drop in tree planting continued as the shortage of labor became more apparent, until 1944 when only 10 million trees were distributed and planted. However, it was gratifying to note that the majority of these trees went to farmers and other private landowners who took the time to plant the trees themselves or with help from the immediate members of their families.

Brener continued the story to include some inner workings of the nursery and information on the trials, tribulations, and successes of the reforestation efforts of 1944. His personal reports, writings, and correspondence are still held in the archives of the Griffith State Nursery. Brener was a part of the nursery system, long after his retirement. He had a deep admiration for the nursery and was very proud of the work he and others did. He made an annual trip to Griffith State Nursery during Memorial Day weekend, until his health declined in the mid-1990s, to view and walk the property.

Wisconsin Nursery System Today and in the Future

Many years have passed since Brener wrote his narrative, and the Wisconsin State nurseries have gone through many changes. The Wisconsin Conservation Department and other resource-related State organizations were combined to create the Wisconsin Department of Natural Resources in 1967. At the height of seedling demand in the 1950s, the State operated six seedling nurseries, with a number of smaller transplant nurseries. As technology and seedling growing techniques improved, facility needs declined. Today, State nurseries in Hayward, Wisconsin Rapids, and Boscobel are able to satisfy demand from both public land managers and private landowners. The nurseries have always produced bareroot seedlings, but the species of trees and shrubs produced has changed dramatically over the years. The first seedlings produced were mostly conifers (red pine, Scotch pine, white pine, white spruce, and balsam fir). Only a small quantity of oak and ash were raised. Most trees were sold as 1-, 2-, or 3-year-old seedlings, but many transplants were also produced. Transplants were phased out in the late 1980s, however. In addition, the nurseries stopped growing nonnative species. The list of available species has expanded to include nearly all native trees and shrubs, including species with only a minor presence in Wisconsin.

Current Reforestation Efforts in Wisconsin

Wisconsin nurseries have experienced a decline in sales during the past 5 years. The 2010 nursery sales were just more than 7.7 million seedlings, a decrease of 900,000 from 2009, and about 4.1 million less than was sold in 2008 (WDNR 2010). The effects of reduced Federal cost-share programs for private landowners interested in tree planting, shifting land ownership priorities, forest fragmentation, competition with agricultural land values, and the downturn in the economy have affected tree planting efforts. By Wisconsin State statute, the nursery program must cover its costs with the price of stock. Accomplishing this has been a challenge, given

declining sales, increasing input costs, and infrastructure costs. Fortunately, innovative thinking and new techniques enable the same quality seedling to be sold at an economical price.

Landowner Goals

Most seedling orders are from private landowners. Overall, however, the greatest numbers of seedlings are purchased and planted by State and county land managers for their publicly owned forest land. The seedlings planted on State- and county-owned property are typically destined for the forest products industry. The private landowners have a range of reasons for planting trees. The most cited reasons are for wildlife habitat improvements, privacy screens and shelterbelts, aesthetics, and timber products. Wisconsin State statutes require a minimum order size of 1,000 trees, 500 shrubs, or 1 packet (300) of stems. This relatively large quantity of seedlings requires engaged landowners.

Reforestation Assistance

To provide more value to customers, the nursery staff expanded landowner assistance and outreach. In 2007, the nursery increased its effort to improve planting success. It is believed that a better relationship with landowners will increase their satisfaction, which translates into better served customers. Nursery staff, specifically the assistant nursery managers, contact landowners throughout the State each spring after seedling delivery and planting. The staff inquires about site preparation, planting technique, seedling status, and current and future plantation maintenance practices. Then, with landowner permission, these plantations are visited throughout the summer. The data collected include seedling health and growth, site characteristics, maintenance efforts, and insect and disease problems, etc. This information is entered into a database. The monitoring will follow a plantation through its first, third, and seventh years of growth. Nursery staff has been able to assist with herbicide use, site preparation techniques, and plantation maintenance practices. The ultimate goal is to provide foresters and landowners with the best information about successful reforestation strategies in their areas. Many landowners are impressed with the increased attention and interest in the success of their tree planting.

The Future of the Wisconsin State Nursery Program

The current economic climate has been a challenge for the Wisconsin State Nursery Program. The current emphasis on increasing biomass, carbon sequestration, and sustainability,

however, may translate into a greater need for nursery stock. Wisconsin's nursery program is proud to celebrate its centennial in 2011 and to honor the reforestation legacy. Since the beginning of the nursery program, more than 1.5 billion seedlings have been distributed throughout the State. After 100 years of growing trees, the mission remains the same, "to insure a consistent supply of high quality seedlings, of desirable forest species, at an economical price, to encourage reforestation in Wisconsin."

REFERENCES

Note: Climate and topography information contained in this article is from the Wisconsin State Climate Office available online at <http://www.aos.wisc.edu/%7Eesco/clim-history/state/stateclimate.html>.

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