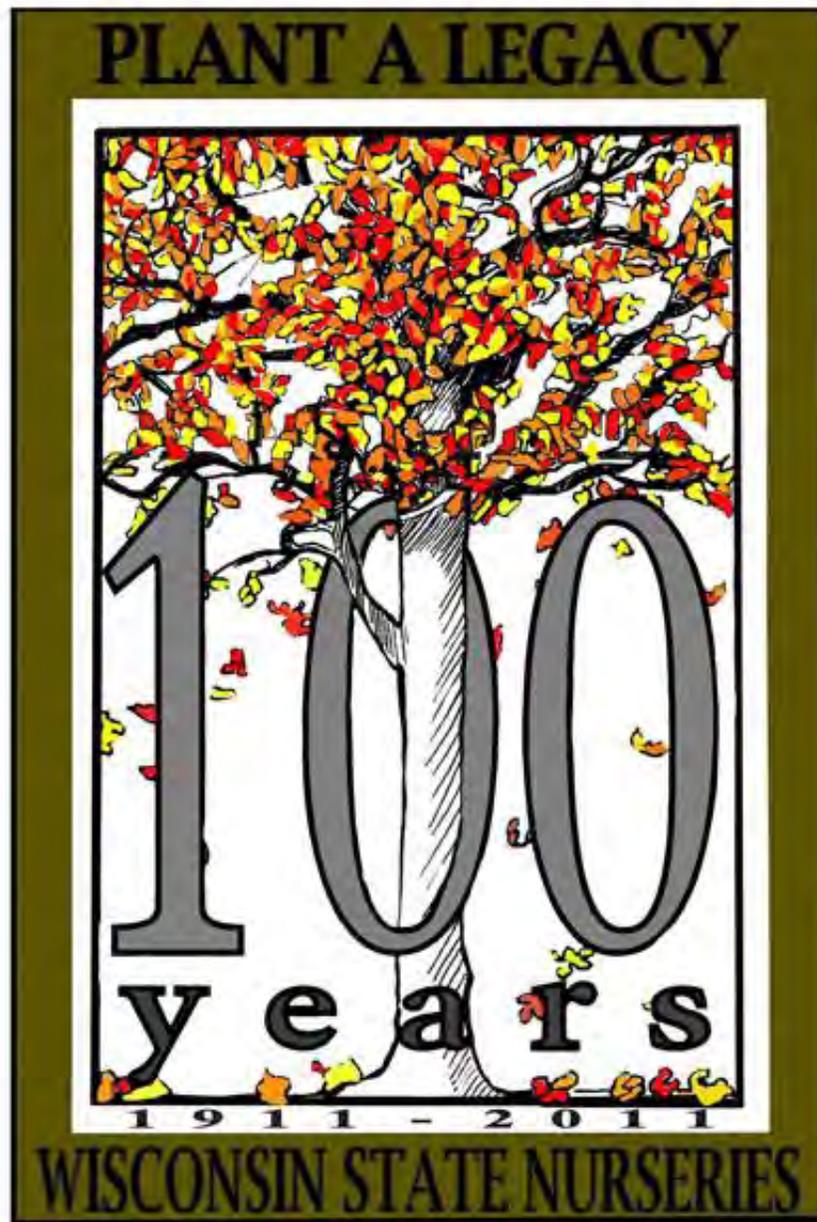


# Wisconsin's Reforestation Programs 2011 Annual Report



Wisconsin's State Nursery Program  
WDNR Forest Genetics Program  
and  
Department of Forest and Wildlife Ecology,  
University of Wisconsin – Madison



## **Tree Improvement Program**

Raymond P. Guries, Professor Emeritus  
Forest and Wildlife Ecology, University of Wisconsin – Madison  
1630 Linden Drive  
Madison, WI 53706  
Email: [rpguries@wisc.edu](mailto:rpguries@wisc.edu)  
Phone: (608) 263-6977

David Stevens, Tree Improvement Specialist  
Forest and Wildlife Ecology, University of Wisconsin – Madison  
1630 Linden Drive  
Madison, WI 53706  
Email: [dstevens@wisc.edu](mailto:dstevens@wisc.edu)  
Phone: (608) 263-6977

Kristin Peterson, Tree Improvement Program Assistant  
Wisconsin Department of Natural Resources  
3911 Fish Hatchery Road  
Fitchburg, WI 53711  
Email: [kristin.peterson@wisconsin.gov](mailto:kristin.peterson@wisconsin.gov)  
Phone: (608) 275-3254

James Warren, Section Chief - Public Lands and Conservation Services  
Wisconsin Department of Natural Resources  
101 South Webster Street  
Madison, WI 53703  
Email: [jamesk.warren@wisconsin.gov](mailto:jamesk.warren@wisconsin.gov)  
Phone: 608-264-8990

## **Nursery Program**

Gordon Christians, Nursery Superintendent  
Wisconsin Department of Natural Resources  
16133 West Nursery Road  
Hayward, WI 54843  
Email: [gordon.christians@wisconsin.gov](mailto:gordon.christians@wisconsin.gov)  
Phone: (715) 634-2717

Jim Storandt, Nursery Superintendent  
Wisconsin Department of Natural Resources  
473 Griffith Avenue  
Wisconsin Rapids, WI 54494  
Email: [james.storandt@wisconsin.gov](mailto:james.storandt@wisconsin.gov)  
Phone: (715) 424-3702

Joe Vande Hey, Nursery Superintendent  
Wisconsin Department of Natural Resources  
5350 Highway 133 East  
Boscobel, WI 53805  
Email: [joseph.vandehay@wisconsin.gov](mailto:joseph.vandehay@wisconsin.gov)  
Phone: (608) 375-4123

## **Reforestation Monitoring**

Jeremiah Auer, Assistant Nursery Manager  
Wisconsin Department of Natural Resources  
473 Griffith Avenue  
Wisconsin Rapids, WI 54494  
Email: [jeremiah.auer@wisconsin.gov](mailto:jeremiah.auer@wisconsin.gov)  
Phone: (715) 424-3700

Roger Bohringer, Assistant Nursery Manager  
Wisconsin Department of Natural Resources  
5350 Highway 133 East  
Boscobel, WI 53805  
Email: [roger.bohringer@wisconsin.gov](mailto:roger.bohringer@wisconsin.gov)  
Phone: (608) 375-4123

## **Introduction**

The Wisconsin Department of Natural Resources' (WDNR) Reforestation effort consists of three linked programs. The Tree Improvement Program, in collaboration with the University of Wisconsin – Madison, Department of Forest and Wildlife Ecology, works to ensure WDNR seedlings are well-adapted to Wisconsin growing conditions and have a high potential for survival and growth. The State Nursery Program consists of three facilities that produce and ship native forest seedlings to customers for reforestation projects. The Reforestation Monitoring Program surveys out-planted seedlings to track seedling health and establishment.

## 2011 Tree Improvement Program Highlights

The Wisconsin Tree Improvement Program, with the long-term support of the state forest nurseries, continues to develop and manage tree seed orchards using a combination of parent tree and family selection, progeny testing, and selective breeding. First-generation seed orchards currently are established for white pine, jack pine, red pine, white spruce, red oak, and black walnut. Second and 3<sup>rd</sup> generation seed orchards are established for jack pine.

Priorities completed for 2011 included planting an 80-family controlled cross 3<sup>rd</sup> generation jack pine breeding population, producing 8000 containerized sugar maple seedlings for the DNR nursery program's centennial celebration, and harvesting jack pine seed from the Greenwood 2<sup>nd</sup> generation seed orchard. The program continues to monitor seed orchards and progeny tests and collect data on variation in tolerance and resistance to various pathogens. The program also assisted WDNR Forest Heath in the collection of scion wood putatively-resistant to beech bark disease.

Seed orchards are the primary mechanism used to produce genetically-improved seed in quantities large enough to support nursery production. We continue to expand and develop our seed orchards for white pine, jack pine, red pine, white spruce, and black walnut (Table 1). Our work also continues to emphasize critical maintenance and intensive management of seed orchards to facilitate the production of greater quantities of improved seed.

This report highlights the 2011 program activities and accomplishments for our principal tree improvement species. Please feel free to contact program staff if you have any questions or comments.

**Table 1. WDNR Genetics Plantings Acreage by Species**

Species	Acreage	Counties with Major Orchards
Jack Pine	25	Jackson, Rusk, Waushara, Wood
Red Pine	45	Iowa, Oneida, Wood
White Pine	52	Jackson, Oneida, Washburn
White Spruce	34	Marathon, Oneida, Washburn
Black Walnut	14	Crawford, Grant, Green
Butternut	1	Crawford

## **Jack Pine**

Jack pine (*Pinus banksiana*) is one of the most widely distributed conifers in Wisconsin and is the third highest selling tree species produced by the DNR State Nursery Program. The species is characterized by large amounts of genetic variation for characters such as growth rate, stem form, and wood specific gravity. Opportunities for genetic improvement in these traits are exceptional as jack pine has a precocious flowering habit, produces regular cone crops, and is adapted to a wide range of sites.

### Black River Falls selection populations

Thirty years of selection and breeding continued this spring with the out-planting of a 3<sup>rd</sup> generation jack pine selection and breeding population in the Black River State Forest (Jackson County). The improvement process began in 1980 with the establishment of four jack pine 'index' populations at the University of Wisconsin's Hancock Research Station (Waushara County). Each population contained twenty families originating from Wisconsin, Minnesota, and Michigan parents and provided a research framework for genetic studies and the coordination of a testing and breeding scheme. Research data from these populations confirmed high levels of variation noted in earlier provenance and progeny tests with estimated genetic improvement for growth rate alone between 11-15% following selection of the best individuals from the best families to serve as parents.



**Black River Falls 3<sup>rd</sup> generation jack pine planting at the end of the first growing season (November 2011).**

### Ten Mile II breeding population

In 1996, a six-acre 2<sup>nd</sup> generation breeding population was created through controlled crosses among the best individuals within each family and was out-planted at the DNR Ten Mile Creek Seed Orchard Complex (Wood County). In the spring of 2008, controlled crosses among the best individuals from all 80 families in the 2<sup>nd</sup> generation population were completed. Parent trees were selected based on height growth, tolerance/resistance to pine-oak gall rust (*Cronartium quercuum*), and better stem form. In January 2010, seed from these crosses were sown at the Forest Genetics greenhouse at the DNR South Central Region headquarters and grown for six months under optimal conditions, resulting in excellent growth rates and no mortality. Following this, the seedlings were out-planted at the DNR Wilson State Nursery in Boscobel to finish their growth cycle and become acclimated to outdoor conditions. In early April of this year, the seedlings were lifted, sorted, and arranged by population. In late April, with the help of DNR Wilson State Nursery staff and DNR Forest Health Specialist Mike Hillstrom, 4800 trees were out-planted onto a five-acre site in the Black River State Forest. Over the summer, a 7½-foot poly deer fence was erected around the planting to prevent deer browse within the planting.

### Ten Mile III breeding population

Thirty-five controlled crosses were completed during spring 2011 using six female trees from different families within this 2<sup>nd</sup> generation breeding population in Wood County. The planting was established in 1999 and contains 2<sup>nd</sup> generation trees from 20 families. These families originated from controlled crosses made at two different Wisconsin breeding populations composed of trees drawn from the western Great Lakes states. The parent trees used for breeding were selected based on superior tree growth, tolerance/resistance to pine-oak gall rust, and better stem form. Seeds produced from these and previous crosses will be used to generate a genetically-enhanced 3<sup>rd</sup> generation breeding population.

### Ladysmith breeding population

This two-acre 2<sup>nd</sup> generation breeding population was established in 1996 in collaboration with Consolidated Papers at a site near Ladysmith (Rusk County). The planting consists of 22 families produced through controlled crosses among the best individuals at Consolidated Papers' Ashland seed orchard. The original selections were made using open-pollinated seed collections from native jack pine stands in Wisconsin, Minnesota, and Michigan. Unfortunately, a large number of the trees were damaged by severe storm events in 1999 and 2002. As a result, much of the material within the planting is in poor or declining condition. In addition, the property has changed ownership numerous times since its establishment. Therefore, we have decided to re-establish the population at a new site in the future. To accomplish this, open-pollinated cones were collected during the fall from selected trees within each family based on pre-storm measurements.

### Greenwood seed orchard

The 548 tree, five-acre Greenwood 2<sup>nd</sup> generation seed orchard (Waushara County) was pollarded in 2009 to facilitate cone collection. The orchard contains trees generated from 33 single-pair controlled crosses made in four different Wisconsin breeding populations composed of material from the upper Midwest. Tree Improvement staff, along with Griffith State Nursery personnel, collected eight bushels of cones during the late summer of 2011 to be used by the state nursery system for jack pine seedling production.

### **Eastern White Pine**

#### Lake Tomahawk test planting

Ten-year height measurements were started this fall in the 15-acre, (10,000 tree) eastern white pine (*Pinus strobus*) family test planting located on the Northern Highland American Legion State Forest near Lake Tomahawk (Oneida County). The planting is composed of 256 unique families from Wisconsin, Minnesota, and the upper peninsula of Michigan. Earlier results indicated significant regional and stand differences in juvenile growth rate. The current measurements will be used to substantiate genetic differences and serve as a basis for thinning the planting.



**Lake Tomahawk white pine family test planting  
(2004 image on left and 2011 image on right).**

#### Black River Falls test planting

In 2003, a southern Wisconsin sister planting to the Lake Tomahawk site was planted on the Black River State Forest near Black River Falls (Jackson County). Slightly smaller in size at ten acres, it is composed of 8000 trees from 240 unique families from Wisconsin, Minnesota, and the upper peninsula of Michigan. Ten-year height measurements will be taken at this planting in the fall of 2012.

### **Red Pine**

Three red pine (*Pinus resinosa*) 15-acre seedling seed orchards consisting of 310 families from native Wisconsin stands were established in 1970 at Avoca (Iowa County), Lake Tomahawk (Oneida County), and Ten Mile Creek (Wood County). These seed orchards were thinned between 2004 and 2006 using height data to retain the tallest families and best-formed trees for seed production.

The 'best' individuals from within the tallest 125 families at each orchard were identified during 2003-2004. Between 2004 and 2009, open-pollinated cones were harvested from these trees as they became available. Seed from these collections will be used to establish a 2<sup>nd</sup> generation seed orchard. The search for an appropriate orchard site will be undertaken during 2012.

### **White Spruce**

White spruce (*Picea glauca*) tree improvement efforts continue to focus on the intensive management of seed orchards and evaluation of progeny tests in order to supply improved seed for WDNR nursery production. During the summer, seed orchards located on the Mead Wildlife Area (Marathon County), Northern Highland American Legion State Forest near Lake Tomahawk (Oneida County), and Sawyer Creek Wildlife Area (Washburn County) were all surveyed for cone crops. No cone crops were produced by these seed orchards in 2011.

### **Black Walnut**

Black walnut (*Juglans nigra*) remains a species of great importance to landowners and the forest products industry in southern Wisconsin. To date, our efforts have focused on identifying superior quality trees in natural stands and collecting and grafting scion wood from those trees into clonal seed banks. During the spring of 2011, nine additional grafts generated from six superior trees originating in Wisconsin were out-planted at the seven-acre Bell Center (Crawford County) clonal seed orchard. During the course of the summer, the orchard was maintained by mowing and herbicide application around each tree to further reduce competition. The poly deer fence erected around the orchard continues to protect the planting from deer damage.



**Beech scion wood collection in Door County, WI.**

### **Beech**

Beech bark disease is the result of an interaction between a beech scale insect (*Cryptococcus fagisuga*) and a fungus (*Nectria coccinea*). The disease results when American beech (*Fagus grandifolia*) becomes infested with the scale which feeds on sap in the tree's inner bark. The tiny feeding holes created allow the Nectria fungus to enter and kill the vascular tissue, eventually leading to tree mortality. The beech scale insect was an accidental introduction into Nova Scotia, Canada in the late 1800's on ornamental beech trees imported from Europe. By the early 1930's, the disease complex that developed with Nectria was first noticed in eastern Canada and Maine. It has now been detected as far south as North Carolina and in 2009, was discovered in Door County, Wisconsin. It has since spread to an additional seven eastern Wisconsin counties. Studies in the northeastern United States have found that about 1% of American beech trees are resistant to beech scale disease. While not completely understood, it appears that bark chemical composition and structure make these trees incompatible hosts for the scale insects. During the spring of 2011, tree improvement staff worked with WDNR forest pathologist, Kyoko Scanlon, and Door County DNR forester, Bill Ruff, to identify and collect scion wood from two putatively-resistant trees. Scion wood was sent to the USDA Forest Service Northern Research Station in Delaware, Ohio where it will be grafted and tested for resistance to the disease.



**Sugar maple seedlings growing in the WDNR's greenhouse in Fitchburg, WI.**

### **Sugar Maple**

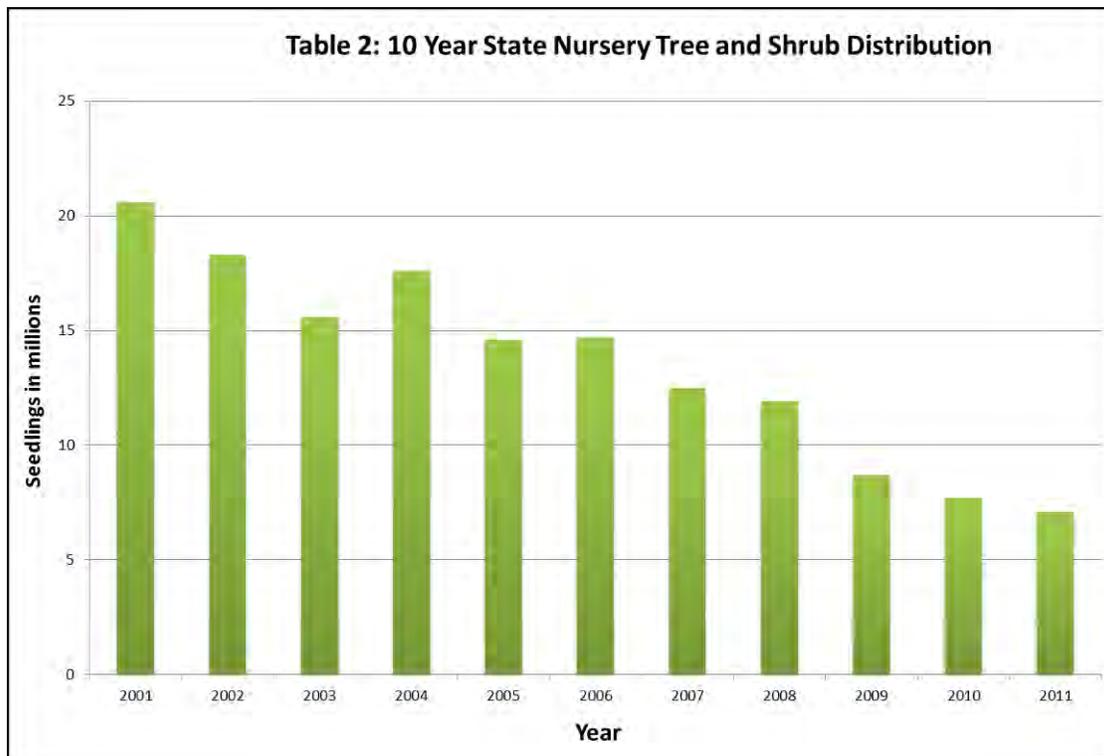
To help commemorate the WDNR State Nursery Program's centennial, the tree improvement program produced 8000 containerized sugar maple seedlings during 2011 for distribution at nursery events throughout the summer. Sugar maple (*Acer saccharum*), Wisconsin's state tree, has the lowest optimal germination temperature (34F) of any forest species. To accommodate this, as well as to accelerate seedling development, seedlings were grown at the Forest Genetics greenhouse facility at the WDNR South Central Region headquarters. Temperature and lighting were maintained at optimal settings for both germination and subsequent seedling growth. Seedlings were distributed at events throughout the state including Wisconsin Farm Technology Days in Marathon County, Devils Lake State Park in Sauk County, Wisconsin State Fair in Milwaukee County, and the Paul Bunyan Logging Camp Museum in Eau Claire County.

## 2011 Nursery Program Highlights

The Wisconsin State Nursery Program distributed 6,873,799 bare-root seedlings and shrubs in its 100th year of operation (1,594,452,349 total since its inception in 1911). To celebrate the centennial year, the nursery system held numerous events throughout the state including open houses and seedling giveaways at a variety of venues. In a continuing effort to increase efficiency while reducing costs in the face of increasing supply costs, the nursery system partnered with the state corrections system to provide a portion of its seedling grading and packing labor. The centennial year also saw the announcement that the Hayward nursery will stop production following the 2013 lifting season.

### Distribution

The ten-year trend (Table 2) for nursery distribution shows a continuing decline in trees and shrubs sent to customers. Factors affecting this include declines in cost sharing programs and changes in forestland ownership throughout the state. Conifer species continue to make up the largest majority of tree species distributed with 5,150,798 sold in 2011 compared to 1,523,613 hardwoods. Conifers were purchased primarily by northern county forests and landholders. While the nursery system is dependent mainly on private landowners for tree seedling requests, county forests are still the single largest customer. As a result of this declining demand, the difficult decision has been made by the WDNR Division of Forestry to stop production at the Hayward Nursery in 2013. This decision is seen as a way to reduce production costs within the system while still allowing for an adequate supply of high quality, genetically-adapted tree and shrub seedlings for the entire state.



## **Stock Quality**

Overall stock quality remains high. All three nurseries continued to monitor the fungus, *Diplodia pinea*, in red pine nursery stock to determine the impacts of previously implemented cultural practices and the elimination of inoculation sources. Beginning in 2006, WDNR Forest Health staff have tested asymptomatic seedling samples from each of the nurseries. In 2011, 588 asymptomatic, healthy 2-0 and 3-0 red pine seedlings were cultured. For the fourth straight year, infection rates were below the 10% tolerance level that has been set for management purposes.

A jack pine gall rust study begun in 2008 continued in 2011. Over time, nursery managers have observed occasional stem and branch galls on jack pine stock during spring lifting. To prevent the out-planting of this stock, symptomatic seedlings are culled from graded stock. An informational sheet is sent out with bulk orders as well to inform landowners on how to identify infected seedlings and to remove them before planting. To understand the distribution and occurrence of the observed galls, a study was initiated with the help of WDNR Forest Health staff. In 2011, fifteen hundred jack pine seedlings from each age class at each nursery were randomly selected during the lifting season. Each seedling was thoroughly inspected for galls and swelling. The number and location of galls were recorded (Table 3).

**Table 3. Incidence of visible galls on jack pine seedlings at the time of lifting.**

<b>Nursery</b>	<b>Seedling age</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>
<b>Hayward</b>	2-0	0.7%	-	3.4%	0.7%
<b>Hayward</b>	1-0	-	0.0%	0.0%	0.1%
<b>Griffith</b>	2-0	7.3%	-	32.6%	18.5%
<b>Griffith</b>	1-0	-	4.2%	2.4%	-
<b>Wilson</b>	1-0	-	0.0%	0.5%	0.4%

The wide fluctuation in infection rates over the four-year period appears to be related to local weather conditions during aeciospore dissemination of the disease, specifically humidity, temperature, and wind. A full description of both studies can be found in the WDNR 2011 Wisconsin Forest Health Protection annual report.

[\(Forest Health Annual Report2011.pdf\)](#)

## **Seed Collection**

Seed collection was successful overall in 2011. Seed purchasing for statewide inventory went well and allowed seeding goals to be met for all species, including perennially difficult to obtain species such as basswood and swamp white oak. Only two species, black cherry and plum, fell short, but were made up for by stored seed from previous seasons. Jack pine continues to be in high demand for direct seeding projects. While 1073 bushels were purchased in 2011, demand is still out-pacing supply. Special emphasis will be placed on jack pine seed procurement in 2012.



### **Centennial Celebration**

The year 2011 marked the 100-year anniversary of the Wisconsin State Nursery Program. In 1911, the first state nursery was established on the shores of Trout Lake in Vilas County. Throughout the year there were events held that highlighted this special milestone. Below is a list of the accomplishments that helped celebrate the nurseries centennial year.

- Development of a nursery centennial logo that was used throughout the year.
- Creation and distribution of nursery centennial posters for DNR foresters, 4<sup>th</sup> grade teachers, natural resource educators, and other venues throughout the state.
- Publication of articles detailing the nursery system's history appeared in The Wisconsin Natural Resources magazine, Tree Planters Notes, The Great Lakes Timber Producers magazine, and several Wisconsin newspapers.
- Design of centennial banners displayed at each of the three nurseries.
- A three-panel display was created depicting the program during the past 100 years and was displayed at events throughout the year.
- A special centennial message was printed on the side of the seedling boxes and was also included with trees distributed through the statewide 4<sup>th</sup> grade Arbor Day program.
- Containerized sugar maple seedlings, the Wisconsin state tree, were handed out at events throughout the year and bare-root trees were provided for the 4<sup>th</sup> grade Arbor Day program.
- A drawing was held for grade schools with the winning schools receiving a six-foot sugar maple for planting on their school property on Arbor Day.
- A special recognition day was coordinated with the Milwaukee Brewers during a home game on June 22<sup>nd</sup>. Nursery personnel were introduced on the field prior to the game while the nursery program highlights were read to the crowd. In the seventh inning, 7500 white spruce seedlings were handed out to fans as they exited the stadium.

- Various items were printed up for distribution throughout the year including magnets, pencils, and bookmarks.
- A radio interview was conducted with the Griffith Nursery manager in Wisconsin Rapids to discuss the nursery program.
- A segment of the TV show, Northland Adventure, was filmed at the Griffith Nursery focusing on the program and the 100 year anniversary.
- The forestry display at the Wisconsin State Fair highlighted the nursery centennial celebration.
- Nursery staff set up and worked educational booths at Farm Technology Days, Woodland Owner conferences, and the Eau Claire Deer Exposition.
- Open houses were held at each of the three nurseries to celebrate the centennial and were attended by nearly 300 people. Special “Centennial” trees were planted at the nurseries to commemorate the anniversary.
- A new idea called “Gift of Green” was developed to promote tree planting in the state.
- A wooden nursery centennial ornament was created from sugar maple and hung on the state capitol Christmas tree.

Overall, the centennial celebration was a tremendous success and helped bring increased recognition to the program. Members of the centennial planning committee were: Jim Storandt, Joe Vande Hey, Gordon Christians, Jeremiah Auer, Ellen Gundrum, Pat Murphy, Kristin Peterson and Randy Mell.

### **Griffith Nursery**

The Griffith Nursery began lifting and grading operations on April 9, 2011 and concluded on May 3, 2011. The spring lifting conditions were favorable with cool temperatures and adequate soil moisture. Frost lingered in 3-0 conifer beds until mid-April, however, and eight inches of snow fell on April 19<sup>th</sup> resulting in lost time in the field. The nursery lifted 2.5 million trees and shrubs this year with approximately 1.3 million trees being shipped graded and 1.2 million shipped bulk. The spring labor force was an outstanding group and provided an efficient, hardworking crew. Stock was shipped in excellent condition and surveys conducted on spring plantings show over 90% survival in the Griffith distribution area.

Spring germination rates in fall-seeded conifers and hardwoods were very good for most species. Black cherry, white oak, and hazelnut, on the other hand, had less than desired germination densities. The stock overall showed excellent growth throughout the season and entered winter in ideal condition. Stock inventory numbers are strong and the quantity of stock available to customers should be able to meet demand for the next three years.



**Conifer beds at Griffith Nursery.**

Fall seeding was completed by late October with goals for all species being met. This was the first time in many years that seeding goals were met for all species. A total of 5,034 nursery beds (4ft x 12ft) were seeded in order to reach a production goal of 4.5 million seedlings. The use of winter rye to protect newly seeded beds was expanded this fall as a means of reducing costs associated with applying commercial hydro-mulch. The rye seed is incorporated into the seed bed during the final bed preparation. The rye germinates in the fall and provides protection from wind and water erosion until the trees germinate in the spring. The rye plants also have shown to reduce weed populations in the seedling beds. Shredded rye straw was also applied to various species of 1-0 stock in order to reduce early spring frost heaving. The straw is produced on the nursery property after the rye seed is harvested. The straw has replaced the use of saw dust which had become expensive and difficult to find.



**Fall sown winter rye in late spring growing in Griffith Nursery beds**

After more than 30 years of service with the Griffith Nursery, Loren Larson retired at the close of the 2011 season. While Loren held the position of facility repair worker at the nursery, he worked across many facets of nursery management during his tenure and had an excellent understanding of nursery infrastructure. The skills and dedication he brought to the job will be missed.

### **Wilson Nursery**

The Wilson Nursery began lifting seedlings on March 28, 2011 with grading and packing starting a few days later. The last of the seedlings were graded and packed April 22, 2011. Approximately two million seedlings were harvested with about 1.5 million being graded and the remainder being shipped bulk or inter-nursery. Spring conditions were relatively dry and mild, making for good working conditions for the crew. Stock appeared to be in great condition, due in part to another winter of above normal snowfall and limited frost in the ground. This spring the nursery partnered with the Department of Corrections – Secure Program Facility to help with the grading and packing of seedlings. Each day, stock was transported to and from the Boscobel Secure Program Facility, located about a mile south of the nursery, where the inmates graded and packaged roughly 235,000 seedlings. They also assisted with the individual packaging of 7,500 white spruce seedlings for distribution at a Milwaukee Brewer’s baseball game as part of their “Green Week” celebration and the State Nursery Program’s centennial celebration.



**Wilson Nursery staff lifting conifers for shipment.**

The growing season started off slow due to below normal temperatures, causing seed to germinate one to two weeks later than average. While most species had good germination, spruce, black cherry, birch, and dogwood struggled. By the end of May, temperatures and growing degree days had increased significantly and other than some scattered cool periods, temperatures were above normal for much of the summer. Though there was a significant dry spell in mid-summer, it was overcome with the use of irrigation. Most species put on good growth in response to the above average summer degree days.

Disease occurrence was very limited over the course of the season, due in part to favorable weather conditions which allowed for timely and effective fungicide applications. The dry spell that occurred this summer allowed for very effective sub-soiling to take place as beds were prepared for fall sowing. A total of 5900 beds or 9.5 acres were prepped, sub-soiled, and fumigated for fall planting. One hundred fifty cubic yards of sedge peat were added to select beds to increase their organic matter.

Favorable weather conditions also resulted in smooth fall seeding. Winter rye was applied to all hardwood and shrub beds with the exception of ninebark and the birches which were covered with screen. The rye germinated well and has provided very effective wind erosion control on windy, snow-free days this winter.

### **Trials**

Wilson Nursery continues to look for ways to improve stock quality while reducing costs and staff workload. Operational trials continued examining to improve fertilizer efficiency as well as the use of winter wheat and rye as an alternative to hydro-mulch. In the fall of 2010, most hardwood and shrub beds were seeded with winter rye and two rows of jack pine were seeded with winter wheat. This spring, herbicides were applied to the winter rye and wheat in these beds prior to seedling germination. The hardwood and shrub beds had very effective wind erosion control and the herbicides also did a great job controlling fall germinating weeds that came in after fumigation. These beds remained almost weed-free for five weeks after germination when pre-emergent herbicides could be applied to maintain weed control. As a result, only limited hand weeding was needed for the remainder of the season. The jack pine seed beds also did very well and the wheat stubble appears to have protected the small seedlings without negatively affecting growth rates.

In another effort to reduce cost and labor connected to the use of shade cloth, winter wheat was also seeded with white spruce in place of shade cloth. In the spring, the winter wheat was allowed to continue growth and was killed just prior to setting seed heads. The stubble was then left in place to provide shade. Germination inventories showed no difference in germination rate and early survival compared to beds with shade cloth. Sales inventory in summer of 2012 will be reviewed to make a final determination as to its effectiveness.

## **Hayward Nursery**

The Hayward Nursery began lifting, grading and packing seedlings on April 11, 2011. With the help of favorable weather conditions, most stock was able to be lifted in about a week. Stock appeared to be in great condition, helped by a winter of good snow cover and only moderate frost in the ground. The last of the seedlings were graded and packed by late April. Approximately 2.4 million seedlings were harvested with roughly 1.3 million being graded and the remainder shipped bulk or inter-nursery. Graded orders accounted for over 50% of the stock orders, a significant increase from past years when most customers ordered bulk. The increased demand came primarily from state and county forests who have found it more effective to receive graded stock.

### **Stock Production**

As Hayward Nursery moved into the 2011 growing season, it did so with significantly fewer beds in production. Seeding in the fall of 2010 was reduced as the State Nursery Program prepared for the end of production at the nursery. Thus, only about a million red pine, jack pine, and tamarack combined were seeded. Due to a cool spring, germination was about one week later than normal. Germination inventories taken later in the season, however, found that seeding targets were met for all species. Stock growth was very good due to above normal rainfall and temperature during the growing season. Stock available for distribution in 2012 is in great shape.

Growing cover crops to harvest the seed and straw has been one of the ways the staff at the nursery made use of the increased available nursery beds. This year, the nursery harvested several thousand pounds of winter wheat, winter rye, and oats and baled several hundred bales of straw. These crops are being made available to all programs throughout the WDNR and have been used on projects such as stream bank stabilization, erosion control on forest trails, prairie grass establishment, and dike stabilization. The sharing of this material resulted in significant cost savings to participating WDNR programs.

### **Seed Processing**

As the restructuring of the State Nursery Program moves forward, it continues to look for new ways to utilize the resources available at the Hayward Nursery. Hayward will continue to be the center for seed collection, cleaning, and storage, especially for conifer seed. In the fall of 2011 and continuing into 2012, Hayward cleaned approximately 1,000 bushels of jack pine seed. With the increased demand for jack pine seed for direct seeding, seed processing will continue to be an important activity at Hayward.



**Hayward Nursery in the fall of 2003.**

### **Hayward's Future**

The Hayward Nursery was built in 1935 by the U.S. Forest Service and purchased by the State of Wisconsin in 1981. Tens of millions of tree and shrub seedlings were produced at the facility over those years. As a result, thousands of acres of regenerated forest in northern Wisconsin stand as a tribute to the facility and the employees who worked there. Although seedling production will be ending in 2013, the nursery will continue to play a key role in the State Nursery Program. In addition to its seed collection, cleaning, and storage role, the facility will continue to function as a seedling distribution center and a resource for tree planting in northern Wisconsin. The facility and nursery beds will also be made available for tree improvement research plantings, seed orchards, and reforestation and herbicide trials. Along with this, the WDNR Division of Forestry will continue to evaluate other opportunities to further utilize the facility in the future.

# **Reforestation Monitoring**

## **Introduction**

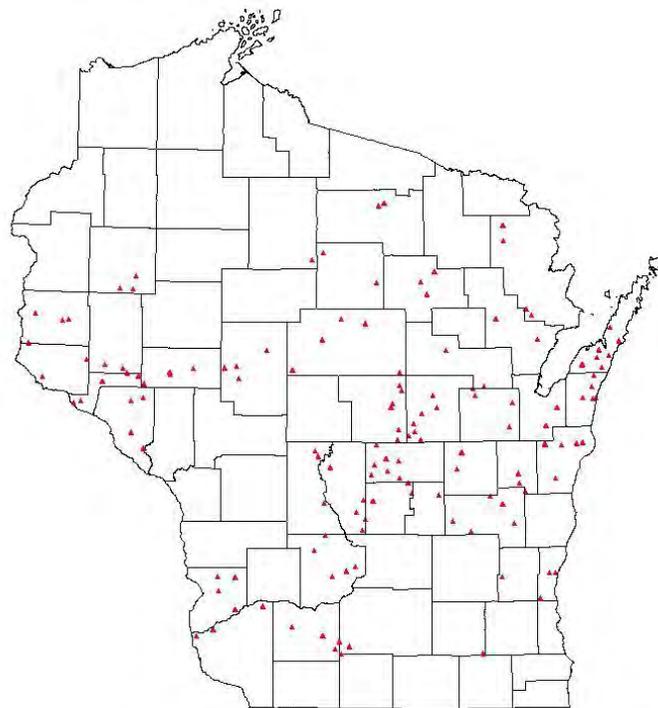
In the summer of 2011, the state nursery assistant managers visited 126 first-year sites and 20 third-year sites to ascertain the status of new tree and shrub plantings in Wisconsin. These sites were scattered around all regions of the state on public and private properties. The departure of the Hayward Nursery assistant manager, Dave Harbec, in January, made collecting data in northern Wisconsin more difficult. However, the remaining assistant managers were able to divide up the northern counties and at least visit a number of counties in the Hayward distribution area. The state will be divided up between the two assistant managers and an LTE in 2012.

## **Weather Conditions**

Planting and growing conditions varied slightly statewide, but were very good overall. Most areas experienced cool and moist conditions in April and early May. This provided a great environment for seedling planting and establishment. Eventually, some areas experienced dry conditions that affected seedling survival, but these areas were isolated. A number of strong storms also blew through Wisconsin and only a few seedlings were impacted. In general, the mid-summer hot weather coupled with ample rainfall provided good growing conditions and resulted in high survival rates.

## **Landowners**

As in the past, landowners were excited to discuss and exhibit their tree plantations. No landowner denied access to their plantations and many asked to accompany the assistant managers during the visit. These requests were accommodated whenever possible, even though it was challenging to coordinate due to increased plot survey time. Nevertheless, what was lost in efficiency was made up for in public relations.



2011 Wisconsin Reforestation Survey Sites by County

## **Plot Data**

### **Wilson Nursery – Roger Bohringer**

The Wilson assistant manager surveyed 32 sites in 11 counties within the Wilson distribution area (Buffalo-4, Crawford-4, Dane-2, Grant-3, Iowa-4, Jefferson-1, Ozaukee-3, Pepin-3, Pierce-2, Sauk-5, and Washington-1) and 14 sites in the southwest portion of the Hayward distribution area (Barron-3, Dunn-3, Eau Claire-4, and St. Croix-4).

Total trees surveyed were 2798. Of these, 388 were considered dead/dying yielding an overall survival rate of 86.14%. On some of the plantings with high mortality, the mortality appeared to be herbicide related due to either over-application or improper timing. Stock care was likely a factor as well. The worst damage was on sites where the landowner/planter held the trees for several days prior to planting, so the stock went into the ground already stressed. Birch and white pine seemed to be hit the hardest. One large, very open site was on light sand and had significant losses due to wind erosion. Another site had heavy losses due to poor stock/site selection (spruce on saturated reed canary/cattail muck soil). This stock was also held for three weeks waiting for the site to dry enough to machine plant.

Deer browse was down from past years. Total browse in the counties surveyed was 5.46%. By class, 8.2% of hardwoods, .09% of conifers (one tree), and 23% of shrubs were browsed. Of the species with an adequate sample size, the hardest hit species was plum (16 of 36 browsed for a 44.4% rate). Next highest was swamp white oak (18%) followed by sugar maple (14%). White and bur oak were both at 11%, red oak was 10%, cherry 8%, and walnut 1% browsed. Note that the swamp white oak browse rate may be artificially high due to increased planting in upland areas with a history of severe deer browse and failed plantings of red and white oak in the past.



**Heavy deer browse on a jack pine seedling.**

Poor planting continues to be a problem: 10% are planted too shallow; 10% are planted crooked; and 5% were recorded as too deep. The most common stress symptoms were insect damage at 3.6% (lots of caterpillars, Japanese beetles, and rose chafers). Top dieback (4%) and scorch (2%) were also frequently recorded, usually indicating root problems on the hardwoods due to over pruning, poor slit closure, or herbicide damage. The same problem on conifers typically is recorded as 'chlorotic', comprising 2% of all seedlings surveyed.

Good rains throughout the area resulted in no significant problems due to water stress. Two plantings suffered from too much water and some sites were planted while too wet.

#### **Griffith Nursery – Jeremiah Auer**

The Griffith assistant manager visited 80 first-year sites and 10 third-year sites, visiting 21 of 23 counties within the Griffith distribution area (Adams-5, Brown-1, Calumet-3, Clark-4, Door-5, Fond du Lac-5, Green Lake-1, Juneau-3, Kewaunee-4, Langlade-3, Lincoln-2, Manitowoc-4, Marathon-5, Marquette-3, Oconto-2, Outagamie-3, Portage-6, Shawano-2, Waupaca-5, Waushara-6, and Winnebago-2) and three counties in the Hayward distribution area (Marinette-4, Oneida-2, and Price-1). This constituted 4440 seedlings including 42 seedlings from private nurseries. The favorable spring weather translated into very successful seedling establishment. Over 81% of the seedlings were rated "live" and 7% were damaged, but considered able to survive and eventually thrive. The seedlings considered dead or not able to survive for another season represented 11% of seedlings planted. The potential for problems was very real as heavy rains in the eastern half of the distribution area coupled with its heavier soils made planting extremely difficult until late May and early June. However, the cooler temperatures in late spring

protected the seedlings from too much planting shock. Surprisingly, only one site was considered a failure due mainly to a herbicide application problem. A few other sites had some relatively high mortality, still less than 30%, where herbicide damage was also suspected.

In the past, heavy weed competition has been an issue with seedling establishment and survival. This year, seedlings with little or no competition comprised over 62% of the total. Moderate competition was about 25% and seedlings dealing with heavy competition were around 13%. While some of the lower levels of competition can be attributed to lighter soils, most landowners are starting to realize the benefits of weed control via mowing and herbicide application.



**Oak planting with winter rye cover crop  
on landowner property in Manitowoc County.**

The presence of deer continues to influence landowner decisions about which species to plant. The vast majority of seedlings planted in the Griffith distribution area are conifers (78%) and as expected, very few are impacted by deer browse during the summer months. However, over 12% of hardwoods showed signs of browse with most concentrated on oaks (about 67% of all seedlings browsed were bur, red, or white oak). The next most browsed species were the maples. Nonetheless, deer browse overall was not a major problem.

While most seedlings were planted well, some issues noted included planting too deep (8%) and planting at an angle over 30 degrees (5%). Only minor problems with planting too shallow, multiple seedlings planted in the same hole, or open furrows were recorded. Problems associated with stresses, insects or disease were few and far between. The only stress symptom that was occasionally present was needle or leaf browning. A few isolated problems with white spruce top dieback and chlorosis on white pine occurred, but not enough to warrant concern. A minor problem with the recording equipment translated into some lost data for one whole site and plots on another site. A renewed emphasis on the database and data collection should limit this as a future problem.

**Overall Interpretation of 2011 Reforestation and 2012 Outlook**

The decrease in demand for nursery stock continued into 2011. While the decrease was not as sharp as years past, lagging sales continue. A number of landowners had concerns about the size of some white spruce grown at the Griffith Nursery. Most of these seedlings were doing very well, but a number of landowners will receive some replacement white spruce in 2012.

