

Wisconsin's Reforestation Programs 2008 Annual Report



Wisconsin's State Nursery Program

WDNR Forest Genetics Program

and

UW Madison, Forest Ecology and Wildlife Management



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Introduction

The Wisconsin Department of Natural Resources' (WDNR) Reforestation program consists of three linked organizations. First, the Tree Improvement program by ensures that 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 forest seedlings to customers throughout the state. Finally The nursery program also surveys a sample of outplanted seedlings through the reforestation and invasive species monitoring program to track seedling health and establishment.

Tree Improvement

The Wisconsin tree improvement program, through the long-term support of the state nurseries, continues to develop and manage 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-generation seed orchards are established for jack pine.

Nurseries

Seedling distribution was successful in 2008 despite a late spring and wet weather. The forest nursery program produced and distributed 11.8 million tree seedlings in 2008, reforesting approximately 14,000 acres of public and private lands in Wiscon-

sin. Innovative ideas around chemical applications, and shipping kept operations going in the face of rising fuel and input material costs.

Reforestation and Invasive Species Monitoring

The reforestation program started its 3rd year with a field test of a new database system for recording and downloading plots. Assistant managers from each nursery divided up the survey task in the absence of a short term field forester. 129 sites were surveyed statewide with a mean survival of 80 percent with planting depth being the most common problem.



2008 Tree Improvement Program

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, red oak, and black walnut (Table 1). Our work continues to emphasize critical maintenance and intensive management of seed orchards to facilitate the production of greater quantities of improved seed.

Jack Pine

The third generation seed orchard site on the Black River Falls State Forest (Jackson Co.) was prepared and laid out to plant. Unfortunately winter damage to the planting stock will delay completion until spring 2010. Breeding work to supplement damaged stock was undertaken in the spring of 2008, with over 600 cones generated through controlled pollinations. 758 open pollinated cones were also harvested from the 80 female selections within the planting to further supplement future seed needs. Seeds from these collections will be extracted in early 2009.

The Ladysmith (Rusk County) 2nd generation breeding population is moving forward a generation in order to conserve families that were damaged in a previous wind event. The 18 cones generated from the forty-two 2007 controlled crosses were harvested in the fall. 2008 breeding efforts, however, were postponed due to Plum Creek's sale of the property in the winter of 2007-2008. Arrangements have now been

made with the new land owner, The Forestland Group, to continue breeding efforts in 2009.

Eastern White Pine

This spring the 10,000 tree white pine genetics planting located on the Northern Highland-American Legion State Forest by Lake Tomahawk, WI (Oneida Co.) and composed of 256 unique families from WI, MN and the upper peninsula of MI, was surveyed for white pine blister rust. The survey was conducted by tree improvement staff along with WDNR forest health specialist Brian Schwingle and U.W.-Madison plant pathologist Glenn Stanoz. Unfortunately, due to the low level of inoculum in the area, damage was not robust enough to indicate genetic differences between families. The southern, sister planting located on the Black River State Forest by Black River Falls, WI (Jackson Co.) will be surveyed in the spring of 2009. This planting is expected to yield more substantial data due to higher levels of inoculum in the area generated by a large population of *ribes sp.*, blister rust's alternate host. Additionally, the 2007 data collected at the Black River Falls planting for survival, fifth-year heights and tip weevil damage was analyzed during early 2008. While still young, height differences between families are statistically significant. Tip weevil damage was severe during 2007, providing a good test wide screen. While family differences were statistically different, there was little to no correlation to damage seen on the same families growing at the Lake Tomahawk site. Both plantings were maintained by mowing through the growing season and bud caps were attached to trees to discourage deer browsing.

Table 1. WDNR seed orchard acreage by species.

Species	Acreage	Counties with Major Orchards
Jack Pine	20	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, Green
Red Oak	13	Crawford, Dane



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The 22-year old Knapp's Creek (Richland Co.) southern Appalachian white pine re- search planting was marked for thinning during the summer. The planting consists of 58 genetically different eastern white pine seed sources collected by the USDA-Forest Service in the Appalachian mountains of Tennessee, Georgia and North Carolina. The thinning scheme was devised with input from DNR Riverway Forester Brad Hutnick to meet the Lower Wisconsin State Riverway Board's standards. Thinning will take place in late 2008 or early 2009 and will allow the planting to remain a viable genetic resource for possible future use.

Red Pine

Three 15-acre seedling seed orchards consisting of 310 families from native Wisconsin stands were established in 1970 at Avoca (Iowa Co.), Lake Tomahawk (Oneida Co.), and Ten Mile Creek (Wood Co.). These seed orchards were thinned between 20004 and 2006 using height data to retain the tallest families and best-formed trees for seed production. During the summer, all three orchards were surveyed and re-mapped to confirm tree identities and retention.

The 'best' individuals from within the tallest 125 families at each orchard were identified during 2003-04 using diameter measurements (in lieu of height – the trees are now 60+ feet tall) and stem form ratings. Beginning in 2004, open pollinated cones have been harvested from these trees as they become available. In the fall of 2008, an additional 169 cones were collected from selected trees. There are now enough seed from all but 4 selections to be used to establish a second generation seed orchard.

White Spruce

White spruce 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. Planted in 1989, the 10-acre Sawyer Creek (Washburn Co.)

progeny test contains selected materials from 168 different families throughout the Lake States region and the Ottawa Valley of Ontario, Canada. Based on seventeen-year height and diameter measurements, families were ranked by mean volume and a weighted thinning scheme was created in order to facilitate crown development and access for cone collection. Based on this, when ever possible, the best 18 trees were retained from families in the top third, the best 10 were retained from families in the middle third and the best four were retained from families in the bottom third. The planting was marked for thinning over the summer. Due to the pre-commercial size of the trees and the tight spacing within the planting, it was necessary to thin the planting by hand, using compact tractors to skid the trees. During December, Dave Harbec from the Hayward Nursery and David Stevens from the Tree Improvement program were able to fell approximately half of the 1730 trees to be removed from the planting. The



*Early cones on White Pine at the Lake Tomahawk Seed Orchard
Photo : Glen Stanoz*

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remaining trees will be cut and removed during 2009.

Black Walnut

Black Walnut 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 grafting scion from those trees into clonal seed orchards. During 2008, eighty-two potted grafts generated from 19 superior quality trees originating in Wisconsin and northern Illinois were out planted at the Bell Center (Crawford County) clonal seed orchard. During the course of the summer the orchard was maintained by mowing and herbicide was applied around each tree to further reduce competition. The poly deer fence erected around the orchard was broken in a number of spots, apparently from wild turkeys running into it while flying in and out of the enclosure. Fortunately the fence remained intact enough to prevent deer entry into the planting prior to being fixed.

Red Oak

Red oak saw no additional work in 2008. Outplanted grafts are being monitored for die off and incompatibility issues.

Staff Changes

Avery Dorland has come to the DNR in the role of Forest Geneticist and Nursery Coordinator in 2008. The position also has moved from Lacrosse to Madison. Avery's

background in tree improvement comes from contracting and consulting with the superior woods tree improvement cooperative in Northern Ontario. Previous Geneticist, Greg Edge has taken on the position of Area Forestry Leader in Lacrosse Wisconsin.

Strategic plan

2008 saw the expiry of the 1998-2008 tree improvement strategic plan. The next 10 year plan will be completed in 2009 and will re-evaluate species focus in light of changing forest landownership and forest demands. The intent of the program is to focus on seed supply to the nurseries, species conservation and adaptability testing.

Greenhouse

After many years of planning, the joint WDNR Forest Health Lab / Tree Improvement greenhouse facility broke ground during 2008 at the South Central region headquarters in Fitchburg. The facility, once completed in early 2009, will improve the programs ability to propagate future research plantings and greatly enhance our ability to produce grafted/clonal seed orchards.

Larch

In 1999 a two and a half acre progeny test consisting of European larch, European x Japanese and Japanese x European larch hybrids was established in Iowa Co. by Spring Green in conjunction with the University of Minnesota's Aspen Larch Cooperative. The cooperative also established



Walnut Processing at the Wilson Nursery
Photo : DNR

identical trials by Newberry, Michigan and Harland, Maine. The goal of the trial is to identify individuals who produce superior progeny in straight European larch crosses and in hybrid crosses involving European larch. During the fall, Tree Improvement staff took 10 year height and diameter measurements that will be analyzed by researchers at the University of Minnesota and used to determine trees to be rogued from the parent seed orchards.

2008 Nursery Program Highlights

The Wisconsin state nursery program distributed 11,800,000 seedlings and shrubs in its ninety-seventh year of operation (1,571,205,315 total since 1911). Table 2 shows how 2008 distribution relates to the trends of the last decade. The 2008 season saw multistate cooperation and efficient ideas from the nursery team. In February 2008 State Nursery managers from Minnesota, Iowa, Michigan, Indiana, Illinois and Wisconsin met in Fitchburg Wisconsin to share information and ideas around the common challenges of small labor pools,

increasing supply costs and pesticides regulations. These discussions combined with a tightening of supply inventories enabled another successful season despite large increases in materials and fuel costs.

Distribution

The ten year trend for nursery distribution shows a continued decline in trees and shrubs sent to customers. This trend can be correlated with declines in cost sharing programs in the state.

Conifer species make up the large majority of tree species distributed. This is consistent with the large orders received from northern county forests and landholders in Northern Wisconsin. These proportions are displayed in Table 3.

The nursery system is dependent mainly on private landowners and entities for tree seedling requests. In terms of single customers, county forests are the single largest customer by far. The chart below shows distribution by land ownership

The state nursery program produces further detailed information on its annual distribution. For example, Table 4 shows the pro-

Table 2: 10 Year State Nursery Tree and Shrub Distribution

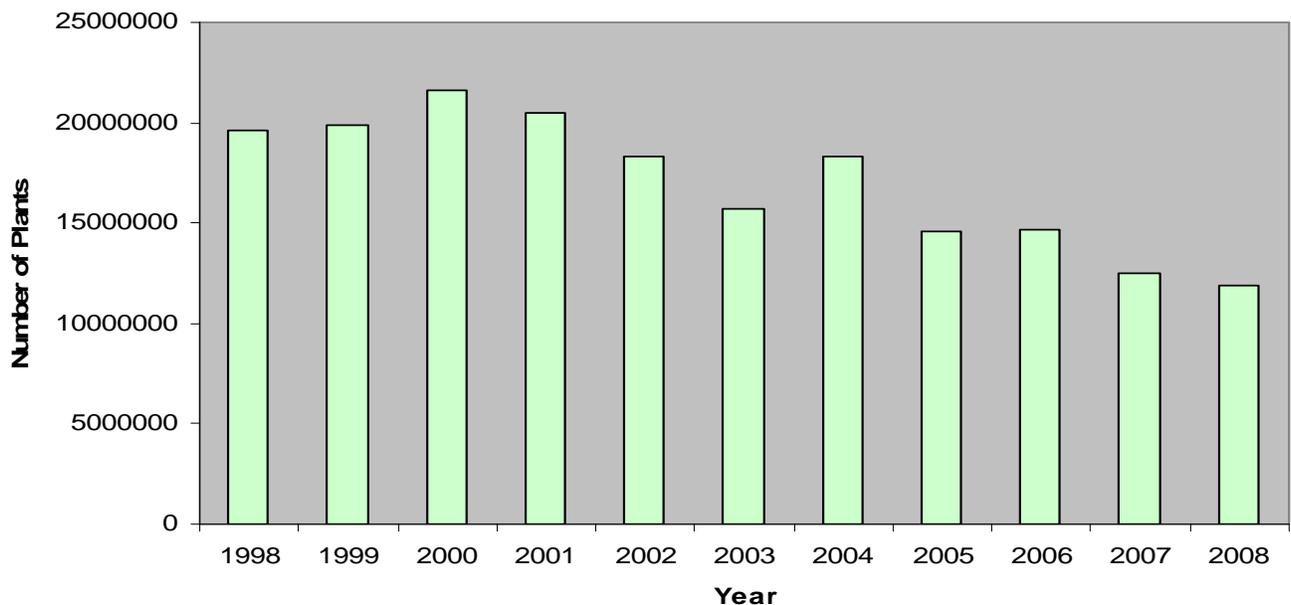
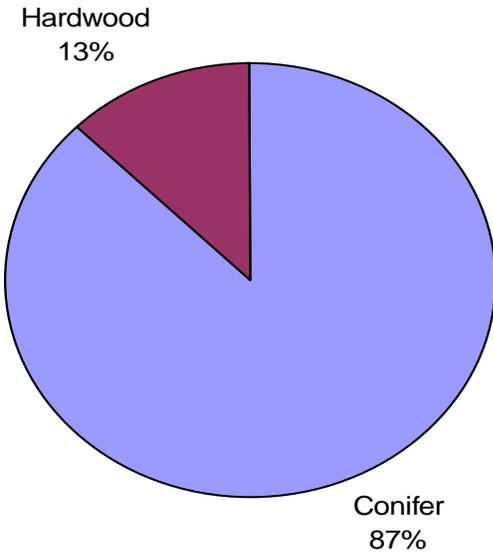
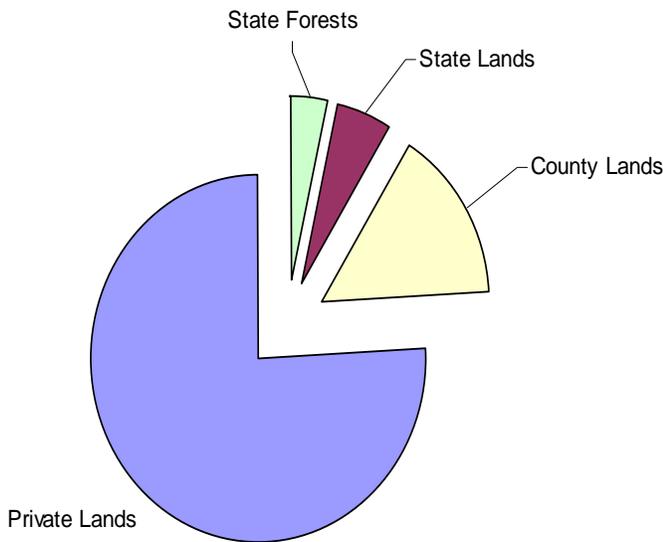


Table 3: Seedling Distribution by Proportion



portions of sales distributions by property ownership. These detailed figures along with historic tracking and species and stock type breakdowns are produced in the annual 'State Nursery Distribution & Tree Planting Report' which can be requested, free of charge from the authors of this report.

Table 4: Seedling Distribution by Ownership Proportion



Stock Quality

Pathogen work – ie. Diplodia survey success – All three nurseries continued to monitor Diplodia in nursery stock to determine the impacts of previously implemented cultural practices. The occurrence of the fungus was very low again this year. Preliminary results show only 3% of sample cultures indicating any presence of the fungus. 2008 also marked the start of another investigative trial on Jack Pine Gall Rust. Trial plots were established at each nursery to test for asymptomatic seedlings

Seed Collection

Seed collections for 2008 were generally adequate for all species and met the requirements for nursery seeding, direct seed applications and storage.

In 2007, almost 2000 bushels of white pine cones were purchased and collected primarily in the Rhinelander area. A second rare bumper crop of white pine cones developed across northwest Wisconsin in 2008 and an additional 3000 bushels were acquired. With 4000 pounds of cleaned seed in storage, white pine seedling availability from the state nurseries is assured for at least the next decade, and direct seeded reforestation projects using white pine can be undertaken.

Most seed stocks in storage at Hayward are in good to excellent amounts. There are however, some species such as sugar maple, basswood, big tooth aspen, and black ash that continue to be in short supply.

Jack pine will be the target species for fall 2009, to replenish stored seed stocks depleted by high demand from direct seeding projects on county and state lands.

Griffith Nursery

The Griffith nursery started lifting trees on April 7 and completed by April 30th. Spring weather was cool and at times wet which created some challenging days for the field crews. Due to deep winter snow cover soil frost was not a problem in the stock. The



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cool spring temperatures kept stock dormant for the entire harvesting season and all species were shipped in excellent condition. One very positive note is that there were no worker injuries during the 2008 distribution season.

One Technician position was filled this summer which brought the nursery to full staffing levels.

The growing season was cool and moist early and then became dry in July and August. Spring germination was excellent with all species meeting or exceeding production goals. This is attributed to good winter snow depths and ideal spring germination weather. One significant change in a nursery cultural practice was the elimination of bed boards and screen/shade tops. The nursery developed a steel hoop which was used to support the shade cloth. The stock performed very well under this cover and resulted in a significant cost savings to the nursery operations. This technique is being expanded at Griffith and started at Wilson. Instead of fall mulching with sawdust the nursery used shredded rye straw to prevent young seedlings from frost heaving. This was a cheaper alternative than sawdust and preliminary results appear positive. Overall stock remained healthy throughout the growing season and inventories are strong for the 2009 spring season.

Hayward Nursery

Deep frosts and dry cool weather hampered tree lifting at Hayward in the spring of 2008. As a result, the start of tree lifting and distribution was delayed until April 14th, with some beds having frost until the last lifting day on April 30th. Conditions for tree care, however, were very good and planting survival was much better than experienced during drought conditions over the previous three years. Labor for the spring distribution included DOC crews, a contract lifting crew, and about 30 local LTE laborers. The Hayward Nursery normally has a full time staff of five. Currently, there are two vacancies which meant some work duties have been shifted to the re-

maining employees, LTEs, and personnel borrowed from the Sawyer/Rusk Forestry Team. Jennifer Peterson and Don Hoeft were instrumental in accomplishing seed purchasing and seed extraction in the fall of 2008. 108,000 seedlings were lifted, graded, and healed in for winter storage in lieu of storing them in a freezer. If this works the method may be a less expensive way to over winter stock. Trials were also initiated to determine any problems that may develop when planting in unfumigated ground in response to concerns about the long term availability of common fumigant agents. The ongoing deer repellent study on the Brule River State Forest continued to show the positive effect of applications in inhibiting browsing on conifers.

Wilson Nursery

The Wilson Nursery began lifting seedlings March 31, 2008, after a beautiful blanket of snow retreated into the ground with no frost to speak of. Above normal precipitation and below normal temperatures continued through the spring making conditions ideal for stock care but these conditions were hard on staff. Foresters from both SCR and WCR, along with the SCR Regional Director, assisted one day after illnesses plagued the nursery staff for several days. In the end the about 3.4 million trees were lifted and 1.3 millions seedlings graded.

The 2008 growing season started out with excellent germination resulting from 100 plus inches of snow cover all winter optimal germination conditions in the spring. This was then followed up with nearly 16" of rain for the month of June. Although some water ponding did occur, it was not nearly to the extent it was in August 2007. Wilson Nursery has also been looking into ways to reduce the cost of cover crops. With seedling inventories low, more acres have been maintained in cover crops. A traditional cover crop rotation historically had been winter rye in the winter and Sudex in the summer. This year, we decided to carry the winter rye through to harvest where it was combined and the straw baled. The straw was then used at Hayward, Griffith and Wil-



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son nurseries as mulch in place of sawdust. Surplus straw was sold. The combined seed was cleaned and bagged. The nurseries use about 75 bushels of that seed to reseed the next years cover crop, as well as offer an additional 150 bushels to other DNR property managers. The end result was no economic loss to the nursery program as it has been in the past. The percent organic matter will need to be monitored to see if it is being impacted. The nursery also marked the retirement of Gary Eldred, Forestry Technician for more than 28 years.

Trials

Wilson Nursery continues its move toward slow release fertilizers to be more environmental friendly and reducing the cost of stock production, while maintaining stock quality. Trials were put in this year using polymer coated urea fertilizers in the red and white pine. After completing the first

growing season there is no visible difference between the 2 urea based fertilizers and the tradition polymer coated slow release we have been using for about 6 years now.

Wilson nursery finished follow up with its fall lifting outplant trial. A sample of 25 seedlings were taken from all species fall lifted in 2006. The were stored overwinter in the cooler at 26 F with all the other stock. In the spring they were thawed in the cooler in late March and stored in cold storage until being out planted in the nursery in mid May. We had virtually 100 percent survive through year 2 and no signs of damage from being fall lifted. Species included; red and white pine, white spruce, red oak, black cherry, sugar maple, river birch, prairie crab, silky and red osier dogwood, ninebark, plum, and hazelnut.

Fumigation is becoming increasingly more difficult and more expensive. Trials were completed this past year looking at how well black walnut would grow on non-fumigated ground. Fumigation resulted in nearly double the height (Table 5), 31% more caliper and 25% better root score (Table 6) And although the average seedlings grown on unfumigated ground met the minimum specifications for height, they did not meet the minimum specification of 6.5 mm for caliper.



Table 5: Height Comparison MC3 3 Fumigation vs. Unfumigated

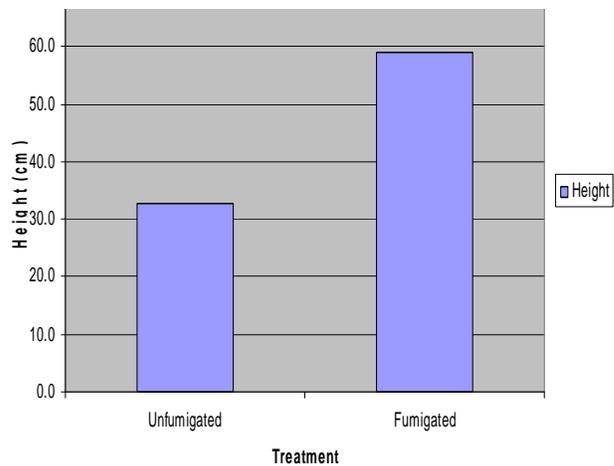
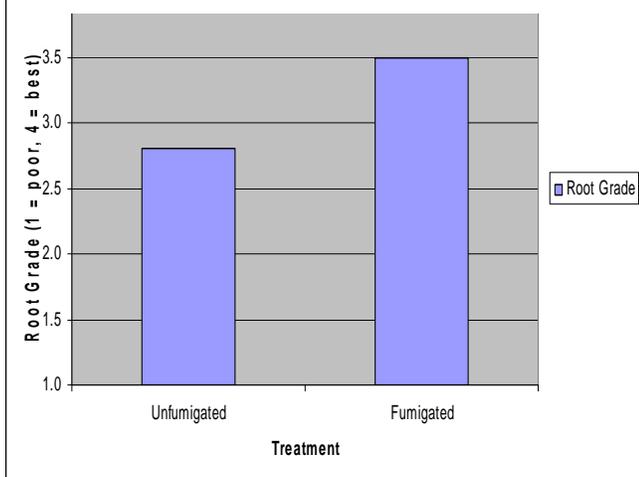


Table 6: Root Grade MC3 3 Fumigated vs. Unfumigated Black Walnut



Reforestation and Invasive Species Monitoring

In the summer of 2008, the state nursery assistant managers visited 129 sites in Wisconsin. These sites are scattered around all regions of the state, on public and private properties. The sites vary from small fields and shelterwood under planting to 20-acre agriculture field conversions and 200-acre jack pine clear cuts.

Weather conditions

The planting conditions for most landowners in Wisconsin were ideal. Cool temperatures and ample precipitation provided seedlings a great start to life outside the nursery. Unfortunately, in some areas the rain did not stop and more than a few plantations were inundated with flood waters. Later in the summer a number of locations started to suffer from lack of precipitation. Overall, the weather conditions were favorable for seedling development.

Landowners

As in the past, landowners were very willing and excited to discuss and exhibit their tree plantations. Only a few landowners denied access to their seedlings, citing unhappiness with the DNR in other disciplines or lack of time. Many landowners like to accompany during the site visit. Staff try to accommodate, even though it takes longer to finish plots. Including landowners in the

reforestation monitoring process, can be cumbersome, but is well worth it.

Plot Data

The team used a MS Access based recording program this year, rather than the Excel program. The new program took a little time to get used to, but works better for data entry and analysis.

Survival

Overall, only a small number of sites were considered failed plantings. This was mostly due to flooding in the South East and East Central counties. Statewide survival was good, just over 80%. When the mortality excludes cull seedlings (not all landowners separate the good trees from the bad trees, as we suggest) the survival rate jumps to about 90%. While it doesn't represent a major problem, it suggests we need to continue stressing the importance of culling seedlings.

Damage

A few sites had weed competition levels that put their future prospects in doubt. Time will tell. Over 60% of seedlings in surveyed sites showed little to no vegetative competition. However, many sites had weed competition levels that put their future prospects in doubt. More work in educating landowners on the perils of seedlings struggling through hip-deep reed canary grass and alfalfa is needed. The inclusion of landowners in the survey work provides a good opportunity for this education. Their seems to be some anecdotal evidence that landowners are improving their weed control, but more observations are needed. Planting problems, seedlings too deep or too shallow, are prevalent on almost all sites. Foresters and nursery folks need to stress the importance of quality control during planting. Deer browse is present, but not a major issue during our site visits. Insect damage, girdling, slight chlorosis and other minor planting mishaps are also slight concerns in some plantings.

Invasive Species

Occurrence of invasive species are also noted during site visits. Invasive plant spe-

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cies are documented by name, size of infestation area, and the number of stems (individuals) present in the infestation area. A GPS coordinate is also assigned to the planting site as part of the general protocol.

Invasive plant species documented during the 2008 reforestation and invasives monitoring season (number of sites in parenthesis):

- Autumn Olive (4)
- Asian Bush Honeysuckle (8)
- Black Locust (7)
- Common Buckthorn (8)
- Glossy Buckthorn (2)
- Reed Canary Grass (18)
- Garlic Mustard (4)
- Multiflora Rose (10)
- Siberian Elm (4)
- Spotted Knapweed (5)

Out of the 129 plantings monitored in 2009, 32 had at least one invasive plant species present. Many sites had multiple invasives present, and one case in particular had 6. Reed Canary Grass was by far the most prevalent (found in 14 counties). Over half of these sites had infestations of greater than 1 acre in size. Other notable species recorded were Multiflora Rose, Common Buckthorn and Asian Bush Honeysuckle; each having noted infestations averaging over one acre in size, and found mainly in southern counties.

Overall Interpretation of 2008 Reforestation and 2009 Outlook

A slight decline in nursery sales, certain logistics issues, and limited available employees limited the number of sites visited in 2008. The weather for monitoring was ideal; rain only hampered a few visits. Overall, seedling survival was good in most areas, landowners were relatively happy with the seedlings in most area and there is no reason to believe the seedlings will not flourish in the years to come.

The nursery sales continue to lag, suggest-

ing this coming year will have fewer suitable sites to choose from. The program will again have only 3 surveyors to monitor the 2009 plantations as well as the 2nd survey of the 2007 plantings. The protocol for the 2nd survey is still being fine-tuned.

It seems there will be no shortage of work for the assistant nursery managers in summer 2009.

Reforestation Trials

Wilson Nursery conducted a deer repellent trial on two hardwood plantings. Both sites showed heavy browsing pressure when sampled in 2007 as part of the reforestation monitoring survey. One site was on Nature Conservancy land in Sauk County, just southwest of Baraboo. The other site was in Outagamie County, on private land near Kaukauna.

- 5 chemical repellents were tested, 2 replications of each on white oak and/or red oak. The Kaukauna site also had a block testing Aspen
- Chemicals tested were: Plankskydd (blood), Deer Off (putrescent egg/capsaicin), Deer Out (Mint oil/Garlic oil), Tree Guard (Birtrex), and Hinder (Ammonia Soap of Fatty Acids)



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- Applications were made on May 23rd 2008 at both sites percent browse per plot was recorded prior to application of repellents.
- Applications were again made on June 30th 2008 at Baraboo and July 8th 2008 at Kaukauna. Percent browse per plot, only new browse since 1st application, was again recorded.
- The Kaukauna site was evaluated again on September 30th 2008. No new repellent application was applied, but browse and height were measured on the aspen replication.
- Throughout the trial, browse was measured as either present or not present. No measure of severity was recorded.

Summary

The measurement results from Oak were inconclusive and the repellents used had varying results. Deer Out and Hinder consistently performed most poorly, usually equal to or worse than the controls. The others showed moderate controls but there was no standout performer.

Table 7 shows height and browse measurements, recorded late September. The Kaukauna aspen plots showed that frequency of browse is probably not the best measure. The row with the best average height also had the highest % browse. Browse was frequent, but not typically as severe. It's worth noting that TreeGuard is a "taste" repellent, not a "smell" repellent.

Due to the variable browse results it was concluded that any further testing needs a mechanism to measure browse severity at each application. However, there are some lessons to be learned on application frequency and timing. 3 applications per growing season may be needed for consistent results. A Four week interval between treatments appears to be too long depending on summer weather conditions, including heavy rains.

Table 7: Repellent on Aspen Results

Product Name	Height (inches)	% Browse
TreeGuard	38.76	30
Plantskydd	37.85	14
DeerOff	35.65	8
DeerOut	35.36	24
Control Plot	34.17	24