Annual Report 2024

WISCONSIN REFORESTATION PROGRAM

Wisconsin Department of Natural Resources
State Reforestation Program
Forest Genetics Program

Photo: Credit Wisconsin DNR

WISCONSIN DEPT. OF NATURAL RESOURCES

WISCONSIN DEPARTMENT OF NATURAL RESOURCES | DNR.WI.GOV

Wisconsin DNR Reforestation Program

Carmen Hardin, Applied Forestry Bureau Director*

Joe Vande Hey, Reforestation Team Leader**

Jeremiah Auer, Regeneration Specialist***

Roger Bohringer, Wilson Nursery Assistant Manager**

Richard Nesslar, Tree Improvement Specialist****

Scott O'Donnell, Forest Geneticist/Ecologist*****

Stuart Seaborne, Tree Improvement Research Specialist******

Gary McCormick, Wilson Nursery Operations Coordinator**

Pat Hromadka, Wilson Nursery Operations Coordinator**

Jackie Knoble, Wilson Nursery Operations Coordinator**

Melissa Prieve, Hayward Nursery Foreman****

Carey Skerven, Reforestation Program Assistant***

*Wisconsin Department of Natural Resources, 107 Sutliff Ave., Rhinelander, WI 54501

**Wilson State Nursery 5350, Hwy 133 E, Boscobel, WI 53805

***Griffith State Nursery 473, Griffith Ave., Wisconsin Rapids, WI 54494

******Hayward State Nursery, 16133 W Nursery Rd., Hayward, WI 54843

********Wisconsin Department of Natural Resources, 101 S Webster St., Madison, WI 53707

WISCONSIN
DEPT. OF NATURAL RESOURCES

THE UNIVERSITY of WISCONSIN MADISON

Table Of Contents

Reforestation Monitoring

Introduction

Since 2007, the Division of Forestry's Reforestation Program (RP) staff has examined a sample of Wisconsin's forest plantations during their initial year of establishment to assess the successes and failures of tree planting throughout Wisconsin. Many of these sites are then revisited after the third and seventh year of establishment to examine the health and vitality of the seedlings and plantations. The sites included are public and privately owned, large and small acreages and single or mixed species plantings. This monitoring also allows for interactions and discussions with landowners and land managers.

Personnel

The Regeneration Specialist, Jeremiah Auer, directed a team of limited term employees (LTEs) in 2024. Ian Walton led the field data collection team in his second season and newcomer Chris Huesemann assisted in his first. This crew was effective, and while Auer accompanied on occasion, this duo was responsible for most of the data collection statewide. The crew was engaged in other Reforestation Program activities, so they were not able to devote 100% of their time to regeneration monitoring, but they met the goals required.

Weather Conditions

Planting and growing conditions in late spring were cool and wet, conducive to seedling establishment. This continued throughout the growing season. Most of the state received adequate moisture during the critical growing season. There were dry conditions later in the autumn, but that did not impact seedling survival or growth.

Site Selection And Plot Installation

Sites are selected from among landowners who order a minimum of 3,000 seedlings from Wisconsin Department of Natural Resources (DNR) nurseries, a volume that can cover approximately three acres of land. The landowner's main objective must be to establish a forested environment. Other goals, including wildlife habitat and erosion mitigation can be considered, but the management techniques must focus on developing a forest.

After the sites are randomly selected, plots are installed within the planted area. Plantings greater than 10 acres receive six plots, and sites with less than 10 acres receive three plots. Each plot center is marked with a wooden stake and orange flagging. The corners are established at 20.87 ft. at bearings of SW, NW, NE and SE. Each seedling within the plot is marked with an identification whisker (first blue, then red whiskers designating the other seedlings) and is mapped to ease data collection in the third and seventh years.

Plot Installation 2024

The 2024 field season was fruitful. Staff established plots on 26 sites, representing 26 ownerships. Of these sites, 14 are located on public lands and 12 on private property. The counties involved include Chippewa (1), Clark (1), Columbia (1), Crawford (1), Dane (1), Douglas (1), Iowa (1), Jefferson (1), Juneau (1), Langlade (1), Marathon (1), Monroe (1), Oconto (1), Polk (1), Portage (1), Richland (1), Rock (1), Rusk (1), Sauk (1), Sheboygan (1), Vilas (1), Washington (1), Waukesha (1), Waupaca (1) and Winnebago (2). This widespread approach allows us to monitor seedling growth and development in a wide variety of soils and conditions.

After the third growing season, staff also remeasured monitoring sites on plantations from 2022. Staff revisited 25 of the original

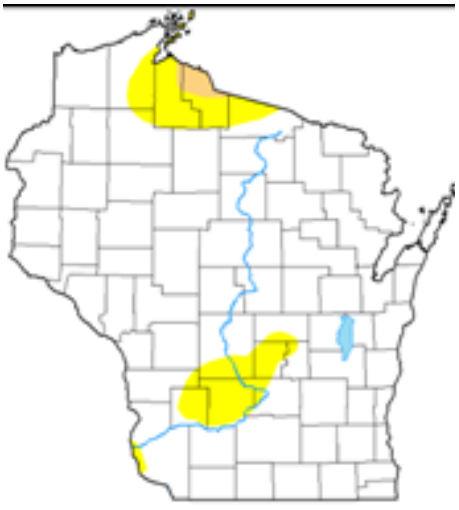

Figure 1: Wisconsin Drought Monitor, May 08, 2024

Figure 2: Wisconsin Drought Monitor, July 2, 2024

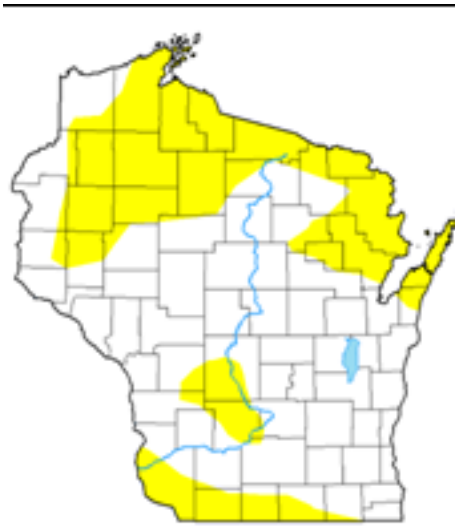

Figure 3: Wisconsin Drought Monitor, Aug. 27, 2024

Source: National Drought Mitigation Center, University of Nebraska-Lincoln

37 sites, representing 16 public and 9 private properties. Again, these sites were scattered across Wisconsin, in the counties of Adams (1), Bayfield (1), Burnett (2), Chippewa (1), Douglas (1), Iron (1), Juneau (2), Lafayette (1), Lincoln (1), Marathon (1), Marquette (2), Monroe (1), Ozaukee (1), Portage (2), Sauk (2), Taylor (1), Vernon (1), Washington (1), Waukesha (1) and Wood (1).

Finally, staff revisited 24 of the original 31 sites after their seventh growing season. These were established in 2018 and remeasured after their third growing season in 2020. There are 13 public and 11 privately owned sites. These are found in Adams (1), Ashland (1), Bayfield (1), Burnett (2), Chippewa (1), Columbia (1), Crawford (1), Douglas (1), Iowa (1), Jackson (2), Jefferson (1), Juneau (1), Marathon (1), Monroe (1), Ozaukee (1), Polk (1), Racine (1), Sawyer (1), Sheboygan (1), Trempealeau (1) and Vilas (2) counties. Staff was unable to visit seven of the original sites. Three landowners have never returned calls since the first visit, so the crew didn't have high hopes to be able to revisit in the seventh year. The other four did not respond to numerous attempts to contact them.

Data Analysis: Year Zero

Data was collected on 1,732 newly planted seedlings at 26 sites. All seedlings originated at a DNR nursery. Overall, seedlings had a survival of 92.8%. A further breakdown shows 82.8% are considered healthy and 10.0% are lightly damaged but growing and expected to survive. Mortality is 7.2%, with 4.4% suffering from some form of heavy damage, indicating the seedling is damaged to the point that it would not be able to recover and likely die prior to being surveyed again after the third growing season and 2.8% were dead. Compared to previous years, 2024 seedling survival is above the 10-year average of 86.2%.

Public lands: Of the 1,101 seedlings sampled on public lands, 35% are conifers and 65% hardwoods. Overall, seedling health was above the overall average. Both hardwoods and conifers are doing very well, surviving at 90.8% and 91.7%, respectively. It is not easy to estimate the impact of browse or girdling during the early summer when the data was collected, as conifers generally suffer from these impacts during mid-to-late winter when there is much less sustenance available to wildlife. Thus, no conifer seedlings exhibited signs of browse.

Hardwoods tend to be more susceptible to browse in summer, especially oaks and maples. Approximately 3% of hardwood suffered some sort of browse with enough impact to damage the seedlings. A common problem with conifers on public lands has been planting too deep (>2" above the root collar). This year, it wasn't a concern with only 5% of seedlings planted deeper than suggested. Planting a seedling deeper than suggested doesn't typically impact survival or health in the first few years of growth. However, it can become detrimental in later years as disease and insects are more apt to attack a compromised stem. Hardwoods, with their larger root systems are susceptible to being planted too shallow (>2" below the root collar), but this was not visible in 2024, with only 6.4% of seedlings being planted at a depth shallower than what the nursery recommends. Hopefully, both these improved planting trends continue.

Private lands: Private lands tend to have smaller plantings and be heavier to conifers. In 2024, this trend held true. Of the 631 seedlings sampled, 462 were conifers. The seedlings did well overall. The overall rate of healthy and slightly damaged trees is 95.7%. As most seedlings were conifers, browse was minimal, impacting only 11 seedlings. When it did occur, the oak and hackberry was subject to the most pressure. Other hardwoods have only been minimally impacted by browse to this point.

	Public Lands		Private Lands	
	No. Seedlings	%	No. Seedlings	%
Healthy	856	77.7	578	91.6
Light Damage	147	13.4	26	4.1
Heavy Damage	63	5.7	14	2.2
Dead	35	3.2	13	2.1
Total	1,101	100.0	631	100.0

Table 1: 2024 Seedling Health Year Zero

Year Three

These 37 sites were planted in 2022. Staff visited 25, representing 24 ownerships. Of the 12 not revisited, the landowners either did not return our staff contact attempts, the property was sold or our staff ran out of time before the field season ended. Staff will try to revisit some when spring arrives.

In Year 0, data was collected on 2,502 seedlings – all originating from a Wisconsin DNR nursery. Overall, seedlings had a survival of 79.8%. A further breakdown shows 68.2% were considered healthy and 11.6% are lightly damaged but growing and expected to survive. Mortality was 20.2%; with 10.5% suffering from heavy damage and 9.7% dead. In Year 3, a total of 1,727 seedlings were measured on the 25 sites. Of the seedlings remeasured, 48.0% were healthy, 6.1% were slightly damaged, 1.2% were heavily damaged and 41.9% were dead. The 12 sites not remeasured have an additional 775 seedlings. In addition to these sites, three plots within the measured sites could not be located. The number of surviving and thriving seedlings dropped from 2,502 to 1,727 from Year 0 to Year 3.

	2022 Year Zero		2024 Year Three	
	No. Seedlings	%	No. Seedlings	%
Healthy	1707	68.2	879	48.0
Light Damage	291	11.6	105	6.1
Heavy Damage	262	10.5	20	1.2
Dead	242	9.7	723	41.9
Unknown	0	0.0	775	
Total	2502	100.0	1727	100.0

Table 2: 2022 Comparison of Seedling Health from Year Zero to Year Three

Year Seven

These sites were established in 2018 and remeasured in 2020. These are the final measurements to determine if the sites developed to a point where they could be considered successful or unsuccessful. For the purposes of this monitoring, a successful planting is fully stocked with greater than 450 seedlings per acre and trees are above the impacts of deer browse and competing vegetation.

Monitoring

Originally, 31 sites were visited and measured. Then, in 2020, we revisited 27 of the sites to ascertain seedling survival and growth. In the final year, staff revisited 24 of the original sites. The sites not visited were either sold or we were unable to contact the landowner. Overall, of the 24 sites, 13 are public and 11 are privately owned. There are five successful public land plantings and eight unsuccessful. There are four successful private land sites and seven unsuccessful. This represents a success rate of 38.4% on public lands and 36.4% on private lands; an overall rate of 37.5%.

As far as success in relation to having a forester provided planting plan: All public properties are required to have a planting plan. As previously mentioned, the public lands success rate was 38.4%. The reasons that eight sites failed are typical: heavy competition from an overstory or uncontrolled grasses or forbes (3), heavy deer browse (2), fire (2) and droughty conditions on dry sandy soils (2). Four private lands sites did not have a written plan; two were successful. The two unsuccessful sites were overrun by competition, both grass and shrubs. Of the seven others with written plans, two were successful and five were not.

Those with plans that were unsuccessful have been impacted by heavy snow loads that crushed them early in their development (1), heavy weed competition (2) poor planting (1), an increased spacing that dropped the stocking below the minimum with only minor mortality (1). The trend has been that sites with planting plans tend to perform better over the 7-year study than those without. That was not the case this year. There were challenges during the first year of establishment, early in the spring of 2018, there was adequate precipitation, but as summer progressed, there was very little rain in July, August and into the fall. Most sites would have been visited by mid-August, thus any challenges the plantations may have experienced would not have been recorded until the third year survey.

2018	2018 Year Zero		2020 Year Three		2024 Year Seven	
	# Seedlings	%	# Seedlings	%	# Seedlings	%
Healthy	1,454	64.9	879	49.0	741	33.1
Light Damage	378	16.9	148	7.8	33	1.5
Heavy Damage	113	5.0	85	4.7	10	0.4
Dead	286	12.9	723	24.9	715	31.9
Unknown	5	0.2	404	13.5	740	33.1
Total	2,339	100.0	2,239	100.0	2,239	100.0

Table 3: 2018 Comparison of Seedling Health from Years Zero, Three and Seven.

Overall Conclusions

This is the tenth year with the regeneration monitoring current protocol. We completed four full measurement cycles (first, third and seventh years of growth) and have noticed some trends.

1. Plantations with professionally created planting plans tend to do better than those without (see table). The correlation isn't as strong as expected, dropping slightly in the past couple years, but it still shows that private landowners with planting plans tend to have success more often than those without.

	Public Lands				Private Lands			
	Planting Plan		No Plan		Planting Plan		No Plan	
	+	-	+	-	+	-	+	-
2012	6	4	0	0	2	3	4	5
2013	13	2	0	0	4	0	0	1
2014	8	2	0	0	8	0	0	0
2015	11	9	0	0	4	2	2	1
2016	10	8	0	0	6	3	1	1
2017	7	9	0	0	5	4	2	1
2018	5	8	0	0	2	5	2	2
Overall Sucess	59%	41%	0%	0%	65%	35%	50%	50%

Table 4: (+) Successful plantings (-) Unsuccessful plantings

2. Seedlings planted on public lands by private contractors are more likely to be planted deeper than what is suggested. Contract crews are planting 90% plus of the public land sites, mostly by hand. Since 2015, an average of 33.9% of seedlings planted on public lands were planted deeper than suggested by the nursery. Planting depth problems drastically improved in recent years.

Hopefully the efforts by staff in the field during planting will continue this downward trend. Deeply planted seedlings can be susceptible to fungal or insect infection in the lower stem. By comparison, private lands have improved as well, with only 3.3% of seedlings having been planted too deeply. There was a spike in shallow planting in 2023, most likely due to the increase in distribution of larger 2-0 hardwood seedlings and the increased number being planted on state lands. Thankfully this did not continue in 2024, with just as many larger 2-0 seedling having been planted.

Public Lands Planting 2015-2024			
	Acceptable	Deep (soil level >2" above root collar)	Shallow (soil level >2" below root collar)
2015	88.2%	11.2%	0.6%
2016	42.6%	55.6%	1.8%
2017	45.1%	52.0%	2.8%
2018	32.5%	58.0%	9.6%
2019	33.7%	56.3%	10.0%
2020	63.8%	36.2%	0.0%
2021	71.7%	24.3%	4.0%
2022	60.8%	32.6%	6.6%
2023	76.7%	7.1%	16.2%
2024	88.3%	5.3%	6.4%
Average	60.3%	33.9%	5.8%

Table 5: (+) Successful plantings (-) Unsuccessful plantings.

Photo Credit: Wisconsin DNR

Monitoring

The reforestation monitoring effort has proven useful and allows the RP to gather information about seedling performance and plantation establishment statewide and stay abreast of short- and long-term challenges or trends. In addition to providing valuable data on plantation performance, customers and staff interact and provide an opportunity for idea exchange and advice. The 2024 field season was a success in that our staff was able to visit a variety of diverse plantings. Continued data collection and analysis will continue to provide the information needed to assist landowners and property managers in maintaining and growing their forests.

Photo Credit: Wisconsin DNR

Regeneration Trials

Introduction

In addition to supplying landowners and managers with quality nursery stock, the RP also endeavors to act as a reservoir of information and experience in all aspects of reforestation. To that end, we undertake trials to test the efficacy of herbicides used in site preparation, chemicals that claim to mitigate deer browse, seedling lifting and storage techniques, etc.

Fall Lifted Seedlings: 2023 Planting

Nurseries have long used fall harvest and overwintering to lessen the stress of early spring. In the case of Wisconsin DNR nurseries, some hardwoods, and most conifers in the fields tend to stay frozen well into the spring, making it difficult to keep trucking schedules and distribution goals. With seedlings already in storage, this early season crunch can be alleviated. However, the concern is that seedlings will not be as healthy and thus, not perform as well when out planted. Nursery staff plant a small subset of seedlings harvested in the fall to monitor seedling performance throughout the following summer. In 2023, staff planted red pine 2 and 3-0, white pine 2 and 3-0, white spruce 2 and 3-0, swamp white oak 2-0 and red oak 2-0 in the fields of Griffith Nursery. The seedlings were planted on a cool, sunny day using a DNR tree planter. The original evaluation was completed in July 2023. The seedlings were measured again in May 2024 to determine the results, found in Table 6.

	STATUS							
	PR2	PR3	PW2	PW3	SW2	SW3	OR2	OS2
Healthy	20	23	19	17	15	11	11	22
Light Damage	0	0	0	0	1	0	0	2
Heavy Damage	0	0	0	0	2	0	0	0
Dead	5	2	6	8	5	14	14	1
Total	25	25	25	25	23	25	25	25
Survival	80%	92%	76%	68%	70%	44%	44%	96%

Table 6: Overwintered seedling survival 2023

Of those out planted, the red pine, white pine 2-0 and swamp white oak did the best. Surprisingly, red oak performed very poorly. Others fell in-between. Staff did hear of some challenges with seedlings during the summer, but most problems were attributed to the lack of precipitation across the state. However, if evidence suggests that seedlings were compromised prior to planting, staff will reach out to customers in the future. A control group was not planted in 2023, but as we continue in this effort, we will establish a control group to compare seedling performance.

Fall Lifted Seedlings: 2024 Planting

In 2024, staff planted red pine 2 and 3-0, white pine 2 and 3-0, white spruce 3-0, bur oak 2-0, swamp white oak 2-0 and red oak 2-0 and hazelnut in the fields of Griffith Nursery. Staff also planted a control group, seedlings of the same species and ages harvested in the spring of 2024. These were planted in the same field and treated the same as the fall lifted seedlings. All were planted on a warm, sunny day using a DNR tree planter. The original evaluation was completed in July 2024. For the purposes of this data collection, seedlings that are healthy are showing signs of growth (bud elongation, growing needles, bud set, etc.). Those categorized as light damage may have some delayed growth or a slight chlorotic appearance. Those marked as heavily damaged are seedlings that have shown no sign of bud elongation, browning needles, etc. and the staff does not expect them to survive through the season and then winter. And dead seedlings have typically lost leaves/needles, never had a flush of growth and exhibit all the qualities associated with not being alive.

Status	Species									
Lifitng	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Species	PR 2-0	PR 2-0	PR 3-0	PR 3-0	PW 2-0	PW 2-0	PW 3-0	SW 2-0	SW 3-0	SW 3-0
Healthy	20	25	14	23	23	25	20	24	24	25
Light Damage	1	0	6	2	0	0	1	0	0	0
Heavy Damage	3	0	0	0	1	0	0	0	0	0
Dead	1	0	5	0	1	0	4	0	1	0
Total	25	25	25	25	25	25	25	24	25	25
Survival	84%	100%	80%	100%	92%	100%	80%	100%	96%	100%

Table 7: Overwintered seedling survival 2024 – hardwoods and shrubs

The evidence seems to show that most seedlings show little affect related to survival from either fall or spring lifting. However, the red pine 2 and 3-0 lifted in the fall did not perform quite as well as those lifted in spring. The seedlings will be measured again in spring 2025 to determine their health status after a full year out planted and results reported then.

Tree Shelter Efficacy

Protecting young trees from herbivory is a challenge that many forestry professionals and stakeholders face. There are several ways to protect young trees, ranging from fencing a large area around them to installing individual shelters, to applying topical deterrents. Success of each protective measure is variable and may depend on tree species, location, herbivore abundance, etc. Individual shelters for young trees are a popular protection method, but several types of individual shelters exist. Some have solid tubing and others have venting to allow for more air flow. The extent to which differences in tree shelter design protect trees, impact survival and growth is not well understood, but is a question being asked by stakeholders who invest significant money and effort in planting trees.

A pilot study conducted in 2020-2022 using vented and unvented

shelters, indicated that black walnut did well in either shelter but results for red and white oak were mixed. Determining whether shelter type alone was responsible for mixed survival results of oaks was difficult due to instances of white-tailed deer pulling shelters off trees to browse them, differences in location of individual trees and a droughty period during the pilot study.

Given the mixed results for oak and the desire to test an additional tree species, we will build upon the pilot study to test the impacts of two types of common tree shelter (vented and unvented) on survival and growth of several tree species so we can make informed recommendations to our stakeholders.

To determine the impacts of protecting young trees from herbivory using tree shelters, we will test two types of commonly used shelters; Plantra 58" SunFlex grow tube shelters (vented) and Blue-X 54" tree shelters (unvented), along with a control of open grown seedlings. Three species of tree will be used in this study: red oak, white oak and black cherry. We will use a randomized complete block design with 30 replicates of each species and each tree shelter, resulting in 90 trees per species and a total N of 270. Species and shelter replicates will be evenly divided among three rows. Within each group/species combination 10 trees will be covered with vented shelters, 10 trees will be covered with unvented shelters and 10 trees will be unsheltered controls. See study spreadsheet for a planting map.

We will collect two types of data for this study: survival and growth. Survival will be assessed visually with a determination of alive or dead. Growth will involve two measurements: a measurement of overall height (from ground surface to the top of the live woody stem without lifting or supporting the stem), and a measurement of basal diameter taken just above the root collar.

All seedlings were planted in May 2024. Seedlings were 2-0 at the time of planting. Seedlings were bare root lifted and transplanted to the study block using shovels. Some seedlings required some root trimming; those will be identified.

The initial measurement were taken at the time of planting, recording all seedling heights and basal diameters. Each fall, including the year of planting (2024), each seedling will be assessed for survival (alive/dead) and growth (height and basal diameter). Fall measurements will be done prior to senescence (before leaf-drop). Growth measurements will require brief removal of tree shelters, which will be immediately replaced after height and basal diameter are measured. Then, each spring, after leaf-out, each seedling will be assessed for survival (alive/dead). Given the difficulty sometimes in determining if a tree is truly dead, if a seedling appears dead, it will be assessed again for the following two survival measurements, either the following fall and spring or the following spring and fall depending on when apparent death is first observed. Once a seedling is determined to be dead, it will no longer be measured.

Data sheets will be scanned to PDF files and saved after each instance of data collection. Data will then be entered into Excel spreadsheets and later checked against datasheets for errors by someone other than the person who entered the data. Survival will be analyzed for each species, using either an ANOVA or survival analysis such as Kaplan-Meier or Cox Proportional Hazard models. Changes in height and basal diameter will be assessed using a repeated measures ANOVA. We will write a Technical Report that will be published on our forestry research webpage to provide guidance for forestry professionals and other stakeholders.

Wilson Nursery Report

Distribution

The nursery's 2024 spring distribution season began on Nov. 2, 2023, when the nursery crew began lifting some of the smaller lots of shrubs and hardwoods. Starting on Nov. 6, and working through Dec. 1, a contract labor crew from Champion Forestry worked to lift and grade approximately 900,000 seedlings, which were held in cold storage until spring. Fall lifting allows us to get a hard count of many of our species, especially shrubs, so that we can sell from a verified inventory instead of from field estimates that are not always accurate. This greatly reduces the number of orders needing to be modified or canceled due to inventory shortfalls. Fall lifting also allows inventory over-runs to be discovered early enough that the surplus stock can be sold to help meet customer demand. During spring grading, any surpluses are often discovered late in the distribution season, resulting in surplus stock being destroyed. However, the advantage of fall lifting is that it allows the nursery to start packing and shipping orders as soon as the spring thaw arrives, instead of having to lift and grade for a week or more to build up graded inventory before packing orders.

The contract for spring lifting and grading was once again awarded to Superior Forestry Service, who sent us two experienced crews familiar with our operation. One crew graded trees full time, while the other crew worked in the field pulling trees. When not pulling seedlings, they bulk packed seedlings or graded trees on our auxiliary grade line. The contract crews were supported by Reforestation Program staff, who operated the machinery and did whatever jobs were needed to keep the contract crew working efficiently and the operation running smoothly. Both crews began work on March 18, 2024. By April 16, the grade shed crew was done. The field crew stayed on two more days to finish lifting a few odds and ends and to wrap up the last of the grading. The final combined tally for both crews over the 25 workday period was 3,597,000 conifers and 883,000 hardwoods lifted. Grading totals over the same period were 2,978,000 conifers and 860,000 hardwoods. An additional 671,000 conifers and 35,000 hardwoods were bulk packed. The lifting crew spent at least a couple hours in the grade shed most days, but when lifting all day they averaged 351,000 seedlings per day, with a mix of conifers and hardwoods. The dedicated grading crew averaged over 119,000 seedlings per day, grading both conifers and hardwoods. The overall per day grading average with the field crew helping in the shed on partial days was over 153,000 seedlings. These impressive lifting and grading averages made for a relatively smooth and stress-free distribution season, despite the larger than normal sales volume.

Although lifting and grading operations were wrapped up by April 19, order packing and distribution was still going strong. With 900,000 fall lifted seedlings in the cooler, and unseasonably mild weather, we were able to start distributing seedlings early, with the first semi leaving the loading dock on March 26. From that date on, there were three to five full semi loads per week, until the last truck shipped out on May 2. Twenty-one semi loads in total were shipped. A total of 5,424,375 seedlings were distributed in 3,488 orders. Of that, 49,371 seedlings in 764 orders were packed for the Fourth Grade Arbor Day program. See the 2024 Distribution Report for more details.

Spring Seedling

The completion of seedling lifting and grading triggers the start of spring sowing operations, even as other staff finish packing and shipping the last few trucks. Since the nursery began using contract labor for the lifting and grading, those operations wrap up much sooner than they historically did, leaving more time and nursery workforce to devote to spring sowing. Some species, like silver maple, aspen and elm, are spring seed dispersers. Silver maple does not store well, so it can't be sown until fresh seed ripens around Memorial Day (end of May). However, other species, such as tamarack, spruce and hackberry, can be sown from stored seed as soon as the danger of frost has passed, provided the seed has been properly hydrated and stratified to bring it out of dormancy. In 2024, sowing began on April 30, with the sowing of stored, stratified hackberry seed. Spring seeding wrapped up on May 28 with the sowing of the silver maple. In all, seventeen species were spring sown.

Historically, silver maple was hand-sown in the spring as seed became available. This was a labor intensive job, tying up the entire nursery crew for days, but fresh silver maple seed is too bulky to machine plant. In recent years, we have gotten around that problem by drying the seed slightly, mechanically de-winging it and machine planting it with a standard Whitfield hardwood seeder. However, this process damages a lot of seed and results were inconsistent. One year would be successful and the next would yield poor, low-density beds. In the spring of 2024, Wilson Nursery went back to hand-sowing fresh, high-moisture seed to see if germination would improve. However, to make the process more efficient, we used a Whitfield planter that had previously been modified for sowing aspen root cuttings. The machine makes five uniform planting trenches like a standard planter, but the drop tubes have been replaced with 4-inch PVC tubes, and a platform was added to allow five workers to stand on the machine as it moves down the field. Each worker is in charge of uniformly dropping seed down their tube as the tractor moves down the row. Another worker follows the machine, telling the crew on the planter if they need to drop more or less seed and watching for any clogged tubes. It is still a labor-intensive process, but with the machine it can be completed in a day instead of a week, and the crew can do the work standing up instead of on their knees. Best of all, the process yielded the best stand of silver maple that the nursery has produced in many years.

Nursery

Germination

2024 germination was on target for most species, with the exception of the fall sown shrubs, which were a near total loss. Dogwoods, ninebark, Juneberry, elderberry and buttonbush beds were all extremely spotty, with germination rates at only 10-20% of the target bed density despite being covered with germination fabric all winter. Prairie crab, hazelnut and chokecherry, which are sown much deeper, all had very good germination. This seems to indicate that the shallow, small-seeded shrub species likely desiccated in the dry winter soil, failing to find enough moisture to properly stratify in the dry ground. The other possibility is that they began germinating during unseasonably warm winter weather, only to freeze and die when the weather turned cold once again. In early February, Boscobel had temperatures near 60° F with active thunderstorms. Germination was observed in the highbush cranberry and prairie crab during this warm period, but no other species were observed breaking ground. Interestingly, the cranberry and prairie crab both produced excellent stands despite the early germination, but they have greater frost tolerance than most species.

Overall, conifer germination was very good, with most seedlots germinating near or above target rates. Blackbird pressure on the pine beds was heavy, despite steady hazing and culling of birds under the nursery's depredation permit. Due to the cool, wet weather in May, pine germination was slow and carried on for nearly three weeks, leaving the germinating seedlings vulnerable to bird predation for a longer than normal period. Unfortunately, just as the fall sown pine seedlings were finishing the germination process and becoming less vulnerable to birds, the spring sown jack pine and red pine beds began to germinate and were quickly discovered by the now experienced black birds. Unlike the fall sown conifers, this spring-sown seed was not treated with Thiram, which makes the seed less palatable to birds. The jack pine suffered heavy losses but the crop was salvageable. All three rows of spring sown red pine were a total loss. In the future, any spring-sown conifer seed will need to be treated with Thiram prior to sowing.

Hardwood germination was quite good for the most part. The lack of frozen ground and warm rainy February weather broke seed dormancy, but very few trees fully emerged from the soil until mid-April. Late April brought a couple freezing nights, but nothing that caused significant damage. Heavy river valley fog on the sub-freezing nights helped protect the trees against frost damage and no frost watering was necessary all season. Unfortunately, heavy rains later in April and May caused some flooding and standing water issues in the nursery that did lead to substantial loss of germinating birch and aspen seedlings. These newly germinating seedlings are very tiny, and do not handle ponding well. Even after the water receded, many more of these seedlings were lost to damping off or root rot issues later in the summer. Flooding may also have played a role in the loss of the spring-sown red pine beds. Once these fields are fallowed, they will be re-levelled to correct these drainage problems.

Nursery Trials: White Oak Mulch

White oak acorns are very susceptible to winter mortality in the seedbed. Past experiments with various mulches on white oak seedbeds have led to the conclusion that DeWitt ½ oz germination fabric is the most practical and economical mulch cover for our situation and that has become our standard practice. However, 2023 proved to be another banner year for white oak mast production and the nursery found itself with an inadequate supply of fabric to cover all white oak rows. Because of this, several rows were covered with a living mulch instead. This consisted of winter wheat, sown at a heavy rate of 200 lbs/ac and covered with cellulose fiber hydromulch at 0. 5 oz/ft2. Two rows were sown with winter wheat only, but not hydromulched. Assuming an average count of 200 acorns/qt, and averaging to account for the varying sowing rates per row, the average percent germination was determined for each method. As expected, the fabric covered rows did best, but the living mulch was close behind.

These results show that a living mulch of winter wheat can be successful for germinating white oak acorns, but the data is not conclusive. 2023 was a very mild winter with good snow cover and no frozen ground conditions all winter. Plus, mild November and December weather allowed the winter wheat to grow well past normal freeze-up, establishing a thick ground cover. This is not always the case. Because of this, germination fabric will remain the default method for mulching white oak beds, but these results prove that a living mulch of winter wheat can be a cheap, viable alternative when necessary.

Treatment	Number of rows sown*	Average quarts sown/48ft2 bed	Average acorns sown/48ft2 bed **	June 2024 inventory trees/bed	% of sown acorns that germinated
Winter wheat only	2	5. 6	1127	518	46. 0
Wheat plus hydromulch	7	6. 6	1318	630	47. 8
½ oz germination fabric	13	5. 9	1180	672	56. 9

Table 8: White Oak Mulch Trial.
*Two rows not included in results because different seedlot/poor quality seed
**assumes 200 white oak acorns/quart

Biochar Trials

During fall 2022 sowing, several test plots were established where biochar was applied pre-plant to a variety of species. This char was made on-site from nursery brush piles by Brian Zweifel of the DNR Forest Products Team. These plots are also being monitored by Joanne Tirocke of the US Forest Service, Rocky Mountain Research Station, who flew in from Idaho to install monitoring instruments. Her study has been hampered by the nursery's local fox population, which seems to think her instruments are their own personal chew toys. However, some equipment has survived the curious canines, and her data collection is ongoing, with plans to analyze and publish a formal paper sometime in the future. Samples of hazelnut and silky dogwood were collected during the 2023 fall lifting season. Samples of the remaining study species (black walnut, white oak, red pine, white pine) will be collected during spring 2025 lifting season.

Planning is in progress to install future biochar test plots, either in spring 2025 or during the fall 2025 planting season.

Other Trials

Two other university studies are currently underway at the nursery. Both studies are in the early stages but should eventually be the subject of published research papers. The first study involves the relationship between soil pH and nursery pathogens, particularly Fusarium spp. It is under the direction Dr. Nick Balster, Professor of Soil Science at the University of Wisconsin – Madison, Department of Soil Science. The second study is taking place in several different midwestern nurseries, including Wilson State Nursery. It studies the microbial associations that tree seedlings develop in nurseries, and how well these microbes serve the trees after out-planting. It also plans to subject the nursery seedbed to various environmental stressors to see how the microbial population responds. That study is being led by Dr. Richard Lankau and Dr. Cassandra Allsup, of the University of Wisconsin – Madison, Department of Plant Pathology. Both studies should yield valuable insights on how we can improve our growing operations at the nursery, leading to better seedlings for our customers. Results will be shared as they become available.

Photo credit: Wisconsin DNR

Seedling Health And Monthly Nursery Walks

Nursery staff once again teamed up with DNR Forest Health staff for monthly nursery walks. This practice began in 2021 and has become a regular monthly occurrence during the nursery growing season. These walks help to familiarize Forest Health staff with the day-to-day operations of the nursery, allowing them to make more informed decisions when the inevitable seedling health issues come up. The nursery gains the observations and insights of professional pathologists, who may notice seedling health issues that nursery staff have overlooked. Scheduling a 3-4 hour block of time once per month for a thorough walking tour of the nursery beds is a far more reliable way of finding and fixing problems than simply waiting until someone notices something amiss.

Overall, seedling health was excellent in 2024, although there were some serious exceptions. Germination of the small-seeded shrubs was horrible, with no definitive reason to explain it. Birds and flooding caused serious losses to some species. 2024's cool, foggy and rainy weather was perfect for transmitting leaf blights and other diseases, and the wet weather made it difficult to apply preventive fungicides on a regular schedule. Leaf blights caused some stunting in the shrubs that did manage to germinate, as well as some moderately serious defoliation and stunting in the black cherry beds, despite regular fungicide applications. The beautiful stand of choke cherry that germinated in April was completely defoliated by mid-summer, despite our best efforts to control it with regular fungicide applications. It should survive and re-flush next spring, but the entire crop will need to be grown another season and be sold as 2-0 seedlings. By mid-summer, we were also seeing signs of downy mildew in the highbush cranberry, and powdery mildew in the white and bur oaks. Downy mildew is a very aggressive disease spread by water splash, and it was treated immediately. Powdery mildew is a common occurrence on seedlings within the white oak family, but this observation was worrisome due to it showing up in June, weeks earlier than normal. It was monitored closely, but never progressed to the point of warranting a fungicide application. Potato leaf hopper is a perennially serious pest of oak seedlings that migrates in from the southern states, riding spring storm fronts. Their feeding on tender new oak shoots causes stunting and deformed growth. With the mild winter and early spring, this pest showed up weeks earlier than normal. It did cause some stunting in the 1-0 oak, maple and hackberry beds, but luckily it never developed into a major problem. The wet weather likely kept the population in check. We were able to avoid spraying insecticides until much later in the summer, when the weather became drier and the leafhopper population grew fast enough to overwhelm its natural predators.

Historically, one of the nursery's biggest disease problems is infection by conifer tip blight, *Diplodia pinea*. This serious red pine disease is common throughout the state, but it can be especially troublesome under crowded nursery conditions. Seedlings infected in the nursery can appear healthy, but they are at increased risk of dying when exposed to drought stress after out-planting. Red pine nursery stock is monitored annually under a strict sampling protocol, to ensure that stock being distributed to customers is not infected or asymptomatic. The disease spreads primarily through water droplets during the driving rain of summer storm events, when spores from infected trees can be picked up and carried much further than a simple raindrop splash. The frequent rains and foggy, humid weather of 2024 provided perfect infection conditions and disrupted fungicide schedules. Despite this, 2024 once again had some of the lowest detected incidences of diplodia since the state forest health lab started testing for asymptomatic infection in 2009. Due to the continued low incidence of infection, and the heavy workload for the Forest Health Lab to process all these samples, the decision was made to cease with testing of 1-0 red pine seedlings.

Nursery

2024 Asymptomatic Diplodia Sampling Results		
Age Class	Positive samples	% positive
2-0 red pine	3 of 267	1. 1%
3-0 red pine	2 of 270	0. 7%

Table 9: 2024 Asymptomatic Diplodia Sampling Results

Another disease that the Forest Health Team tests for annually is eastern pine gall rust Cronartium quercuum. A diverse, random sample of 1000 seedlings each of 1-0 and 2-0 jack pine are given a thorough visual inspection for the presence of stem galls or any suspicious swollen areas. Suspicious trees are then grown out in pots to see if galls develop. This disease typically has a very low incidence in Wilson Nursery, but stock is on a preventative fungicide schedule, nonetheless, and tested annually to assure that stock we are shipping is disease free. 2024 samples were a little short of the desired 1000 seedlings, but testing revealed no gall rust in the 1-0 jack pine (783 seedlings examined), and only two of 859 2-0 jack pine were found to have galls, for an infection rate of 0. 2%. Most 2-0 jack pine is sold as graded stock. Graders are instructed to watch for stem galls and cull all suspicious seedlings. A few may slip through, but the infection rate of graded stock leaving the nursery is probably far lower than the 0. 2% found in the sample inspected.

Pestalotiopsis infections in the white pine beds continues to be an area of concern for the nursery. 2024 was the second year since implementing a prophylactic fungicide regime for all white pine beds. They are now on the same every 10-14 day fungicide schedule as the red pine's diplodia protocol. The new protocol seems to be working, as for the second year in a row there does not appear to be any of the yellow and brown root rot pockets characteristic of Pestalotiopsis, despite the wet summer.

Fumigation And Fall Sowing

Planting acreage was up slightly in 2024 with 15 acres prepped for sowing and fumigated in August. The weather cooperated nicely, and fumigation was wrapped up in two days. Pre-fumigation prep work included the addition once again of 400 lbs/ac of Sulfur 90, to help with the nursery's rising pH rates. It also included the addition of 20-75 yards/acre of sedge peat, based on soil testing data, in an attempt to further lower pH and reach a minimum 2% soil organic matter. Maintaining organic matter in the nursery's light sandy soil is always a challenge. The fields were then subsoiled to a depth of 24 inches and moldboard plowed to incorporate the cover crop, peat, and sulfur. Late July was hot and dry, unlike the spring, so the bare fields were also irrigated to keep the soil microbes from going dormant. Most pine ground (2. 0 acres) was treated with straight chloropicrin (Tri-Pic 100) at 175 lbs/acre. The other 13 acres of prepped ground were treated with a 67% methyl bromide/33% chloropicrin mixture (MBC-33) at a rate of 300 lbs/ac. All beds were left tarped for two weeks after fumigation, and then the plastic covers were removed.

Fall sowing began on Sept. 26, with black cherry being the first seed sown. In the past, we have observed erratic germination of late planted cherry. Literature suggests that stored cherry seeds need a 40-60 days warm stratification period prior to freeze-up in order to properly break dormancy. Frozen ground conditions vary from year to year, but seldom occur in southern Wisconsin prior to the Thanksgiving holiday, so sowing in late September while the ground is still relatively warm gives the cherry seed plenty of warm stratification time ahead of winter. The data is far from conclusive, but making black cherry the first species sown in the fall is an easy operational change to make. More years of data are needed to see if this truly helps, or if the erratic germination is simply a product of the usual winter issues of wind erosion, frost heave, and highly variable freeze-thaw cycles.

Black Cherry Bed Density Relative To Sowing Date		
Year sown	Avg. trees/ft2 at June inventory	Date sown
2013	16. 0	Oct. 11
2014	15. 5	Oct.7
2015	11. 0	Oct.9
2016	12. 1	Oct.7
2017	3. 0	Oct. 24
2018	5. 5	Oct.19
2019	3. 2	Oct.16
2020	2. 7	Oct.15
2021	13. 7	Oct.12
2022	7. 2	Sept. 27
2023	19. 4*	Sept.28

Table 10: Black Cherry Bed Density Relative To Sowing Date
* Good snow cover and no frozen soil entire winter

Planting season continued through October, wrapping up on Oct.23 with the sowing of the jack pine beds. Jack pine does not require any stratification period to germinate, so it is important to delay planting as late as possible. If sown too early there is a risk of fall germination, and seedlings germinated in the fall are unlikely to survive the winter.

More than four-and-a-half acres of fumigated ground remain available for spring sowing. Just under three acres of that total are beds intentionally set aside for spring sowing. The rest of the vacant ground is the result of empty white oak and swamp white oak beds, due to the incredibly poor 2024 mast crop. Any fumigated blocks still unplanted after spring sowing will be sown to a cover crop and monitored over the summer to keep the fields as weed free as possible, so that it can be used as hardwood beds in the fall of 2025.

Fall Lifting And Grading

Seeding operations wrapped up on Wednesday, Oct. 23. That left the nursery crew one week to clean up, put away equipment and prepare for fall lifting, scheduled to begin on Monday, Nov. 4. Forecasts for the first week of November were for cold and rainy weather, so the nursery crew began lifting shrubs and some of the small lots of hardwoods on Oct. 29, so that we would have some trees in the cooler to grade in case the weather was too poor to

lift trees when our contract crew from Champion Forestry arrived Monday. Three days of lifting with our small nursery crew resulted in 64,000 trees in the cooler, enough for one day of grading. The forecasted wet and freezing weather arrived, and delayed the arrival of our Champion crew until Friday, November 8, when they were able to get a full day of lifting accomplished. The crew finished on November 26, the day before Thanksgiving. The final tally for the fall lift was 667,000 trees lifted, and 654,000 graded. The discrepancy in the numbers is due to the lift number being based on the fall inventory, which are estimates, and the grade number being an actual hard count of saleable seedlings. These discrepancies are normal, and the nursery management typically holds back a 10-20% buffer from the inventory when offering stock for sale. One of the biggest advantages of fall lifting and grading is that it allows us to test the inventory to see which species are grading long or short and make the necessary inventory adjustments early in the selling season. In all, 36 species/age classes were sampled this fall, with some of the smaller lots being graded in their entirety. That's 36 inventory items that can now be adjusted to reduce the likelihood of over-selling and having to cancel or substitute orders, or having to destroy unexpected surpluses at the end of the distribution season rather than getting those trees into customers' hands.

Photo credit: Wisconsin DNR

Seed Collection

Seed Production And Collection

The reforestation team had a projected annual need of $294,652.00 for seed purchasing in the 2024 collection season. Of this, $106,376.00 or 36.1% was spent on seed purchases. Seed was acquired from a total of 197 individuals or organizations. Emphasis was placed on collections of both red pine and white pine cones in 2024. These two species are produced in high volume at the Wilson State Nursery making them of high importance to the reforestation team. Prior to the Fall 2024 seed collection season, the reforestation team had 373.41 pounds of red pine seed in storage, or a three year supply, and 893.54 pounds of white pine seed in storage, or a four year supply. The reforestation team aims to keep an eight year minimum supply of conifer seed on hand for most coniferous species. This allows the team to cope with the effects of supply disruptions such as poor cone production years.

To meet storage needs for both red pine and white pine, the reforestation team set quotas for collecting and purchasing seed for both species. The red pine quota was set at 670 bushels and the white pine quota was set at 1000 bushels. Quotas for seed collection are based on projections that take into account seed per bushel yields, direct seeding demands and seedling production demands. Neither species came close to their respective quotas with both species having down years in cone production and cone quality.

Red Pine public collection totaled at 159.5 bushels producing 66.5 pounds of processed seed. These totals were down drastically from last year, which saw 452 bushels of red pine cones purchased from the public, processing out to 360 pounds of cleaned seed. Not only were collections down, but per bushel yield of seed also dropped. The 2023 collection season saw yields exceeding 0.8 lbs/BU of seed acquired after processing, while this number dropped by nearly half with 0.41 lbs/BU of yield realized in 2024. Through observations throughout the seed collection season, one potential culprit for lowered seed amounts and yield could be pest pressures. Visual observations showed large numbers of cones experiencing pest damage causing them to prematurely open with increased seed mortality inside. Hot and dry conditions during the peak of red pine cone collections also potentially played a role in early opening of cones. Regardless of cause, both overall collection volume and yield dropped significantly in comparison to the previous year. On a high note, collections from the Hayward Nursery Red Pine Orchard more than tripled from last year, with 35.3 bushels of cones collected processing out to 13.82 pounds of seed. Cone production within the orchard has been increasing since the Orchard's establishment in 2014, seed acquired from this orchard is considered of "improved" genetics based on selections for tree growth and form.

White pine collections were also down, with only 35.2 bushels being collected statewide or 3.5% of the quota. Verbal reports from seed collectors, indicated that white pine cones did not exist across the landscape. This was surprising, as visual inventories in the spring of 2024 found large numbers of second year cones across northern parts of the state. White pine cones take two years to develop, with pollination of female cones from male cones occurring in spring of the first year and further development into mature full size cones occurring in the second year. Visual estimates of second year cones during the spring and summer can provide a good indicator of the cone crop to be. In some cases, though, mass cone failure can occur from predation or other causes negating the usefulness of past estimates. Regardless of cause, white pine seed collection was down and this will put pressure on the reforestation team's ability to provide a continuous supply of white pine seedlings and fill direct seed orders. Emphasis will need to be put on cone collection for the species until supplies in storage become sufficient.

Photo credit: Wisconsin DNR

Other conifer species had strong cone production and collection success this year with most species having met or exceeded quotas. The stand-out was eastern hemlock. This is a species that is normally a struggle to acquire. In 2024, 24.66 bushels of cones were purchased by the reforestation team, or 112.1% of the established goal. After processing, 51.22 pounds of seed was placed in storage, this is 51 year supply at current demand. Raising the purchase price from $500/BU to $1000/BU, along with a solid outreach campaign, and a good cone crop are likely factors that contributed to this collection success. This recipe has worked in the past and warrants continued utilization by the reforestation team.

Oak collections in 2024 came with varied results. Northern red oak and bur oak both met collection goals with 45 bushels and 80 bushels purchased respectively. White oak and swamp white oak both experienced down years. White oak only saw four bushels collected statewide, meeting only 2.7% of the set goal. Swamp white oak had 15.9 bushels collected throughout the state, accounting for only 15.1% of the established goal. For a complete breakdown of seed purchasing statewide, refer to Table1on the next page.

Conifer And Hardwood Seed Collection 2024					
Species	Nursery Goals (bu/lbs.)	Direct Seeding Needs (bu/lbs.)	Total Needs (bu/lbs.)	Purchases	Surplus/Deficit
Balsam Fir	16.0	0.0	16.0	16.3	0.3
Eastern Hemlock	22.0	0.0	22.0	24.66	2.7
Jack Pine	714.0	288.0	1002.0	464.6	-537.4
Red Pine	670.0	0.00	670.0	159.5	-510.5
White Pine	1000.0	0.0	1000.0	35.2	-964.8
Black Spruce	10.0	0.0	10.0	6.2	-3.8
White Spruce	10.0	0.0	10.0	25.6	15.6
Tamarack	40.0	0.0	40.0	2.5	-37.5
Quaking Aspen	1.0	0.0	1.0	11.92	10.9
Bigtooth Aspen	1.0	0.0	1.0	8.75	7.8
American Basswood	31.0	0.0	31.0	16.5	-14.5
River Birch	0.0	0.0	0.0	0.1	0.1
Butternut	35.0	0.0	35.0	43.5	8.5
Black Cherry	265.0	0.0	265.0	172.5	-92.5
American Elm	5.0	0.0	5.0	0.6	-4.44
Bitternut Hickory	19.0	0.3	19.3	30.5	11.2
Hackberry	110.0	0.0	110.0	0.0	-110.0
Shagbark Hickory	0.0	6.7	6.7	7.1	0.4
Hard Maple	60.0	0.0	60.0	15.7	-44.3
Red Maple	20.0	0.0	20.0	0.0	-20.0
Silver Maple	12.0	0.0	12.0	15.0	3.0
Bur Oak	80.0	25.0	105.0	97.5	-7.5
Southern Pin Oak	7.0	0.0	7.0	1.0	-6.0
Red Oak	45.0	37.5	82.5	87.4	4.9
Swamp White Oak	105.0	0.0	105.0	15.9	-89.1
White Oak	150.0	8.0	158.0	4.0	-154.0
Balsam Poplar	1.0	0.0	1.0	0.0	-1.0
Sycamore	0.0	0.0	0.0	0.7	0.7
Black Walnut	732.0	264.0	996.0	1006.5	10.5
Choke Cherry	105.0	0.0	105.0	0.0	-105.0
Grey Dogwood	12.0	0.0	12.0	6.1	-5.9
Red Osier Dogwood	112.0	0.0	112.0	2.6	-109.4
American Hazelnut	90.0	0.0	90.0	63.1	-26.9
Highbush Cranberry	300.0	0.0	300.0	312.2	12.2
Hawthorne	10.0	0.0	10.0	2.1	-7.9
Juneberry	7.0	0.0	7.0	8.0	1.0
Ninebark	6.0	0.0	6.0	4.3	-1.8
Nannyberry	0.0	0.0	0.0	2.2	2.2
American Plum	45.0	0.0	45.0	0.0	-45.0

Table 11: Showing nursery purchasing goals, direct seed needs, seed purchases, and surplus/deficit by each species in 2024.

Seed

Other highlights of the 2024 seed collection season include two successful large-scale orchard collections of improved seed. The first occurred at the Sawyer Creek White Spruce Orchard located in Washburn County, WI. Here, 78 bushels of white spruce cones were collected producing 43.98 pounds of seed for the reforestation program. This equates to a 3.52 year supply and brings the total amount of improved white spruce seed in storage to 14.95 years. Jack pine seed was also collected from the Greenwood Jack Pine Orchard located in Waushara County, WI. This collection effort attained 62 bushels of cones which produced 16.72 pounds of seed. That is an estimated 1.11 year supply of improved jack pine seed bringing the total improved seed in storage to 4.02 years.

Outside of seed collection efforts, the reforestation program also began a pilot project at the Hayward Nursery in 2023 looking into red pine cone and seed ripening. The objective was to determine the earliest date at which cones can be collected, while still being able to open using traditional processing methods and producing a viable seed with acceptable germination rates. The first year's data yielded potentially important results. Findings show that germination rates prior to September averaged 2.0% while those after September averaged 45.9%. There was a steep jump in germination rate in just a two week period with germination rate being 0% on cones collected on Aug. 22, 2023 and a germination rate of 44.2% for cones collected on Sept. 6, 2023.

Photo credit: Wisconsin DNR

These findings are preliminary and sample sizes are small, so no definitive answers have yet been determined. Additional collections were made in fall 2024 from both the Hayward Nursery Red Pine Orchard and red pine found at the Griffith Nursery. This data will be invaluable in guiding seed picking efforts regionally, by providing a better time frame for when collection efforts can begin. Future plans are to continue red pine collections during cone picking season and to expand this effort to other species like jack pine and white pine to better calibrate timing of our collection efforts.

Seed Sales

The reforestation team accommodates the sale and distribution of "surplus" seed in the form of direct seed sales to state forests, state wildlife/fisheries areas, county forests, private landowners, private nurseries and research institutions annually. The determination of what is considered "surplus" seed is based on target goals set for storage to insure a consistent supply of seed for growing seedlings at the Wilson State Nursery. If storage goals are not met for a given species, direct seed sales are not made available. The reforestation team filled $44,129.50 in direct seed orders in 2024. Species making up the largest proportion of orders were red oak (40.5 bushels), bur oak (25 bushels), and jack pine (118.8 lbs. of cleaned seed). Regional private nurseries continue to establish themselves as a new type of purchaser for the reforestation team's surplus seed. A total of 2 BU of shagbark hickory, 1 BU of bitternut hickory, 6 BU of bur oak acorns, 3 BU of red oak acorns, and 2 lbs. of white birch seed were sold and distributed to private nurseries located in Wisconsin and Michigan's Upper Peninsula. Multiple orders to private nurseries were also unable to be filled due to poor acorn crops and limited seed on hand in storage for the reforestation team.

Private hardwood direct seed orders remained consistent when compared to last year. Multiple orders required either substitutes, partial declines, or full declines. Oak acorn production this year was moderate to poor depending on species and region. White oak had a nearly non-existent acorn crop statewide resulting in the reforestation team having to substitute orders or decline them in full. For the most part, orders of red oak and bur oak were filled, with some small substitutions of species needed in a couple of cases. Both shagbark hickory and bitternut hickory had sufficient nut production allowing these orders to be filled when received.

The reforestation team also provided maple and basswood seed to one research project in 2024. The study, being conducted by the University of Tennessee-Knoxville, is trying to understand the interactions among different mycorrhizal fungi communities and genetically distinct populations of their host species. The goal is to determine how this effects the extent to which plant populations can establish outside of their native range and how this may impact assisted migration. Seed was also sent the previous year, but fridge malfunctions caused the sprouts needed for the study to freeze and die.

Personnel Changes And Facility Improvements

The Hayward State Nursery, the primary location for seed collection and cleaning efforts, experienced a number of changes in 2024. First, James Gadicke was hired in June of 2024 as an LTE Forestry/Maintenance Technician. Gadicke was able to shadow and learn from Stanley Klais, the previous Technician who retired after 25 years of work at the Hayward Nursery in December of 2024. Klais was an asset to the facility and was able to train Gadicke in the variety of daily tasks that are required to operate and maintain the seed production facilities at the Hayward Nursery.

Another new hire was also made to replace Domingo Aguilera, the Forestry Technician/Lead Forman at the Hayward Nursery who retired in 2023. Melissa Prieve was hired in August of 2024 as the Forestry Technician/Lead Forman in a project position. Prieve will take over primary operations of the Seed Extractory and be the lead on all maintenance activities occurring at the Hayward Nursery. She was also able to benefit from the knowledge of Klais which eased the transition and will allow for efficient operations.

Finally, the reforestation team has continued to work towards creation of the new Seed Extractory and Lab at the Hayward State Nursery. Funding has been secured for the project and work with Civil Engineers continues. Joe Vande Hey and Richard Nesslar have begun to research and acquire seed cleaning equipment for the new facility. Work will persist on this project and the hope is to have the facility operational by Fall of 2026. Updates will be included as they come and will be reflected in next year's annual report.

Tree Improvement Program

2024 Highlights

The Wisconsin Tree Improvement Program (TIP) successfully accomplished most goals stated in the 2024 Work Plan. These include successful cone harvests at three TIP seed orchards and completion of two management projects that had been goals for several years.

Highlights for 2025 are as follows:

•Harvesting cones at the Greenwood jack pine, the Sawyer Creek white spruce, and the Hayward State Nursery jack pine and red pine seed orchards.

•Measuring first and second-year growth at the Clark County and Munz Ln. (Grant County) white oak progeny tests.

•Measuring and recording the heights and growth characteristics of red pine at Hayward State Nursery.

•Assisting USFS personnel with canker incidence evaluations in the Bell Center butternut canker trial.

•Completing the roguing of the red and white pine seed orchards at Lake Tomahawk.

•Finish clearing the downed tree trunks from the 2021 roguing operation at the Sawyer Creek white spruce orchard.

•Planning and preparing for future grafting and seedling production facilities.

•Completing the contracted repair work on the Nevin Fish Hatchery greenhouse.

•Applying herbicide treatments to the Munz Ln. (Grant County) and Clark County white oak progeny tests.

•Applying insecticide treatments to the red and jack pine orchards at Hayward State Nursery and to the jack pine orchard at Black River Falls.

•Mowing and other maintenance work, especially at Munz Ln., Greenwood, Bell Center and Ten Mile.

These highlights are described more thoroughly in the following report. The 2025 TIP Work Plan further details specific 2024 accomplishments and 2025 goals for each of the actively managed tree improvement orchards.

Cone Harvests In 2024

Cone harvests were conducted at four of the Tree Improvement orchards in 2024: the Greenwood jack pine orchard, the Sawyer Creek white spruce orchard and the red pine and jack pine orchards at Hayward State Nursery. Each required its own methods and timing for collecting cones, but ultimately the harvests were successful in providing needed inventory of improved seed for each species.

Greenwood Jack Pine Cone Harvest

The Greenwood orchard is the only jack pine planting specifically designated as a seed orchard, using controlled crosses of parent trees from previous breeding population plantings and the Hancock 1st generation index population. It is aging as a productive seed orchard and has been rogued to final orchard spacing. The last previous cone harvest here was in 2020.

The Lower Wisconsin River and the Mississippi River meet at Wyalusing State Park as seen from the Munz Ln. white oak progeny test. Photo Credit: Wisconsin DNR

Improvement

The reforestation team visited Greenwood during its 2024 Tour of Wisconsin and observed that the cone set here was very good, so a plan was made to conduct a harvest here. The first part of the process was site prep to allow easy access to the trees. During the second half of July, the team of Tess Sautter, Ian Walton and Chris Huesemann from Griffith Nursery worked to cut out low-lying dead limbs and remove them from the orchard along with other down branches and trunk pieces. Stuart Seaborne mowed within the entire orchard with the DR mower, while Sautter mowed the perimeter with a tractor brush-hog. This preparation greatly helped with the actual harvesting process.

The harvest consisted of two stages. First, the main central limb was cut out of each jack pine tree selected for cone collection using a pole chainsaw. Once the limb was on the ground, then the secondary branches which had cones on them were cut off with a lopper or chainsaw. These were put in a pile for snipping the cones off, and the remaining limb and branch material was piled up in separate mounds. This work happened the week of Aug. 19-23, 2024.

The second part involved the hiring of a contract crew to process the piles of branches by using hand snips to remove the cones. These were collected into buckets, measured out into bushel amounts, and bagged for transport and processing. This work was completed the week of Aug. 26-30, 2024.

There are always lessons to be learned conducting a cone harvest. One observation this year was that cutting the branches from the trees and letting them sit even a few days in the heat before being collected by the crew allowed some of the cones to open, leading to more potential for seed loss during handling. It might be better to have crews come in more quickly once limbs are being cut out of the trees, with less processing of the limbs beforehand.

Richard Nesslar measuring Munz Ln. white oak in November 2024. Photo Credit: Stuart Seaborne

In total, 62 bushels of jack pine cones were harvested during the operation. After processing, 16.72 lbs. of clean seed was acquired, providing a yield of 0.27 lbs. of seed per bushel of cones.

Sawyer Creek White Spruce Cone Harvest

The white spruce orchard at Sawyer Creek, planted in 1989, was one of the stops on the Reforestation Team's Tour of Wisconsin on July 2, 2024. It was readily apparent that there was significant cone production in the orchard warranting a harvest, but it was also clear there was much work to prepare the site before that could happen. That work is described separately later in this report.

There were two objectives for the harvest. One was to collect cones from trees that were the top two (by 2003 height) remaining representatives from each of their respective families. Seed from these cones will preserve genetics from these families and can be used to propagate seedlings with known origins for use in future seed orchards. The second purpose was to collect seed for general nursery use and increase inventory of improved white spruce seed.

The actual cone harvest was done using an aerial lift on the dates Aug. 12-23, 2024. Stan Klais and James Gadicke were in the bucket cutting off the cone-bearing branches, while Richard Nesslar or Scott O'Donnell bagged branches by family from trees identified for that purpose. It is not an easy process to maneuver an aerial lift through a stand of 50'+ trees and access the desired branches, and having to collect from specific trees and bag those branches individually adds another layer of challenge to the whole affair.

Cones were collected from 134 different trees at Sawyer Creek to be stored for future orchard use. In addition to that, approximately 78 bushels of cones were collected for the nursery system, which after processing provided 44 lbs. of clean seed at a 1.12 lb. of clean seed per bushel of cones rate. This translates to about a 3.5-year supply of seed for the nursery.

Hayward Red Pine Cone Harvest

The red pine seed orchard at Hayward State Nursery was planted in 2014 at orchard spacing, and cones have been collected here since 2022. Klais, Gadicke, and Missy Prieve collected cones in the orchard as time allowed from Sept.19-27, 2024. 35.4 bushes of cones were collected yielding 13.82 lb. of seed, at a .39 lb/bu. rate.

Hayward Jack Pine Cone Harvest

The Hayward State Nursery jack pine seed orchard and 3rd generation breeding population was planted in 2014 at progeny test spacing. The trees have been rogued to under 25% of the original trees planted. In 2024, cones were collected by Klais, Gadicke and Prieve in the second and third weeks of September. 2.5 bushels were collected yielding 1.76 lb. of seed, which is .7 lb./bu.

Height Measurements For White Oak at Munz Ln. and Clark County

The white oak progeny tests at Munz Ln. in Grant County and Clark County were measured for first-year growth in early spring and second-year growth in fall of 2024. Both sites provide very different environments. Munz Ln. in southwestern Wisconsin is a dry exposed ridge top previously covered in prairie and weedy wildflowers, while Clark County in central Wisconsin is on the Clark

County Forest and was previously wooded with many remaining stumps and wetter soils.

The two five acre progeny test sites were planted in 2023 with bareroot seedlings propagated in Kentucky at the Morgan County Nursery. The DNR is collaborating with the White Oak Genetics and Tree Improvement Program (WOGTIP) led by Dr. Laura DeWald, tree improvement specialist in the Dept. of Forestry and Natural Resources at the University of Kentucky. The WOGTIP is a partner in the White Oak Initiative along with the bourbon industry.

It was necessary to record first-year heights and survival in the early spring before the buds broke and new growth began. O'Donnell and Seaborne measured the white oak at Munz Ln. on February 14 and 22, 2024, and the white oak at Clark County on April 9-10, 2024.

Second-year growth of the white oak seedlings was measured at Clark County on October 29-30, 2024 by O'Donnell and Nesslar. Nesslar and Seaborne measured the white oak at Munz Ln. on November 12-13, 2024.

Survival rate between the two sites varied greatly. Munz Ln. has a high survival rate, with 1300 out of 1426 (91%) trial trees planted still alive. The Clark County white oak saplings have suffered a much higher mortality rate, with 843 out of 1426 (59%) surviving as of October, 2024. The discrepancy between Munz Ln. and Clark County are likely due to several stress factors at Clark County, including a late freeze, an outbreak of weevils that chewed on leaves in 2023, competition from stump regrowth, and evidence of poorly drained areas throughout the site.

Height Measurements For Hayward Red Pine Orchard

The red pine seed orchard at Hayward State Nursery was planted in 2014 at orchard spacing. The trees here include six selections from each of 155 families at the older Avoca (now removed), Lake Tomahawk and Ten Mile Creek orchards. The initial measurement of the red pine at Hayward was in 2019. After five years, it was time in 2024 to again measure the trees.

Scott O'Donnell, Nick LaBonte and Paul Berang evaluating the butternut canker trial at Bell Center on April 30, 2024. Photo Credit: Stuart Seaborne.

Heights of the red pine trees were measured and recorded on May 6-7, 2024 by Seaborne, Klais and Nesslar. Double trunks and forked tops were also noted. Data collection for height and other characteristics at five-year intervals ensures that differences between individual trees and families are captured, and that the best performing individuals and families are identified.

Evaluation of Canker Incidence In Bell Center Butternut Canker Trial

The five acre butternut canker trial at Bell Center was planted in 2019 as a collaboration between the USFS, the Hardwood Tree Improvement and Regeneration Center at Purdue and the Wisconsin Reforestation Program. The families being evaluated there are a mix of native butternut (*Juglans cinerea)* and non-native butternut varieties. A total of 3000 butternut trees representing 40 families plus sacrificial trees used for inoculation purposes were planted.

On April 30 and May 1, the trial was evaluated for canker incidence and height by Nick LaBonte (USFS Regional Geneticist) and James Jacobs (USFS Forest Pathologist), with assistance from Paul Berang (retired USFS geneticist), O'Donnell (WDNR Forest Geneticist/ Ecologist) and Seaborne (UW-Madison Research Specialist). LaBonte analyzed the data collected and provided a summary of the results comparing canker occurrence between the 2022 and 2024 evaluations, which he gave permission to share.

The incidence of naturally occurring cankers overall increased between 2022 and 2024. In 2022, about 21% of the trees had at least one canker, while in 2024 that number jumped to 34%. The presence of basal stem cankers also increased in those two years from 8% to 16%.

The hybrid butternut families that have non-native genetics show substantially fewer cankers present than the native types being trialed. The four hybrid families ranged from 4-9% of the trees having cankers, while only two of the 35 native families had an infection rate lower than 20%. Table 12 lists the families of trees being trialed from highest percentage of trees cankered to lowest.

This trial was designed to have every third row planted in butternut trees acting as sacrificial hosts for the disease, ensuring even exposure to the fungal infection throughout the planting. A team including LaBonte and other USFS personnel inoculated trees in these rows in August, 2024. The first evaluation after this inoculation will be in the fall of 2025.

Lake Tomahawk Red And White Pine Orchards Rogued At Last

The red and white pine orchards at Lake Tomahawk had both been marked for roguing since 2021, so it was a relief to finally have a timber sale arranged that would include selectively cutting out the trees marked in each orchard.

The red pine orchard was planted in 1970 and contains mature trees that have value as lumber. 287 trees were marked for removal to open the crown spacing for better cone production, and to cut around an area of observed pocket decline. On March 19-25, 2024 these trees were harvested, creating the desired orchard spacing. The remaining branch material and log sections left after

Improvement

Fam	hyb?	origin	trees	alive	trees w/ cankers	total # cankers	total # basal cankers	avg. ht.	% w/ cankers	# w/ basal cankers	% w/ basal cankers
19-35	no	Milwaukee WI	36	33	21	52	13	2.62	0.64	11	0.33
19-47	no	unk Ostry collection	53	52	30	88	23	2.41	0.58	14	0.27
19-3	no	Walworth WI	42	35	20	36	19	2.51	0.57	14	0.4
19-34	no	Milwaukee WI	30	20	11	17	6	2.66	0.55	6	0.3
19-28	no	Arlington WI	51	51	27	70	14	2.22	0.53	13	0.25
19-5	no	Cass MI	41	38	20	54	11	2.63	0.53	10	0.26
19-14	no	Martin IN	56	54	28	87	15	2.43	0.52	11	0.2
19-12	no	Jessamine KY	43	42	21	49	10	2.63	0.5	9	0.21
19-7	no	Wayne OH	37	37	18	38	10	2.49	0.49	10	0.27
19-38	no	unknown WA	47	47	22	54	12	2.31	0.47	12	0.26
19-51	(?)	NC	48	47	22	70	24	2.3	0.47	15	0.32
19-16	no	Gloester OH	37	37	17	34	6	2.51	0.46	6	0.16
19-17	no	Morgan IN	57	56	25	47	10	2.46	0.45	8	0.14
19-20	no	Southeast OH	60	60	26	57	19	2.36	0.43	12	0.2
19-10	no	Bracken KY	58	58	24	65	10	2.41	0.41	8	0.14
19-23	no	Vinton OH	54	54	22	54	16	2.57	0.41	13	0.24
19-13	no	Trimble KY	57	57	23	37	5	2.24	0.4	5	0.09
19-6	no	WV near OH	43	43	16	31	12	2.53	0.37	10	0.23
19-25	no	Lawrence IN	52	52	18	41	11	2.34	0.35	8	0.15
19-15	no	Vinton OH	54	52	18	29	8	2.22	0.35	6	0.12
19-9	no	Ross OH	51	50	17	26	11	2.41	0.34	10	0.2
19-26	no	Martin IN	52	50	17	35	7	2.55	0.34	7	0.14
19-24	no	Lawrence IN	53	53	18	21	4	2.52	0.34	3	0.06
19-45	no	Arlington WI	53	53	18	38	21	2.51	0.34	14	0.26
19-18	no	Hoosier IN	57	56	18	22	12	2.33	0.32	11	0.2
19-19	no	Zaleski OH	52	53	16	20	9	2.56	0.3	8	0.15
19-1	no	Walworth WI	42	42	12	20	8	2.39	0.29	5	0.12
19-22	no	Hoosier OH	56	56	15	30	9	2.38	0.27	7	0.13
19-8	no	Vinton OH	45	45	12	20	6	2.59	0.27	5	0.11
19-36	no	unk Severeid	38	38	9	19	6	2.47	0.24	5	0.13
19-21	no	Gloester OH	52	51	12	18	7	2.48	0.24	7	0.14
19-11	no	Taylor KY	54	54	12	25	4	2.73	0.22	4	0.07
19-32	poss hybrid	near LaCrosse WI	39	39	8	8	5	2.61	0.21	5	0.13
19-37	no	Vernon WI	52	50	9	14	5	2.3	0.18	4	0.08
19-30	no	unk Rosemount	52	50	6	6	3	2.6	0.12	3	0.06
19-40	HYBRID	Marshall IN	54	54	5	6	3	2.43	0.09	3	0.06
19-39	HYBRID	Verna, MO	59	59	5	6	2	2.62	0.08	2	0.03
19-42	HYBRID	Steuben IN	53	52	4	4	2	2.55	0.08	2	0.04
19-41	HYBRID	Marshall IN	53	52	2	2	1	2.79	0.04	1	0.02

Table 12: Butternut Canker Trial Families Credit: Nick LaBonte.

the harvest will be cleared from areas within the orchard in 2025.

The white pine provenance test is a much younger planting, established in 2002. The orchard had been rogued in 2016 and 2017 using a forestry mulcher, and was again marked in 2021 to retain only one tree from each four row family plot/rep, and reduce the number of trees to less than 20% of what was planted originally. The marked trees were harvested on March 19-25, 2024, achieving a more optimal spacing for cone production. The white pine here are just beginning to produce cones, so the completion of this work comes at an excellent time. The program will continue to do preparation work in this orchard during 2025 by removing the lower dead branches on the remaining trees and using a forestry mulcher for the remaining branch material on the ground.

Sawyer Creek White Spruce

Removing downed trees and debris throughout the Sawyer Creek white spruce orchard became a priority in the summer of 2024 when an abundant cone crop was identified. This effort presented many challenges to complete. A roguing operation performed by a feller training class in 2021 left 455 dead trees lying throughout the orchard, making access even by foot almost impossible. The logs were finally cut up and removed from the orchard in the first two weeks of August, 2024. This enabled it to be mowed with a tractor brush-hog after several years without mowing. It also allowed for the subsequent August cone harvest that utilized an aerial lift, something which would not have been possible otherwise.

To complete this task, the staff from Hayward State Nursery plus a crew from Griffith State Nursery and Seaborne removed the log sections from within the orchard by hand. Chainsaw work was also necessary to cut up whole trees that remained. Grinding the logs using a chipper was tried initially, but the chipper struggled and continued to jam, so the rest of the logs were piled in areas around the perimeter of the site using a grappler attachment on a skidsteer instead.

It was a lot of manual labor and sustained effort to complete, but the pay-off was the ability to mow with the tractor brush-hog again. The buckthorn and brambles had become a serious concern in the understory, so the orchard was mowed in both directions prior to the cone harvest. It is a relief to again have the Sawyer Creek white spruce orchard accessible throughout for mowing, scion collection, and cone harvests.

O'Donnell has monumented a selection of trees which are priority individuals for grafting propagation and genetics preservation. Work to monument the trees here will continue in 2025.

Grafting And Greenhouse Projects

The Wisconsin Tree Improvement Program is in the process of reconfiguring its resources for grafting that will be used to replicate select trees for creating new seed orchards. Grafting will now be done at Hayward State Nursery, where facilities are being developed for that purpose. Prior to that, TIP has used the Forest Health greenhouse in Fitchburg for its grafting efforts. That greenhouse will now be used primarily for seedling propagation.

The Reforestation Team has begun work to setup two coolers at the Hayward State Nursery to become climate-controlled grafting chambers. Temperature and humidity need to remain constant to produce successful grafts, and the coolers are well insulated providing ideal conditions to do so. Repairs were made to the cooling units on both coolers in 2024. In 2025, the goal will be to purchase heaters and humidifying units to aid in regulation of temperature and humidity. Grafting work is scheduled to begin at Hayward Nursery in January, 2026.

White spruce remains the top priority for grafting work at present, and in late February, 2024 O'Donnell, Nesslar, and Seaborne collected scion wood at the Sawyer Creek white spruce orchard to use for practice grafting on some older leftover potted rootstock. Once the new grafting room and environmental controls are in place at Hayward, the work to expand the small grafted white spruce planting there will begin in earnest.

One excellent piece of news is that the repair work for the Forest Health greenhouse roof vent, shade cloth, and insect screens was finally completed after a lengthy process to finalize a successful contract. In late April, 2024, the Wisconsin Greenhouse Company received the purchase order to complete the needed repairs, which were completed in November, 2024. The greenhouse is now able to function correctly and be utilized for seedling production. The 4th generation jack pine progeny tests will be the top priority for growing seedlings in 2026.

The white oak progeny test at Munz Ln. on Oct. 5, 2024. Photo Credit: Stuart Seaborne.

Herbicide And Insecticide Applications

The white oak progeny tests at Munz Ln. and Clark County were planted in April, 2023, and the young seedlings are still easily overgrown by the surrounding volunteer growth. To reduce competition from these weeds and keep the seedlings visible to prevent being mowed over, control with use the of herbicides was deemed essential in 2024.

Improvement

In the Munz Ln. white oaks, Oust XP had been applied in November 2023, but follow up weed control was still needed. Fusilade DX was sprayed at a rate of 24 oz/acre over the top of the tree rows on July 12, 2024 by Roger Bohringer to control grasses. RoundUp ProMax was sprayed as a 1.5% solution on July 24-25, 2024 by Roger Bohringer targeting scattered woody weeds, mostly grape and poison ivy, spraying in a 1 ft. radius around the oak seedlings. RoundUp PowerMax 3 was used at the same rate for the last 5 rows to the east side plus the fence line as the RoundUp ProMax ran out.

In the Clark County white oaks, the Oust XP applied in November 2023 generally provided good weed control. However, there was some hardwood sprouting. These were cut off and Alligare Triclopyr 4 was applied as a 20% solution mixed with crop oil on cut hardwood stumps on June 19, 20, 26 and July 1, 2024 by Sautter, Thomas Hoover, Walton and Huessmann. Total herbicide used was 96 oz.

Root collar weevils have been a problem with red and jack pine plantings, so preventative maintenance and spraying has been a strategy in recent years. In thered pine orchard at Hayward State Nursery, previously pruned lower branches were removed from the orchard and the needles were raked past each tree's dripline in the spring of 2024. This reduced favorable habitat for the pine root collar weevils around the trees and improved contact potential for future chemical applications aimed at controlling the root collar weevils.

Pemethrin 3.2 EC at 1 qu/100 gal. was applied on the Hayward jack pine as a stem drench for root collar weevils by Nesslar on May 23, 2024. Nesslar and Klais performed the same treatment on the Hayward red pine orchard on May 29-30, 2024. Another application of Pemethrin at the same concentration was applied as a stem drench to the jack pine orchard by Nesslar on August 21, 2024. At the Black River Falls jack pine orchard, Asana XL was sprayed at 10.9 oz/100 gal. for root collar weevil by Roger Bohringer with Pat Hromadka driving tractor on August 21, 2024.

Mowing And Other Maintenance

Every site has unique maintenance needs depending on the age of the trees, the nature of the volunteer undergrowth, and work needed on the orchard trees to maintain optimal spacing and orchard access.

Mowing is needed most frequently in younger plantings, where the canopy has not yet closed in and shaded out more of the competing understory. This is true at the Munz Ln. white oak progeny test planting, where the young seedlings are still quickly outgrown by the surrounding vegetation. Mowing with the DR mower started in early June and continued throughout the growing season through October 15.

The Bell Center grafted red oak and black walnut orchard was mowed with the DR mower in late-May and again in late-October in 2024. The 5-acre butternut canker trial was mowed in the spring by Paul Berang, retired USFS geneticist and collaborator in the trial, and in August by Seaborne using the zero-turn mower from Wilson State Nursery. The butternut canker trial has also had lopping work done over the 2023-24 and 2024-25 winters to remove lower side-branches, making it easier to mow and to access the trees for cankers data collection.

The Greenwood jack pine seed orchard was mowed using the DR mower during the second half of July into early August in preparation for the late August cone harvest. Grasses and other herbaceous plants are thick and tall here, so mowing was an important first step in making a cone harvest possible.

The Ten Mile red pine orchard has a thick covering of volunteer oak as the dominant understory species, and regular management is necessary. The oak was sprayed with Remedy Ultra in 2020, but surviving clumps had resprouted and started to grow tall. Thomas Hoover from Griffith Nursery finished mowing the 15-acre orchard on June 27, 2024 using a tractor brush-hog.

The butternut canker trial at Bell Center in August 2024 and February 2025. Photo Credit: Stuart Seaborne

Annual Report 2024

WISCONSIN REFORESTATION PROGRAM

Photo: Credit Wisconsin DNR

WISCONSIN
DEPT. OF NATURAL RESOURCES

THE UNIVERSITY of WISCONSIN
MADISON