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IMPLEMENTATION

OF THE

WHITE PINE INITIATIVE

FY99 Report
to the
Minnesota Forest Resources Council

March 2000

Minnesota Department of Natural Resources
Division of Forestry

1997 Minn. Laws Chap. 216
Sec. 5

Table of Contents

I. Introduction

This report is prepared pursuant to the commitment made by DNR Commissioner, Rodney Sando, in his letter to the legislature on March 10, 1997. It states:

> **The DNR is committed to provide a report each year for annual review by the Forest Resources Council on progress in implementing the white pine report's recommendations involving DNR programs and DNR administered lands to the Minnesota Forest Resource Council for inclusion in their biennial report to the legislature.**

In addition, it was an agreement in the report of the White Pine Timber Management Planning Public Involvement Process Work Group of August 1997 to provide an annual report to the Forest Resources Council.

> **DNR provides report each year for Forest Resources Council review on progress in implementing the White Pine Regeneration Strategies Work Group Report recommendations involving DNR programs and DNR-administered lands.**

II. Background

For many reasons there are not as many white pine in Minnesota's forests as many people would like. Reasons include:

-Intensive harvesting for lumber from mid-1800s and early 1900s, followed by burning of slash and forest fires.
-Clearing of forest land for agricultural, urban, highway, utility, and other uses.
-Introduction of white pine blister rust disease from Europe in 1916.
-Increased deer populations that feed on white pine.
-Emphasis on managing other tree species because of insect, disease, and deer browsing problems in growing white pine.

Because of widespread concern about the white pine resource in Minnesota, a White Pine Regeneration Strategies Work Group was appointed in 1996 by the DNR to prepare a report to the Minnesota Forest Resources Council and the Department of Natural Resources. The Work Group's December 1996 report, *Minnesota's White Pine, Now and for the Future*, addressed:

-The status of Minnesota's white pine resource and its historical and current occurrence.
-Existing efforts at managing white pine.
-Research needs to address specific concerns about white pine.
-Recommended regeneration and management strategies to increase the role and presence of white pine in Minnesota.

In 1997, the Minnesota legislature appropriated $1.5 million to begin implementing the recommendations made by the White Pine Regeneration Strategies Work Group. The 1997 Laws of Minnesota, Chapter 216, Section 5, Subdivision 4 states in part:

> $600,000 the first year and $600,000 the second year are for programs and practices on state, county, and private lands to regenerate and protect Minnesota's white pine. Up to $280,000 of the appropriation in each year may be used by the commissioner to provide 50 percent matching funds to implement cultural practices for white pine management on nonindustrial private forest lands at rates specified in the Minnesota stewardship incentives program manual. Up to $150,000 of the appropriation in each year may be used by the commissioner to provide funds to implement cultural practices for white pine management on county-administered lands through grant agreements with individual counties. $40,000 each year is for a study of the natural regeneration process of white pine. The remainder of the funds in each fiscal year will be available to the commissioner for white pine regeneration and protection on department-administered lands. $150,000 the first year and $150,000 the second year is appropriated to the commissioner for a grant to the University of Minnesota's College of Natural Resources for research to reduce the impact of blister rust on Minnesota's white pine.

With this funding, implementation of the work group's recommendations regarding white pine management began on the various land ownerships. This white pine regeneration report provides information on accomplishments.

During the 1997 legislative session, the DNR held discussions with a variety of interest groups to clarify statewide goals for white pine management on DNR lands. These discussions led to a

commitment by Commissioner Sando that the public should have input into our white pine timber management planning process. A stakeholder work group made up of representatives from various interest groups was selected by the DNR. The work group met several times and developed a report entitled *Recommendations to Improve Public Involvement in White Pine Timber Management Planning on Minnesota DNR Timber Lands* in August 1997. The Commissioner approved the adoption of the report's recommendations.

In 1998, the Minnesota legislature provided an additional $600,000 funding for planting and managing white pine and improved public involvement in white pine management planning. The 1998 Laws of Minnesota, Chapter 401, Section 4 states in part:

> $180,000 in fiscal year 1998 and $120,000 in fiscal year 1999 are for increased public involvement in white pine management planning and to accelerate white pine management on state forest lands. Any amount of this appropriation not used in fiscal year 1998 is available in fiscal year 1999. (Supplemental General Fund)

Chapter 404, Section 7, Subd. 12 states in part:

> White Pine Management. For planting of stands of white pine and management of white pine resources. $300,000 (Bonding)

The 1999 Laws of Minnesota, Chapter 231, Section 5, Subd. 4 states in part:

> $722,000 the first year and $724,000 the second year are for programs and practices on state, county, and private lands to regenerate and protect Minnesota's white pine. Up to $280,000 of the appropriation in each year may be used by the commissioner to provide 50 percent matching funds to implement cultural practices for white pine management on nonindustrial, private forest lands at rates specified in the Minnesota stewardship incentives program manual. Up to $150,000 of the appropriation in each year may be used by the commissioner to provide funds to implement cultural practices for white pine management on county-administered lands through grant agreements with individual counties, with priorities for areas that experienced wind damage in July 1995. $40,000 each year is for a study of the natural regeneration process of white pine. The remainder of the funds in each fiscal year will be available to the commissioner for white pine regeneration and protection on department- administered lands.

The 1999 Laws of Minnesota, Chapter 249, Section 9, Correction 8A states in part:

> $150,000 the first year and $150,000 the second year are for a grant to the University of Minnesota's College of Natural Resources for research to reduce the impact of blister rust on Minnesota's white pine.

With strong support from the public, forest industry, and legislature, recommendations by the White Pine Regeneration Strategies Work Group and the White Pine Timber Management Planning Public Involvement Process Work Group are being implemented on forest lands throughout Minnesota.

This report is organized based on recommendations taken out of the White Pine Regeneration Strategies Work Group Report, *Minnesota's White Pine, Now and For the Future*. The recommendations from each section are followed by actions taken since 1997, the beginning of the white pine initiative.

III. Summary - White Pine Initiative FY99 Report

Funding provided by the legislature specifically for white pine management, education, and research has made it possible to greatly increase these efforts on state, county, and private forest lands. Federal, tribal, and forest industry land ownerships have also increased white pine management on their lands. Recommendations made by the 1996 White Pine Regenerations Strategies Work Group to regenerate and manage white pine to increase the role and presence of white pine now and in the future in Minnesota are being followed. Recommended white pine research has occurred and is continuing. There has been an excellent response to the white pine initiative throughout the state.

The white pine initiative has greatly increased white pine planting on all ownerships in the state. In 1996, it was estimated that 1.4 million white pine were planted in the state on all forest land ownerships and in FY99 the reported number doubled to 2.8 million seedlings. In 1998, the first year of the initiative, 2.4 million white pine were planted. DNR Forestry had been averaging 270,000 seedlings planted per year in the 7 years prior to the initiative and during the last 2 years have averaged 714,000 white pine seedlings. White pine planting on county lands has more than tripled. It is estimated that over 8100 acres were planted in 1999 on all ownerships with white pine as the main species or a component of a plantation.

Seedling demand was greater than supply, so it was necessary to procure additional seedlings from outside the state that were suitable for planting in Minnesota. The DNR state nursery is increasing its production of white pine seedlings to better meet the demand. Also, white pine seed procurement is being emphasized to meet the needs of increased planting and seeding of sites.

Practices to increase natural regeneration from white pine trees not harvested on a site tripled from 467 acres in FY98 to 1565 acres in FY99. Acres of prescribed burning to encourage natural regeneration of white pine has increased, while artificial seeding was about 450 acres each year.

Follow-up care of white pine seedlings to reduce deer browsing damage, prevent white pine blister rust, and to provide adequate growing space increased greatly from what was done prior to the initiative. Deer browse protection of white pine seedlings more than doubled from 1515 acres in FY98 to 3815 acres in FY99. White pine blister rust pruning increased from 1154 acres in FY98 to 1607 in FY99. Acres of release of white pine from competing vegetation increased from 1654 to 3729 acres in the state. With increased funding from the 1998 legislature, the Minnesota Conservation Corps (MCC) were utilized much more to complete 1750 acres of the above types of work on DNR forestry, parks, and wildlife lands and county lands compared to 428 acres in FY98. Volunteers assisted by completing 62 acres of follow-up care of white pine seedlings, compared to 18 acres reported in FY98.

Designation of sites to be managed for old growth white pine on state lands is progressing and will be completed in 2001. Designations have now been completed in 5 of 15 subsection landscape units with over 4200 acres now designated for old growth management and protection.

Recommended research on white pine blister rust and regeneration of white pine is ongoing. As research is completed, this information is disseminated to forestry field offices. Training sessions on white pine management and field tours have been held since the initiative began, and some information is available on web sites. Information on white pine management has been made available to the public through forest management assistance programs and woodland stewardship plans for private landowners. Information was also provided through distribution of white pine care kits and literature at county and state fairs. The White Pine Planting and Care Guide is also on the DNR web site.

The white pine initiative has greatly accelerated efforts to restore white pine throughout its original range in the state. Interest in the white pine initiative remains high; projects proposed for FY2000 exceed available funding.

IV. Recommendations and Actions

Planning/Budgeting

1. Recommendation: Set a regeneration goal so that the acreage of white pine stocked with 25 or more trees per acre under 5 inches (dbh) will be doubled from 149,000 acres to 298,000 acres over the next seven years through a combination of fostering natural regeneration and planting. In both natural regeneration and planting systems, there should be appropriate measures to promote growth and protection from pathogens and wildlife browsing for the early critical years.

Action: A State Forest Land White Pine Management Policy Letter was completed on 1-5-98. It states that the overall objective of the white pine initiative is to double the acreage of young white pine on all ownerships within seven years and that this would be the minimum objective for state land. See Appendix B. White Pine Planting on State Forest Lands (**1987-99**) for the large increase in white pine planting on DNR Forestry lands during FY98 - 99.

A February 1997 inventory report of state-administered forest lands indicated that there were 14,115 acres where white pine was the main species in a cover type and 108,651 acres where it was found as a component of other forest types. The same report in February 2000 shows 17,021 acres, a 20% increase of the white pine cover type, plus 128,482 acres where it is a component, an 18% increase.

In February 1997, there were 3163 acres of the white pine cover type less than 31 years old and in February 2000 there were 4708 acres, an increase of 49% of this age class in the white pine cover type on DNR forest lands. In this example, the white pine cover type less than 30 years old is being used as a rough estimate of DNR forest inventory white pine cover type acreage under 5 inches diameter at breast height(dbh).

A survey was conducted by the Minnesota Forest Resources Partnership in 1996 of white pine planting programs on DNR, 2 national forests, 14 counties, and forest industries lands (Page 35-36, White Pine Regeneration Strategies Work Group Report). Surveys completed in 1998 and 1999 by the DNR (Appendix A, Table 1.) show a large increase in white pine planting on these same ownerships, an increase of 1 million+ seedlings both years(see table below). In addition, 954 acres of seeding through natural or artificial regeneration occurred in 1998 and in 1999 there were 1998 acres of seeding.

Survey Year	White Pine Seedlings Planted	Acres Planted
1996	967,000	1,405
1998	1,969,650	5,555
1999	1,977,000	5,549

In 1996, it was estimated that on all ownerships, 1.4 million white pine seedlings were planted and in 1999 the number of white pine planted has doubled to a reported total of 2.8 million seedlings.

Appendix A shows FY98 and 99 accomplishments on various forest land ownerships in the state. FY98 and 99 accomplishments show strong efforts by DNR Forestry personnel to promote growth of white pine and protection from white pine blister rust and wildlife browsing on state lands.

State Forest Lands White Pine Management Practice	FY98 Acres	FY99 Acres
Release of existing white pine regeneration	853	1134
Thinning to increase growth	61	18
Pruning to prevent white pine blister rust infection	271	843
Bud protection to prevent deer browse damage	632	1269
Totals	1817	3264

2. Recommendation: Through the budgeting process, public funding should:
1: Target silviculture efforts that favor the survival and development of existing white pine regeneration;
2: Target silvicultural methods that favor establishment of natural regeneration;
3: Target planting, especially in areas with little or no existing white pine.

Action: Funding from the legislature in 1997 and 1998 greatly increased the management efforts in planting and caring for white pine in the state. The 1997 legislation states that funding is provided to implement cultural practices for white pine management on nonindustrial private forest lands and county-administered lands and for white pine regeneration and protection on department-administered lands. The 1998 legislation provides funding to accelerate white pine management on state forest lands and for planting of stands of white pine and management of white pine resources. Following are the budget distribution plans for FY98 - FY2000:

WHITE PINE INITIATIVE
Budget Allocation

Item	FY98 $$	FY99 $$	FY00 $$
Private Lands	150,000	50,000	*25,000
County Lands	150,000	176,000	150,000
DNR Lands	260,000	602,000	742,500
Research (Natural Processes)	40,000	40,000	40,000
Research (White Pine Blister Rust)	150,000	150,000	150,000
Research (Regeneration)		5,000	5,000
Seed Procurement		40,000	
Coordination, Public Involvement, and Education		113,000	59,500
Totals	750,000	1,176,000	1,172,000

1997 Legislation $1.5MM for FY98-99
1998 Legislation $300M Supplemental FY98-99 & $300M Bonding
1999 Legislation $722,000 for FY2000 and $724,000 for FY2001
$150,000 for FY2000 and $150,000 for FY2001 for white pine blister rust research.

*Private lands budget is based on the previous year utilization of cost-share funds for white pine projects. Much of the white pine planting on private lands is included in mixed species plantations and is cost-shared under other programs.

The State Forest Land White Pine Management Policy letter of January 5, 1998 includes the above listed recommendations for prioritizing white pine management practices. This letter has been distributed to all DNR Division of Forestry, Parks and Recreation, and Wildlife offices.

FY98 and FY99 accomplishments for state and county lands show that public funding has increased efforts in caring for existing white pine, planting of white pine, and establishing white pine through natural regeneration. Accomplishments are included in this report.

Requests for funding FY2000 white pine projects on state and county lands exceeded the dollars available. The $300,000 bonding monies were all used For FY2000 projects. Based on the increased amount of white pine management, it is projected that FY2001 project funding requests will significantly exceed the white pine funding available.

3. Recommendation: Each DNR forestry area, state park, major wildlife management unit, and county land department within the range of white pine should set targets to increase the presence of white pine on lands under their administration through a process that incorporates goals set forth in this report.

Action: State-wide meetings of State Land Management Program Foresters and Private Forest Management(PFM) Program Foresters were held in 1997 and 1998 to discuss white pine initiative goals. Forest resource management plans, which will now be completed on the subsection level of the Ecological Classification System(ECS), will set targets to increase the presence of white pine on state lands if white pine was historically more common. Forestry, Wildlife, and Parks Division personnel in the Areas are involved in the process. Counties have been participating in the grant program for funding white pine management. Increased white pine management is occurring because of the renewed interest in growing white pine, funding from the legislature, and the direction to increase the amount of white pine in the state. Also, the Chippewa and Superior National Forests have held meetings to discuss white pine management and to place more emphasis on white pine management, even though they are not included in the state funding.

4. Recommendation: The Department of Natural Resources (DNR) should develop a state-funded incentives program to encourage the establishment and long-term management of white pine on non-industrial private forest (NIPF) lands. This state-funded incentive program should be developed in coordination with the Forest Stewardship Program, and be implemented through Forest Stewardship Plans and Stewardship Incentives Program practices.

Action: Funding has been appropriated in the white pine initiative legislation to be used by the commissioner to provide 50 percent matching funds to implement cultural practices for white pine management on non-industrial private lands at rates specified in the Minnesota Stewardship Incentives Program manual.

The Minnesota White Pine Cost-Share Incentives Program administered by DNR Forestry was in place in October 1997. Landowners must have a Forest Stewardship Plan to be eligible for the program. Cost-share practices include white pine site preparation, planting, pruning, protection, and thinning. Practices signed-up for during FY98 include planting of 61,000 seedlings, 69 acres of site preparation, 15 acres of basal pruning, 15 acres of release, and 110 acres of bud capping. Approximately $17,000 of white pine cost-share funding was requested by private landowners in FY98. Since the requests for white pine funding for private lands were much less than expected in FY98, the amount budgeted for FY99 was reduced to $50,000. Approximately 1500 acres of white pine planting occurred as mixed plantings with other species cost-shared under Legislative Commission on Minnesota Resources(LCMR) and Conservation Reserve Program(CRP) cost-share programs. In FY99, $17,342 was utilized for cost-share project funding.

Based on State Forest Nursery tree seedling sales records, white pine planting on private lands has increased significantly(does not include seedlings from private nursery orders):

Year	Private Landowner White Pine Seedlings Sold
1994	305,200
1995	351,000
1996	407,800
1997	385,600
1998	458,200
1999	699,400

To reach landowners who own smaller parcels of land or who want to plant fewer trees, a partnership with Soil and Water Conservation Districts(SWCDs) was used to distribute White Pine Care Kits to landowners. White Pine Care Kits consist of a *White Pine Planting and Care Guide*, wire flags to mark tree locations, and paper for bud capping the seedlings to prevent deer browsing. The kits were developed to help landowners properly plant and protect their white pine seedlings. One kit was distributed with each order of 25 white pine seedlings sold by the SWCDs. Twenty-two SWCD offices participated and distributed nearly 1500 kits with the 38,000 trees they sold to private landowners in 1998. Twenty-five SWCDs participated in 1999, distributing approximately 1500 kits. In addition, Itasca Greenhouse and North Central Reforestation Nurseries, Rajala Companies, and Hedstrom Lumber were provided with a total of 120 kits for distribution to private landowners (See Appendix C). DNR State Nursery private landowner tree orders that included white pine also included a white pine care kit.

5. Recommendation: Forest land management organizations should plan harvest schedules or other disturbance regimes and time the establishment of new areas of white pine cover type so that age classes of the white pine resource are distributed more evenly.

Action: DNR Forestry is managing white pine on an extended rotation basis, where the final harvest age will be 150-180 years or more versus 100-120 years. When harvesting in the pine cover types, white pine harvesting will be restricted to thinning, selective harvest, or shelterwood harvest. When harvesting in other forest cover types which contain white pine, adequate seed producing white pine will be retained and treatments carried out to increase white pine regeneration. Elimination of white

pine from other cover types will not be permitted. White pine planting has increased in FY98 and FY99.

During Subsection Forest Resource Management Plan development, maps and data that are available from other public land ownerships on age-class distribution of cover types will be utilized in the planning process. Increased white pine management and more uniform age class distribution are part of the statewide goals in state land forest management plans.

6. Recommendation: Funding should be made available to county land management organizations actively encouraging the establishment and long-term management of white pine on county-administered lands.

Action: The white pine initiative legislation appropriated up to $150,000 each year to provide funds to implement cultural practices for white pine management on county-administered lands through grant agreements with individual counties.

In FY98, 11 of 14 eligible counties participated in the grant contracts totaling $150,000 for white pine regeneration and management. Approximately $96,000 was expended during the FY98. Requests for FY99 from 12 counties total $176,000. The following table shows the acres of white pine management completed during FY98 and FY99.

Management Practice	FY98 Acres	FY99 Acres
White Pine Planting	629 (205,500 seedlings)	722 (330,200 seedlings)
Deer Browse Protection	108	159
White Pine Blister Rust Pruning	350	153
Release	45	21
Site Preparation	489	1157

Based on seedling orders through the State Forest Nursery and surveys completed in 1998 and 1999, white pine planting has greatly increased on county forest lands.

Year	County White Pine Seedlings Purchased from State Nursery	County Total White Pine Seedlings Planted
1994	45,600	
1995	66,300	
1996	70,600	
1997	40,000	
1998	168,000	205,500
1999	283,000	330,200

7. Recommendation: An advocate for white pine regeneration should be a participant at DNR goal setting processes designed to set the deer population goal in areas where increased regeneration is desirable.

Action: Memo's were sent out in March-April 1998 by Division of Wildlife and Parks & Recreation Directors to Region, Area, and Parks personnel reminding them to be aware of this recommendation when setting deer population goals. This has been done in some of the state parks. The DNR Section of Wildlife had planned to pilot a public involvement process for deer goal setting sometime in 1999, and planned on involving a white pine advocate in this process in those areas where it is appropriate. However, pilots were not initiated due to budget and staff reductions in the Section.

Management/Regeneration

1. Recommendation: Harvests of white pine in the pine cover types on state-administered lands should be restricted to thinnings, selective harvests, or shelterwood harvests. When harvesting white pine in other forest cover types, the best seed producing white pine will be retained and treatments carried out so as to increase white pine regeneration. These restrictions shall govern planning and timber sale design by managers on state-administered lands until new inventory indicates that the number of white pine trees has doubled from 25.9 to 51.8 million trees on all ownerships. An exception to these restrictions would allow harvest if a tree poses a hazard to the public or has been severely damaged by natural causes.

Action: White Pine Management Policy Letter, dated January 5, 1998, which includes the above recommendation, has been distributed to DNR Forestry, Wildlife, and Parks offices. Also, this recommendation is included in the December 1997 revision of the DNR-Forestry White Pine Cover Type Management Guideline. This revision has been distributed to DNR-Forestry offices, County Land Departments, Chippewa and Superior National Forests, Forest Industry, and others.

This recommendation will be followed in timber harvest plans developed during subsection forest resource management planning on state lands.

2. Recommendation: Forest land management organizations should be encouraged to reserve the better white pine trees that occur as scattered individuals or in small groups for their seed producing, aesthetic, wildlife, and ecological benefits.

Action: Same as 1. Reserving some scattered white pine from harvest has been occurring on state timber sales for several years. Distribution and distance between seed trees is covered in the management guidelines and has been discussed at training sessions.

3. Recommendation: All white pine on state-administered timber lands should be managed under the DNR's Extended Rotation Forest (ERF) Guideline so as to increase the acreage and distribution of older white pine stands and trees on the landscape.

Action: Same as 1. The minimum extended rotation age for white pine on good sites(Site Index 55-65) is 150 years and on excellent sites(Site Index >65), 180 years is the rotation age for harvest. Previous guidelines suggested rotation ages of 100 to 120 years.

4. Recommendation: White pine should be planted in smaller groups as well as on larger acreages, within its range where white pine was once abundant but is now rare or non-existent.

Action: Same as 1. A large part of the increase in acres planted with white pine in FY98 and FY99 is due to increased planting of white pine in small groups or mixed with plantings of other species. According to the survey of white pine management in the state in 1998, approximately 60 percent of the acres planted with white pine were in small groups or mixed throughout plantings of other species. In 1999, the percentage was 49%. White pine planting is occurring throughout its range in Minnesota.

5. Recommendation: Managers should enhance natural seeding opportunities through treatments that create proper microsites for seedling establishment near white pine seed trees when natural and man-made disturbances occur. Treatments in the vicinity of seed trees could include mechanical scarification, prescribed burns, or leaving or enhancing the presence of coarse woody debris in advanced stages of decay on the forest floor.

Action: Same as 1. According to the 1998 accomplishment survey, natural seeding management techniques were used on 467 acres. In 1999, there was a significant increase to 1565 acres. Methods used were seed tree with scarification, seed tree with prescribed burn, and white pine shelterwood system.

6. Recommendation: The DNR should create a forum for resource managers that manage areas reserved from harvest for the purpose of identifying and discussing management techniques, including intensive management practices, to assist in the establishment, regeneration and maintenance of white pine in reserved areas.

Action: Currently, research is being conducted by Lee Frelich, University of Minnesota, on natural regeneration processes of white pine. There are tentative plans to hold a training session during Summer 2000 that would include research findings to date. The 5th Eastern U.S. Old-Growth Forest Conference held in Duluth on June 10-12, 1999 included topics related to white pine management.

7. Recommendation: DNR tree nurseries should expand the procurement of white pine seed native to Minnesota in collaboration with other forest land management agencies and work with private nurseries to grow more white pine adapted to Minnesota's conditions.

Action: With an anticipated good white pine cone crop during August-September 1998, efforts were made to collect cones for a several year supply of white pine seed. $40,000 of white pine initiative monies was budgeted to purchase 2000 bushel of cones. The Minnesota Forest Resources Partnership assisted with getting the word out to the public regarding cone collection via statewide news releases and letters to its member organizations.

With a hot, dry late August and early September 1998, the white pine cones ripened fast, opened, and released their seed sooner than normal. Also, cone borer insects were widespread affecting cone production and the cone crop was variable in the state, ranging from few cones is some areas to many cones on some sites. Even with the abbreviated cone collection period, 1168 bushels of cones were purchased and delivered to the state nursery which yielded about 680 pounds of seed. This was the most white pine cones collected in the last 10 years. Additional purchases of seed were made to bring the total seed collected or purchased in 1998 to 865 pounds. The nursery uses about 200 pounds of seed each year for sowing in nursery beds.

Efforts continued in 1999 to increase the nursery supply of white pine seed. A poor cone crop resulted in only 283 bushels being purchased in 1999 which yielded 207 pounds of seed. As of February 2000, there are about 850 pounds of white pine seed in the nursery seed bank, about a 4-year supply.

1998. The DNR State Forest Nursery sold out its supply of 3-year old white pine seedlings(1.13 million) for Spring 1998 planting orders. An additional 350,000 seedlings were procured from the USFS nursery in Michigan(250,000 - Oconto River Seed Orchard) and Wisconsin(100,000) which were of seed sources suitable for planting in Minnesota.

1999. Approximately 1.3 million 3-year old white pine seedlings were produced and sold by the state forest nursery for planting in Spring 1999. An additional 500,000 white pine seedlings were sold or distributed by the nursery in the form of transplants, 2-year old seedlings, and additional seedlings from other nurseries and containerized stock. Private tree nurseries were contacted regarding availability of white pine seedlings and referrals were made to them for seedling purchases by private landowners. There are 1.4 million white pine seedlings on order through the nursery for planting during Spring 2000. To meet the demand, 250,000 seedlings will be procured from the USFS nursery in Michigan. These seedlings are from Minnesota seed sources. White pine seedling production is on an upward trend at the DNR tree nursery with the increasing demand for white pine.(See the following table.)

White Pine Seedlings (3-year old) Minnesota State Forest Nursery Production	
Year	**Seedling Production**
1996	851,000
1997	1,119,000
1998	1,130,600
1999	1,276,600
2000	1,000,000*
2001	1,500,000
2002	1,700,000

*Heavy rains caused loss of seed planted in 1997.
Years 2001-2002 production estimated.

8. Recommendation: The DNR should protect (maintain) selected stands of white pine greater than 20 acres in size in various age classes on state-administered lands to provide for future old growth. Limited harvesting for sanitation and maintenance may be allowed in some of the selected stands to help perpetuate the life of the stand and promote regeneration. Resource managers on federal and county-administered lands are encouraged to also follow this recommendation.

Action: As of November 1998, approximately 4000 acres of potential future old growth stands with white pine less than 120 years old had been identified for evaluation. Evaluation and selection of forest stands for white pine future old growth continues throughout the state on DNR-administered lands. The table on Page 15 shows the current status of the designation process. Efforts through forest management planning processes will be made to work together in protecting and/or managing older white pine stands on adjacent public land ownerships.

9. Recommendation: The DNR should protect (maintain) older white pine stands greater than 20 acres in size so that approximately 25 percent of the acreage of these older and larger stands exceeds 120 years of age on state-administered lands. Fifty percent of the acreage of these stands older than 120 years should be maintained as old growth. Resource managers on federal and county-administered lands are encouraged to also follow this recommendation.

Action: According to CSA state land inventory records in February 2000, there are 2210 acres, including stands less than 20 acres in size, of the white pine cover type greater than 120 years old on state-administered lands. This is about 13% of the total white pine cover type on state lands. DNR Forestry policy is to manage white pine on an extended rotation forest(ERF) basis where the final harvest age is 150-180 years old, so white pine stands available for harvest will be managed to an older age.

Evaluation and selection of forest stands for white pine old growth forest continues throughout the state on DNR-administered lands. As of November 1998, over 900 acres of old growth white pine stands had been identified to be reserved or evaluated. Landscape teams from 5 ecological classification system(ECS) subsections have completed the designation process of old growth stands. Efforts through forest management planning processes will be made to work together in

protecting and/or managing older white pine stands on adjacent public land ownerships. The following table shows the current status of old growth designation on state-administered lands.

White Pine Old Growth Forests - Designation Status
February 2000

Subsection	Old-Growth Goal Acres	Acres Designated of Old-Growth and FOG	Year Designations To Be Completed
Agassiz Lowlands	230	45	2000
Anoka Sand Plain	135	0	2000
Blufflands & Rochester Plateau	185	149	**1999**
Border Lakes	1585	3232	**2000**
Chippewa Plains	90	9	2001
Glacial Lake Superior	305	77	2000
Hardwood Hills		0	2001
Laurentian Highlands	185	144	**2000**
Littlefork Vermilion	375	385	**1999**
Mille Lacs Uplands	230	13	2000
Nashwauk Uplands	90	10	2000
North Shore	135	0	2000
Pine Moraines	320	363	**1999**
St. Louis Moraines	230	63	2000
Tamarack Lowlands	185	0	2001
Totals	4280	4490	

Bold year (**1999**) indicates the landscape team has completed the old growth stand designation process for the subsection.

The majority of old growth white pine acres (2472 of 3232 acres) in the Border Lakes Subsection are on state land located in the BWCAW.

10. Recommendation: The Commissioner of Natural Resources, in cooperation with stakeholders should create a pilot project to identify blocks of state lands in management units of the Outdoor Recreation Act (e.g. state forest, state park) where deer density would be reduced for the short term (5-7 years) to allow white pine regeneration to out-grow the reach of the deer.

Action: Discussions have taken place with wildlife staff and some state parks are actively reducing deer populations for this purpose. The severe winters in 1995-96 and 1996-97 reduced deer populations by 50% or more in much of the northern third of the state, and it is expected that recovery

will take at least 5 years in some hard hit areas. This should make identification of specific pilot areas less necessary in the short term. In addition, in 1999 the DNR Section of Wildlife implemented revised deer management unit boundaries that align closely with ecological classification system (ECS) subsection boundaries. This will facilitate consideration of deer management objectives during subsection landscape planning processes.

11. Recommendation: Resource managers should increase the use of prescribed surface fires to regenerate white pine on reserved and commercial forest land.

Action: According to the 1998 survey on white pine management in the state (see Appendix A, Table 5.), prescribed burning was used on 875 acres in FY98 to promote white pine regeneration. Of this amount, 313 acres were completed on state-administered lands. In FY99, 2139 acres of prescribed burning for natural seeding or site preparation were completed. Most of this occurred in parks, 1852 acres in state parks and 181 acres in Voyageurs National Park.

12. Recommendation: The Minnesota Conservation Corps (MCC) should be utilized as a partner in conducting management activities that will promote the presence of white pine. For the next few years, a significant portion of the MCC's time should be devoted to projects directly related to increasing the presence of white pine on the landscape.

Action: Funding from the 1998 legislature made it possible to greatly increase the amount of white pine management activities that MCC could accomplish in FY99 on state lands. Approximately $115,000 was budgeted in FY99 for MCC work on white pine management. The following table shows the accomplishments for FY98 and FY99, with a dramatic increase in FY99 because of the increased funding and emphasis on white pine regeneration activities by MCC crews.

Minnesota Conservation Corp (MCC) - White Pine Regeneration Accomplishments

Silviculture Practice	1998 Acres	1999 Acres
Planting white pine	31	124
Bud capping white pine	95	550
Application of deer repellants	1	5
Installing wire cage around seedlings	5	30
Pruning for blister rust control	121	765
Thinning	10	0
Release from competition - mechanical	142	340
Release from competition - herbicide	23	60
Prescribed burning assistance	0	1550
Site preparation - mechanical	4	15
Site preparation - herbicide	0	5

The table includes MCC accomplishments on DNR Forestry, Parks, and Wildlife lands and county lands. Most of the prescribed burning accomplishments (Itasca State Park) were funded from other sources than the white pine initiative funding in FY99.

Education/Training

1. Recommendation: A "Silvicultural Guide" should be developed to recommend the care and management of white pine.

Guidelines should address the variety of landowners and land classifications in Minnesota (e.g. parks; natural areas; private, county, state, and federal ownerships). The following must be included in this guide:

- Focus and emphasis should be placed on the importance of care and management practices of white pine after regeneration and establishment. Follow-up practices ensuring the establishment of seedlings by release from competing vegetation should be suggested.
- Emphasis must be placed on the range of difficulty of establishing white pine from one type of site to another; information must be given on what prescriptions are necessary on each site.
- Additional management options, site analysis considerations, and cultural practices should be included.

Action: A revised silvicultural guide, *White Pine Cover Type Management Guideline*, was developed based on recommendations found in the White Pine Regeneration Strategies Work Group Report. It is a part of the DNR-Forestry's Forest Development Manual. It was distributed to DNR forestry offices in February 1998 and copies of the guideline were sent to counties, national forests, and forest industries in Minnesota.

The *White Pine Planting and Care Guide* was completed in January 1998. It was written for general public use. This guide covers site selection, planting, and follow-up care of white pine. It is on the DNR website at http://www.dnr.state.mn.us/forestry/white_pine/index.html or it can be obtained at DNR-Forestry offices.

Silviculture field tip sheets have been revised and developed regarding care of white pine. The field tip sheet, *Protect Pine Tree Seedlings From Deer Browsing With Paper Bud Caps*, was revised in July 1997. The field tip, *White Pine: How to Prune for Blister Rust*, was completed in January 1998. These tip sheets provide detailed descriptions, diagrams, and photos of protecting white pine by bud capping and pruning.

An Ecological Classification System(ECS) field key for the Northern Minnesota Drift and Lake Plain Section contains information for identifying sites suitable for white pine and aids in predicting difficulty to establish white pine regeneration on various sites. Training sessions were held in June 1998. Handbooks and keys for other sections are being worked on.

Silviculture training, White Pine Regeneration: Research Findings and Practical Applications Workshop, was held in June and October 1998. Handouts included the above information and information on new research findings on regenerating white pine was presented. In June 1999, Dr. Klaus Puettmann and Mike Saunders of the U of MN held a White Pine Cooperator's Meeting that was attended by forestry representatives from the state, counties, and USFS. This material provided on white pine regeneration research was distributed to DNR Forestry Region and Area offices.

A white pine bibliography on diskette, containing 548 citations on white pine regeneration topics with more than 450 abstracts, was distributed to all DNR Forestry Areas in July 1997.

The Chippewa National Forest distributed a White Pine Source Book, a collection of white pine research papers, to attendees at a workshop in October 1997.

2. Recommendation: Develop a continuing education program for foresters that explains and demonstrates management techniques that can increase the presence of white pine. This program needs to teach how to take advantage of, and enhance natural regeneration opportunities as well as incorporate artificial processes (e.g. site preparation work, prescribed burns, planting). A similar program should also be available to all forest landowner groups and timber harvesters. These programs should consider the development of areas that demonstrate regeneration and management techniques.

Action: Several white pine training sessions and field tours were held during FY98. During September 1997, approximately 40 people attended a field tour of white pine management near Eveleth sponsored by the DNR Forestry Employees Association. In October 1997, the U.S. Forest Service held a white pine workshop at Walker that 50 people attended. Several white pine sites on the Chippewa National Forest were visited. During June 1998 in Cloquet and October 1998 in Grand Rapids, a training session called White Pine Regeneration: Research Findings and Practical Applications was held. It included information on the ecological history of white pine in Minnesota and how ECS keys can be useful in growing white pine, insect and disease management, and current white pine regeneration research by Dr. Klaus Puettmann and graduate students from the University of Minnesota. The research addressed deer browsing and the effects of competition on the growth and survival of white pine. A total of 115 resource managers attended from federal, state, county, and tribal agencies and forest industries besides the public. ECS training sessions included information on using field keys and handbooks for site selection in planting white pine. Forest pest training sessions have included information on insects and disease problems in growing white pine.

On June 4, 1999 a white pine symposium/field tour was held in Grand Marais. It was sponsored by local organizations and businesses, the USFS, DNR, and the White Pine Society. It included information on USFS white pine management in the area, white pine research by Dr. Paul Anderson and Dr. Paul Zambino, and a field tour including sites with various site preparation methods, and the Gunflint Pines old growth. Forest managers and the public attended.

3. Recommendation: Educational materials should be developed for non-industrial private forest landowners that describe white pine ecology, values, and silviculture, and that encourage landowners to regenerate and manage white pine on appropriate sites. These materials should reveal the numerous opportunities and scientific data available to make white pine regeneration a success. These materials should emphasize that the success will depend on commitment and follow-up treatments. There should be active promotion for white pine management in "stewardship plans" on appropriate sites.

Action: The *White Pine Planting and Care Guide* was published in January 1998. It is a guide for private landowners designed to provide the public with tips and information on how to successfully plant and protect white pine seedlings. Over 9000 had been distributed by November 1998. It is on the DNR website at http://www.dnr.state.mn.us/forestry/white_pine or it can be obtained at DNR-Forestry offices. Approximately 1500 White Pine Care Kits have been provided each year to private landowners through a partnership with SWCDs during Spring 1998 and 1999. These kits include the care guide, wire flags for marking tree locations, and budcaps for follow-up care to prevent deer browsing. Also, a care kit was included in most of the state nursery private landowner seedling orders in 1998 that included white pine and all orders with white pine in 1999.

Woodland Stewardship Plans include the silvicultural field tip sheets on bud capping and pruning for white pine blister rust prevention. Increased white pine planting has been encouraged at Private Forest Management(PFM) Foresters annual meetings and there is a cost-share program in place for planting and caring for white pine. A Woodland Stewardship Plan and a project plan are required for cost-share funding.

4. Recommendations: The DNR should prepare a brief key that can be used by resource managers to identify potential sites for white pine management that currently lack a white pine component.

Action: Field keys to forested native plant communities in Minnesota are being developed. In June 1998, a field key for the Northern Minnesota Drift & Lake Plain Section was completed. Two training sessions were held in June at Deep Portage and workshops were conducted in Bemidji, Pequot Lakes, Hill City, and Aitkin Forestry Areas and Bemidji State Park during summer 1998. Handbooks and keys for other sections are being worked on by ECS staff.

5. Recommendation: Establish an "Adopt Young White Pines" program that provides education, training, and recognition to any individual, family, or organized group that adopts a young white pine site managed by participating public forest land management agencies and that agrees to apply cultural practices that will protect young pine from pest problems during their early critical years.

Action: During Fall 1997, two groups of Sierra Club volunteers completed bud capping projects on state land. A 14-acre site near Onamia had 26 volunteers in 1997 and 25 - 30 volunteers from the Sierra Club and Audubon Society completed the site again in Fall 1998. A 4-acre site was completed in the Lewiston Area by about 15 Sierra Club volunteers during Fall 1997. Volunteer opportunities for caring for white pine have been advertised at open house meetings for public input into Area Forest Resource Management Plans, in the DNR Volunteer Opportunities newsletter, and *DiaLogue,* the school forest newsletter.

During FY99, volunteers assisted in 3 DNR Forestry Areas with 36 acres of white pine pruning and/or bud capping and in 3 DNR State Parks with 26 acres of white pine planting, bud capping, fencing, or pruning.

Research

1. Recommendation: Research should be funded to address the following questions concerning white-tailed deer:

1. Determine the extent of deer browsing that will kill or retard seedling growth enough that it will lose its competitive edge.
2. Determine whether there is a threshold in patch/plantation size and/or seedling densities at which deer browsing will not prevent sufficient stocking levels to occur.
3. Determine whether there are specific "habitat types" in which white pine is less likely to be browsed.
4. Determine deer palatability as it relates to seed source and type of planting stock.

Action: A research project and manuscript, *Use of Vegetational Characteristics and Browsing Patterns to Predict Deer Damage in Eastern White Pine Plantations*, was completed by Mike R. Saunders and Klaus J. Puettmann, University of Minnesota, Department of Forest Resources during 1998. A number of oral and poster presentations have been based on this research project. Funding was through the Iron Range Resources & Rehabilitation Board(IRRRB), Minnesota DNR, and St. Louis County Land Department.

Also research by Saunders and Puettmann, included the response of white pine seedlings to deer browsing intensity and frequency where white pine seedlings were clipped to simulate deer browsing under a range of growing conditions.

Additional research needs to be pursued and funded regarding deer browsing.

2. Recommendation: Research efforts should be funded to refine management and harvesting practices that improves the cost effectiveness of regeneration, and expansion of white pine from individual trees, clusters or stands.

Action: A research project and manuscript, *The Response of White Pine Seedlings to Weeding in Shelterwood Treatments*, was completed in 1998 by Mathew F. Smidt, Klaus J. Puettmann, and Matthew D. Duvall. This research looked at the response of white pine seedlings to overstory and understory competition. Other white pine research under the direction of Dr. Puettmann includes the importance of above and below ground competition on white pine seedling growth and survival. Funding was from the IRRRB, St. Louis County, Itasca County, and the Minnesota DNR.

3. Recommendation: Research should be funded to address the following concerns with blister rust in the State of Minnesota.

- Investigate methods of predicting site specific blister rust impacts: Where will severe impacts be likely and, therefore, where will management of white pine be difficult.
- Develop management tools and techniques that can be utilized in Minnesota to reduce the impact of blister rust.

Action: The 1997 and 1999 Legislature provided funding for white pine blister rust research. A literature review on site specific blister rust incidence was conducted with research grant monies to the University of Minnesota. A research project, *Identification of Risk Factors for Blister Rust on Eastern White Pine* was completed by the Natural Resources Research Institute, U of MN, Duluth in October 1999. This research paper can be viewed at the following website: http://www.nrri.umn.edu/rustmap/ .

White pine and insect and disease training sessions have included information on environmental factors affecting the distribution and severity of blister rust, hazard zones and their basis, and micro-scale factors favoring blister rust infection. Management/control methods for white pine blister rust were presented including site selection, Ribes eradication, understory planting, basal pruning, and resistant planting stock.

The DNR Silviculture Field Tip, *White Pine: How to Prune for Blister Rust* was printed in January 1998 has been widely distributed to foresters and private landowners. Also, site selection and blister rust control information is included in the *White Pine Planting and Care Guide*.

4. Recommendation: Funding should be provided to develop genetic improvement in growth rates and blister rust resistance in white pine.

Action: The 1997 and 1999 Legislature provided $150,000 each year for FY98-01 in grants to the University of Minnesota's College of Natural Resources for research to reduce the impact of blister rust on Minnesota's white pine. Research work in progress includes: flower induction on young grafted material; early screening for blister rust susceptibility; histological characterization of rust resistance mechanisms, salvage and measurement of Ahlgren's advanced generation plantings, and genetic improvement projects for improved growth rates. See Appendix D - Research, Research to Reduce the Impact of White Pine Blister Rust progress report.

Genetic improvement projects require many years of project work and continued funding may be needed.

5. Recommendation: Research should be funded to study the regeneration processes that occur in old growth stands (as defined by the Minnesota Department of Natural Resources) where white pine is an important component.

Action: The 1997 and 1999 Legislature provided $40,000 each year for FY98-01 for a studies of the natural regeneration process of white pine. This money was granted by the DNR to the University of Minnesota, College of Natural Resources. See Appendix D - Research, Research on Natural Regeneration Processes of White Pine - December 1999.

6. Recommendation: An economic analysis should be conducted to gauge the potential benefit of intensively managing white pine under three situations: white pine stands, white pine as a component of other forest types, and where white pine is currently not present. The analysis should take into account different risk factors (e.g. blister rust hazard zones) and include costs associated with the long-term care required to grow white pine.

Action: No action yet, an analysis should be funded.

The DNR Forest Development Module through its Stand History Report provides a summary of all the work done on a stand, including costs, as well as a summary of all of the regeneration surveys completed. It is a summary of the silviculture applied to a stand and the efficacy and cost of that silviculture. This data could be used in analyzing the costs of growing white pine on state lands.

Inventory/Monitoring

1. Recommendation: Forest land management organizations should develop ecological classification systems that have utility for managing white pine at the field level and that address plant community dynamics.

Action: Federal, state, and county forest land management agencies and forest industries have all been working on developing ecological classification systems for managing forests. In June 1998, DNR Forestry completed its first handbook and field key to forested native plant communities. The key and the Ecological Land Classification Handbook for the Northern Minnesota Drift & Lake Plains and the Chippewa National Forest was completed and training was conducted in June and throughout the summer. The handbook includes information on each native plant community regarding observed presence and abundance of white pine in the canopy of mature forests, estimated ability of white pine seedlings and saplings to reach the canopy with minimal silvicultural activities, and competing vegetation expressed as a percent of all plant species in a community with greater cover or abundance than white pine trees. Handbooks and keys for each of the ECS sections in the state will be completed over the next several years.

2. Recommendation: The Department of Natural Resources should develop a comprehensive monitoring program to evaluate the effectiveness of managing for white pine at the stand level. The program should be designed to select relevant sites through a stratified random sampling process. It should also include field audits similar to those used in the Best Management Practices to Protect Water Quality program.

Action: No action on BMP type audits yet, to be initiated in 2000.

Changes have been made to the Cooperative Stand Assessment(CSA) inventory in response to state land white pine management objectives. White pine cover types will be mapped down to a stand size of 1/2 acre and white pine clusters(less than 1/2 acre) can be identified by a "wp" symbol on CSA inventory township maps. This will help in better locating small white pine stands for follow-up regeneration surveys and management work. State forest land plantations currently have regeneration surveys conducted at 1, 3, 5, and 10 years after planting or artificial seeding. Additional stand visits may occur based on need and timing of follow-up care.

3. Recommendation: The Annual Forest Inventory System (AFIS) should be used to the extent possible in assessing the condition of the white pine resource and monitoring progress towards goals.

Action: No action yet. AFIS, which was based on a combination of re-measuring permanent inventory plots that had some type of disturbance and undisturbed plots is now being replaced by an annual inventory where a percentage of established inventory plots are visited each year. This change will capture underplantings of white pine, natural regeneration, and selective harvests which would have been difficult to detect based on a stand disturbance basis. The annual inventories of Forest Inventory Analysis(FIA) plots will be used to the extent possible along with additional information provided by the various forest landowners in the state in reports, such as Appendix A, and through stand based forest inventory records (e.g., CSA) to monitor progress towards goals.

V. Public Involvement in Forest Resources Management Plans

The recommendations to improve public involvement in white pine timber management planning on Minnesota DNR timber lands developed by the White Pine Timber Management Planning Public Involvement Process Work Group in 1997 were used as a basis in developing the steps for the new method of vegetation management planning on forest lands administered by DNR Forestry and Wildlife Divisions. These new plans called Subsection Forest Resource Management Plans (SFRMP) will use the subsection level of the ecological classification system (ECS) rather than administrative areas as the basic planning units. These landscape level plans will identify a desired future forest composition (DFFC) 50 years into the future and identify forest stands to be treated, e.g. harvest, thinning, re-inventory, over the next 7-year period. A more standardized process for state-administered forest lands will be used that will give the public more opportunities to become informed and involved in the planning process. For more information on the SFRMP process, see the Subsection Forest Resource Management Planning web page: http://www.dnr.state.mn.us/forestry/subsection/.

White pine management will be a part of the process and management recommendations in the State Forest Land White Pine Management Policy, January 5, 1998, and the revised White Pine Cover Type Management Guideline will be followed. This policy and guideline include the recommendations of the 1996 White Pine Regeneration Strategies Work Group.

The public now has the opportunity to obtain information and provide comments on annual timber harvest plans for the upcoming state's fiscal year. This information is posted on the Timber Harvest Plans web page: http://www.dnr.state.mn.us/forestry/harvest/tp.html

In addition, information regarding upcoming state timber auction sales and results of recent auction sales is posted on the Forestry Timber Auction Sales Calendar web page: http://www.ra.dnr.state.mn.us/timber_sales/ .

The above information sources will allow the public to be more informed on what is occurring regarding white pine management on state lands as well as all other tree species management and harvest plans.

White Pine

Regeneration and Management

Accomplishments

on

Minnesota Forest Lands

during

Fiscal Years 1998 and 1999
(July 1 - June 30)

Foreword

The information in this report is based on survey responses received from forest land managers regarding white pine regeneration and management accomplishments that were completed during the periods July 1, 1997 to June 30, 1998 (State Fiscal Year 98) and July 1, 1998 to June 30, 1999 (FY99). A White Pine Regeneration and Management Accomplishment Report was sent to the following forest land managers in the state: DNR Forestry, Parks, and Wildlife Divisions, County Land Departments, U.S. Forest Service National Forests, Voyageurs National Park, Tribal Agencies, and Forest Industry. Non-industrial Private Forest Land data is based on information provided by DNR Private Forest Management (PFM) Program Foresters and the Minnesota State Forest Nursery. This report includes data only from surveys returned, so there is probably additional white pine regeneration and management work occurring in the state beyond what is in the report. Also, the report does not include regeneration from white pine reserved on a harvested site where there was no follow-up site preparation to enhance white pine seeding success. Thanks to everyone that returned the survey and provided information for this report.

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Table 1. FY98-99 Acres of White Pine Planted by Ownership and Type of Planting and Number of Seedlings Planted

Land Ownership	Year	Main Species	Underplanting	Small Groups	Mixed Species	Total Acres	White Pine Seedlings Planted
DNR-Forestry	1998	445	242	66	1558	2311	738550
	1999	555	273	68	1589	2485	689800
DNR-Parks	1998	2	33	2	0	37	7100
	1999	20	419	0	56	495	117461
DNR-Wildlife	1998	0	0	0	0	0	0
	1999	2	16	0	0	18	6036
County	1998	65	196	22	346	629	205500
	1999	158	126	0	438	722	330213
US Forest Service	1998	1537	201	90	550	2378	858500
	1999	1267	213	74	538	2092	769000
Tribal	1998	15	0	0	0	15	15000
	1999	10	0	0	0	10	10000
Industry	1998	0	200	0	0	200	160000
	1999	20	230	0	0	250	188000
Private (PFM)	1998	86	46	36	1617	1785	304100
	1999	254	27	38	1086	1405	366275
Private (SWCD)	1998	0	0	75	0	75	37800
	1999	0	0	75	0	75	37500

Table 1. FY98-99 Acres of White Pine Planted by Ownership and Type of Planting and Number of Seedlings Planted

Land Ownership	Year	Main Species	Underplanting	Small Groups	Mixed Species	Total Acres	White Pine Seedlings Planted
Private (Other)	1998	230	0	0	0	0	115000
	1999	600	0	0	0	600	292000
Total	**1998**	**2380**	**918**	**291**	**4071**	**7660**	**2441550**
	1999	**2886**	**1304**	**255**	**3707**	**8152**	**2815085**
FY98-99 Total		5266	2222	546	7778	15812	5256635

Data is based on survey responses received from land managers regarding white pine regeneration and management accomplishments during the period of July 1 to June 30 Fiscal Year (FY) 1998 and 1999 and DNR tree nursery records. Private Lands (PFM) data is from DNR Private Forest Management (PFM) Program Foresters. Private Lands (SWCD) data based on Soil Water Conservation District (SWCD) state nursery tree orders and the White Pine Care Kits they distributed. Private Lands (Other) is the DNR tree nursery private sales total minus the amount reported for PFM and SWCD. Private Lands (Other) acres estimate based on approximately 500 seedlings planted per acre and all have been reported as Main Species type of planting.

Main Species: Planting where white pine is the main tree species planted on the site, greater than 50% white pine.
Underplanting: White pine planted under an existing tree canopy where stand density is or has been reduced to a level which allows sufficient sunlight for seedling growth.
Small Groups: Planting of small groups of white pine on favorable sites within other species plantations.
Mixed Species: White pine planted scattered throughout the site in mixed species plantations where white pine is not the main species, less than 50% white pine.

1-31-2000

Table 2. FY98-99 White Pine Seeding by Ownership and Method - Natural and Artificial - Acres

Land Ownership	Year	Natural Seeding			Artificial Seeding	
		Seed Tree with Scarification	Seed Tree with Prescribed Burn	Shelterwood	Aerial Seeding	Hand Seeding
DNR-Forestry	1998	47	2	48	477	10
	1999	403	5	125	399	14
DNR-Parks	1998	4	156	0	0	0
	1999	0	370	0	0	0
County	1998	10	0	0	0	0
	1999	97	0	57	20	0
US Forest Service	1998	111	69	0	0	0
	1999	0	0	323	0	0
Tribal	1998	20	0	0	0	0
	1999	20	0	10	0	0
Industry	1998	0	0	0	0	0
	1999	0	0	140	0	0
Private (PFM)	1998	0	0	0	0	0
	1999	15	0	0	0	0
Total	**1998**	**192**	**227**	**48**	**477**	**10**
	1999	**535**	**375**	**655**	**419**	**14**
FY98-99 Total		727	602	703	896	24

Table 2. FY98-99 White Pine Seeding by Ownership and Method - Natural and Artificial - Acres

Total acres of Natural Seeding:	FY98 = 467 FY99 = 1565 Total = 2032	Total acres of Artificial Seeding:	FY98 = 487 FY99 = 433 Total = 920

Data is based on survey responses received from land managers regarding white pine regeneration and management accomplishments during the period of July 1 to June 30 Fiscal Year (FY) for 1998 and 1999. Private(PFM) data is from DNR Private Forest Management(PFM) Program Foresters.

Natural seeding figures include only those acres where some method of site preparation or timber harvest has occurred for the purpose of regenerating white pine from reserved white pine on the site. It does not include seeding from scattered white pine reserved on harvested sites with no follow-up site preparation or soil scarification.

Seed tree with scarification: scarification or exposure of mineral soil around white pine seed trees to provide a good seedbed for seeds to germinate and grow. White pine seed trees have been reserved from harvest in a timber sale area or scarification was performed around scattered white pine trees in an unharvested area.
Seed tree with prescribed burn: prescribed fire used to reduce forest floor vegetation, litter, and duff layer to provide a good seedbed for seeds to germinate and grow. White pine seed trees may have been reserved from harvest in a timber sale area or prescribed burning was performed on a site with scattered white pine trees in an unharvested area.
Shelterwood: a partial harvest, resembling a thinning, in which trees on a harvest area are removed in a series of two or more cuttings to allow the establishment and early growth of seedlings under partial shade and protection of older trees.
Aerial seeding: distributing white pine seed from a helicopter equipped with a seeder on a site where timber harvest, site preparation, or a natural disturbance such as a wildfire or windstorm has occurred.
Hand seeding: distribution of white pine seed, usually on small acreages, by means of a hand seeder.

1-31-2000

Table 3. FY98-99 White Pine Deer Browse Protection and Blister Rust Control Pruning

Land Ownership	Year	Bud Capping	Repellents	Tree Shelters or Wire Cages	Deer Exclosure	White Pine Blister Rust Pruning
DNR-Forestry	1998	632	0	0	0	271
	1999	1160	98	11	0	843
DNR-Parks	1998	39	1	44	7	30
	1999	222	0	92	4	207
DNR-Wildlife	1998	0	0	0	0	0
	1999	2	5	1	0	12
County	1998	93	0	15	0	350
	1999	159	0	0	0	153
US Forest Service	1998	50	0	0	0	335
	1999	414	628	1	0	318
Tribal	1998	0	0	0	0	150
	1999	0	0	0	0	30
Industry	1998	600	0	0	0	0
	1999	770	0	0	0	0
Private (PFM)	1998	31	1	2	0	18
	1999	175	66	7	0	44

Table 3. FY98-99 White Pine Deer Browse Protection and Blister Rust Control Pruning

Land Ownership	Year	Bud Capping	Repellents	Tree Shelters or Wire Cages	Deer Exclosure	White Pine Blister Rust Pruning
Total	**1998**	**1445**	**2**	**61**	**7**	**1154**
	1999	**2902**	**797**	**112**	**4**	**1607**
FY98-99 Total		4347	799	173	11	2761

Total acres of deer browse protection: FY98 = 1515
FY99 = 3815
Total = 5330

Data is based on survey responses received from land managers regarding white pine regeneration and management accomplishments during the period of July 1 to June 30 Fiscal Year (FY) for 1998 and 1999. Private(PFM) data is from DNR Private Forest Management(PFM) Program Foresters.

Bud capping: A piece of paper wrapped and stapled around the terminal leader and bud of a seedling to deter deer from browsing the bud. Where deer browsing is a hazard, bud caps should be reapplied every fall until the tree is at least 4 feet tall and out of easy reach of deer.
Repellents: A substance (solution, spray, powder, or capsule) that deters animals from eating or browsing the buds of a seedling to which it has been applied. Deterred by odor or taste. Effective for 2 months to 1 year depending on product used.
Tree shelters: A biodegradable plastic tube or a mesh tube installed around each seedling to protect the tree from browsing for several years.
Wire cage: A wire fence installed around each seedling to protect the tree from browsing for many years.
Deer exclosure: A wire fence installed around a plantation or acres of trees to protect the seedlings from deer browsing.
WPBR pruning: Pruning off of the lower one-third of the branches on white pine to reduce the chance of infection by white pine blister rust (WPBR) disease.

1-31-2000

Table 4. FY98-99 White Pine Timber Stand Improvement - Release and Thinning by Ownership - Acres

Land Ownership	Year	Hand or Mechanical Release	Ground Herbicide Release	Aerial Herbicide Release	Thinning
DNR-Forestry	1998	713	55	85	61
	1999	568	331	235	18
DNR-Parks	1998	9	9	0	11
	1999	109	40	0	6
County	1998	21	0	24	0
	1999	6	15	0	0
US Forest Service	1998	484	0	0	0
	1999	2143	0	0	0
Tribal	1998	20	0	0	0
	1999	20	0	0	0
Industry	1998	200	0	0	0
	1999	100	0	0	0
Private (PFM)	1998	14	20	0	32
	1999	65	93	0	5
Total	**1998**	**1461**	**84**	**109**	**104**
	1999	**3011**	**483**	**235**	**29**
FY98-99 Total		4472	567	344	133

Table 4. FY98-99 White Pine Timber Stand Improvement - Release and Thinning by Ownership - Acres

Total acres of release: FY98 = 1654
FY99 = 3729
Total = 5383

Data is based on survey responses received from land managers regarding white pine regeneration and management accomplishments during the period of July 1 to June 30 Fiscal Year (FY) for 1998 and 1999. Private(PFM) data is from DNR Private Forest Management(PFM) Program Foresters.

Timber Stand Improvement: Timber stand management practices designed to produce improved forest crops, including thinning, pruning, and the release of crop trees from competing vegetation.
Release: To free young trees from competing vegetation that is overtopping or closely surrounding them by cutting or otherwise removing or killing nearby vegetation and branches.
Hand or Mechanical Release: Cutting of competing vegetation by use of hand tools, brush saws, chainsaws, or other mechanical equipment.
Ground Herbicide Release: Killing of competing vegetation by use of herbicides applied by use of a hand or backpack sprayer, applicator, or injector or by broadcast spraying equipment on the ground.
Aerial Herbicide Release: Killing of competing vegetation by use of herbicides applied aerially from a helicopter equipped with a spray boom.
Thinning: Removal of some of the trees in an overstocked stand to give the remaining trees adequate room for good growth.

1-31-2000

Table 5. FY98-99 White Pine Site Preparation by Ownership and Method - Acres

Land Ownership	Year	Hand Methods	Prescribed Burn	Trench, Furrow, or Patch	Rake or Shear Blade	Discing	Other Methods	Herbicide and Disc Trench	Herbicide
DNR-Forestry	1998	36	147	221	539	5	37	455	189
	1999	22	70	489	214	0	5	225	388
DNR-Parks	1998	2	166	0	0	0	1	0	0
	1999	111	1852	0	0	0	0	0	5
DNR-Wildlife	1998	0	0	0	0	0	0	0	0
	1999	4	0	0	0	0	0	0	0
County	1998	0	0	35	174	6	17	232	25
	1999	0	0	213	224	0	97	365	258
US Forest Service	1998	0	482	923	78	0	0	0	0
	1999	25	36	750	17	0	0	0	0
Nat'l Park Service	1998	0	80	0	0	0	0	0	0
	1999	0	181	0	0	0	0	0	0
Tribal	1998	0	0	0	20	0	0	0	0
	1999	0	0	0	20	0	0	0	0
Industry	1998	0	0	0	200	0	0	0	200
	1999	0	0	0	200	0	0	0	0
Private (PFM)	1998	10	0	34	0	68	76	0	85
	1999	13	0	161	6	0	0	0	135

Table 5. FY98-99 White Pine Site Preparation by Ownership and Method - Acres

Land Ownership	Year	Hand Methods	Prescribed Burn	Trench, Furrow, or Patch	Rake or Shear Blade	Discing	Other Methods	Herbicide and Disc Trench	Herbicide
Total	**1998**	**48**	**875**	**1213**	**1011**	**79**	**131**	**687**	**499**
	1999	**175**	**2139**	**1613**	**681**	**0**	**102**	**590**	**786**
FY98-99 Total		223	3014	2816	1692	79	233	1277	1285

Data is based on survey responses received from land managers regarding white pine regeneration and management accomplishments during the period of July 1 to June 30 Fiscal Year (FY) for 1998 and 1999. Private(PFM) data is from DNR Private Forest Management(PFM) Program Foresters.

Site Preparation: Treatment of a site to remove, reduce, redistribute, or pile unwanted vegetation and other material , and to cultivate or prepare the soil for tree seedling planting or seeding.
Hand Methods: Hand or manual methods of site preparation by use of hand tools, brush saws, or chainsaws.
Prescribed burn: Use of a planned fire on a site to reduce, set back, or eliminate forest floor vegetation, logging slash, or duff.
Trench, Furrow, or Patch: Exposing mineral soil and clearing woody debris and ground vegetation in narrow strips or patches by use of equipment such as a disc trencher, V-plow, or patch scarifier.
Rake or Shear Blade: Site preparation where logging slash is piled by use of a brush or rock rake or the shearing and windrow piling of undesirable vegetation to reduce competition and prepare a clean site for planting or seeding.
Disking: Use of a heavy harrow with large discs on a site to eliminate competing vegetation.
Other Methods: Miscellaneous methods used for site preparation such as brush mowing, anchor chain, small dozer, logging, or cover crop.
Herbicide & Disc Trench: Using a combination of herbicide application and disc trencher to prepare a site for planting or seeding.
Herbicide: Use of herbicides to kill vegetation that would compete with seedling survival and growth. Applied by ground equipment or helicopter.

1-31-2000

Appendix B

White Pine Planting on State Forest Lands (1991-2000)

Year	Bareroot Seedlings	Containerized Seedlings	Total White Pine Planted	Total Acres Planted
1991	173,500	0	173,500	200
1992	129,100	20,000	149,100	200
1993	113,100	18,400	131,500	100
1994	172,300	141,500	313,800	300
1995	181,200	96,800	278,000	300
1996	350,100	97,000	447,100	500
1997	323,100	51,900	375,000	400
1998	644,150	94,400	738,550	2,311
1999	555,800	134,000	689,800	2,485
2000	691,000	93,000	784,000	1,777
Totals:	**3,333,350**	**747,000**	**4,080,350**	**8,573**

1991-97 acres estimated. 1998-2000 acres include white pine as a main species in a plantation, planting white pine in an understory, small patches or inclusions of white pine in other species plantations, and white pine mixed throughout other species plantations. 2000 data based on FY2000 work plan. 1998 was the first year of white pine initiative funding.

Appendix C: 1999 WHITE PINE CARE KIT DISTRIBUTION SUMMARY

SWCD	Number of Kits
Aitkin	80
Anoka	128
Beltrami	95
Becker	20
Benton	20
Chisago	120
Clearwater	35
Cook	20
Crow Wing	25
Goodhue	40
Hubbard/Cass	35
Kanabec	35
Koochiching	25
Morrison	140
Pine	60
Root River(Houston)	20
Sherburne	40
North St. Louis	90
South St. Louis	250
Washington	100
Wadena	25
Winona	25
SWCD Total	1428
Other	
Itasca Greenhouse	20
No. Central Reforest.	10
Rajala Companies	20
Hedstrom Lumber	70
TOTAL	**1548**

East Ottertail, Lake of the Woods, and Mille Lacs SWCDs had kits remaining from 1998 for distribution in 1999.

Appendix D - Research

Research to Reduce the Impact of White Pine Blister Rust - December 1999

Prepared by Robert Stine

The 1997 State Legislature provided $300,000 for research to reduce the impact of blister rust on eastern white pine in Minnesota. The research focused on several areas. One area was development of methods to better predict rust hazard on both a regional and site scale. Existing work on selection and testing of trees for increased growth rates and blister rust resistance was accelerated. To support the genetics work, research on flower induction, rapid screening for rust resistance, and histological examination of infected material was initiated.

A new rust hazard map for northeastern Minnesota was created using inventory information, climate, topography, distance to water, and several other factors. It shows that even within areas previously classified as "high hazard", there are places where the rust hazard is quite lower. New GIS maps are available for land managers to help make decisions about the level of blister rust to anticipate when growing white pine. See: http://oden.nrri.umn.edu/rustmap/

Selection of fast growing and disease resistant trees, and subsequent establishment of seed orchards was accelerated as part of the research project. In addition, a breeding arboretum containing promising clones was expanded using selected material from an earlier progeny test.

To support shortened generation cycles (breeding-testing-selecting), research on flower induction was initiated. A foliar spray application of gibberellic acid during the period of rapid shoot elongation induces both male and female inflorescences, but not consistently across all genotypes. The study continues in order to increase the quantity and consistency of both male and female flowering. Stem injection trials were initiated in May 1999 as an alternative to foliar spray. The critical time of year for stem injections, hormone concentration, effects of tree fertilization, and effects on pollen viability will all be determined as the study continues.

A rapid and reliable method was created for early screening of blister rust susceptibility. Five-month-old seedlings are inoculated with blister rust, and resistant families can be identified within 1½ years. This is an improvement over less reliable methods that require up to 5 years for results. Field plantings of the families tested using the accelerated method were planted to measure how well early screening results correspond to field trials.

Histological examinations of the early stage of seedling colonization of both resistant and susceptible white pine seedlings were conducted. In a very short time, remarkable progress was made in understanding what actually occurs within a needle when blister rust infection occurs. This work is useful in helping to understand potential defense mechanisms, and supports research on the ability to induce greater resistant responses in trees by biological or chemical additives to the soil or surfaces of the tree.

Future research is building on information developed during the first two-year period. Refinements to the flower induction and early screening techniques are being developed. Preparations are being made for breeding work in the arboretum. Internal biological and chemical methods of blocking infection are also being explored.

Research on Natural Regeneration Processes of White Pine - December 1999

Submitted by Lee E. Frelich

White Pine (Pinus Strobus) Regeneration in Minnesota

Progress Report by Martin Dovciak

1. Study of Old-field Succession at Boot Lake

All data collection and data entry has been completed, and currently, the map and database of seedlings, saplings, and seed trees is being developed. Conversion of point data to polygon data as well as rotation of both polygon and point data is required, in order to merge two different sampling designs that had to be implemented due to large variation of sapling densities in the field. The maps and database will be used to study secondary succession of white pine into an old field. This study complements analyses that are currently underway based on the northern Minnesota sites by providing very large and homogeneous area within which seedling and sapling dispersion relative to seed trees as well as relative to forest edge can be studied.

2. Study of Discordance in Cohort Spatial Patterns at Purvis Lake

A paper on discordance of spatial patterns of different white pine cohorts is being finalized for publication based on Purvis Lake site in northeastern Minnesota. The paper, Spatial Pattern Analysis of White Pine Cohorts in Aspen-Dominated Near-Boreal Forests, was presented last summer at 5th World Congress of International Association for Landscape Ecology in Colorado. It has been extended from original draft to incorporate the study of the dispersion of different sapling cohorts relative to seed trees on a stand scale (0-70m). The major finding from this extension was that saplings 0.5-2m tall (cohort 1 and 2) tend to be distributed mostly far away from seed trees while more advance saplings over 4m tall are distributed relatively nearby seed trees. This disparity in the distributions of less and more advanced saplings is likely due to different affinities of these cohorts to different environmental conditions that are patchily distributed within the stand. What are these conditions precisely is currently being investigated in a related study below.

3. Study of White Pine Regeneration in Northeastern Minnesota

Preliminary stage of analyses that investigate suitability of different regeneration settings for different white pine cohorts at five sites was concluded. This part of the study, Spatial Patterns of White Pine Regeneration in Relation to Seed Rain, Competing Vegetation, and Resources, was presented last summer at the Annual Meeting of the Ecological Society of America in Washington. The end product of this stage will be a white pine regeneration model.

White Pine Regeneration in Stands Recently Disturbed by Fire and Logging in NE Minnesota

Research Project by Scott Weyenberg

This research will investigate how does the invasion of white pine into burned and logged stands of similar ages differ. The hypothesis is that white pine will invade burned areas to a greater extent and rate than logged sites because of the decrease in competition and increase in suitable seed-beds on the burned sites. The project area of 60 sites were sampled during the summer of 1999

and were divided approximately equally between logged and burned areas. The sites are located within and around the BWCAW and occur in five main clumps that are widely spaced from west to east across the wilderness. White pine stands (seed source) were a minimum of 60 years old and directly abutted (within 30m) burns or clearcuts. All disturbances selected occurred between 1971 and 1989. Post disturbance white pine were recorded on sample plots along a 130m transect. Deer browse was not significant at any of the sites and was not recorded. Preliminary analysis, not all of the sites were included in the analysis, does not appear to show any significant difference in seedling and sapling count totals between burned and logged areas.

Other White Pine Related Research

A number of other research projects relating to eastern white pine, with minor or no funding from the white pine initiative, have been completed or are in process. Following is a list of the known projects:

1. Effects of overstory and understory competition and simulated herbivory on growth and survival of white pine seedlings. Mike R. Saunders and Klaus J. Puettmann, U of MN, 1999.

2. Use of vegetational characteristics and browsing patterns to predict deer damage in eastern white pine (Pinus strobus) plantations. Mike. R. Saunders and Klaus .J. Puettmann, U of MN, 1999.

3. Overstory and understory competition affect underplanted eastern white pine. Mathew F. Smidt and Klaus J. Puettmann, U of MN, 1998.

4. Effects of overstory canopy type and resource levels on seasonal growth and photosynthesis of white pine (Pinus Strobus) seedlings. Michael A. Counte and Klaus J. Puettmann, 1999.

5. Overstory release study, Cartwright Road Plantation, Cloquet Forestry Center, Klaus J. Puettmann, U of MN.

6. Studies of distribution, abundance, growth, and survival of white pine (and other woody species) in the understory of mature and old growth white pine stands. Studies focus on the effect of light, nitrogen supply, and soil depth, and used mapped plots in the Superior National Forest and other plots in the Cloquet Forestry Center. Machado and Reich, U of MN.

7. Studies of the mature tree growth, understory composition, and regeneration of white and red pine in mature and old growth white and red pine stands along a gradient from the Arrowhead region to the southwest edge of the range (near Detroit Lakes). Investigating how the variable change along climate and associated vegetation type and fragmentation gradients. Bakker and Reich, U of MN.

8. Studies of pattern of tree and total plant species diversity as a function of forest type, stand age, and disturbance history (wildfire vs. logging) in the northeastern part of Minnesota. Reich, U of MN.

9. Studies of the distribution and abundance of white pine (and other species) trees in the late 19th century, based on bearing tree data from the Public Land Survey, in relation to soil, topography, geology, and hydrology. Also included are studies of changes from pre-settlement and current vegetation in burned vs. logged areas. Friedman and Reich, U of MN.

10. White pine competition and resources use in monoculture and mixed species stands. Puettmann and Reich, U of MN.

11. White pine seed zones in Minnesota: A genetic, physiological and pathogenic evaluation of provenance-progeny performance. Paul A. Anderson, USDA Forest Service, North Central Forest Experiment Station, Rhinelander, WI. Investigating genetic variability in white pine across northern Minnesota and the Lake States.

12. Conservation of North Shore white pine project. Objectives are to preserve the North Shore white pine population, characterize the genetic diversity of North Shore white pine, and establish a framework which will secure the North Shore white pine population for reforestation and future research. USFS, DNR, and the White Pine Society.

13. Utilization of Historic Timberland Survey Records. The project will convert historical environmental records, Reports of Estimates and Appraisals of the Timber Commissioners Board, 1895-1905, to a digital GIS format and use information technology to provide access to the valuable data they contain. These records contain information on where white pine existed and appraised volumes at that time in the locations that were surveyed. LCMR grant to the Minnesota Historical Society, Robert Horton, Project Manager.

14. White pine demonstration plantings on the Superior and Chippewa National Forests. The plantings were done to refine management recommendations for establishing white pine in northern Minnesota where blister rust is a major concern, deer and hare browsing is common, and where white pine weevil populations can be significant. Planting and monitoring for 3 years so far. USFS.