

Minnesota's Forest Resources



**Department of Natural Resources
Division of Forestry
August 2002**

**500 Lafayette Road
St. Paul, Minnesota 55155**

Minnesota's Forest Resources Revised 8-28-02

This book is published annually by the Minnesota DNR – Forestry Division Utilization & Marketing staff. Publication was begun in the mid 1980s by John Krantz, former Utilization & Marketing Program Coordinator. We gratefully acknowledge his leadership in providing information intended to guide the wise use of Minnesota's forest resource. The book is intended to answer many of the common "questions of the day" about Minnesota's forest resources, such as; present condition and use of our forests, and trends in resource use and condition that will affect forest management and forest industry. Foresters, other resource managers, planners, people in forest industry and policy makers will find items of interest in these pages.

Many thanks to those who cooperated in providing information for this book, including many of Minnesota's wood product companies, and the U.S. Forest Service Forest Inventory and Analysis (FIA) unit. Without their cooperation, much of the information in this book cannot be gathered or disseminated.

Most of the figures and charts depend on the Minnesota 1990 FIA inventory, but the 2000 inventory figures (currently only two years of data are available, of a 5 year inventory project) were used in the aspen and birch cover type age distribution charts on pages 16 and 21. The 2000 data is not yet reliable enough to use for many analyses. It will be fully available by 2004.

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Minnesota Wood Industry – 2002

Annual Economic Impact

- Value of Forest Products Manufacturing Shipments 2000: 7 Billion (estimated)***
- 4th Largest Manufacturing Industry in Minnesota Based on Employment (#1 Computer & Electronic Equipment, # 2 Fabricated Metal Products, #3 Food Manufacturing)*
- Generates 11% of dollars of all manufacturing shipments*
- Value-Added = \$4.7 Billion that stays in Minnesota*

Employment

- 56,000 Employees (Primary Processing = 25,700, Secondary Manufacturing = 30,300)**
- 1.8 Billion in wages paid (10% of all manufacturing in Minnesota)
- **Important Industries Include:** Cabinets and Cabinet Parts, Window & Door Components (MN # 2 in U.S.), Store Fixtures, Office & Residential Furniture, Pallets, Crating & Pallet Parts, Millwork, Wood Shavings (for poultry industry).
- **Non-Traditional Industries Dependent on Forestry:** Balsam Boughs for Wreath Industry (annual sales of \$20 Million+), Wood “flour” energy for taconite industry, 6 co-generation facilities utilizing wood for energy production.

Industry

- 5 Pulp and Paper Mills
- 3 Recycled Pulp & Paper
- 3 Hardboard & Specialty
- 6 Oriented Strand/Structural Board
- 500 Sawmills
- 150 Associated Industries
- Over 850 Secondary Manufacturers

Annual Volume of Timber Harvested

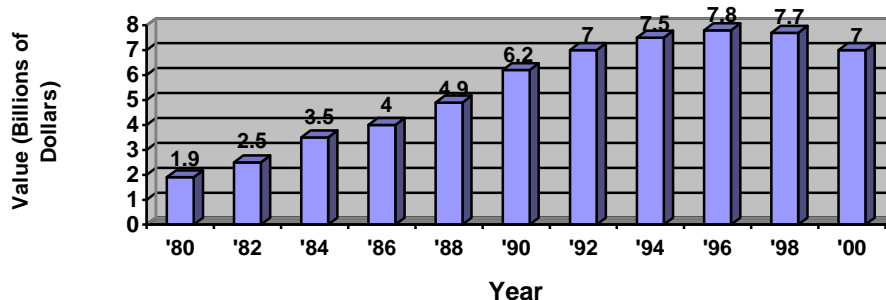
- Pulpwood = 2,915,000 Cords (2000)
- Sawlogs = 288 Million Board Feet (2001)
- Fuelwood = 752,000 Cords (203,000 from timberland)
- Veneer = 8.0 Million Board Feet (domestic)
= .5 Million Board Feet (exported)
- Chips = 9,000 Cords (fuel & mulch)
- Shavings = 14,000 Cords (animal bedding)
- Posts & Poles = 9,100 Cords

*Minnesota Department of Trade & Economic Development analysis

**Minnesota Department of Economic Security statistics

***Minnesota Forest Industries estimate

Value of Forest Products Manufactured in Minnesota



Minnesota Pulp and Paper – 2002

Firm	Wood Used	Product
UPM - Kymenne Blandin Paper Company Grand Rapids	Aspen, Balsam Fir and Spruce	Magazines, Catalogs
Boise Cascade International Falls	Aspen, Balm, Pine, Spruce, Balsam Fir, Birch, Tamarack	Business, Xerox, Envelope, Computer
International Paper Sartell	Aspen, Balsam Fir, Spruce	Magazines, Catalogs
Stora Enso Duluth	Balsam Fir, Pine, Spruce	Advertising Supplements
Sappi Fine Paper Company Cloquet	Aspen, Balm, Maple, Basswood, Tamarack, Pine	Business & Printing
Recycling Mills		
Rock-Tenn Company St. Paul	Recycled Paper & Corrugated	Cardboard & Corrugated Boxes
Stora-Enso Recycled Fiber Mill Duluth	High Grade office Paper & Computer Paper	Market Pulp for Paper
Liberty Paper Company Becker	Recycled Paper & Corrugated	Cardboard & Corrugated Boxes

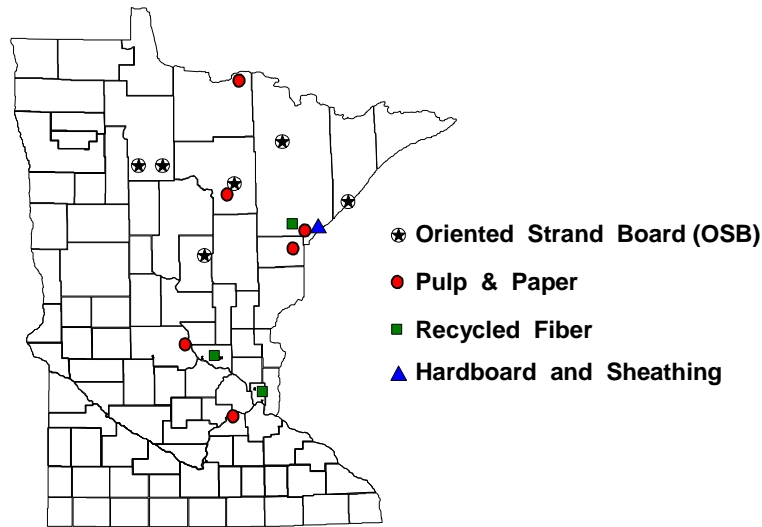
Minnesota Oriented Strand Board – 2002

Firm	Wood Used	Product
Potlatch Grand Rapids	Aspen, Balm, Birch, Pine, Maple	OSB – “Potlatch Select”
Louisiana-Pacific Two Harbors	Aspen & Balm	OSB – Siding “Inner Seal”
Northwood Panelboard Bemidji	Aspen & Balm	OSB – “Norboard”
Potlatch Bemidji	Aspen, Balm, Birch, Pine, Maple	OSB – “Oxboard”
Potlatch Cook	Aspen, Balm, Birch, Pine, Maple	OSB – “Oxboard”
Trus Joist Weyerhaeuser Deerwood	Aspen	Laminated Structural Lumber “Timberstrand”

Minnesota Hardboard and Specialty – 2002

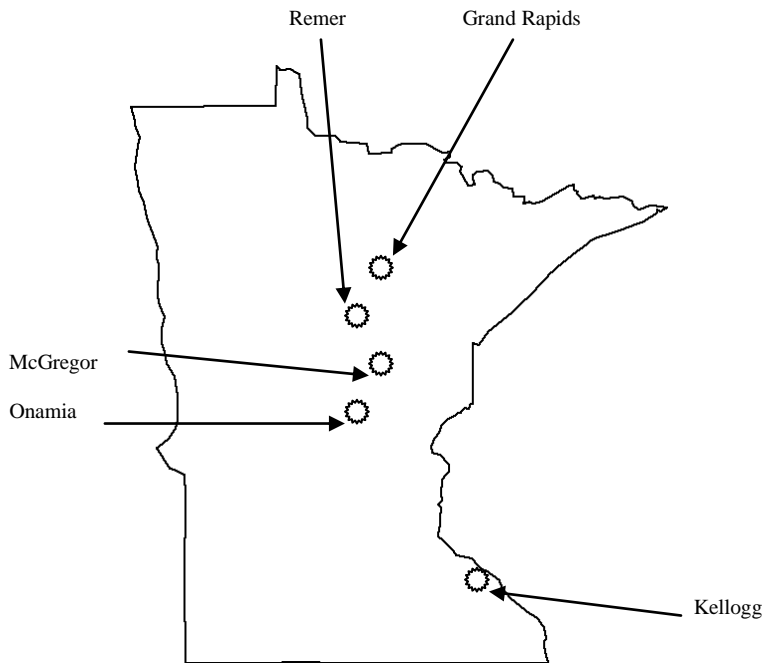
Firm	Wood Used	Product
Certaiteed Corporation Shakopee	Aspen & Recycled Paper	Roofing Felt
International Biltrite International Falls	Aspen, Balm & Recycled Paper	Medium Density Fiberboard
Georgia-Pacific Corporation, Superwood Division Duluth	Aspen, Pine, Mixed Hardwoods	Industrial Hardboard

OSB, PULP & PAPER, HARDBOARD & RECYCLING MILLS
Minnesota 2002



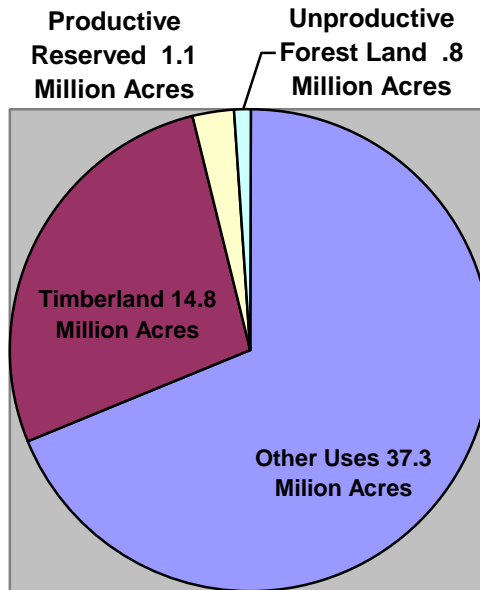
Location of mills is a big factor in determining markets for wood. The map above shows the larger OSB, Pulp & Paper, Recycled Fiber and Hardboard Sheathing mills in Minnesota. These mills utilize various species of pulpwood – sized material, with aspen being by far the largest component.

Minnesota Sawmills Utilizing Small Diameter Hardwoods – 2002



Recently, several Minnesota mills have invested in equipment that enables them to efficiently utilize smaller diameter hardwoods. This has improved markets for some of this material, giving landowners more income for their timber and giving forest managers more management options.

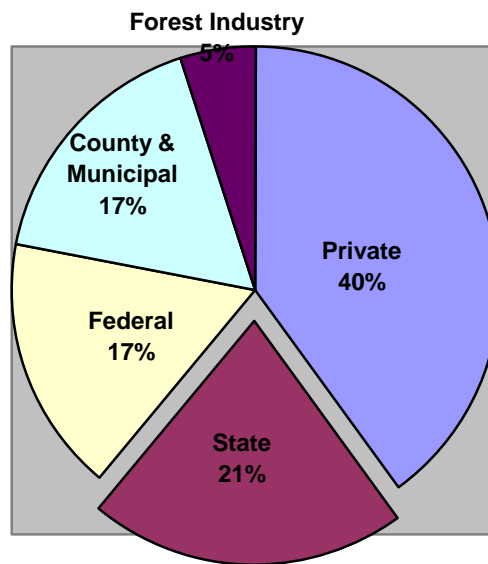
Minnesota Land Use -Total of 54 Million Acres



Source: Minnesota FIA 1990 Eastwide Database Provided by USFS North Central Forest Experiment Station

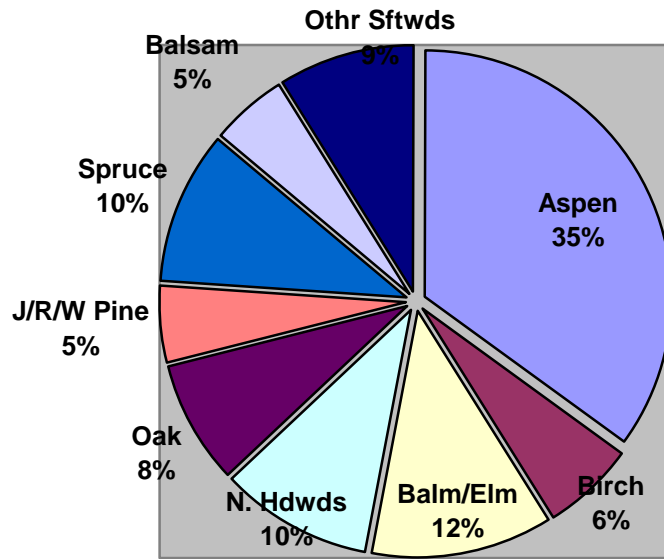
Minnesota has 14.8 million acres of forest land that is classified as “timberland”. Timberland is forest land that is productive enough to produce a commercial crop of trees and is not reserved from harvesting by policy or law. Forest land reserved from harvest by policy or law include designated wilderness areas like the Boundary Waters Canoe Area (BWCA), Old Growth reserves and others.

Minnesota Timberland by Ownership -14.8 Million Acres-



Source: Minnesota Forest Statistics, 1990 – USFS, Resource Bulletin NC-141 (Table 2) Ownership of timberland is an important factor in assessing many factors, including timber supply. For instance, national forestland harvest levels have dropped dramatically in the last 10 years. Since society continues to demand more raw materials including wood, the difference has been made up largely from private forestlands.

Minnesota Timberland By Cover Type (Total 14.8 Million Acres)



Cover Type: A classification of forest land based on the species forming a plurality of live tree stocking.
Source: USDA Forest Service "Minnesota Forest Statistics" Resource Bulletin NC-141, 1990

Area of Timberland in Minnesota by Forest Type - 1990

Forest Type	Acres (in Thousands)
Jack Pine	447.5
Red Pine	301.6
White Pine	63.2
Balsam Fir	734.3
White Spruce	93.8
Black Spruce	1,332.1
Cedar	680.5
Tamarack	705.1
Oak	1,184.3
Elm-Ash	1,291.5
Maple-Basswood	1,402.9
Aspen	5,114.2
Birch	835.8
Balm of Gilead	427.7
Non-Forest	168.9
Total All Types	14,773.4

Source: USDA Forest Service "Minnesota Forest Statistics" Resource Bulletin NC-141, 1990

Total Wood Harvested in Minnesota by Species – Timberland

(Pulpwood 2000; Sawtimber 2001; Fuelwood 1995-96)

(In Thousand Cords)

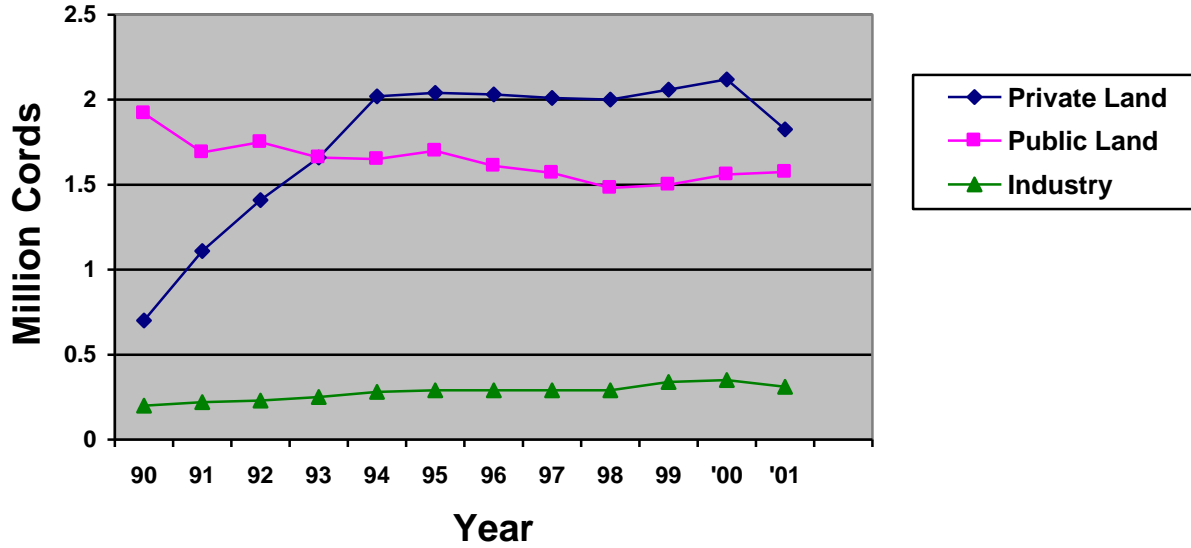
Species	Pulpwood*	Sawlogs & Others	Fuel		Total
			Residential**	Commercial	
Aspen	2111.6	120.6	29.0	.6	2261.8
Birch	154.0	32.4	40.3	6.3	233
Balm of Gilead	92.8	.9	0	.1	93.8
Ash	1.3	10.9	11.5	.2	23.9
Oak	.2	94.2	77.6	1.0	173
Basswood	10.0	24.5	3.2	0	37.7
Maple	45.0	11.8	11.4	4.7	72.9
Cottonwood	0	7.7	0	0	7.7
Other Hardwood	0	9.1	13.1	0	22.2
Sub-Total Hardwood	2414.9	312.1	186.1	12.9	2926
Pine					
Red Pine	35.4	95.9	1.0	0	132.3
White Pine	1.1	13.2	.2	0	14.5
Jack Pine	79.1	151.8	1.3	0	232.2
Spruce	182.5	12.8	.1	0	195.4
Balsam	184.4	7.6	.1	0	192.1
Tamarack	17.8	1.8	.6	0	20.2
Cedar	0	5.3	.6	0	5.9
Other Softwood		4.9			4.9
Sub-Total Softwood	500.3	293.3	3.9	0	797.5
Total	2915.2	605.4	186.1	12.9	3723.5

*Figures include pulpwood exported to Wisconsin: Aspen: 55,600 cords, Spruce: 41,400 cords, Red Pine: 5,700 cords, Tamarack: 14,700 cords, Birch: 52,000 cords.

** This is fuelwood removed from growing stock

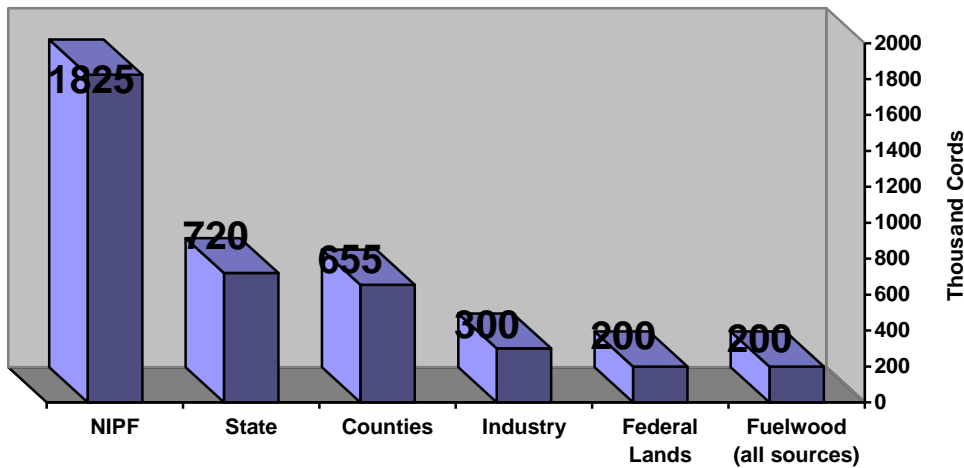
Sources: Pulpwood (USDA Forest Service, North Central Forest Experiment Station), Sawtimber & Fuelwood (MN DNR) surveys

Volume of Timber Sold by Ownership - Minnesota -



Public Land: State, Chippewa & Superior Nat'l Forests, BIA and 15 Counties.
 Source: Volume of timber sold by public land agencies, DNR survey, USFS North Central Forest Experiment Station pulpwood use survey, MFI industry survey.

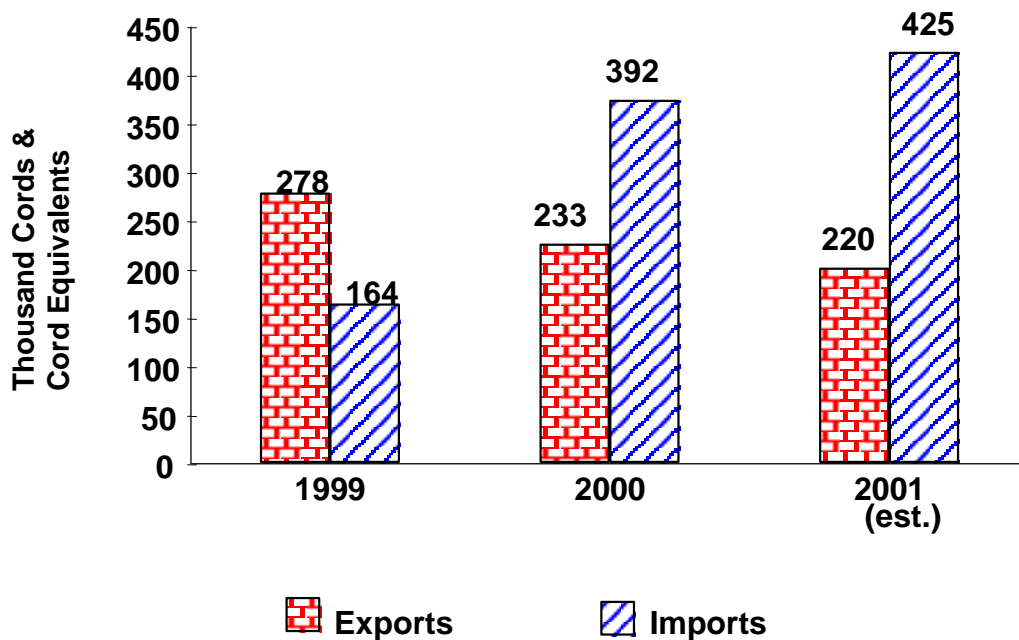
Contributors to Estimated Harvest in Minnesota - 2001 Total Harvest = 3.9 Million Cords, all sources



Ownership of lands has a large impact on policy regarding forest management and timber harvest. For example, forest management and harvest activity on national forests declined drastically over the last 10 years, with much of the slack picked up by increased harvest and management of private lands.

Exports & Imports of Pulpwood Roundwood & Chips

Minnesota



Exports are mainly to Wisconsin mills. Imports are from Canada, Wisconsin and Michigan.
Data From USFS North Central Station FIA Unit Survey of Industrial Wood Using Industry.

Minnesota has become a large net importer of wood over the last several years, as our stumpage prices have increased, and offerings of timber from federal lands have been reduced. Mills have needed to increasingly look outside of Minnesota's borders in order to meet their raw material needs, especially for aspen.

Estimate of Increases/Decreases by 2003: Minnesota Harvest (In Cords)

	Aspen/ Balm	Pine	Spruce	Balsam Fir	Birch	Maple	Basswood
Potlatch OSB Mills (Bemidji, Cook, Grand Rapids)	90,000	6,000			17,000		
SAPPI Pulp & Paper Mill*	(-)264,000	55,000				148,000	46,000
Boise Cascade**	10,000		2,000	2,000	6,000		
Blandin	(-)25,000		12,500	12,500			
Potlatch Lumber Mill**		2,000	2,000	4,000			
Sawmills	(-)20,000	5,000			5,000		
Total	(-)209,000	+68,000	+16,500	+18,500	+28,000	+148,000	+46,000

*Assumes 15% of procurement from Wisconsin for Aspen/Balm & Pine, 40% for Maple & Basswood.

**20% of expected increase over a 10 year period.

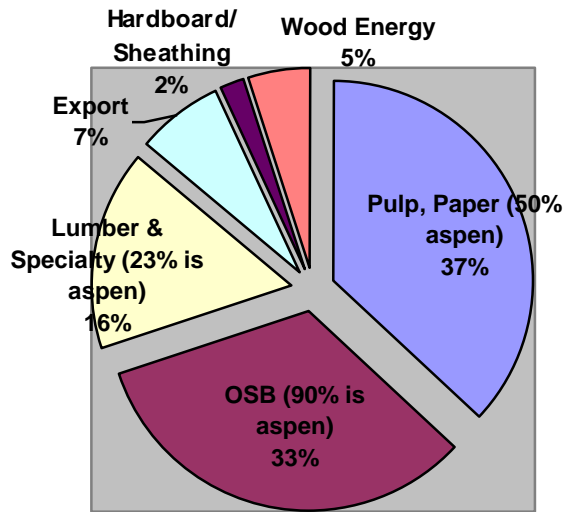
***Assumes all wood harvested in Minnesota.

NOTES

- 1) 2000 harvest figures are used as a basis for determining estimated harvest in 2003.
- 2) Pulpwood exports to Wisconsin will continue to decrease as demand and stumpage prices in Minnesota continue to increase.
- 3) May be a decrease in softwood imports from Ontario, due to establishment of new management guidelines and the establishment of several new parks.

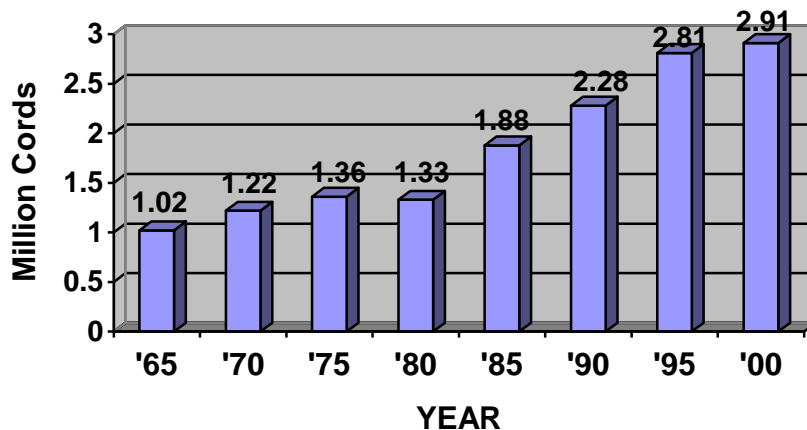
Wood Use by Product from Timber Harvest in Minnesota 1999

Total 3.81 Million Cords (Includes All Species)



Harvest Data Compiled by USDA Forest Service, North Central Forest Experiment Station & DNR
 Special products include veneer, posts & poles, shavings & landscape chips
 Export is primarily pulpwood shipped to Wisconsin mills

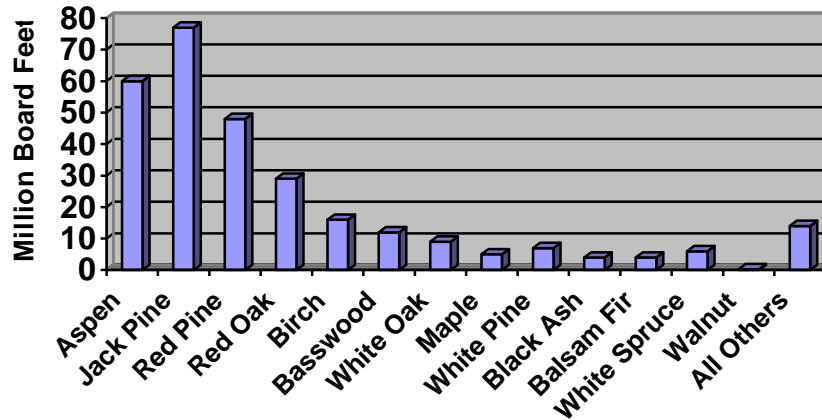
PULPWOOD PRODUCTION IN MINNESOTA 1965-2000 - All Species -



Source: USFS, North Central Forest Experiment Station Surveys

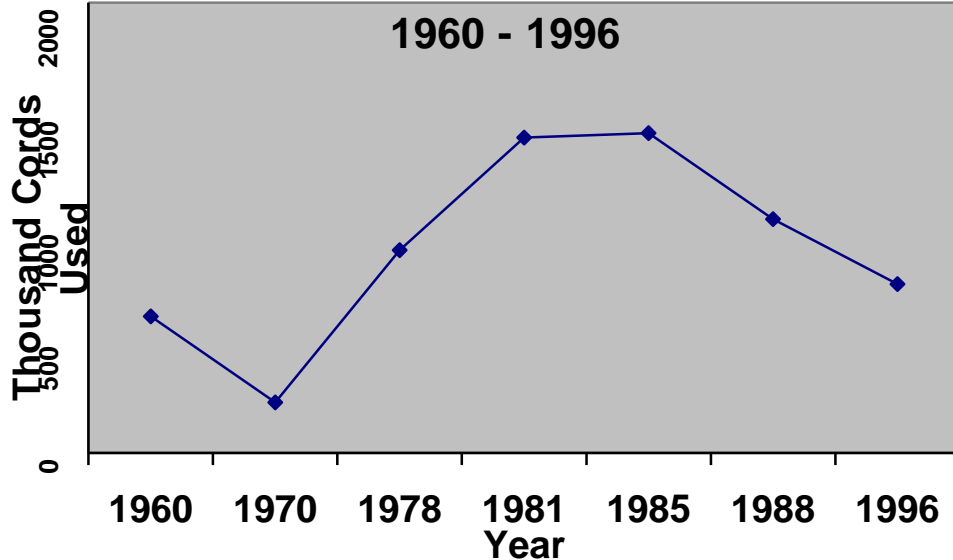
Timber Harvested & Used by Sawmills in Minnesota by Species -2001 -

(Lumber, Posts/Poles, Shavings, Veneer, Energy & Landscape Chips)
Total 300 Million Board Feet



Source: MN DNR Sawmill Survey. Sawtimber is generally the highest value product for wood that meets merchantability requirements. Generally speaking, a log needs to be at least 8 feet in length and 10 inches diameter inside bark at the small end in order to be of merchantable sawlog size. There are some mills that can utilize smaller diameter material profitably.

Fuelwood Demand in Minnesota



Source: MN DNR Fuelwood Surveys

Public Land: State, Chip & Superior Nat' 1 Forests and 15 Counties

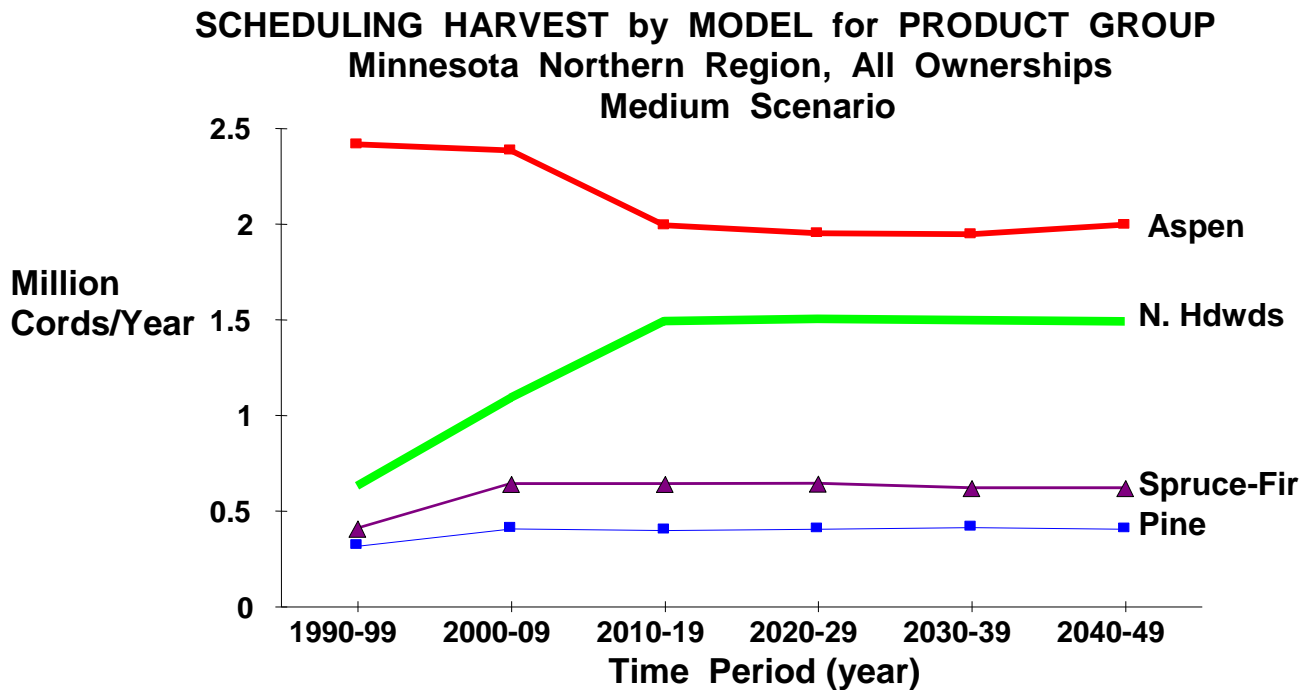
Source: Volume of timber sold by public land agencies, DNR Survey, NCFES Pulpwood Use survey, MFI Industry Survey.

Fuelwood is a relatively small portion of total timber harvest. Additionally, it is important to note that only a portion of fuelwood comes off of timberland, thereby having an affect on forest management. The remainder is from sawmill residue, urban tree waste, land and powerline clearing.

Sustainable Harvest Levels

Note to readers: There is no direct correlation between current harvest levels and long term sustained harvest levels because there are many options for moving towards a fully regulated forest age class structure. Normally, transitions from the present structure to a target age class structure require several rotations. The choice of amount and timing of harvest can vary considerably by decade. Harvest plans are typically assessed periodically as markets and other conditions dictate.

There is no one best way or time period to reach a target age class structure. Transition harvests may at some time be either lower or higher than the long term sustained yield.



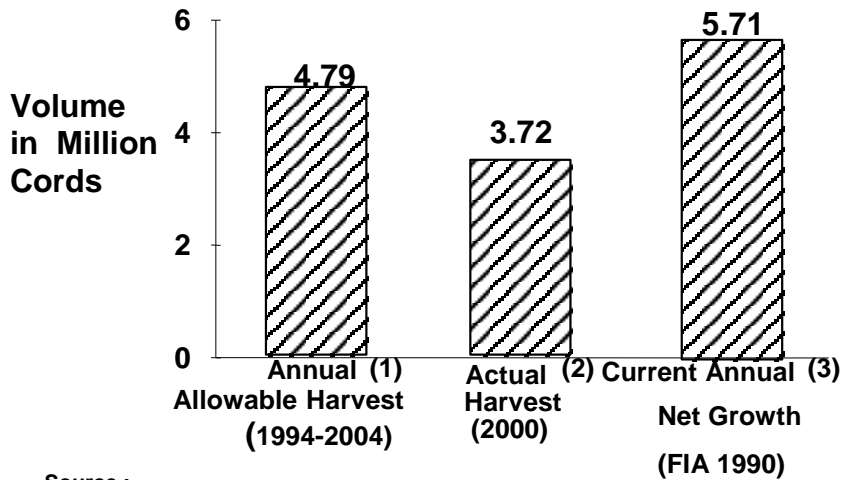
Source : GEIS table 6.8 medium scenario, 2nd run (p210 of M.P. & F. Reso. Base, 12/1992)
Assumptions used : Ownership constraints (riparian lands & old growth forests, etc.)

1994 saw the completion of Minnesota's Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota (GEIS). This study was commissioned by the Minnesota Environmental Quality Board at the request of a citizen petition. The GEIS assessed how three levels of statewide timber harvesting activity relate to Minnesota's environmental, economic and social resources. Base, medium and high harvesting scenarios were looked at: 4 million cords annually, 4.9 million cords annually, and 7 million cords annually.

Each scenario was projected over a 50-year planning horizon. They are not recommended in the GEIS as levels of harvest to follow, nor should their development and analysis be considered a plan. Rather, they are levels the GEIS study was given to analyze to determine what the impacts would be if they were to occur.

ESTIMATED ALLOWABLE HARVEST, HARVEST & ANNUAL GROWTH
- Minnesota Statewide Timberland , all Ownerships -

For All Species

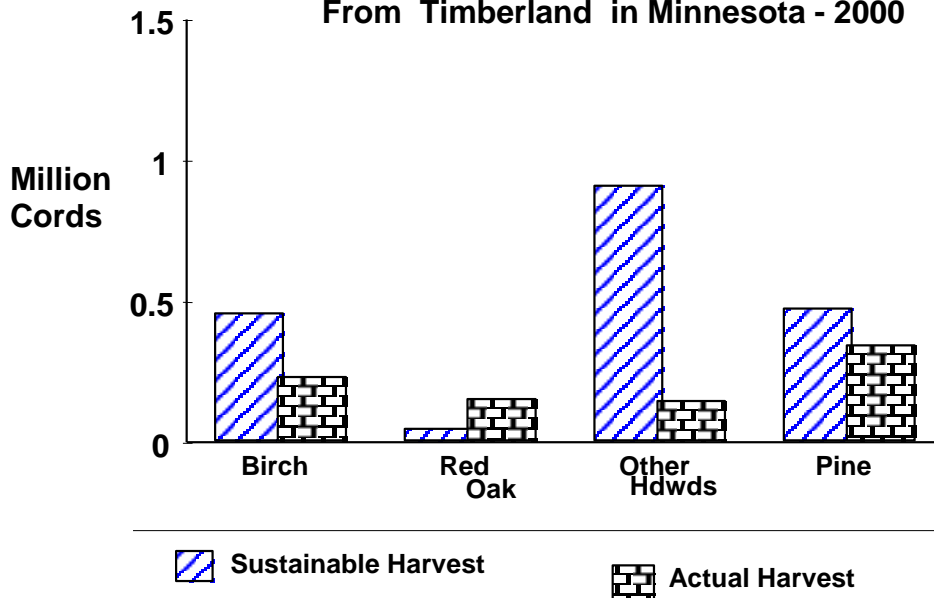


Source :

- 1). Table 6.25, GEIS, Medium Level : Maintaining Productivity & Forest Resource Base Tech. Pap., Dec 92
- 2). NCFES 1999 Pulpwood Harvest, 2001 DNR Sawtimber Survey, 95-96 Statewide Fuelwood Use Survey.
- 3). Table #63 of NCFES Resource Bulletin, NC-141, Aug. 92.

DNR 6/02

ESTIMATED SUSTAINABLE HARVEST & ACTUAL HARVEST
From Timberland in Minnesota - 2000

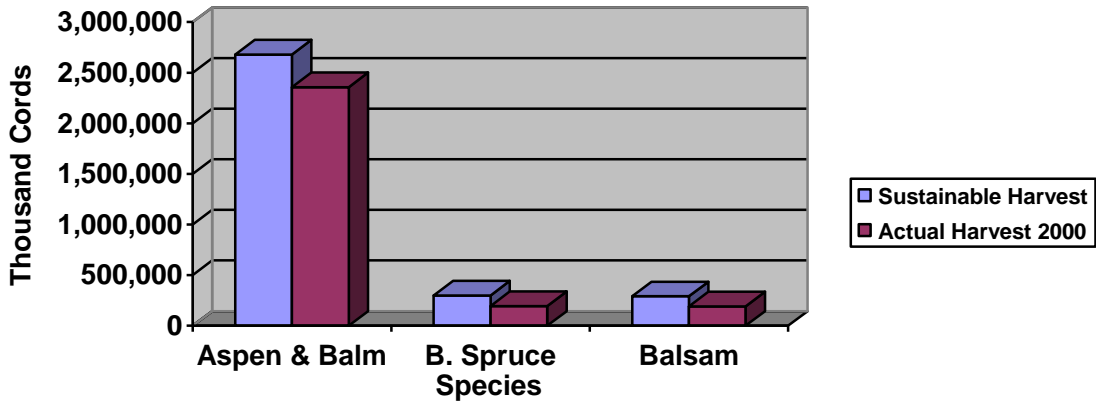


DNR 11/01

Based on DNR method of calculating allowable harvest

ESTIMATED SUSTAINABLE HARVEST AND ACTUAL HARVEST

From Timberland in Minnesota - Year 2000 -



Aspen/Balm sustainable harvest based on GEIS (Table 6.25, medium level, Dec. 1992)

Balsam Fir sustainable harvest based on DNR method with 32% reduction in 2000 due to mortality in fir since 1990 inventory. Spruce sustainable harvest based on DNR method.

Harvest data for 2000 from NCFES pulpwood survey & DNR 2001 sawmill & fuelwood survey

Current and Projected Wood Harvest from Timberland

- Minnesota Statewide -

Species	In Thousand Cords	
	2000	Projected 2003*
Aspen/Balm of Gilead	2,355.5	2,136
Birch	233.0	253
Ash	23.9	25
Oak	173.0	175
Basswood	37.8	84
Maple	72.9	221
Cottonwood	7.8	8
Other Hardwoods	22.2	21
Pine	379.0	447
Spruce	195.4	196
Balsam Fir	192.1	213
Tamarack	20.1	36
Cedar	5.4	6
Other Softwoods	4.9	4
Total	3,723	3,825

Source: 2000 Harvest data compiled by NCFES and DNR

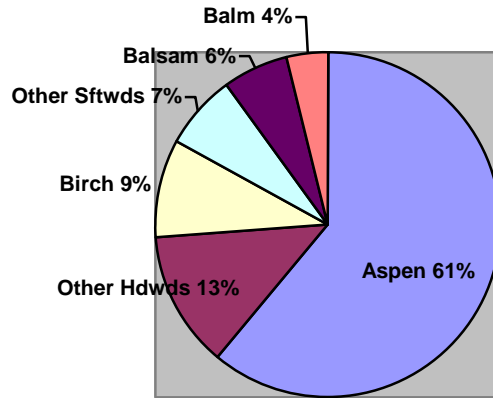
Projected 2003 based on announced expansions and industry interviews

Adjustments due to:

- Sappi pulp mill in Cloquet expansion & species mix change.
- Potlatch rebuild of OSB mill at Cook.
- Potlatch 3rd kiln addition at Bemidji.
- A portion of Boise Cascade proposed increase.

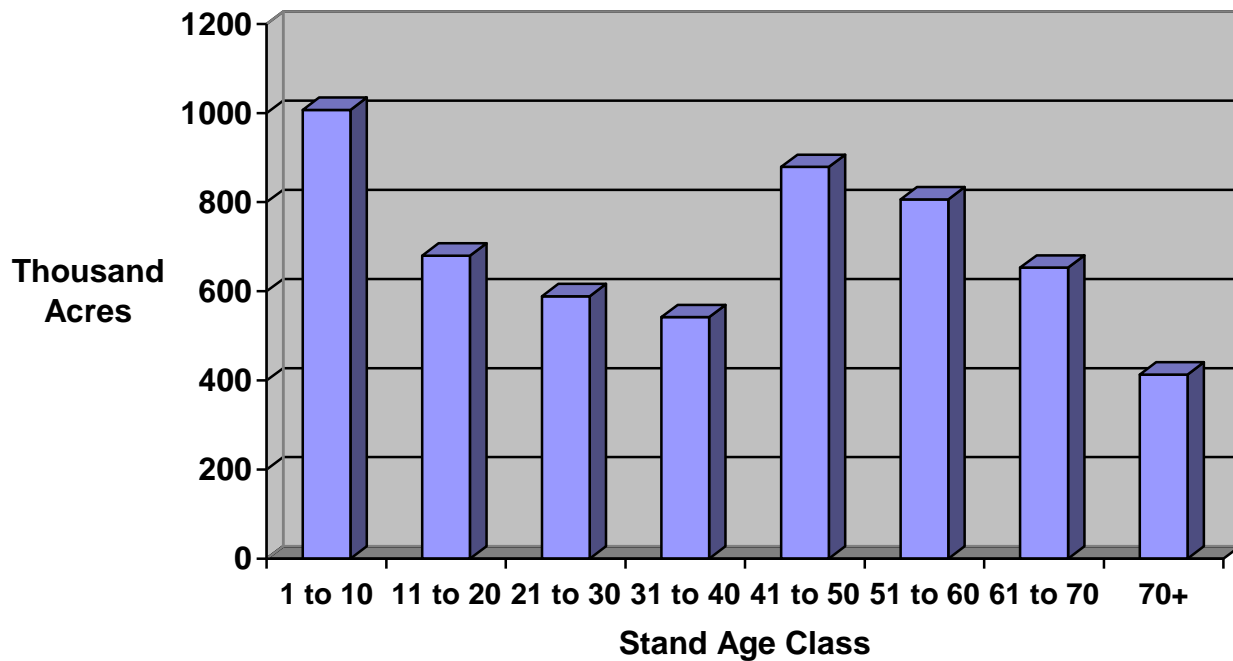
Minnesota's Aspen Resource

Aspen Type by Species Composition
(5.1 Million Acres Aspen Type)



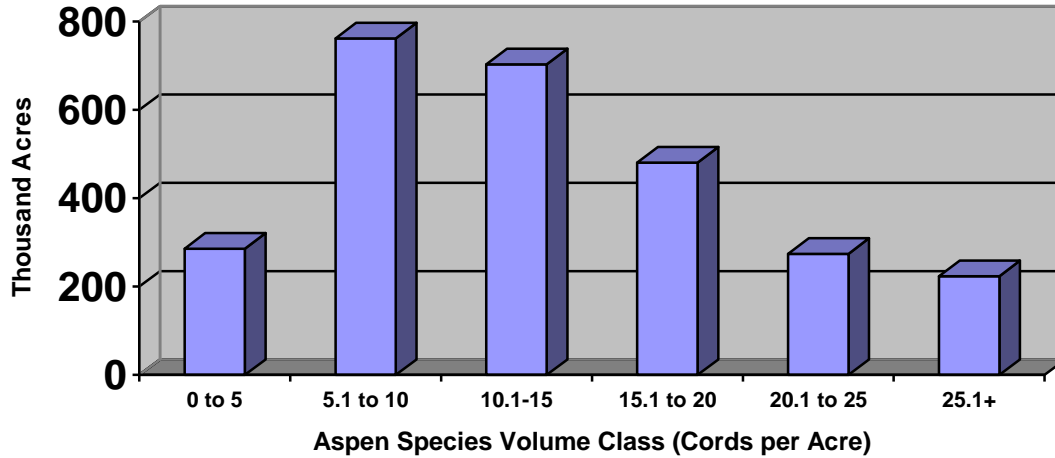
Source: Minnesota Forest Statistics, 1990 – USFS Resource Bulletin NC-141 (Table 47)
The aspen cover type is made up of a mixture of species. Pure stands of aspen are rare.

Aspen and Balm Type Age Distribution
- Year 2000 -



Total of 5,577,000 acres in aspen & balsam poplar (balm) cover types.
Source: MN FIA 2000, cycle 12, Eastwide database

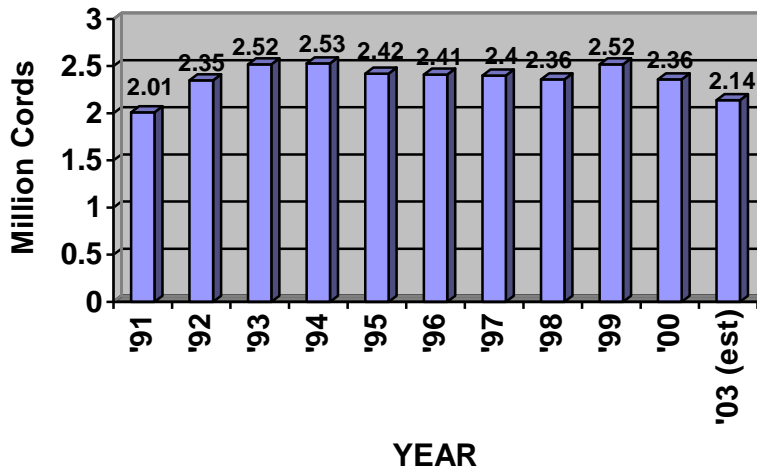
Aspen Species in Aspen Type: Total Acreage by Species Volume Class For Stand Age 40 & Over at Time of Survey



Source: Minnesota 1990 FIA Eastwide Database, provided by USFS North Central Experiment Station.

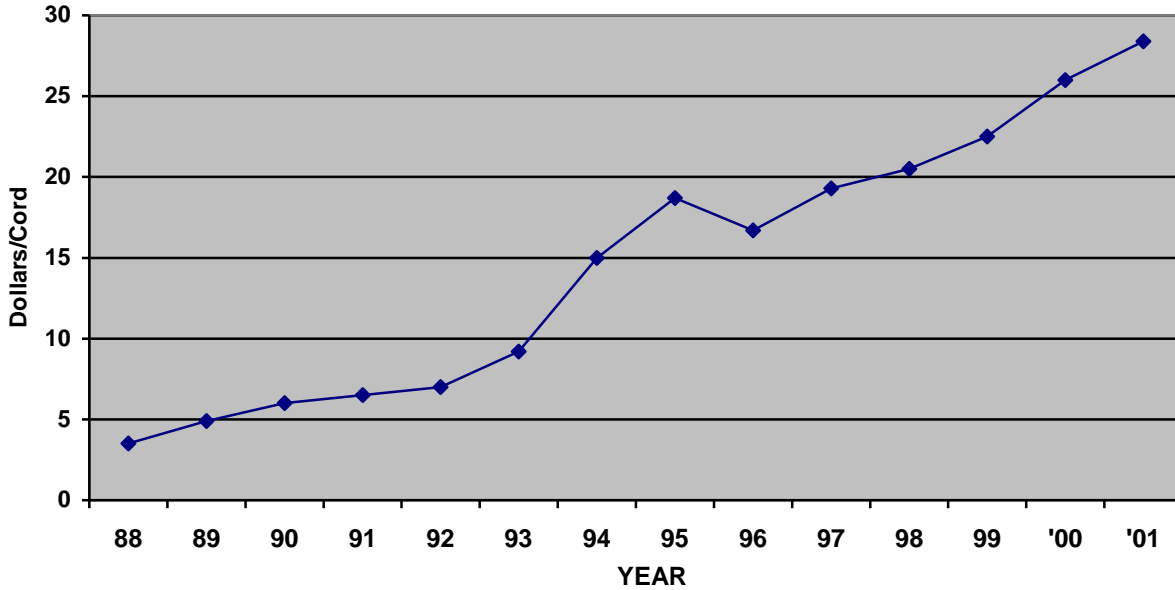
Much of our aspen resource is in stands with aspen volumes under 15 cords per acre. This is partly because many of the stands have a mixture of other species present, and partly due to some stands being low overall volume. Low volume stands are more difficult to harvest profitably.

Aspen & Balm Harvest in Minnesota: Actual & Projected (Includes pulpwood, sawtimber, wood for energy & specialty products)

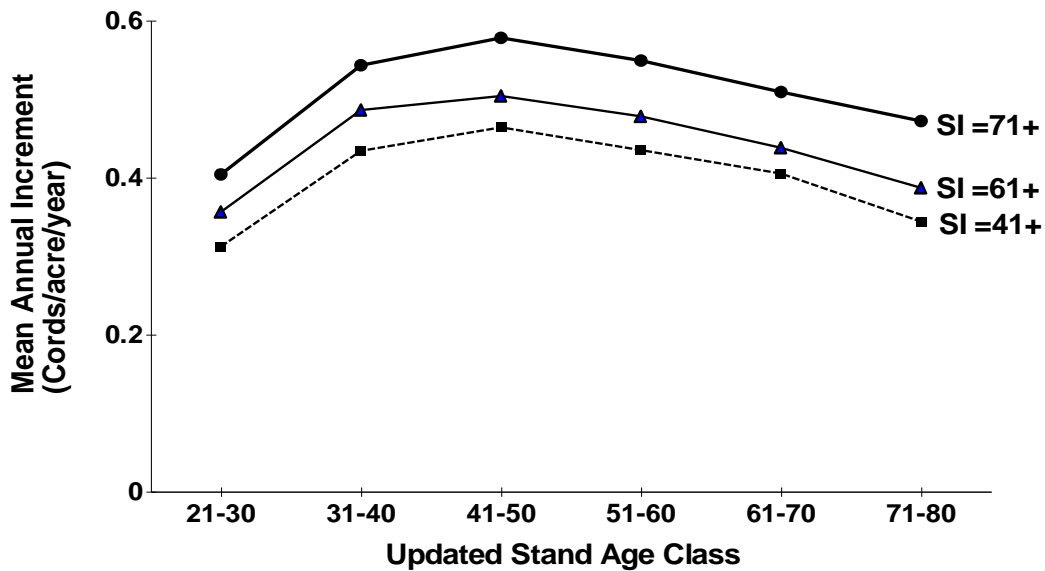


Annual sustainable yield= 2.68 million cords based on Table 6.25 GEIS, medium level, Dec. 1992
Harvest data compiled by NCFES and DNR

Average Prices Recieved for Aspen Pulpwood Stumpage Sold by Public Land Agencies in Minnesota: 1988-2001



Aspen Type Mean Annual Increment by Updated Age CSA Statewide : Based on Volume Yield Model



* The CSA biological yield model based on stands at the time of survey age.

Gross volume including net & cull volume of live trees

DNR-Forestry 11/30/01

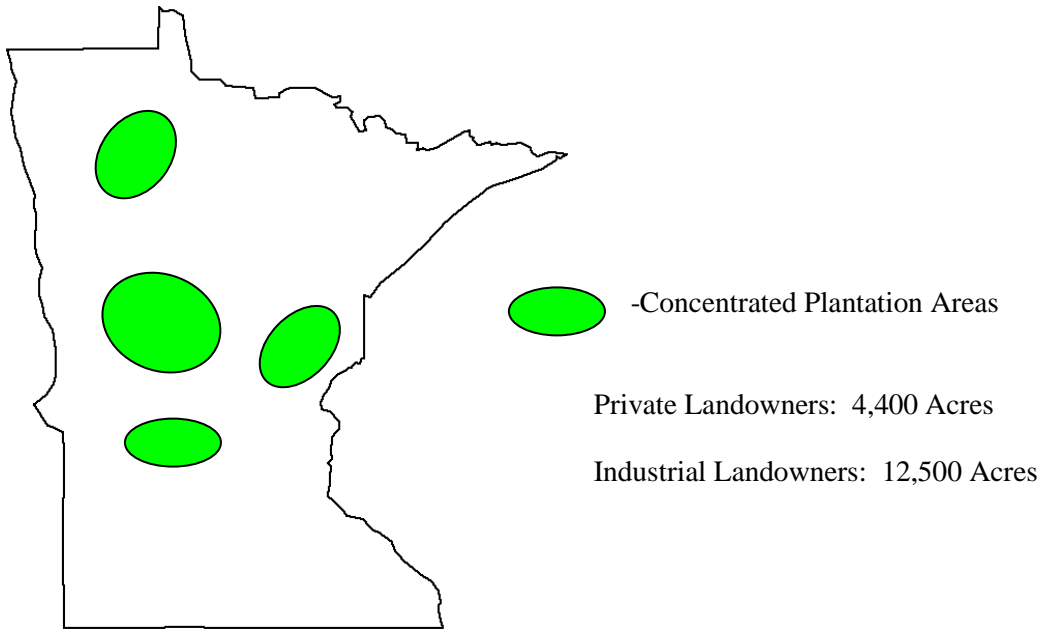
Mean Annual Increment (MAI) is the average annual increase in volume of a stand at a specified point in time. MAI changes with different growth phases in a tree's life, generally being highest in the middle ages & decreasing with age. The point at which MAI peaks is sometimes used as a guide to identify biological maturity and a stand's readiness for harvesting. This chart shows MAI for several different site indices (site index is a measure of site productivity).

Present and Projected Demand for Aspen/Balm of Gillead from Minnesota Timberlands

	Cords
2000 Harvest.....	2,355,500
• Minnesota Pulpwood Industries	2,148,200
• Pulpwood Export.....	56,200
• Sawlogs & Other.....	120,600
• Fuelwood (from growing stock).....	29,600
 2003 Projected Harvest.....	 2,136,000
• Minnesota Pulpwood Industries.....	1,959,000
• Pulpwood Export.....	46,000
• Sawlogs & Other.....	101,000
• Fuelwood (from growing stock).....	30,000

Figures include increases in OSB & pulp use by present companies and a shift to use of alternative species by several present OSB & pulp companies.

Hybrid Poplar in Minnesota - 2002

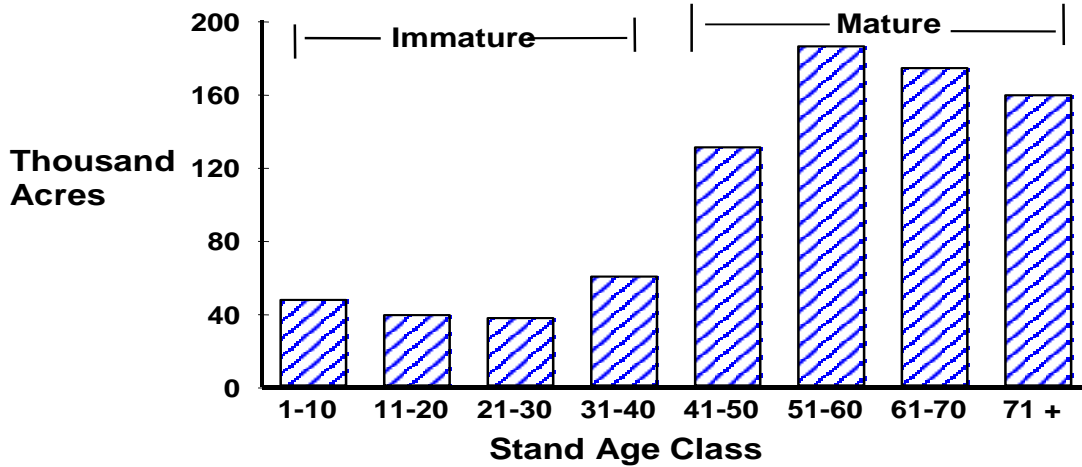


Hybrid Poplar has been found to be an acceptable substitute for aspen fiber in papermaking and Oriented Strand Board (OSB) production.

- Hybrid Poplar can reach merchantable size in 7 to 12 years.
- Intensive culture (herbicides, tilling, sometimes insect control) is required for the first 3 years in order to grow hybrid poplar.
- It is commonly grown on marginal agricultural fields.
- Establishment costs vary from \$300 to \$360 per acre.

Minnesota's Birch Resource

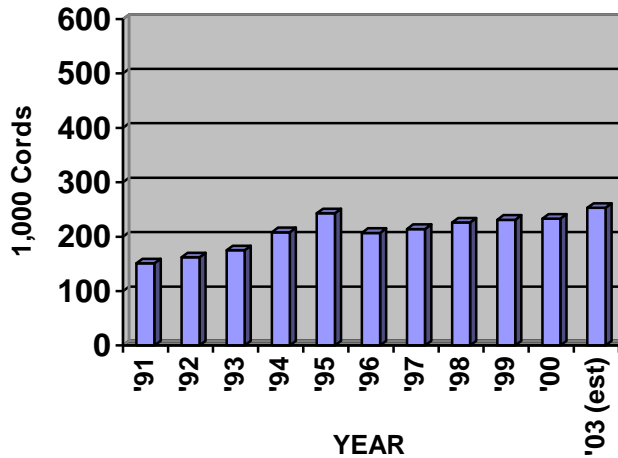
BIRCH AGE DISTRIBUTION - (1990) Minnesota Statewide, all Ownerships Timberland, Total 835.8 thousand acres



Source : USFS NC Table #116 (10/7/91)

5/13/92

BIRCH HARVEST IN MINNESOTA: ACTUAL & PROJECTED (includes pulpwood, sawtimber, wood for energy & specialty products)

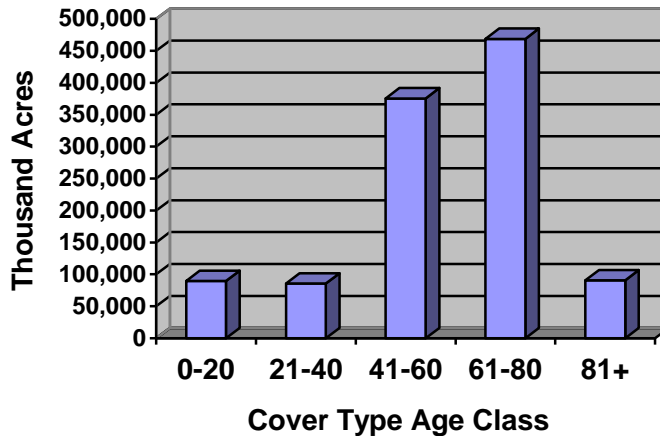


Harvest data compiled by NCFES & DNR

Sustainable harvest 457,000 cords/year, based on DNR method, which consists of Area regulation with growth contribution of all live trees (based on MN 1990 FIA). Figure was adjusted downward 30% due to heavy mortality since 1990 inventory due mostly to 1987 and 1988 drought effects. Sustainable harvest not adjusted for restrictions (riparian & other).

Estimated average net annual growth of birch growing stock: 296,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 21. Estimated average annual mortality of birch growing stock: 266,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 25.

PAPER BIRCH COVER TYPE AGE DISTRIBUTION - 2000 -
 Minnesota Statewide, All Ownerships (Total – 1,110,000 acres)



Source: USFS Eastwide Database, 2000 cycle 12. Only two years' worth of plot data is currently available of five years' total that will be available in 2004, so birch cover type can only be broken into 20 year age classes with reasonable reliability with new FIA data.

Present and Projected Demand for Birch from Minnesota Timberlands



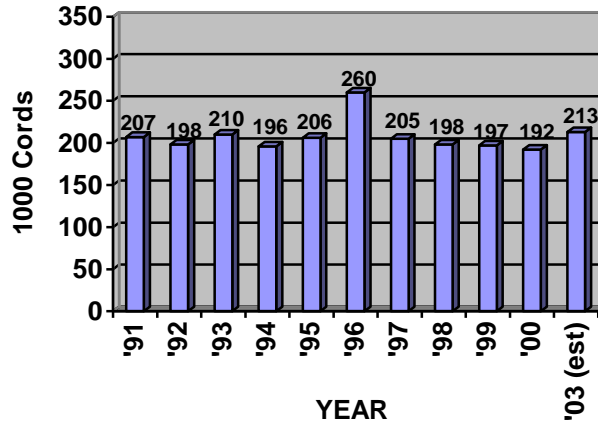
	cords
2000 Harvest.....	232,900
• Minnesota Pulpwood Industries.....	101,800
• Pulpwood Export.....	52,100
• Sawlogs & Other.....	32,400
• Fuelwood (from growing stock).....	46,600
2003 Projected Harvest.....	253,000
• Minnesota Pulpwood Industries.....	124,000
• Pulpwood Export.....	45,000
• Sawlogs & Other.....	38,000
• Fuelwood (from growing stock).....	46,000

Figures include increases in OSB use by present companies

Source: NCFES & DNR Surveys
 Projections based on DNR/Industry Announcements

Minnesota's Balsam Fir Resource

BALSAM FIR HARVEST IN MINNESOTA: ACTUAL & PROJECTED (includes pulpwood and sawtimber)



Harvest data compiled by NCFES & DNR.

Sustainable harvest 291,000 cords/year, based on DNR method, which consists of Area regulation with growth contribution of all live trees (based on MN 1990 FIA). Figure was reduced 32 % since 1989 due to mortality from spruce budworm. Sustainable harvest not adjusted for restrictions (riparian and other).

Estimated average net annual growth of balsam fir growing stock: 216,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 21. Estimated average annual mortality of balsam fir growing stock: 280,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 25.

Present and Projected Demand for Balsam Fir from Minnesota Timberlands



	Cords
2000 Harvest.....	192,100
• Minnesota Pulpwood Industries & Export (Export only 680 cords).....	184,400
• Sawlogs & Other.....	7,600
• Fuelwood.....	100
2003 Projected Harvest.....	213,100
• Minnesota Pulpwood Industries & Export.....	201,000
• Sawlogs & Other.....	12,000
• Fuelwood.....	100

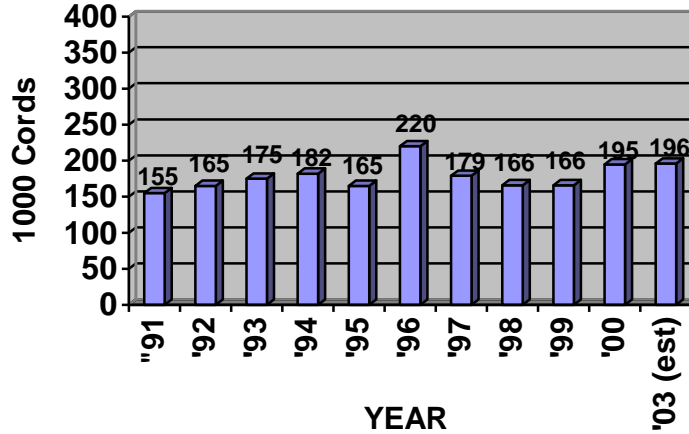
Concerns:

- Balsam availability dependent on harvest of aspen (45% of balsam in aspen type).
- Volume tied up in types not currently harvestable.
- Summer access wood: 30 to 50% maximum.
- Spruce budworm impact in NE Minnesota.

Source: NCFES & DNR Surveys
Projections based on DNR/Industry Announcements

Minnesota's Spruce Resource

SPRUCE HARVEST IN MINNESOTA: ACTUAL & PROJECTED (includes pulpwood and sawtimber)



Source: Harvest data compiled by NCFES & DNR

Estimated sustainable harvest = 298,700 cords/year based on DNR method, which consists of Area regulation with growth contribution of all live trees (based on MN 1990 FIA). Sustainable harvest not adjusted for restrictions (riparian & other). Estimated average net annual growth of spruce growing stock: 308,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 21. Estimated average annual mortality of spruce growing stock: 212,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 25.

Present and Projected Demand for Spruce from Minnesota Timberlands



	Cords
2000 Harvest.....	195,300
• Minnesota Pulpwood Industries.....	141,000
• Pulpwood Export.....	41,400
• Sawlogs & Other.....	12,800
• Fuelwood.....	100
2003 Projected Harvest.....	196,000
• Minnesota Pulpwood Industries.....	156,000
• Pulpwood Export.....	25,000
• Sawlogs & Other.....	15,000

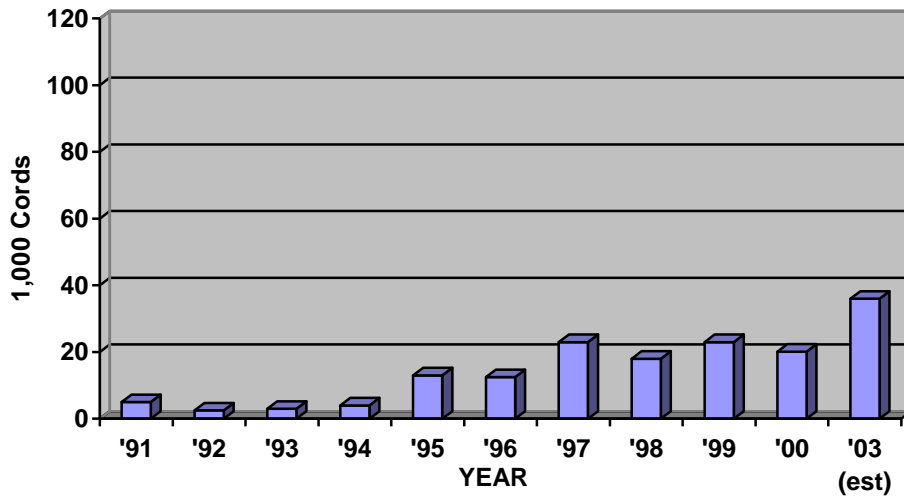
Concerns:

- Forest types with low volume/acre of spruce.
- Volume tied up in types not currently harvestable.
- Little summer access
- Increasing competition for sawbolts.

Source: NCFES & DNR Surveys
Projections based on DNR/Industry Announcements

Minnesota's Tamarack Resource

TAMARACK HARVEST IN MINNESOTA: ACTUAL & PROJECTED (from Timberland)



Estimated sustainable harvest for tamarack is 121,000 cords/year, based on DNR method, which consists of Area regulation with growth contribution of all live trees (based on MN 1990 FIA). Not adjusted for restrictions (riparian & other). Estimated average net annual growth of tamarack growing stock: 156,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 21. Estimated average annual mortality of tamarack growing stock: 56,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 25.

Present and Projected Demand for Tamarack from Minnesota Timberlands



	Cords
2000 Harvest.....	20,100
• Minnesota Pulpwood Industries.....	3,100
• Pulpwood Export.....	14,700
• Sawlogs & Other.....	1,800
• Fuelwood.....	600
2003 Projected Harvest.....	36,000
• Minnesota Pulpwood Industries.....	8,000
• Pulpwood Export.....	25,000
• Sawlogs & Other.....	2,000
• Fuelwood.....	600

Concerns:

- Forest types with low volume/acre of tamarack.
- Winter access only.
- Some small, poor site stands.

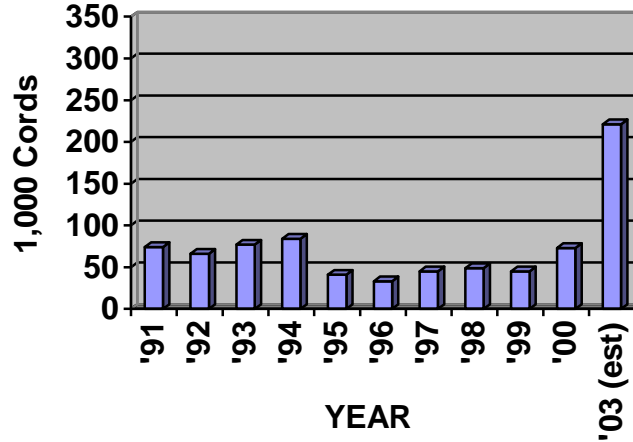
Available Annual Surplus: 2001.....80,000 to 90,000 cords

Source: NCFES & DNR Surveys. Projections based on DNR/Industry Announcements

Minnesota's Maple Resource

MAPLE HARVEST IN MINNESOTA: ACTUAL & PROJECTED

From MN Statewide Timberland, all Ownerships



Source: NCFES Pulpwood Surveys, DNR Sawmill & Fuelwood Surveys.

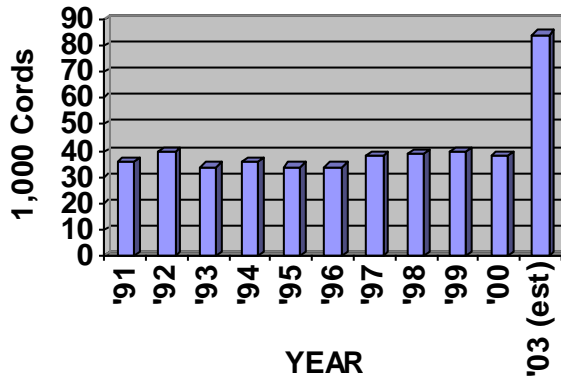
Sustainable harvest for maple in Minnesota is 255,000 cords/year, based on DNR method, which consists of Area regulation with growth contribution of all live trees (based on MN 1990 FIA).

Estimated average annual net growth for maple growing stock in Minnesota is 346,000 cords (based on 1990 USDA FS Resource Bulletin NC-141, Table # 21) Estimated average annual mortality of maple growing stock is 42,000 cords (based on 1990 USDA FS Resource Bulletin NC-141, Table # 61)

Minnesota's Basswood Resource

BASSWOOD HARVEST IN MINNESOTA: ACTUAL & PROJECTED

Minnesota statewide Timberland, all Ownerships



Source: NCFES Pulpwood Surveys, DNR Sawmill & Fuelwood Surveys.

Sustainable harvest level for basswood in Minnesota is 213,000 cords/year, based on DNR method, which consists of Area regulation with growth contribution of all live trees (based on MN 1990 FIA).

Estimated net annual basswood growth: 222,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 21.

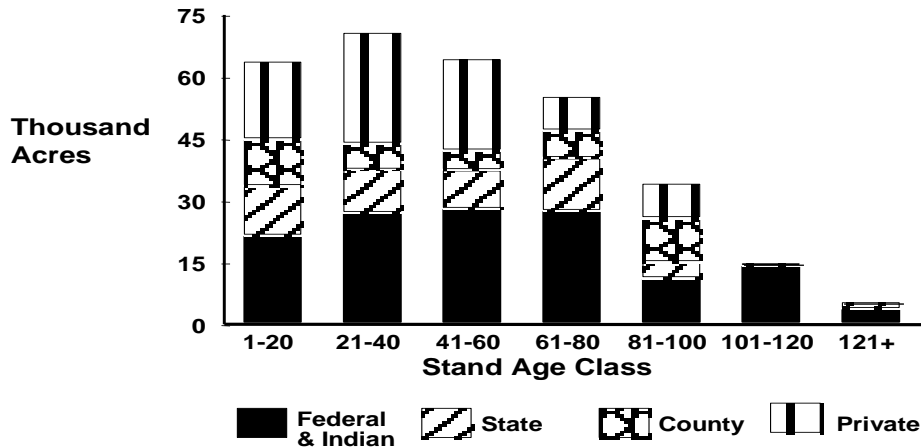
Estimated annual basswood mortality: 39,000 Cords, based on table # 25 in 1990 USDA FS Resource Bulletin NC-141.

Minnesota's Pine Resource

Red Pine

RED PINE TYPE AGE DISTRIBUTION BY OWNERSHIP

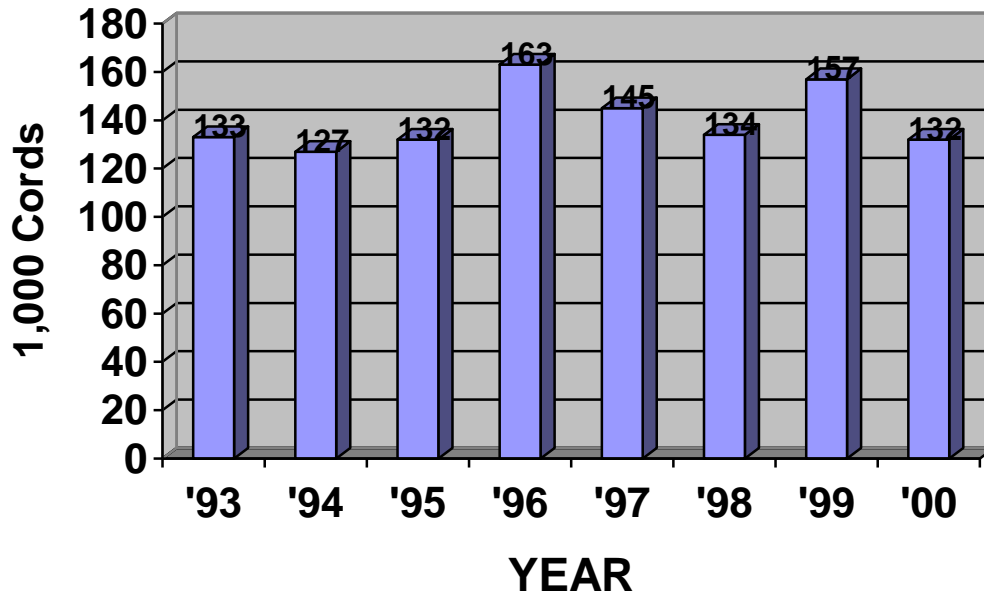
Minnesota Statewide Timberland, 1990



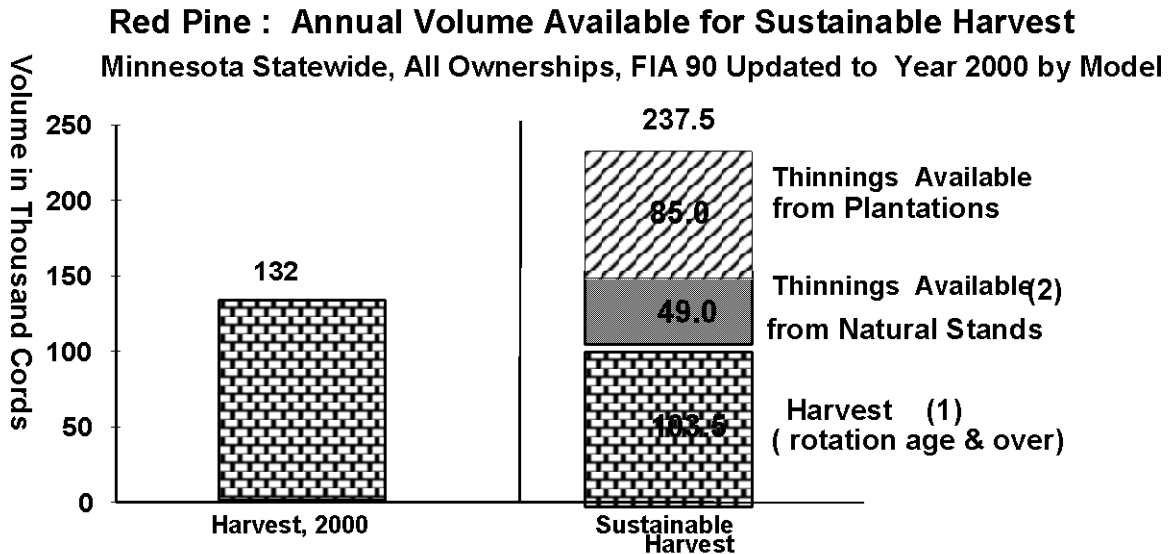
9/2/94

RED PINE HARVEST IN MINNESOTA

(Pulpwood, Sawtimber, Special Products)
Statewide, All Ownerships



Source: NCFES & DNR Surveys



(1) The sustainable harvest (red pine from all types) not adjusted for restrictions (riparian & other)

Assumes 20% of the red pine in the non-pine cover types would be harvested at the rotation specified for the non-pine cover type.

(2) Annual thinnings from the natural red pine stands= (751,000 cords/10 years) x 65.3% red pine .

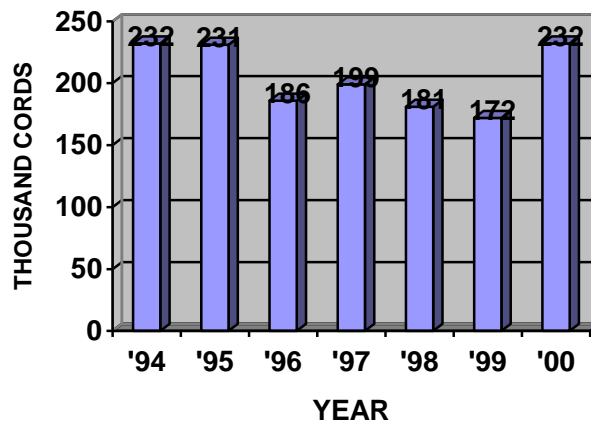
(3) The annual volume available from thinnings : thin to 90 sq.ft/acre from age 31-90.

11 / 00

Jack Pine

JACK PINE HARVEST

Minnesota Statewide, All Ownerships

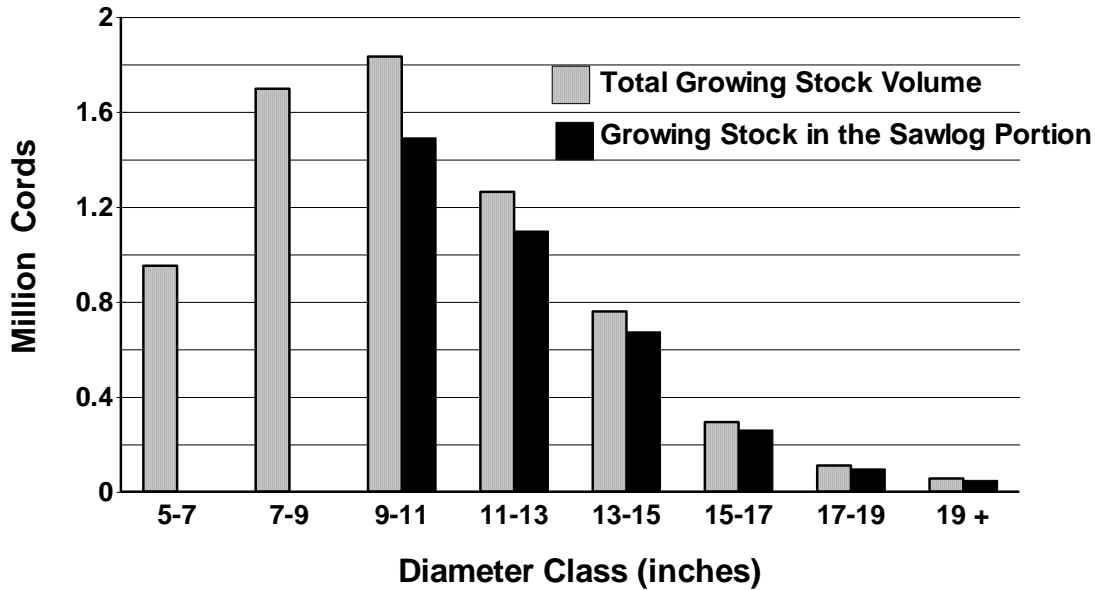


Source: NCFES Pulpwood Surveys, DNR Sawmill & Fuelwood Surveys.

Sustainable Harvest (DNR Method, not adjusted for restrictions): 219,000 cords, based on Minnesota 1990 FIA. Average net annual growth of jack pine growing stock: 139,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 21. Average annual mortality of jack pine growing stock: 130,000 cords, based on 1990 USDA FS Resource Bulletin NC-141, Table # 25.

JACK PINE VOLUME by DIAMETER CLASS

Minnesota Statewide, 1990

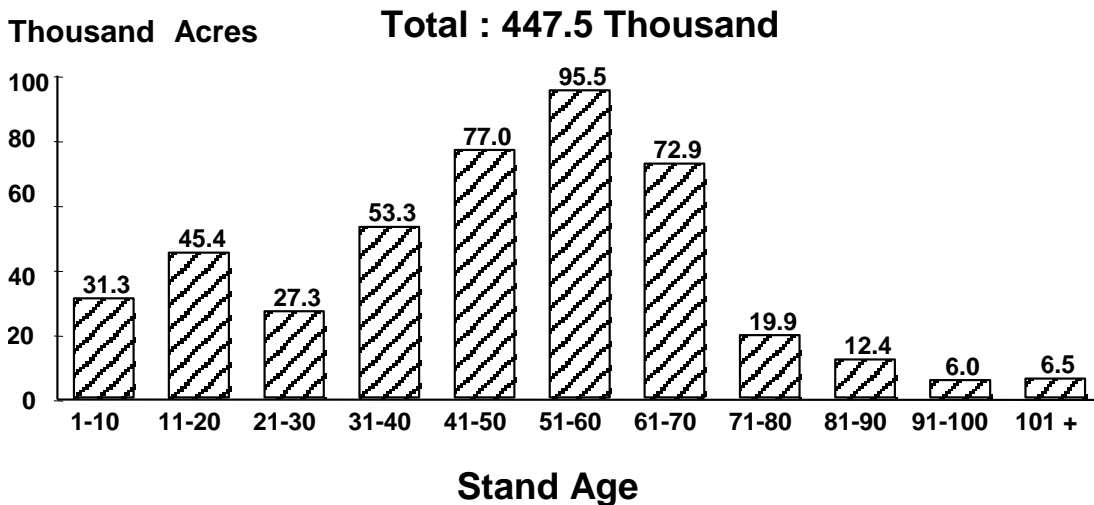


JACK PINE TYPE ACRES by AGE CLASS

6/21/99

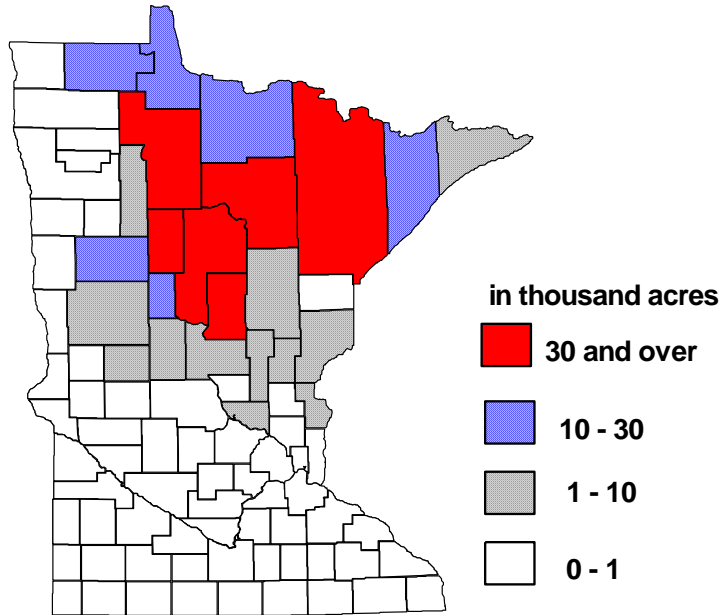
Minnesota Statewide (FIA 1990, all ownerships)

(Does not include reserved land)



Jack Pine Type Acreage Distribution by County
 Based on MN FIA 90, Statewide, All ownerships

Total : 441.5 thousand acres



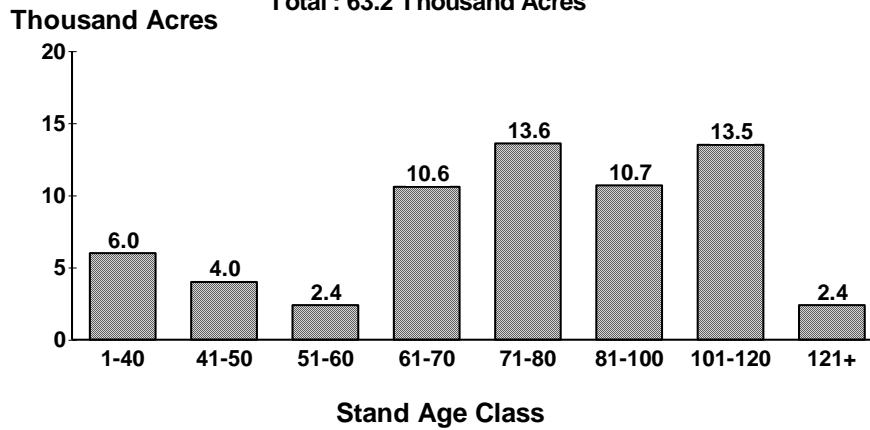
White Pine

WHITE PINE TYPE ACRES by AGE CLASS 4/1/92

Minnesota Statewide (all ownerships)

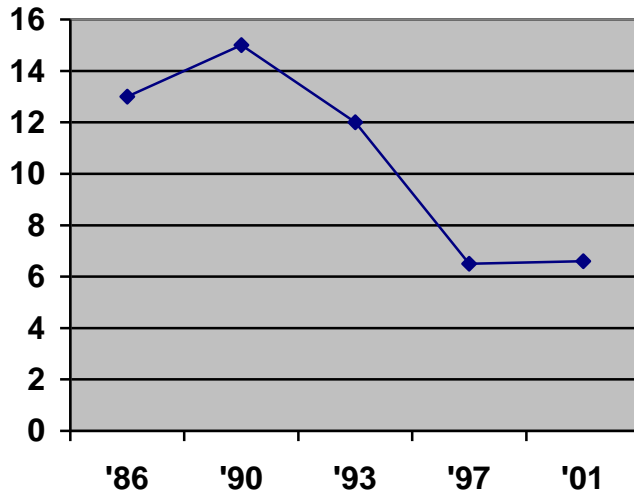
(Does not include reserved land)

Total : 63.2 Thousand Acres



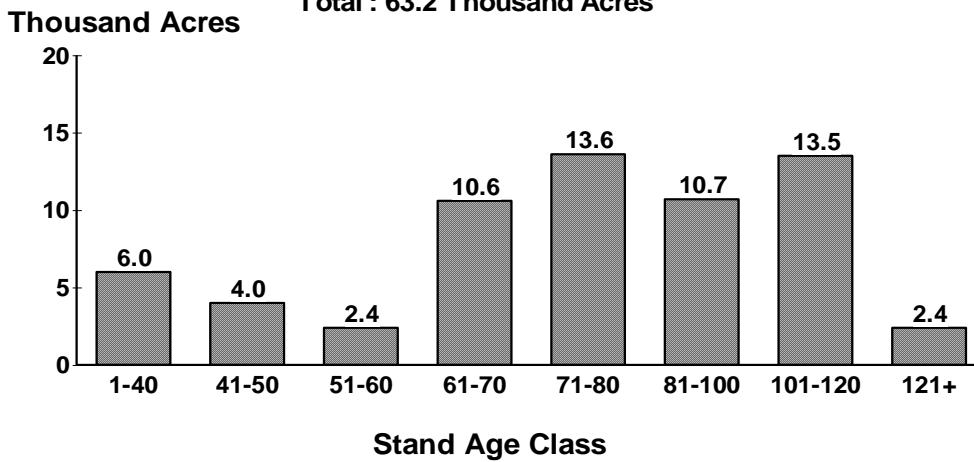
Source : 1990 Forest Survey Data, USFS NC Table #116 (10/7/91)

**White Pine Sawtimber Harvest in Minnesota
1986 to 2001**



Source: DNR – Division of Forestry
Based on DNR Sawmill Surveys

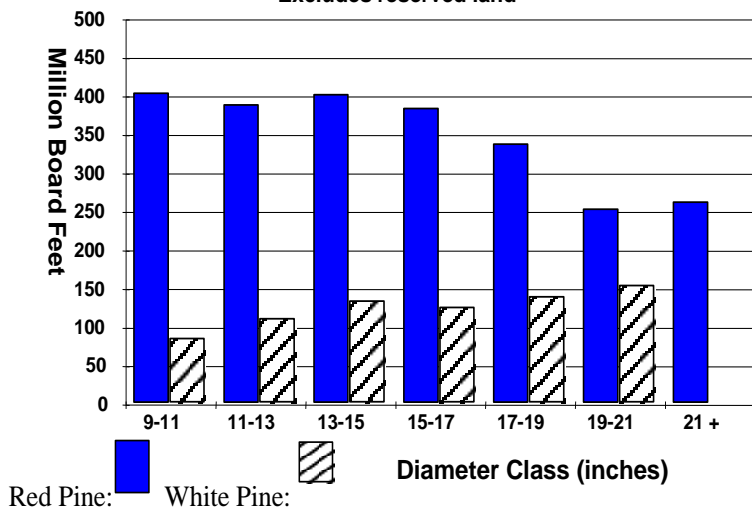
WHITE PINE TYPE ACRES by AGE CLASS 4/1/92
Minnesota Statewide (all ownerships)
 (Does not include reserved land)
 Total : 63.2 Thousand Acres



Source : 1990 Forest Survey Data, USFS NC Table #116 (10/7/91)

**RED & WHITE PINE SPECIES NET VOLUME of SAWTIMBER
by DIAMETER CLASS**

Timberland in Minnesota, all Ownerships, 1990
Excludes reserved land



**Average Prices Received for Stumpage Sold
by Public Land Agencies in Minnesota: 1993-2001**

Pulpwood (\$'s per cord)									
Species	1993	1994	1995	1996	1997	1998	1999	2000	2001
Aspen	9.28	14.82	18.69	16.09	19.20	20.54	23.40	25.28	28.76
Balm	6.43	12.73	16.48	13.24	13.76	16.95	14.13	25.27	32.06
Birch	3.23	5.45	3.52	7.52	7.88	7.53	7.66	7.69	8.31
Ash	3.60	3.42	4.46	5.00	4.46	5.51	2.28	4.09	3.91
Oak	5.24	5.27	4.51	4.37	5.64	8.98	10.76	9.27	7.74
Basswood	---	---	4.85	4.01	4.27	4.88	5.67	5.68	5.48
Balsam	10.36	15.15	18.76	14.35	12.65	14.12	12.09	14.84	14.61
W. Spruce	12.16	15.66	26.18	19.06	12.8	19.18	26.62	32.63	29.90
B. Spruce	11.96	20.54	23.65	22.90	18.40	21.16	20.61	22.23	29.17
Tamarack	4.38	4.90	7.73	7.25	6.71	7.29	5.79	5.67	6.40
Cedar	8.37	9.92	10.48	10.55	11.27	7.31	6.83	8.46	6.74
J. Pine	15.99	24.81	32.08	23.48	23.59	24.72	24.32	21.94	21.63
R & W Pine	10.39	24.57	17.49	21.18	23.35	15.63	17.02	18.61	20.79

*Salvage from July 1999 windstorm included in price for stumpage in 1999 and 2000
Figures compiled by Doug Ford, Timber Sales Program Supervisor, DNR-Forestry

**Average Prices Received for Stumpage Sold
by Public Land Agencies in Minnesota: 1993-2001**

Sawtimber (\$ per Thousand Board Feet)									
Species	1993	1994	1995	1996	1997	1998	1999	2000	2001
Aspen	37.20	64.67	68.93	71.22	93.83	100.54	85.09	102.28	114.11
Birch	26.34	43.12	50.67	52.31	36.60	39.78	36.12	43.17	50.48
Ash**	106.62	132.52	151.28	147.18	108.93	97.09	48.70	71.39	81.97
Elm	48.90	50.68	47.02	60.08	107.20	53.31	56.50	---	44.10
Oak*	91.69	110.67	156.88	177.30	155.97	140.20	146.00	109.53	118.72
Basswood	66.80	90.60	120.91	105.37	107.07	81.15	74.77	70.25	81.24
Balsam	34.30	52.95	55.10	61.49	71.61	88.30	80.82	120.65	144.20
W. Spruce	48.04	72.45	77.79	73.47	83.23	78.34	81.91	90.00	91.27
Cedar	33.88	37.59	38.55	42.58	37.00	38.64	39.13	19.96	30.46
J. Pine	83.59	120.51	136.55	108.37	115.46	121.84	124.00	114.86	154.35
R & W Pine	132.83	183.95	171.55	163.64	174.34	161.01	198.99	176.01	170.13
*Oak sawtimber prices mainly from public lands in northern Minnesota									
**Black ash includes veneer									
Average prices based on those reported by Minnesota Counties, Chippewa and Superior National Forests, Bureau of Indian Affairs, and Minnesota DNR-Forestry.									

**Average Prices Received for Stumpage Sold
by Public Land Agencies in Minnesota: 1994-2001**

Sold as Pulp & Bolts in Combination (\$'s per cord)								
Species	1994	1995	1996	1997	1998	1999	2000	2001
Aspen	17.16	20.59	19.05	22.85	25.39	26.35	28.66	34.33
Balm	13.23	16.96	15.48	16.01	19.51	18.04	25.41	32.57
Birch	7.51	5.48	9.51	9.03	9.40	8.97	9.45	10.40
Ash	23.95	28.76	28.65	26.70	18.45	7.09	10.01	11.52
Oak	20.34	32.82	35.48	30.71	24.58	34.00	25.35	24.33
Basswood	21.70	29.80	18.69	30.17	17.80	17.65	17.00	18.87
Balsam	16.03	19.26	15.68	14.97	17.49	15.60	19.87	24.01
W. Spruce	17.04	29.57	26.51	27.78	26.56	29.83	34.25	33.84
B. Spruce	22.45	23.76	23.03	19.05	21.16	21.28	23.04	30.01
Tamarack	5.36	8.00	7.78	6.96	8.18	6.97	6.60	7.37
Cedar	12.28	11.73	12.53	12.05	9.29	10.24	8.32	8.68
J. Pine	34.26	39.21	31.27	31.97	33.83	32.78	30.39	37.95
R & W Pine	50.60	53.05	44.78	44.71	48.81	57.93	53.35	43.89
A <i>bolt</i> is defined as a short log, usually 100" length, with a specific minimum diameter and generally sawn for lumber								
Average prices based on those reported by Minnesota Counties, Chippewa and Superior National Forests, Bureau of Indian Affairs, and Minnesota DNR-Forestry.								

Figures compiled by Doug Ford, Timber Sales Program Supervisor, DNR-Forestry

Private Pine Acreage by Species and County 1984 DNR Survey

County:	Aitkin	Anoka	Becker	Beltrami	Benton	Carlton	Cass	Chisago	Clearwater	Crow Wing	Douglas	Fillmore
Species	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Red Pine	442	444	542	1127	488	1070	1482	1048	476	1233	17	68
Jack Pine		192	69	20	51	17	32	1	90	20		12
Scotch Pine	30	167	197	131	22	98	23	103	13	134		
White Pine	3	64	9	5	7		8	29	89	3	5	11
Mixed Pine			13	35	403	21	65	117		64		5
White Spruce	49	60	248	244		61	87	41		95		8
Other	1			5	6	13	2			14		
County Total	525	927	1078	1567	977	1280	1699	1339	668	1563	22	104

County:	Goodhue	Houston	Hubbard	Isanti	Itasca	Kanabec	Koochiching	Lake	LOW	Mille Lacs	Morrison	Ottertail
Species	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Red Pine	118	65	5809	2182	684	223	223	39	266	403	743	422
Jack Pine	42	12	616	40	12	5	5	2	17	5	74	84
Scotch Pine	32	2	339	172	47	26	5	3		7	106	843
White Pine	21	16	17	60			7	3			44	20
Mixed Pine	100		423	421	273		26			227	169	
White Spruce			319	101	128	6	149	16	37	20	280	71
Other	17				2			8				130
County Total	330	95	7523	2976	1146	260	415	71	320	662	1416	1570

County:	Ottertail	Pine	Pope	Roseau	Sherburne	St. Louis	Todd	Wabasha	Wadena	Washington	Winona	Grand Totals	
Species	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	
Red Pine	422	1656	57	268	1128	1736		186	183	945	307	137	26217
Jack Pine	84	55			37	111		3	16	243		30	1913
Scotch Pine	843	69			220	76		14	30	2	1	18	2930
White Pine	20	28			27	16		13	40	12	5	39	601
Mixed Pine		103	20		439	252		167	302	10	825	3	4483
White Spruce	71	99		98	12	355		8	6	62	16		2676
Other	130		4	4	21	2		3				6	238
County Total	1570	2010	81	370	1884	2548		394	577	1274	1154	233	39058

1984 Statewide Pine Survey. Obviously, this data is old, but the survey still gives us a pretty good idea of pine acreages by species and county. The information does not reflect any of the plantations established since 1984 (so CRP plantations are completely missed).

Glossary

BIA – Bureau of Indian Affairs

Cover Type - A classification of forest land based on the species forming a plurality of live tree stocking.

CSA – Cooperative Stand Assessment. This is the inventory system used on state-owned land. Different vegetative stands are mapped using aerial photography and ground checks. Variable radius sample plots are distributed throughout each cover type and measured on the ground. A variety of information on stand condition is collected. Things like timber volumes, species mixes and insect and disease damage for the state forest and wildlife management areas can be determined using CSA data

Cull – Portions of a tree that are unusable for industrial wood products because of rot, form, missing or dead material, or other defect.

FIA – Forest Inventory & Analysis. In this inventory, permanent plots are remeasured periodically. Field remeasurements were last completed in 1977 and 1990. A recent change is that after completion in 2004, the inventory will be updated continually, with approximately 20% of the plots revisited each year. Minnesota has recently completed year 3 of a five year effort to update its FIA, which is a cooperative effort between the U. S. Forest Service and Minnesota DNR. The inventory will be complete in early 2004.

FIA provides extremely important information on the condition of the forest resource. Things like timber volumes, species mixes, and changes to the forest resource over time can all be determined using FIA data. It is the only way to track condition and changes over time for non-industrial private woodlands and is the only way to get comprehensive data across all ownerships.

Growing Stock Trees- Live trees of commercial species excluding cull trees.

MAI – Mean Annual Increment. the average annual increase in volume of a stand at a specified point in time. MAI changes with different growth phases in a tree's life, generally being highest in the middle ages & decreasing with age. The point at which MAI peaks is sometimes used as a guide to identify biological maturity and a stand's readiness for harvesting.

NCFES – North Central Forest Experiment Station. This is where the FIA unit of the USFS is located. These are the folks that, in cooperation with state DNR, accomplish the FIA inventory and Timber Product Output surveys. Without them, very little of the information in this book would be available.

NIPF – Non-Industrial Private Forest Land. Forest land owned privately by people or groups not involved in forest industry.

Pulpwood – Wood that is harvested and used by primary mills that make products from reconstituted wood fiber. In addition to wood pulp, this includes particleboard and engineered lumber products made from chips, shavings, wafers, flakes, strands and sawdust.

Sawtimber - For our purposes, this is wood that is harvested and used by sawmills.

Timberland – Forest land that is producing, or is capable of producing, more than 20 cubic feet per acre per year of industrial wood crops, that is not withdrawn from timber utilization by policy.

USFS – United States Forest Service.