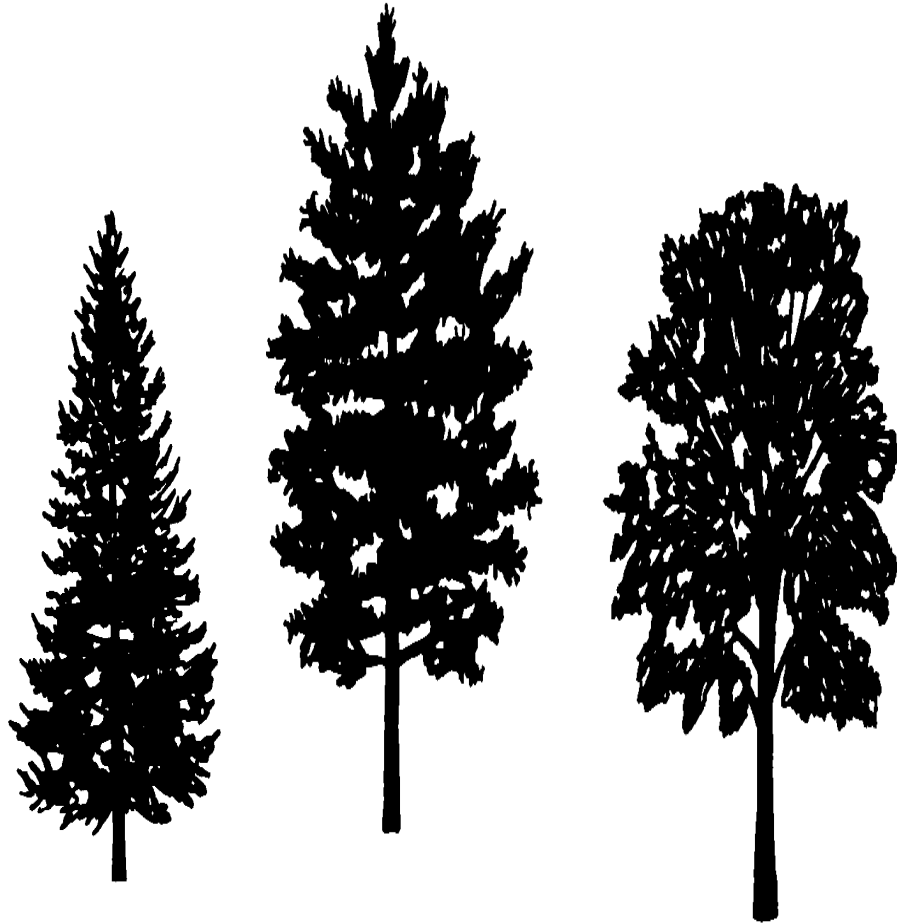


Minnesota's Forest Resources



**Department of Natural Resources
Division of Forestry
December 2005**

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

Minnesota's Forest Resources

Revised 1-11-06

Preface

This report is compiled annually by the Minnesota DNR – Forestry Division Utilization & Marketing staff. Publication began in the mid 1980s by John Krantz, former Utilization & Marketing Program Coordinator. The report is intended to answer frequently asked questions about Minnesota's forest resources such as: current conditions and trends in forest resources and forest resource industrial use. Foresters, other resource managers, planners, people employed in forest industry, and policy makers will find items of interest in these pages.

We thank those who cooperated in providing and updating information for this report. They include many of Minnesota's wood product companies and the USDA Forest Service Forest Inventory and Analysis (FIA) unit. Without their cooperation we would be unable to gather or disseminate much of this information.

Most of the figures and charts are based on the Minnesota 2003 FIA inventory figures.

Highlights:

- *The fifth year of the most recent FIA inventory was completed, now giving Minnesota a full “panel” of FIA data.*
- *Timber imports of pulpwood into the state leveled off in 2003, according to USDA - Forest Service mill surveys. Imports continue to be an important factor affecting harvest levels from Minnesota timberlands. The converse is also true, of course - availability of timber from Minnesota woodlands impacts levels of imported timber.*
- *Tight aspen timber supplies in Minnesota are the biggest reason for several mills continuing and expanding their efforts to utilize several formerly “underutilized” species such as tamarack, maple, basswood and ash pulpwood. The development of markets for maple, basswood and ash pulpwood will require increasing assistance efforts on private lands to ensure that these species are properly managed.*
- *It is anticipated that the state of Minnesota will achieve third-party certification of its over 4.5 million acres of timberlands effective January 2006.*
- *Overall net growth for all species continued to outpace harvest levels. According to 2003 FIA figures, annual net growth of growing stock on timberland was approximately 5.2 million cords. According to mill and fuelwood survey data, the volume of wood harvested & utilized by industry and fuelwood users was approximately 3.6 million cords.*
- *Potential for utilization of logging residues and other formerly unutilized forest biomass such as brush is increasing. This increasing potential is being driven largely by several new biomass energy projects that plan to begin using woody biomass over the next 1 to 2 years.*

Contact Information

Questions or requests for additional information can be directed to:

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Wood-Using Industry



A brief overview of Minnesota's wood-using industry, including mill location and product information for many of the larger mills, and total industry economic impact.

Minnesota Wood Industry At A Glance – 2005

Annual Economic Impact

- Value of Forest Products Manufacturing Shipments 2003: 6.07 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 impact attributable to Minnesota timber = \$4.3 Billion that stays in Minnesota*

Employment

- 41,260 Employees (Primary Processing [including logging]= 22,400, Secondary Manufacturing = 18,860)**
- 1.72 Billion in wages paid**
- **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 \$23 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 800 Secondary Manufacturers

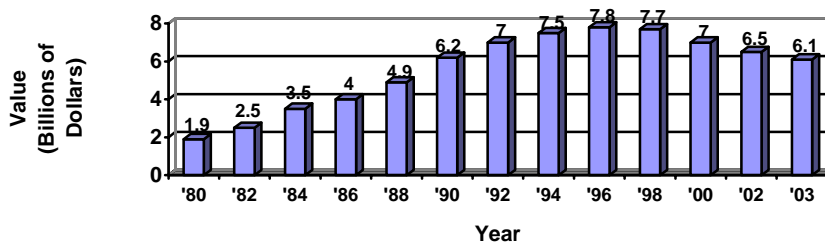
Annual Volume of Timber Harvested

- Pulpwood = 2,829,000 Cords (2003)
- Sawlogs & Specialty = 302 Million Board Feet (2001)
- Fuelwood = 656,000 Cords (149,000 from timberland. 2002-03)
- 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 Employment & Economic Development analysis

**Minnesota Forest Industries estimates based on 2004 data

Value of Forest Products Manufactured in Minnesota



Minnesota Pulp and Paper – 2005

Firm	Wood Used	Product
UPM - Blandin Paper Mill Grand Rapids	Aspen, Balsam Fir and Spruce	Lightweight coated publication papers
Boise Cascade, LLC International Falls	Aspen, Balm, Pine, Spruce, Balsam Fir, Birch, Tamarack, Ash, Maple	Office papers, label and release papers, basesheets, business and specialty printing grades
International Paper Sartell	Aspen, Balsam Fir, Spruce	Coated and uncoated publication papers
Stora Enso North America Duluth	Balsam Fir, Pine, Spruce	Uncoated, lightweight supercalendered magazine and publication papers
SAPPI North America Cloquet	Aspen, Balm, Maple, Basswood, Tamarack, Pine	Coated freesheet fine printing and publication paper, market pulp
Recycling Mills		
Rock-Tenn Company St. Paul	Recycled Paper & Corrugated	Cardboard and corrugated boxes
Stora-Enso Recycled Fiber Mill Duluth	High Grade Office Paper & Computer Paper	Market pulp
Liberty Paper Company Becker	Recycled Paper & Corrugated	Cardboard and corrugated boxes

Minnesota Oriented Strand Board and Engineered Wood Products – 2005

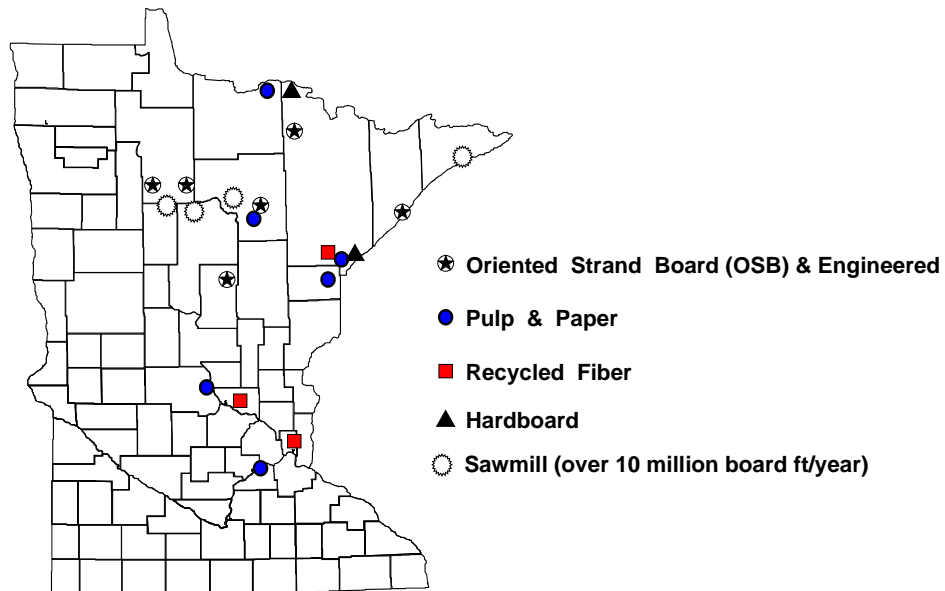
Firm	Wood Used	Product
Ainsworth Engineered USA Grand Rapids	Aspen, Balm, Birch, Pine, Maple, Tamarack, Ash	OSB
Louisiana-Pacific Two Harbors	Aspen, Balm, Birch	OSB – engineered siding panel
Northwood Panelboard Bemidji	Aspen, Balm, Birch, Maple	OSB
Ainsworth Engineered USA Bemidji	Aspen, Balm, Birch, Pine, Maple, Tamarack, Ash	OSB
Ainsworth Engineered USA Cook	Aspen, Balm, Birch, Pine, Maple, Tamarack, Ash	OSB
Trus Joist - a Weyerhaeuser Business Deerwood	Aspen, Balm, Birch	Engineered lumber products for industrial and structural applications

Minnesota Hardboard and Specialty – 2005

Firm	Wood Used	Product
Certaiteed Corporation Shakopee	Aspen, Mixed Hardwoods & Recycled Paper	Roofing felt
International Bildrite International Falls	Aspen, Balm & Recycled Paper	Sheathing
Georgia-Pacific Corporation, Superwood Division Duluth	Aspen, Pine, Mixed Hardwoods	Industrial hardboard

**OSB & ENGINEERED, PULP & PAPER, HARDBOARD, RECYCLING MILLS
and LARGE SAWMILLS**

Minnesota 2005



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

Minnesota – New and Expanding Large Wood Industry

1975-2005	Product	Capital Investments (\$Millions)
Potlatch (now SAPPI) - Expansion	Paper	\$100
Potlatch (now Ainsworth Engineered USA) – Bemidji	OSB	40
Potlatch – (now Ainsworth Engineered USA) - Cook	OSB	40
Northwood Panelboard	OSB	45
Champion International (now International Paper)	Paper	250
Blandin (now Ainsworth Engineered USA)	OSB	50
Louisiana Pacific	OSB	30
Blandin (now UPM)	Paper	350
Potlatch (now SAPPI) – Modernization	Paper	100
LSPI (now Stora-Enso)	Paper	404
International Bildrite	Sheathing	12
Boise	Paper	990
MacMillian Bloedel (now Trus Joist - a Weyerhaeuser Business)	Laminated Strand Lumber	70
Potlatch – (now Ainsworth Engineered USA) Bemidji expansion	OSB	35
Potlatch	Lumber	22
Potlatch (now SAPPI)	Pulp Mill	525
Potlatch – (now Ainsworth Engineered USA) Cook expansion	OSB	60
Total		\$3.123 ≈\$3,123 Billion

Source: MN DNR - Forestry

Small Diameter Timber and Logging Residue Utilization

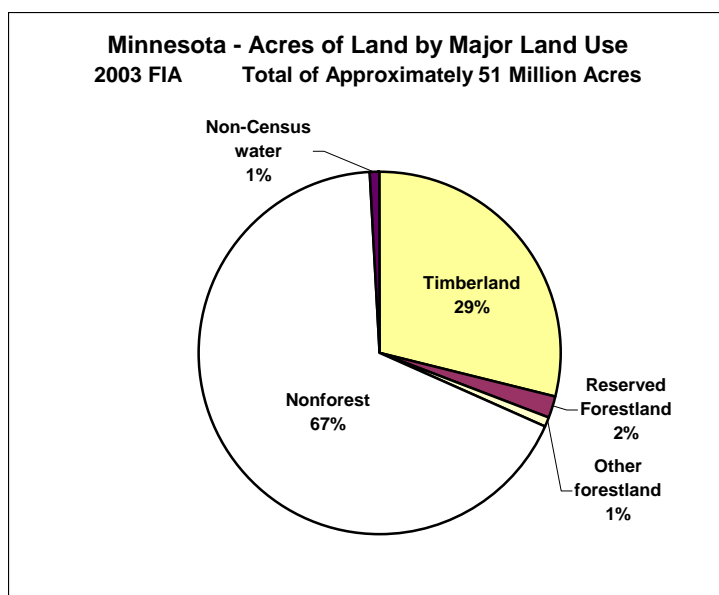
Many pulpwood-using mills have expanded their species mix to include hardwoods over the last 5 years. Additionally, a number of Minnesota sawmills have invested in equipment that enables them to efficiently utilize smaller diameter hardwoods and softwoods. This has greatly improved markets for most small-diameter hardwoods and softwoods, giving landowners more income for their timber and giving forest managers more management options.

Potential for utilization of logging residues and other formerly unutilized forest biomass such as brush is also increasing. The increasing potential is being driven primarily by several biomass energy projects slated to begin purchasing woody biomass over the next 1 to 2 years. The Minnesota Forest Resources Council and DNR are beginning a process of Site-Level Forest Management Guideline development, in order to provide forest managers with improved direction regarding the management and use of logging residues and brush. These Guidelines are due for completion in 2007.

Forest Resources

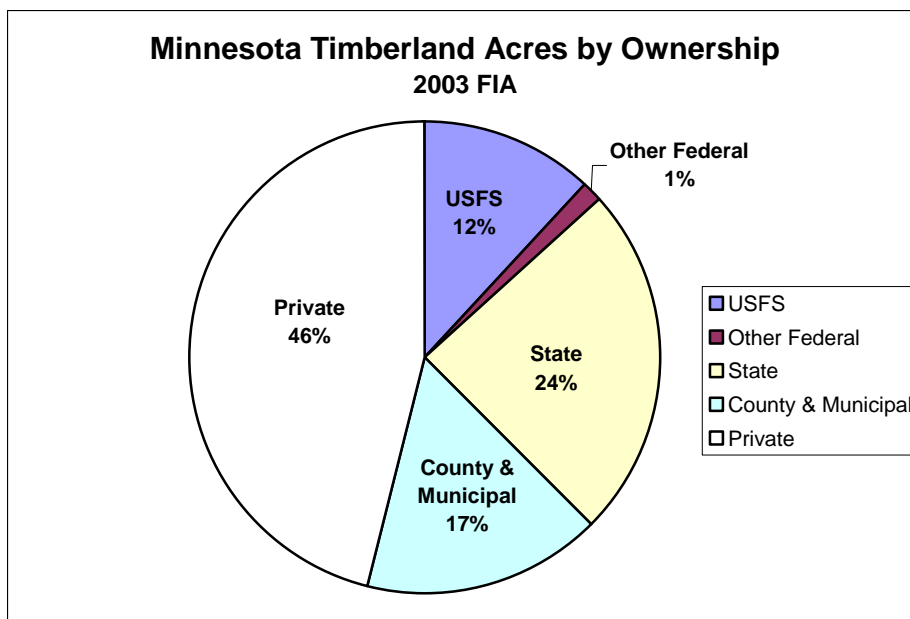


A brief overview of Minnesota's forest resources, including total forestland and timberland acreage, cover type percentages and an ownership breakdown for timberland.



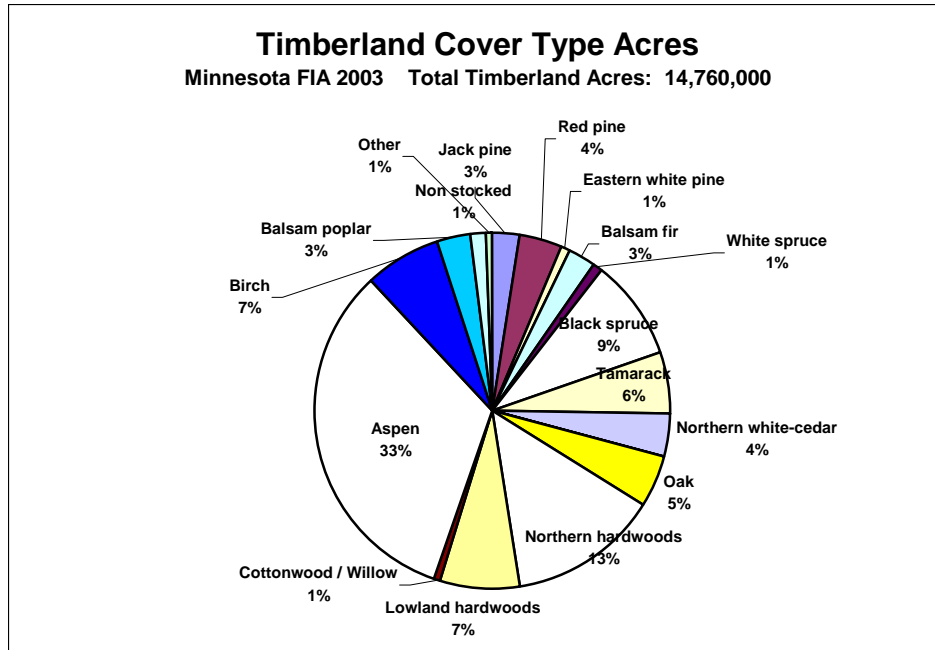
Source: 2003 FIA Database Provided by USFS North Central Forest Experiment Station

Minnesota has approximately 15 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 includes designated wilderness areas like the Boundary Waters Canoe Area (BWCA), Old Growth reserves and others.



Source: USFS - Minnesota FIA 2003 Database (Ownership Corrected 1/10/06)

Ownership of timberland is an important factor in assessing many factors, including timber supply. For instance, national forestland harvest levels have dropped significantly in the last 10 years. Since society continues to demand more raw materials including wood, the difference has been made up largely by wood from private forestlands and imports from Canada and Wisconsin. In order to responsibly provide for society’s needs, continued and improved management and productivity of our forests will become even more critical in the future.



Source: 2003 FIA Database Provided by USFS North Central Forest Experiment Station.

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

It is worth noting that aspen is by far the largest cover type in Minnesota.

Area of Timberland in Minnesota by DNR Forest Type – 2003

Forest Type	Acres (in Thousands)
Jack Pine	387.9
Red Pine	543.1
White Pine	139.9
Balsam Fir	374.5
White Spruce	93.0
Black Spruce	1,355.1
Cedar	573.5
Tamarack	821.8
Other Softwoods	25.9
Oak/ Hickory	701.6
Lowland Hardwoods	1,062.6
Northern Hardwoods	1,977.5
Aspen	4,830.1
Birch	1,045.8
Balm of Gilead	446.0
Cottonwood/ Willow	91.2
Non-Stocked & Other	290.3
Total All Types	14,759.8

Source: USDA Forest Service 2003 FIA Database

Harvest Levels



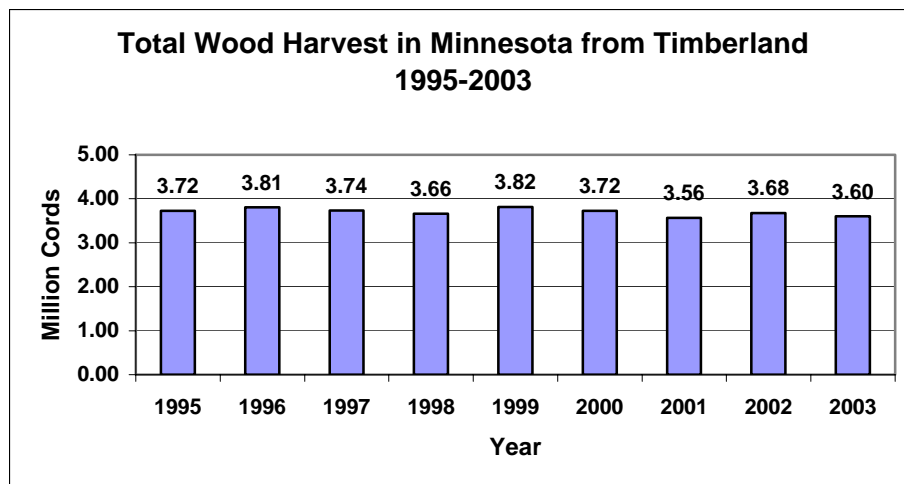
Information on 2003 timber harvest in Minnesota by product category and estimation of contribution by timberland ownership.

**Total Wood Harvested and Utilized by Industry and Fuelwood Users in Minnesota
(In Thousand Cords - by Species – From Timberland)
(Pulpwood 2003; Sawtimber 2001; Fuelwood 2002-03)**

Species	Pulpwood	Sawlogs & Others	Fuel		Total
			Residential*	Commercial	
Aspen	1795.8	120.6	16.7	.6	1933.7
Birch	218.8	32.4	41.0	6.3	298.5
Balm of Gilead	118.9	.9	0	.1	119.9
Ash	10.2	10.9	15.1	.2	36.4
Oak	.5	94.2	45.1	1.0	140.8
Basswood	15.0	24.5	1.3	0	40.8
Maple	92.7	11.8	15.8	4.7	125.0
Cottonwood	1.0	7.7	0	0	8.7
Other Hardwood	3.2	9.1	8.1	0	20.4
Sub-Total Hardwood	2256.1	312.1	143.1	12.9	2724.2
Pine					
Red Pine	35.6	95.9	2.9	0	134.4
White Pine	1.7	13.2	1.4	0	16.3
Jack Pine	91.0	151.8	1.7	0	244.5
Spruce	218.2	12.8	0	0	231.0
Balsam	168.5	7.6	0	0	176.1
Tamarack	58.6	1.8	.7	0	61.1
Cedar	0	5.3	.4	0	5.7
Other Softwood	0	4.9	0	0	4.9
Sub-Total Softwood	573.6	293.3	7.1	0	874
Total	2829.7	605.4	150.2	12.9	3598.2

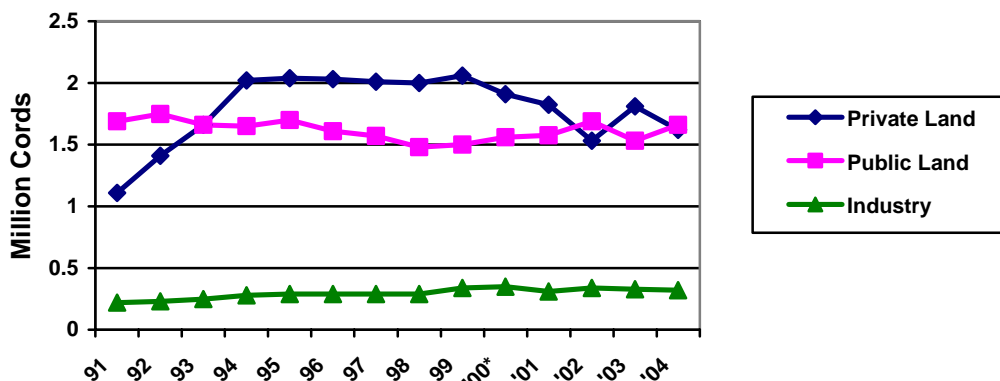
Figures include cords of pulpwood exported to Wisconsin: Aspen: 65,710; Spruce: 51,045; Jack Pine: 6,180; Red Pine: 2,408; Tamarack: 20,866; Birch: 29,594; Soft Maple: 5,518.

* Fuelwood removed from *growing stock*.



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

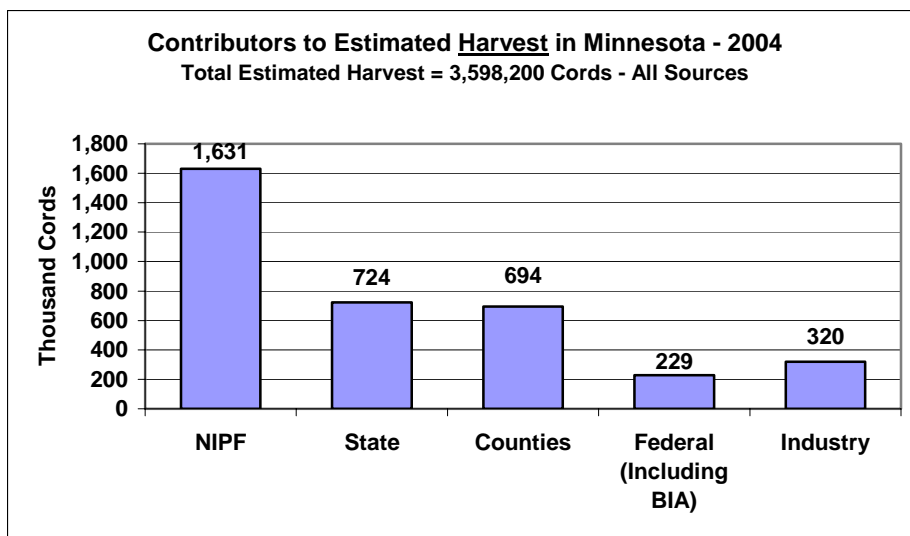
Estimated Volume of Timber Sold by Ownership - Minnesota -



*2000 figures corrected from original versions of this graph. Original version used projected figures.

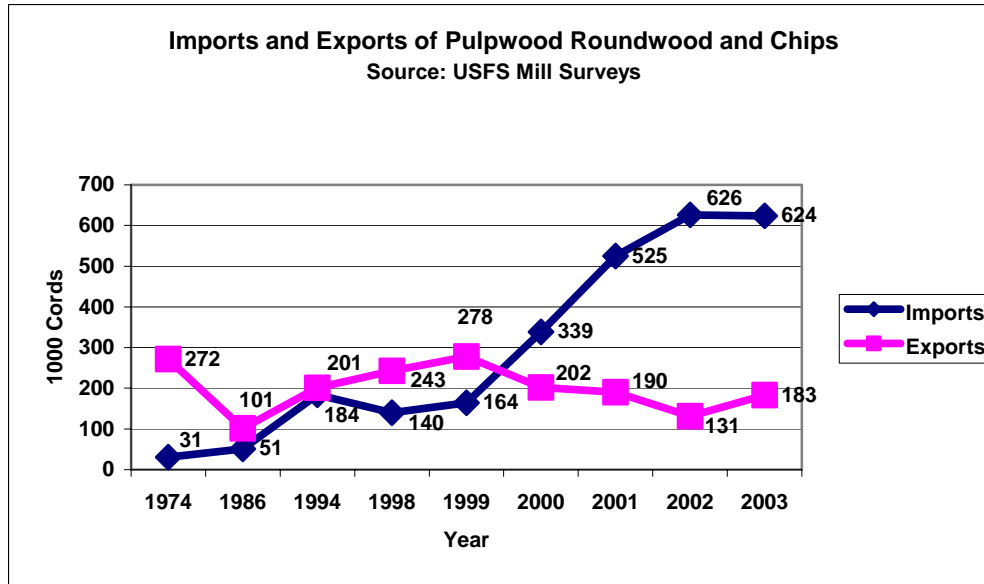
Source: Public Lands: Public Stumpage Price Review. Industry Lands: Minnesota Forest Industries survey. Private Lands = An estimate figured as follows: Total estimated harvest 2003, (Most recent figure available) used as estimate for 2004 harvest, minus 2004 public volume sold, minus 2004 estimated industry volume harvested.

Of interest is the recent trend toward a slight reduction in the private lands harvest level from its height in 1999. Also, more of Minnesota’s total industrial wood demand is now supplied through imports of pulpwood, mostly from Canada and Wisconsin.



Source: State Lands: FY 2004 Harvest, DNR Timber Sales Annual Report, Doug Ford, Author. Federal: Superior National Forest Timber Statistics, and Chippewa National Forest Timber Statistics, 2004; BIA: Public Stumpage Price Review timber sold 2004 used as an estimate for harvest. County Lands: Public Stumpage Price Review timber sold 2004 used as an estimate for harvest. Industry Lands: Minnesota Forest Industries survey. Private Lands = An estimated figured as follows: Total estimated harvest 2003 used as estimate for 2004 harvest, minus state and national forest volume harvested, minus BIA and county volume sold, minus industry volume harvested.

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 significantly over the last 10 years, with much of the slack picked up by increased harvest and management of private lands and imports.



Source: USFS North Central Station FIA Unit Survey of Industrial Wood Using Industry.

Exports are mainly to Wisconsin mills. Imports are largely from Canada and Wisconsin, with a modest volume from Michigan and North Dakota.

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

Estimate of Increases/Decreases 2003 to 2006: Minnesota Harvest (In Cords)

	Aspen/ Balm	Pine	Spruce	Balsam Fir	Tamarack	Ash	Birch	Maple	Basswood
OSB/ Engineered Mills	(-)18,000	35,000	1,000	1,000	20,000	16,000	(-)18,000	5,000	13,000
Pulp & Paper Mills	(-)37,000	(-)17,000	(-)7,000	(-)6,000	4,000	5,000	46,000	20,000	4,000
Sawmills/ Specialty	(-)5,000	12,000	2,000	2,000	0	(-)1,000	(-)4,000	1,000	(-)2,000
Export	(-)5,000	0	0	0	(-)8,000	0	0	0	0
Totals	(-)65,000	30,000	(-)4,000	(-)3,000	16,000	20,000	24,000	26,000	15,000

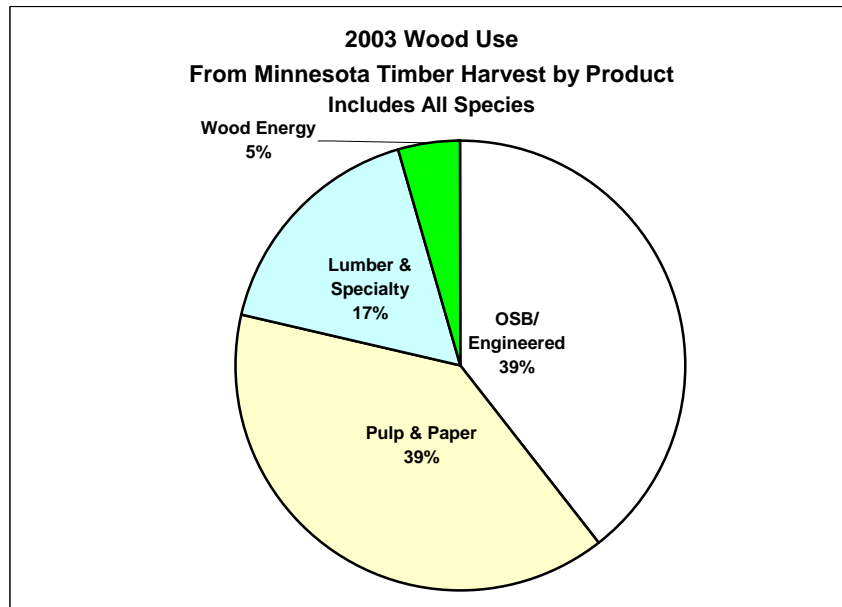
NOTES

-2003 harvest figures are used as the starting point for determining estimated harvest in 2006.

-Projected 2006 based on announced expansions and industry interviews

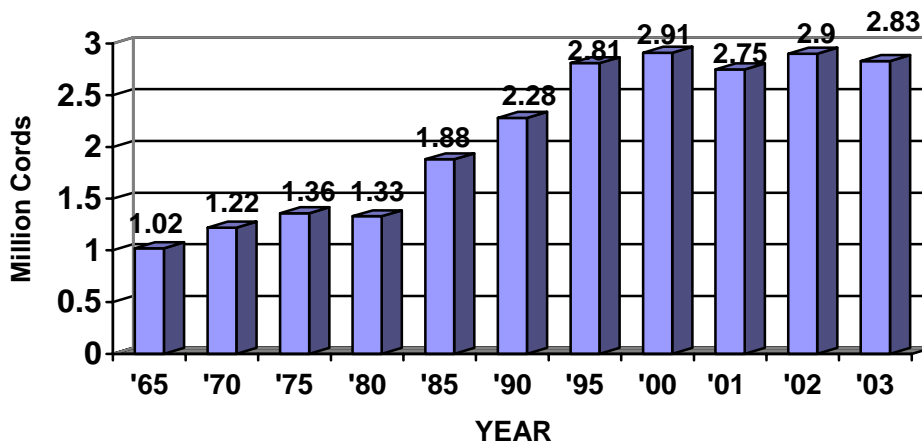
Adjustments mainly due to:

- Species mix changes at paper and OSB mills.
- Incremental production increases at pulp & paper & OSB mills due to new equipment and process efficiencies.
- Shutting down 2 paper machines at UPM-Blandin in March 2003.



Source: Wood Use Data From Mill and Fuelwood Surveys conducted by USDA Forest Service, North Central Forest Experiment Station & DNR Specialty products include veneer, posts & poles, shavings & landscape chips

Timber Harvested from Minnesota Timberlands & Utilized by Minnesota Pulpwood Mills 1965- 2003

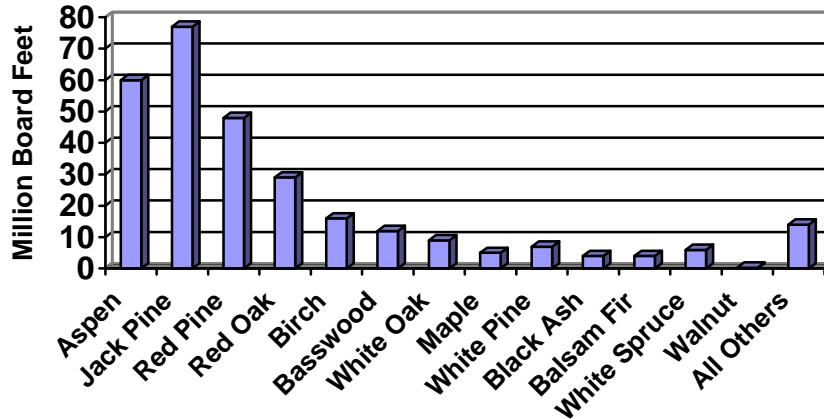


Source: USFS, North Central Forest Experiment Station Surveys

There was a nearly steady increase in pulpwood harvest from 1965 to 2000. 2001 showed the first decrease in many years. A major reason for the 2001 decrease in Minnesota pulpwood harvest was increasing imports, most of which was aspen and maple from Wisconsin and aspen from Canada. Imports result in fewer logging, trucking and support jobs in Minnesota. 2003 saw a modest decrease in Minnesota pulpwood harvest from 2002.

Timber Harvested From Minnesota Timberlands & Utilized by Sawmills - 2001 -

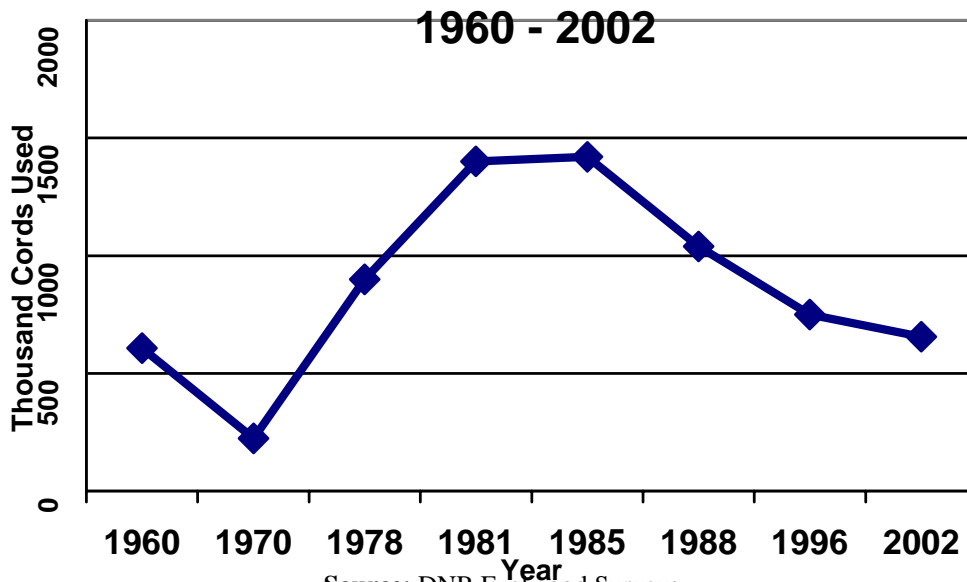
(Lumber, Posts/Poles, Shavings, Veneer, Energy & Landscape Chips)
Total 300 Million Board Feet



Source: MN DNR Sawmill Survey

Sawtimber is often the highest value product for wood that meets merchantability requirements. Generally speaking, a log needs to be at least 8 feet in length and 8 inches minimum diameter inside bark at the small end in order to be of merchantable sawlog size (However, there are an increasing number of sawmills that can utilize smaller diameter material profitably).

Fuelwood Demand in Minnesota



Source: DNR Fuelwood Surveys

Fuelwood is a relatively small portion of total timber harvest.

It is important to note that only a portion of total fuelwood comes from timberland (about 150,000 cords in 2002). The remainder is from sawmill residue, urban tree waste, land and powerline clearing.

Sustainable Harvest Information



Sustainable Harvest Levels

This section contains information on estimated sustainable harvest levels* for many of Minnesota's most significant tree species.

*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 targeted forest age class structure. Normally, transitions from the current 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 changes to the resource, 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 long-term sustained yield estimates. Additionally, it is important to note that it is possible to raise future timber availability through intensified forest management resulting in fewer losses to mortality and improved timber productivity. Sustainable harvest estimates can also vary significantly because of differing assumptions used in deriving the estimates, such as rotation age, harvest restrictions, growth and yield, etc.

For the above reasons, it is important to view the levels as helpful benchmarks that are only one part of the picture in determining long-term sustainability of our forest resources. They should not be viewed as absolute targets. DNR procedure for estimating long-term sustainable harvest levels have undergone significant changes from previous year's reports:

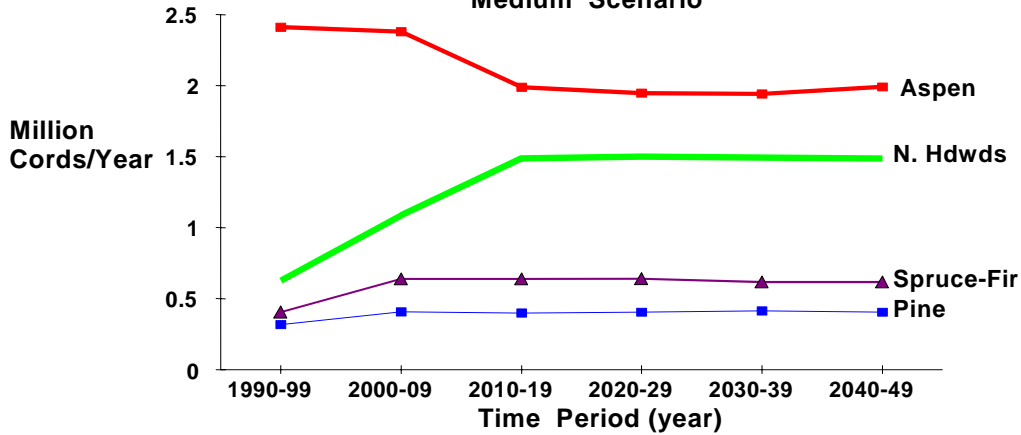
First, the data used is the 2003 FIA inventory, rather than 1990. Second, estimates are now adjusted downward as appropriate by ownership for potential timber supply restrictions that can apply to timberlands (such as riparian, old growth, leave tree and extended rotation). Additionally, rotation ages used to determine the estimates are now based on average rotation ages used in the DNR's Subsection Forest Resource Management Plans.

It is also important to note that DNR sustainable harvest level estimates are averages over an entire rotation. Generally therefore, for cover types with age-classes imbalances resulting from large acreages in older classes, current timber availability is likely to be *above* long-term sustainable estimates. This is due to a need to manage many old stands on timberlands before their health and available timber volume deteriorates. For cover types with young age-class imbalances such as red pine, current timber availability is likely to be *below* long-term sustainable estimates.

DNR is committed to providing excellent analysis, and will therefore periodically review sustainable harvest estimation procedures and assumptions. Future changes to procedure may be made as new information and procedures that would result in improved analysis become available.

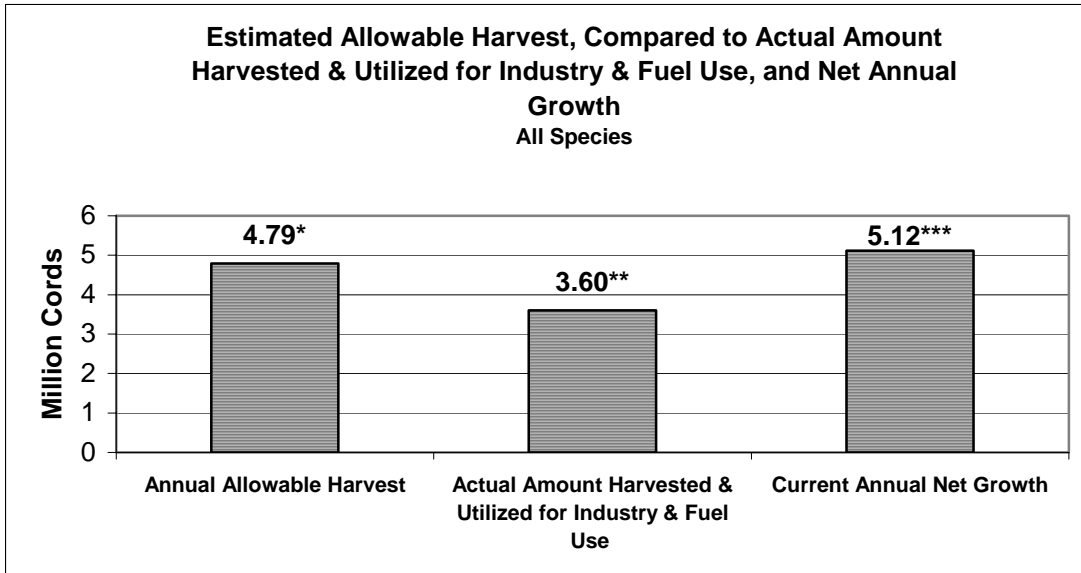
For a document explaining the DNR procedure used to estimate sustainable harvest levels, contact Keith Jacobson at: keith.jacobson@dnr.state.mn.us.

**SCHEDULING HARVEST by MODEL for PRODUCT GROUP
Minnesota Northern Region, All Ownerships
Medium Scenario**

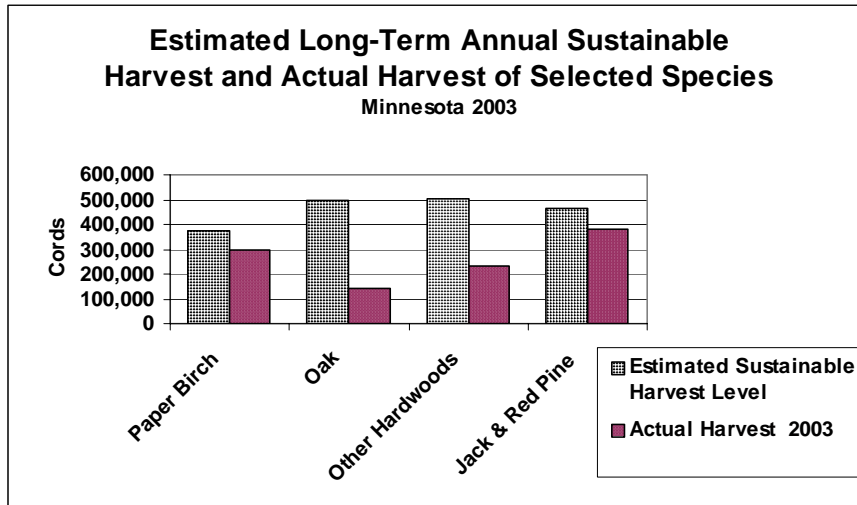


Source : GEIS table 6.8 medium scenario, 2nd run (p210 of M.P. & F. Reso. Base, 12/1992)
Assumptions used : Ownership constraints (riparian lands & old growth forests, etc.)

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 in response to 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. The GEIS did not recommend these 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, in order to determine impacts.

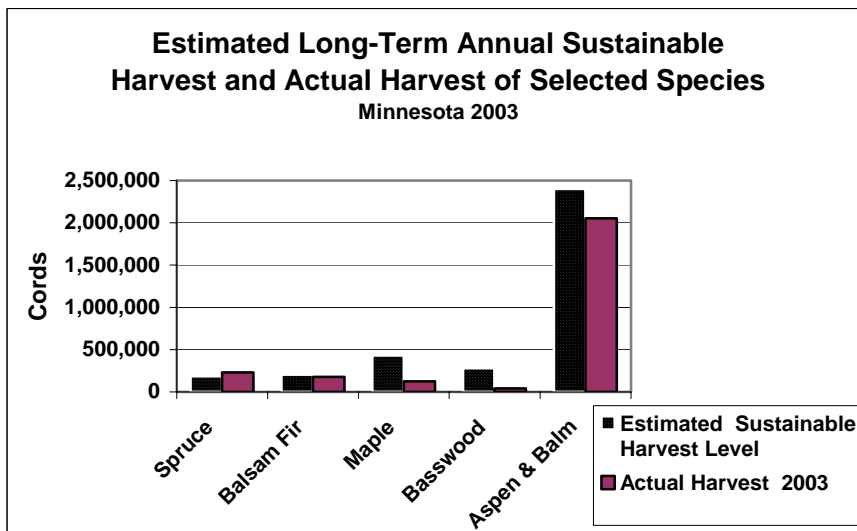


*Table 6.25, GEIS, Medium Level, Maintaining Forest Productivity & Resource Base Tech. Paper, Dec. '92
** 2003 NCFES Pulpwood Survey, 2001 DNR Sawmill Survey, 2002-03 Fuelwood Survey. For Harvest comparisons to Net Growth, it is necessary to add annual logging residue of approximately 275,000 cords to this figure
***USFS FIA Database, 2003



Source: Harvest data for 2003 from NCFES pulpwood survey & DNR 2001 sawmill & 2002 fuelwood survey. Inventory data FIA 2003.

The chart above is based on DNR method of calculating long-term sustainable harvest levels, which consists of area regulation for cover types typically managed as even-aged, and volume regulation for types typically managed as many-aged. Estimates are adjusted downward as appropriate by ownership for potential timber supply restrictions that can apply to timberlands (riparian: 3%, old growth: 0.5%, leave tree: 5%). Rotation ages used to determine the estimates are based on average ages used in the DNR's Subsection Forest Resource Management Plans.



Source: Harvest data for 2003 from NCFES pulpwood survey & DNR 2001 sawmill & 2002 fuelwood survey. Inventory data FIA 2003.

Aspen/Balm sustainable harvest based on GEIS (Table 6.5, medium level, Dec. 1992)
 Figures for spruce, fir, maple and basswood based on DNR method of calculating long-term sustainable harvest levels, which consists of area regulation for cover types typically managed as even-aged, and volume regulation for types typically managed as many-aged. Estimates are adjusted downward as appropriate by ownership for potential timber supply restrictions that can apply to timberlands (riparian: 3%, old growth: 0.5%, leave tree: 5%). Rotation ages used to determine the estimates are based on average ages used in the DNR's Subsection Forest Resource Management Plans.

Current and Projected Wood Harvest from Timberland
- Minnesota Statewide -

Species	In Thousand Cords	
	2003	Projected 2006*
Aspen/Balm of Gilead	2,053.6	1,988.6
Birch	298.5	322.5
Ash	36.4	56.4
Oak	140.8	129.3
Basswood	40.8	55.8
Maple	125.0	150.9
Cottonwood	8.7	9.7
Other Hardwoods	20.4	22.4
Pine	395.2	425.2
Spruce	231.0	227.0
Balsam Fir	176.1	173.1
Tamarack	61.1	77.1
Cedar	5.7	6.7
Other Softwoods	4.9	5.0
Total	3,598.2	3,649.7

Source: 2003 Harvest data compiled by NCFES and DNR

-Projected 2006 based on announced expansions and industry interviews

-2003 harvest figures are used as the starting point for determining estimated harvest in 2006.

Adjustments mainly due to species mix changes at paper and OSB mills, incremental production increases at pulp & paper & OSB mills due to new equipment and process efficiencies, and the shutting down of 2 paper machines at UPM-Blandin in March 2003.

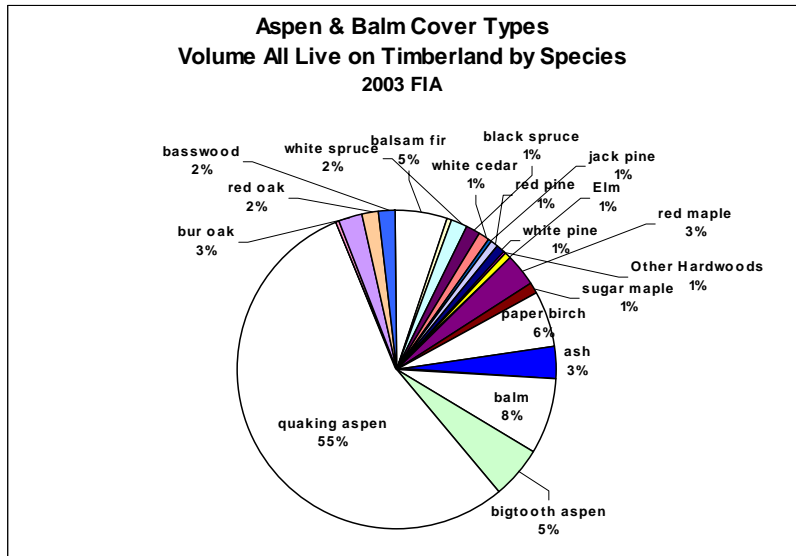
Wood Supply and Demand Information for Important Minnesota Cover Types and Species



Forest resource and harvest level information for Minnesota's most significant cover types and tree species.

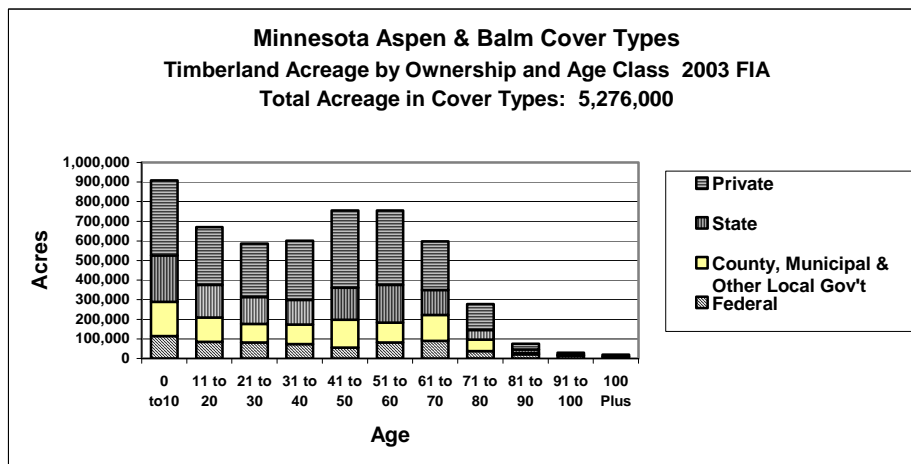
Minnesota's Aspen/Balm of Gilead Resource

Aspen is a relatively short-lived, fast growing tree species that requires nearly full sunlight in order to regenerate. Aspen is, by far, the predominant cover type and species in Minnesota's forests. It is also the species of greatest industrial use by a wide margin. The aspen resource is why every engineered wood mill in Minnesota is located here, and it is also extremely important resource to the pulp and paper sector, and the solid wood industrial segment. Many of Minnesota's largest mills were specifically designed to utilize aspen – it fits their products and manufacturing processes ideally.



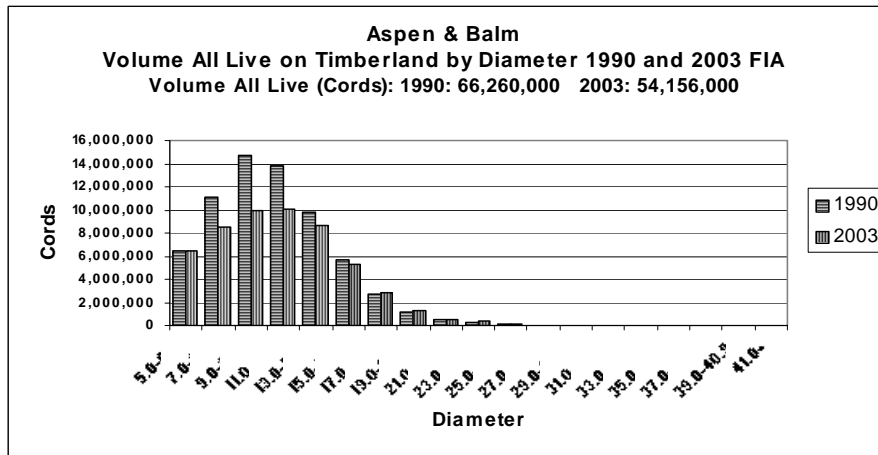
Source: 2003 FIA Database provided by USFS, North Central Research Station

The aspen cover type is made up of a wide mixture of species. Predominant secondary species include balsam fir, paper birch and oak. Aspen is also a significant component in many other upland cover types.



Source: 2003 FIA Database provided by USFS, North Central Research Station

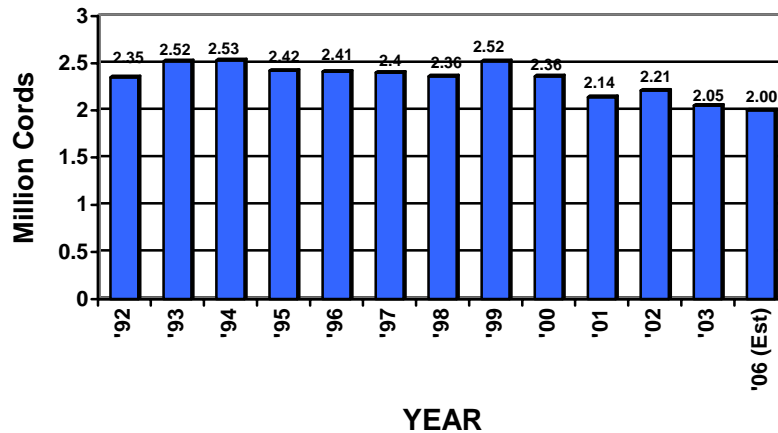
The 2003 FIA inventory indicates a somewhat more even age-class distribution than the 1990 inventory, but aspen supplies are still likely to be tight moving into the future. There is currently far more young aspen than existed 20 years ago, prior to the establishment of solid markets. Readers should also note that there are significant acreages of older aspen still present on the landscape. Regarding availability, in a nutshell: there is aspen out there, but the available supply will continue to trend downward somewhat for the next 15 years or so. Readers should also note that a great deal of the resource is in private hands, so managing it will require greater efforts in private landowner assistance.



Source: FIA Database provided by USFS, North Central Research Station

Total FIA aspen and balm of gilead (balm) volume has gone down since 1990 as significant acreages have been harvested and managed. For at least the next 10 years, more of the available aspen is likely to be found in stands that average less volume than past harvests, which is difficult on efficiency of loggers and mills.

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



Source: Harvest data compiled by NCFES & DNR

Annual long-term allowable harvest= 2.4 million cords based on Table 6.5 GEIS, medium level, Dec. 1992, Based on the 2003 USFS FIA database, estimated average net annual growth of aspen & balm growing stock: 1,260,000 cords, estimated average annual mortality of aspen & balm growing stock: 1,323,000 cords.

Several factors are influencing the reduction in aspen and balm harvest from its peak in 1999:

- Rising stumpage prices, which have resulted in increased imports of aspen pulpwood, especially from Canada.
- Substitution of alternative species by most large mills.

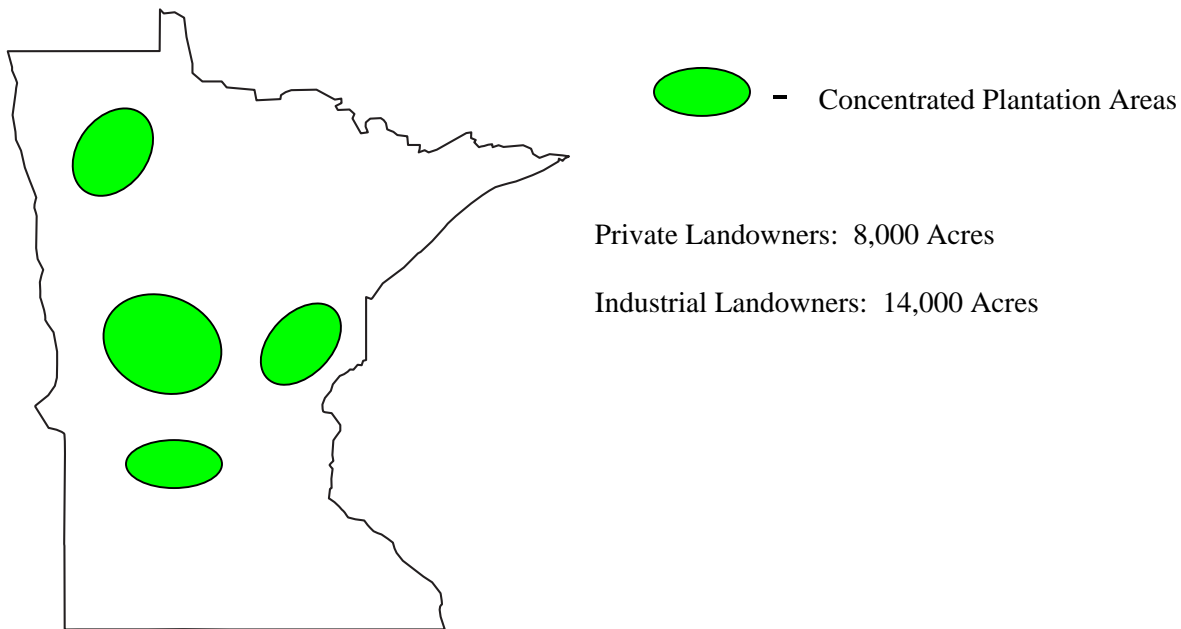
Current and Projected Demand for Aspen/Balm of Gilead from Minnesota Timberlands



	Cords
2003 Harvest.....	2,053,600
• Minnesota Pulpwood Industries	1,849,000
• Pulpwood Export.....	65,700
• Sawlogs & Other.....	121,500
• Fuelwood (from growing stock).....	17,400
 2006 Projected Harvest.....	 1,988,600
• Minnesota Pulpwood Industries.....	1,794,000
• Pulpwood Export.....	60,700
• Sawlogs & Other.....	116,500
• Fuelwood (from growing stock).....	17,400

Figures include a shift to use of alternative species by several existing OSB & pulp companies.

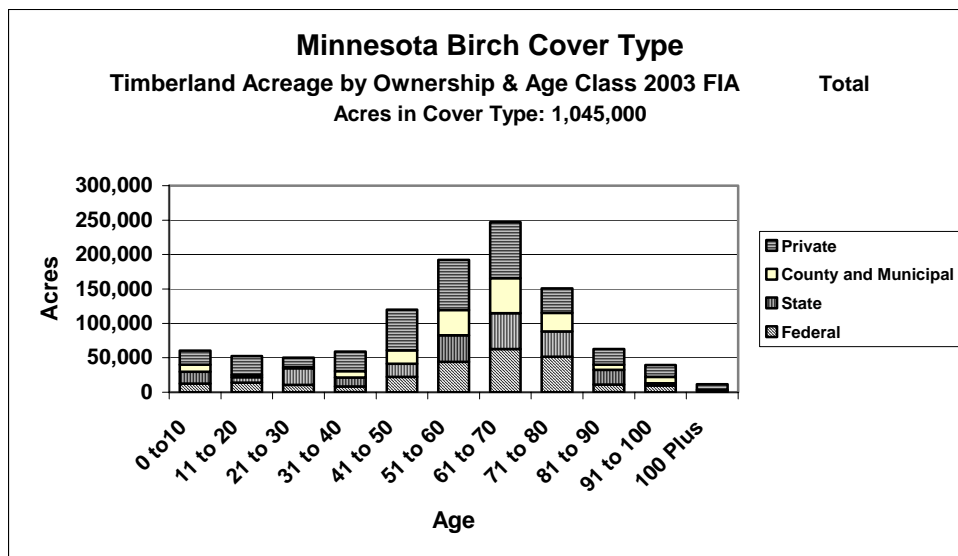
Hybrid Poplar in Minnesota - 2005



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

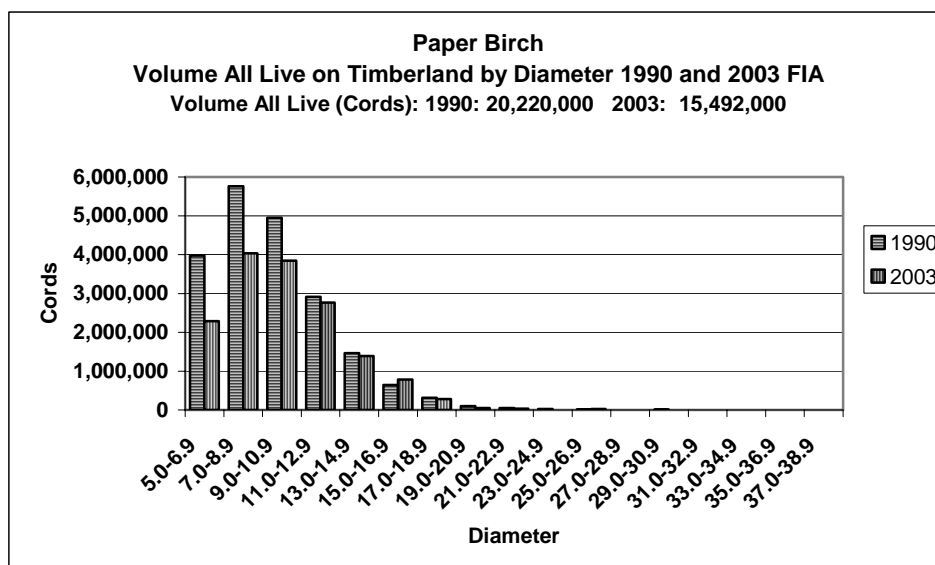
- Hybrid Poplar can reach merchantable size for traditional forest product markets in 10 to 15 years. Poplar harvested for energy markets can be harvested on shorter rotations.
- Intensive culture is required for the first 3 years in order to grow hybrid poplar.
- It is commonly grown on marginal agricultural fields.

Minnesota's Birch Resource



Source: 2003 FIA Database provided by USFS, North Central Research Station

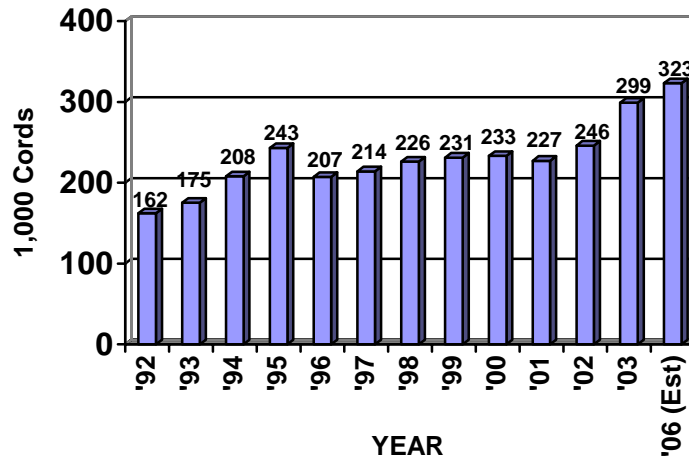
Paper birch is a relatively short-lived species that requires nearly full sunlight for regeneration. It can grow in nearly pure stands, or as a component in mixed stands. It comprises the large majority of the volume in the birch cover type, but it is also a significant component of several other upland cover types, including aspen. Birch has been a neglected resource for too long in Minnesota, but markets are improving as many larger mills widen their species use to include some birch. This should greatly improve management opportunities. There is also a need to increase efforts aimed at improving our ability to consistently regenerate birch stands.



Source: FIA Database provided by USFS, North Central Research Station

Total volume of paper birch has declined since 1990, due largely to serious mortality associated with an aging resource and stress caused by periodic drought.

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



Source: Harvest data compiled by NCFES & DNR

DNR estimated long-term annual sustainable harvest level: 371,500 cords/year. Estimated average net annual growth of paper birch growing stock: -5,837 cords, and estimated average annual mortality of birch growing stock: 548,276 cords, based on the 2003 USFS FIA database.

**Current and Projected Demand for Birch from Minnesota
Timberlands**



	Cords
2003 Harvest.....	298,500
• Minnesota Pulpwood Industries.....	189,200
• Pulpwood Export.....	29,600
• Sawlogs & Other.....	32,400
• Fuelwood (from growing stock).....	47,300
2006 Projected Harvest.....	322,500
• Minnesota Pulpwood Industries.....	217,200
• Pulpwood Export.....	29,600
• Sawlogs & Other.....	28,400
• Fuelwood (from growing stock).....	47,300

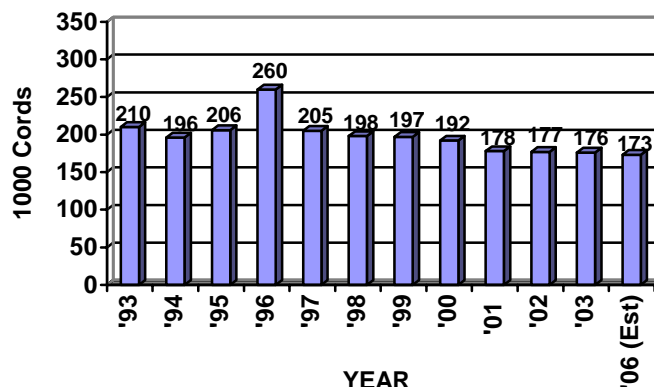
Concerns:

- Consistency in achieving adequate regeneration.
- Wood quality (lots of rot in old birch).
- Major age class imbalance.

Figures include increases in OSB and pulp & paper use by currently operating companies
Source: NCFES & DNR Surveys Projections based on DNR interviews/Industry announcements

Minnesota's Balsam Fir Resource

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

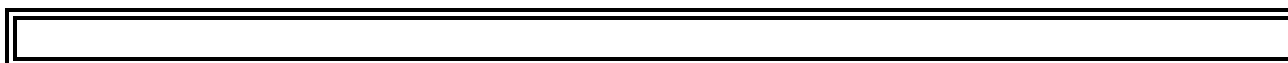


Source: Harvest data compiled by NCFES & DNR.

DNR estimated long-term annual sustainable harvest level 203,500 cords/year. Estimated average net annual growth of balsam fir growing stock: 42,200 cords, based on 2003 FIA database. Estimated average annual mortality of balsam fir growing stock: 459,400 cords, based on 2003 FIA database.

Balsam fir industrial use is similar to that of spruce. It is used largely for making of high quality paper, where it is prized for its excellent fiber qualities. Some is also used by the sawmill industry, mostly in making studs but also in small quantities for other types of lumber. A very small amount of fir is also used in making OSB.

Current and Projected Demand for Balsam Fir from Minnesota Timberlands

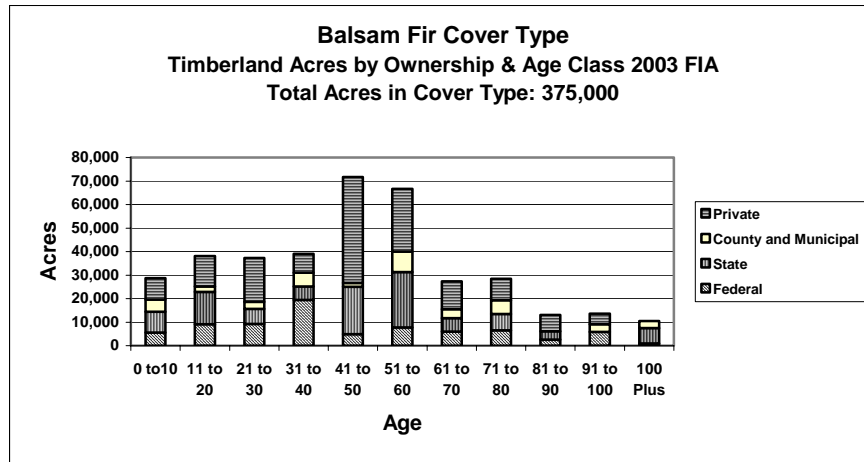


	Cords
2003 Harvest.....	176,100
• Minnesota Pulpwood Industries & Export (Export 400 cords).....	168,500
• Sawlogs & Other.....	7,600
• Fuelwood.....	0
2006 Projected Harvest.....	173,100
• Minnesota Pulpwood Industries & Export.....	163,500
• Sawlogs & Other.....	9,600
• Fuelwood.....	0

Concerns:

- Balsam availability dependent on harvest of aspen (38% of balsam fir in aspen type).
- Spruce budworm impact.
- Age class imbalance.

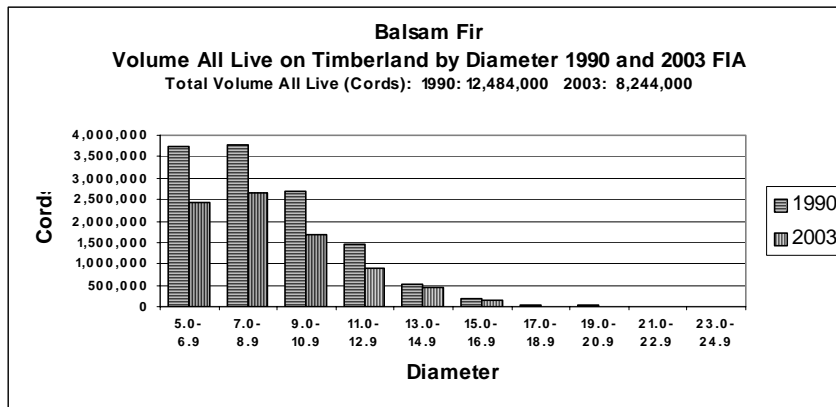
Source: NCFES & DNR Surveys
Projections based on DNR Interviews/Industry Announcements



Source: 2003 FIA Database provided by USFS, North Central Research Station

The cover type is dominated by stands at and above 40 years, making this a relatively old resource for such a short-lived species. Recommended rotation ages can vary with stand productivity and site condition, with 50 years a common average (stands managed as extended rotation are carried beyond this age). A large portion of the resource is found on private lands.

Much of the balsam fir volume in Minnesota (53%) is found mixed in with the aspen and birch cover types, and is therefore tied to aspen and birch harvest. Total balsam volume has dropped significantly since 1990.



Source: FIA Database provided by USFS, North Central Research Station

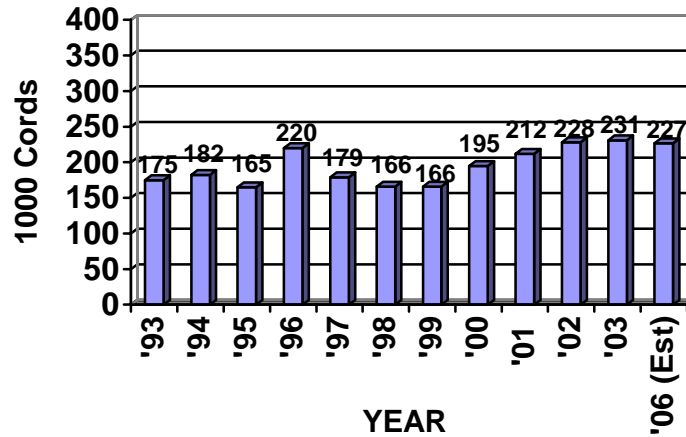
Some Management Issues or Concerns:

Spruce budworm: Spruce budworm is a native defoliator that has balsam fir as its preferred host. Defoliation from the most recent major outbreak peaked at over 500,000 acres in 1995, and has since declined to just over 34,000 acres in 2003. Much of northeastern Minnesota has been impacted. When there are concentrations of balsam fir over 45 to 50 years of age, spruce budworm will increase to take advantage of their preferred food source. If management favoring more conifers in stands, more extended rotation ages, more reserve trees and more mixed stands result in more balsam fir of older ages, then budworm populations will periodically build up to outbreak levels.

Rot: As with black spruce, red rot can be prevalent on some sites, especially in older stands. High levels of rot can have a major impact on stand merchantability, and therefore our ability to manage these stands. Wood with a high percentage of rot is undesirable or unusable for many higher-value wood products, of course.

Minnesota's Spruce Resource

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



Source: Harvest data compiled by NCFES & DNR

DNR estimated long-term annual sustainable harvest level = 183,700 cords. Based on the 2003 FIA database, estimated average net annual growth of spruce growing stock: 259,000 cords, estimated average annual mortality of spruce growing stock: 254,000 cords.

Current and Projected Demand for Spruce from Minnesota Timberlands



	Cords
2003 Harvest.....	231,000
• Minnesota Pulpwood Industries.....	167,200
• Pulpwood Export.....	51,000
• Sawlogs & Other.....	12,800
• Fuelwood.....	0
2006 Projected Harvest.....	227,000
• Minnesota Pulpwood Industries.....	161,200
• Pulpwood Export.....	51,000
• Sawlogs & Other.....	14,800
• Fuelwood.....	0

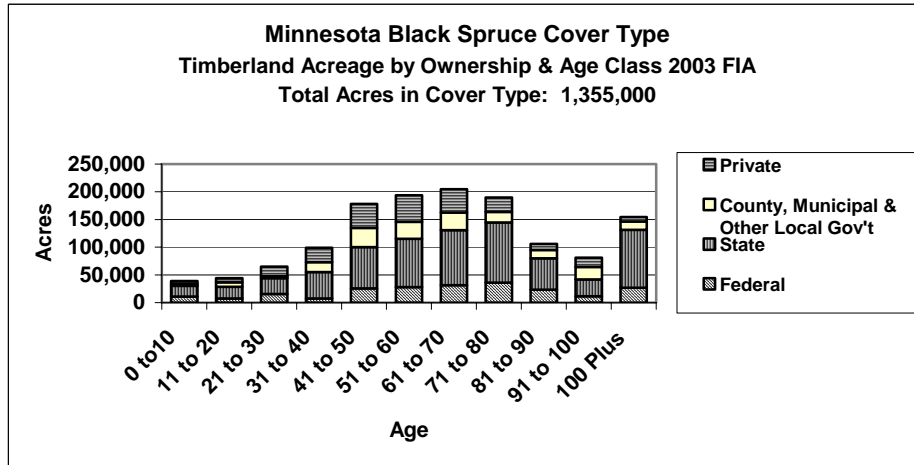
Source: NCFES & DNR Surveys
Projections based on DNR Interviews/Industry Announcements

Management Issues or Concerns:

- Many stands have very low volume/acre of spruce. This increases logging costs, which not only affects logger profitability, but can also impact production costs all the way to finished product. It can also impact our ability to manage some stands.
- Since black spruce is normally found on lowland sites only accessible during frozen conditions, accessibility of the resource is a major issue. Very little summer access.

- There is increasing industrial competition for sawbolt-quality wood.
- Red rot can be prevalent in wood on some sites, especially in older stands. High levels of rot can have a major impact on stand merchantability, and therefore ability to manage stands. Wood with a high percentage of rot is undesirable or unusable for many higher-value wood products.

Black Spruce

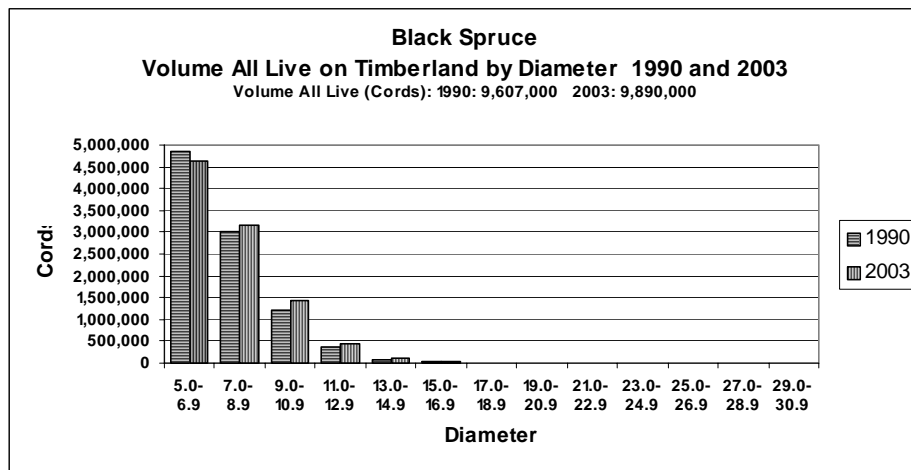


Source: 2003 FIA Database provided by USFS, North Central Research Station

Black spruce cover type acreage is heavily weighted to ages 40 through 80, with a fair amount of acreage also above age 100. Recommended harvest or “rotation” ages can vary with site productivity and site condition from 75 to 120 years of age, with 100 years an “average” figure. Stands managed as “extended rotation” are carried beyond these ages. Black spruce exists largely on lowlands, often in nearly pure stands, or mixed with tamarack and/or white cedar and a variety of minor associated species.

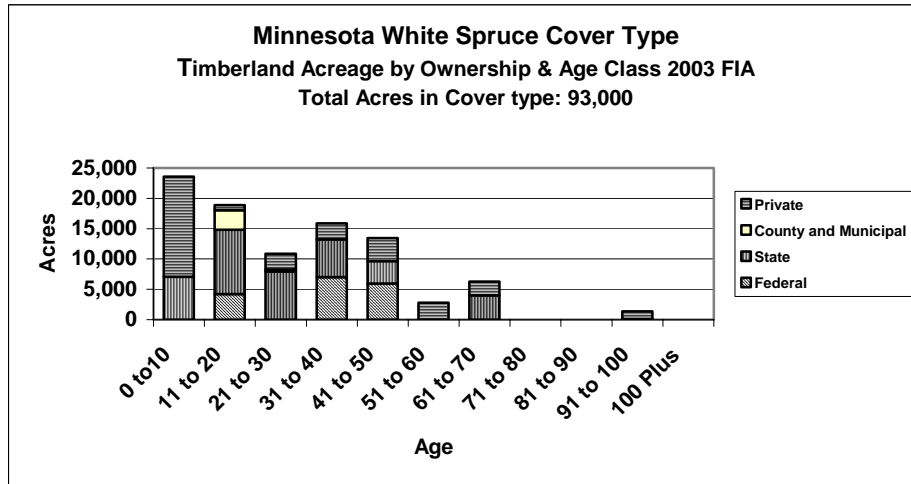
The State of Minnesota is by far the largest owner of black spruce cover type acres, but counties, private owners and our two national forests all have significant acreage.

The vast majority of black and white spruce in Minnesota (over 92%) is used in the making of high quality paper, where it is prized for its excellent fiber qualities. Some is also used by the sawmill industry, mostly in making studs but also in small quantities for other types of lumber. A very small amount of spruce is also used in making Oriented Strand Board (OSB).



Source: FIA Database provided by USFS, North Central Research Station

White Spruce



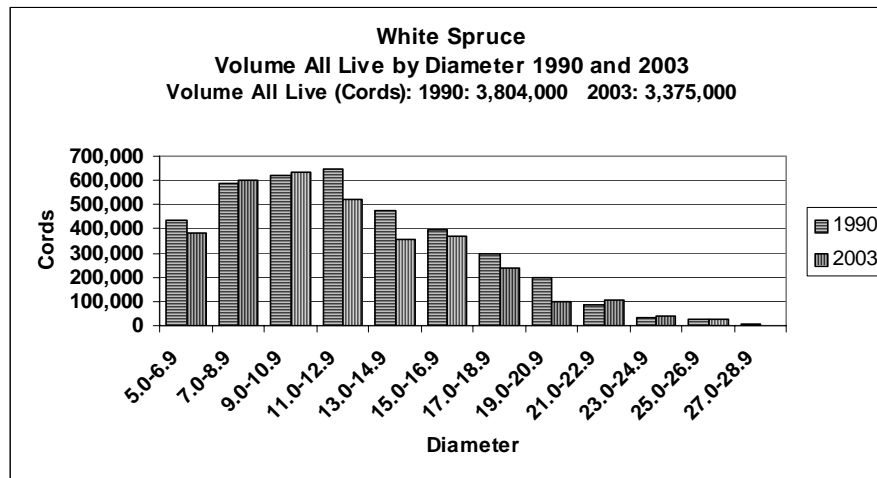
Source: 2003 FIA Database provided by USFS, North Central Research Station

White spruce is a relatively young resource. The cover type is dominated by stands below the age of 50, many of which are in the form of plantations. Recommended rotation ages can range from 60 to 90 years, depending on site productivity and condition (again, some stands managed as extended rotation are held beyond these ages). White spruce is located most often on upland sites, where in natural stands it is commonly found mixed in as a component in aspen, birch, balsam fir & pretty much all upland cover types. Therefore a great deal of white spruce volume exists as a component in mixed stands of other upland cover types.

Some Management Issues or Concerns:

Spruce budworm is a defoliator that has caused top kill and mortality on white spruce, (including plantations). This impact can be lessened by management activities such as thinning to maintain stand vigor and by discriminating against balsam fir in some mixed stands (balsam fir is the preferred host for spruce budworm).

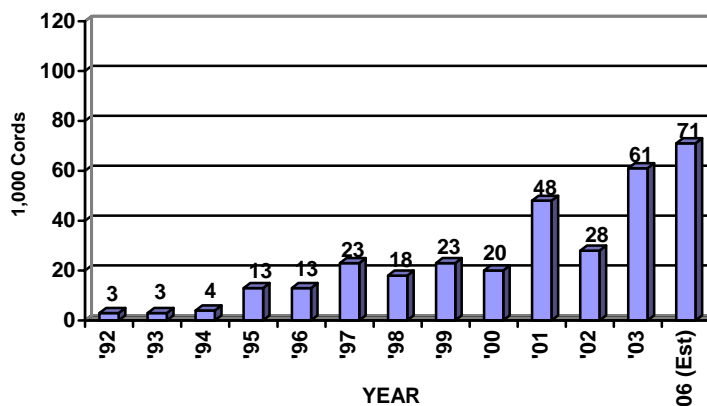
There will be increasing opportunities for thinning white spruce plantations over the next decade, as stands move into merchantable size classes. Thinning normally yields excellent quality pulp with little or no loss to rot or decay. It can be lower volume productivity work for loggers, however.



Source: FIA Database provided by USFS, North Central Research Station

Minnesota's Tamarack Resource

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



Source: Harvest data compiled by NCFES & DNR

DNR estimated long-term annual sustainable harvest level = 114,800 cords/year. Based on the 2003 FIA database, estimated average net annual growth of tamarack growing stock: 210,000 cords, estimated average annual mortality of tamarack growing stock: 74,000 cords.

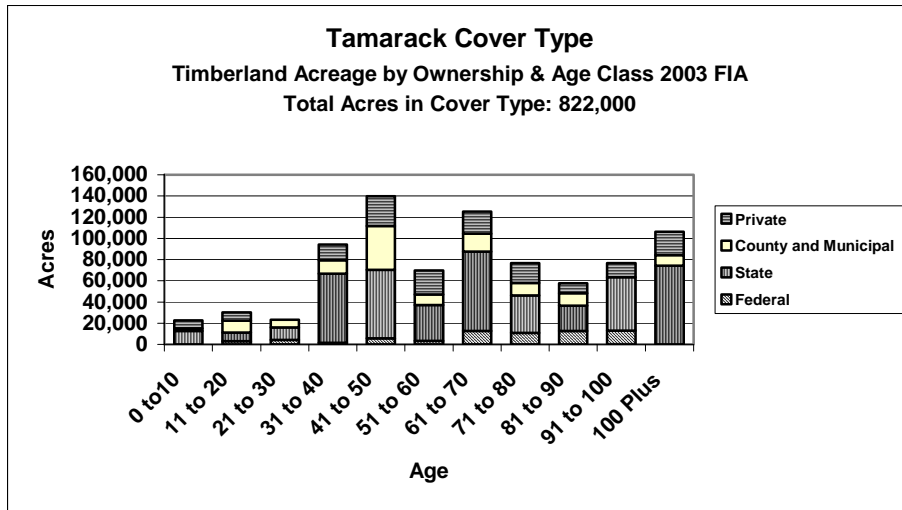
Current and Projected Demand for Tamarack from Minnesota Timberlands

	Cords
2003 Harvest.....	61,100
• Minnesota Pulpwood Industries.....	37,700
• Pulpwood Export (2 Wisconsin pulp & paper mills).....	20,900
• Sawlogs & Other.....	1,800
• Fuelwood.....	700
2006 Projected Harvest.....	77,100
• Minnesota Pulpwood Industries.....	61,700
• Pulpwood Export.....	12,900
• Sawlogs & Other.....	1,800
• Fuelwood.....	700

Concerns:

- Forest stands with low volume/acre of tamarack.
- Forest health (insect) issues, especially in older stands.
- Winter access only.
- Some small, poor site stands.

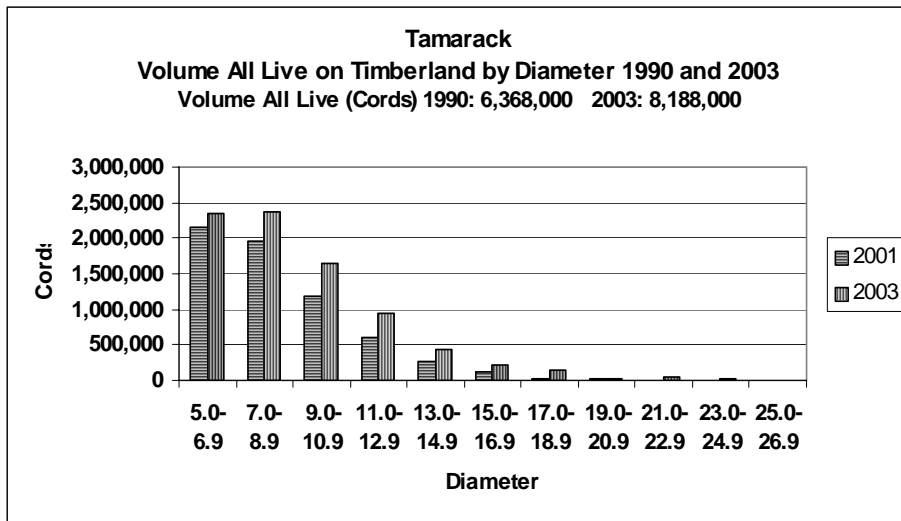
Source: NCFES & DNR Surveys. Projections based on DNR interviews/Industry Announcements



Source: 2003 FIA Database provided by USFS, North Central Research Station

Tamarack is dominated by “middle-aged” stands, but there is a fair amount of very old tamarack (average rotation age= 90). The state of Minnesota owns over 50% of the tamarack cover type.

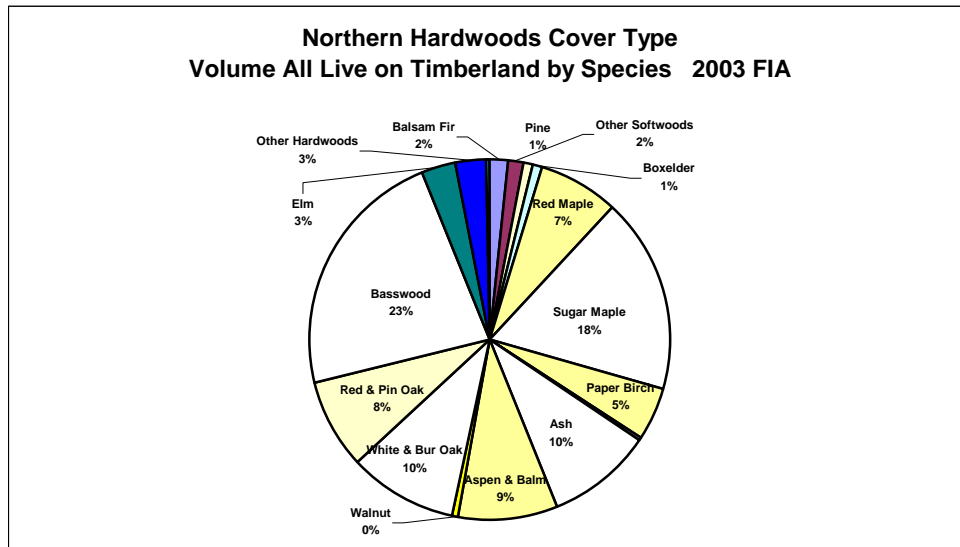
Tamarack is now used in the manufacture of OSB, and with Kraft pulp mills also using some, markets for tamarack have improved greatly over the past 3 years. Improved markets will greatly enhance the ability to manage this important resource.



Source: FIA Database provided by USFS, North Central Research Station

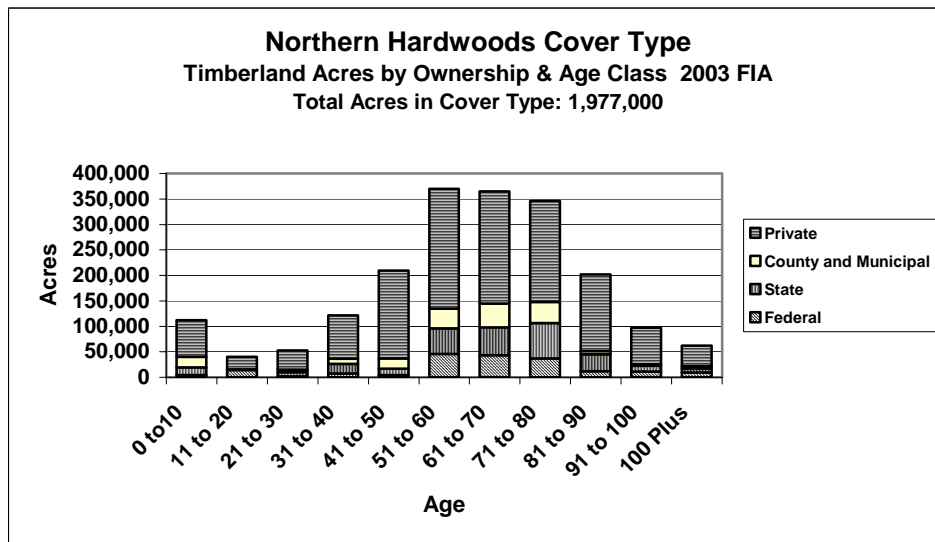
Volume of tamarack has risen substantially since 1990.

Minnesota's Northern Hardwood Resource



Source: 2003 FIA Database provided by USFS, North Central Research Station

The northern hardwoods cover type is a conglomeration of a wide group of species. The dominant species present are the shade tolerant sugar maple and basswood. There are also significant ash, oak, birch and aspen volumes present.



Source: 2003 FIA Database provided by USFS, North Central Research Station

The northern hardwoods cover type is dominated by late “middle aged” stands (average rotation age = 80), many of which are in need of thinning in order to promote optimal growth and forest health.

The northern hardwoods cover type is owned largely by private landowners. Continuing and improved availability and use of forest management technical assistance to private landowners is therefore a critical issue for this type.

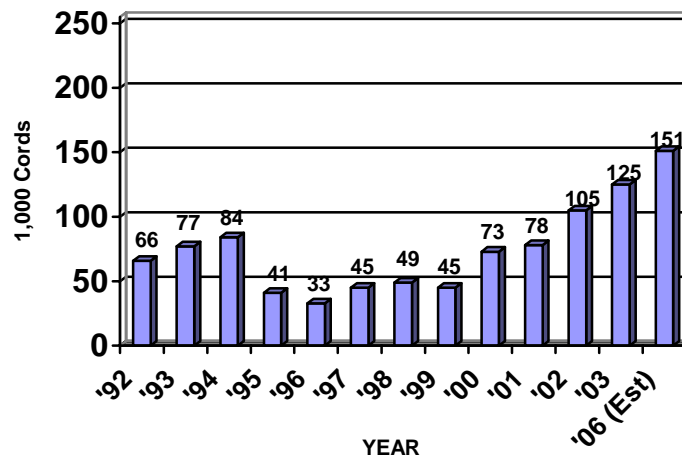
Northern hardwoods are often managed through periodic “thinning” harvests, although clearcutting can be an appropriate tool in some situations.

Our northern hardwoods cover type has been something of a “neglected” resource for many years. This has largely been due to a history of poor markets for many hardwood species and sizes in much of the state. The market situation for most hardwoods has changed drastically in recent years, however. Several Minnesota pulp and paper and OSB mills have expanded their raw material species mix to include maple and other hardwoods. Sawlog markets for most hardwood species are also good throughout most of the state. Better markets mean that greatly improved management of the northern hardwood resource is now possible. Since the majority of the resource is privately owned, availability and use of technical forest management assistance for private landowners will therefore be more critical than ever.

Maple

MAPLE HARVEST IN MINNESOTA: ACTUAL & PROJECTED

From MN Statewide Timberland, all Ownerships



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

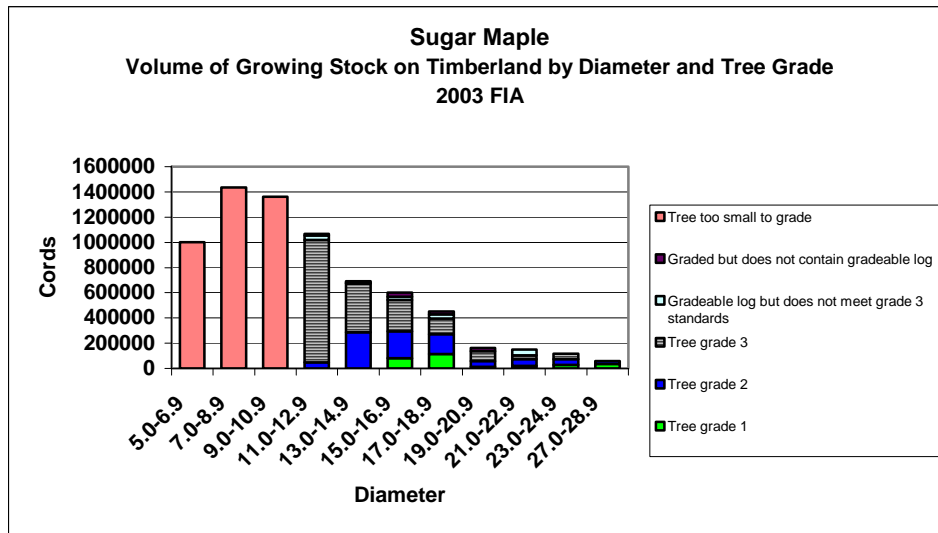
DNR estimated long-term annual sustainable harvest level = 429,600 cords. Based on the 2003 FIA database, estimated average annual net growth for maple growing stock in Minnesota is 579,000 cords, estimated average annual mortality of maple growing stock is 104,000 cords.

Current and Projected Demand for Maple from Minnesota Timberlands

	Cords
2003 Harvest.....	124,900
• Minnesota Pulpwood Industries.....	86,900
• Pulpwood Export.....	5,800
• Sawlogs & Other.....	11,800
• Fuelwood.....	20,400
2006 Projected Harvest.....	150,900
• Minnesota Pulpwood Industries.....	111,900
• Pulpwood Export.....	5,800
• Sawlogs & Other.....	12,800
• Fuelwood.....	20,400

Concerns:

- Promoting good management on non-industrial private lands.
- Different logging equipment and intensity of management required in multiple-entry management.

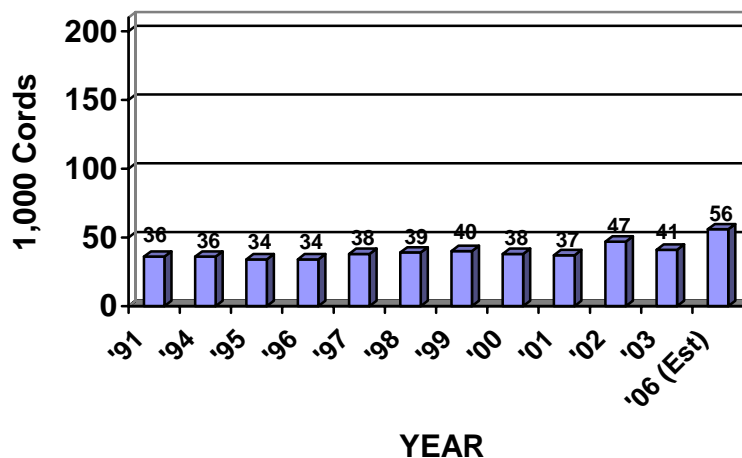


Source: 2003 FIA Database provided by USFS, North Central Research Station

Growing conditions for maple in most of Minnesota are marginal because we are on the western edge of its natural range. The result is that sugar maple in most of the state tends to be of lower sawlog quality than that grown in some regions of the country, due to relatively small size and poor form. Some higher quality sugar maple is grown in southeastern Minnesota, however.

Basswood

BASSWOOD HARVEST IN MINNESOTA: ACTUAL & PROJECTED Minnesota statewide Timberland, all Ownerships



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

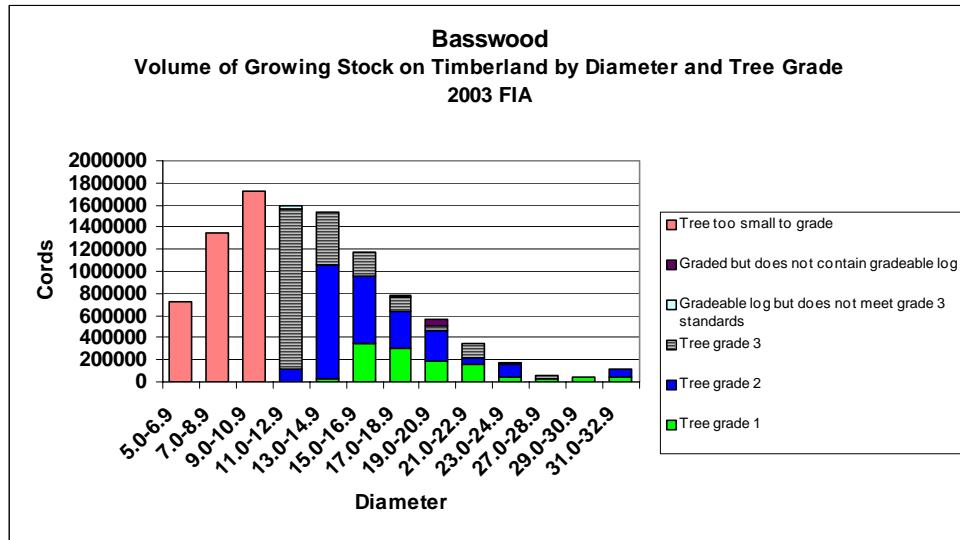
DNR estimated long-term annual sustainable harvest level = 280,300 cords. Based on the 2003 FIA database, estimated net annual basswood growth: 301,000 cords, estimated annual basswood mortality: 78,000 cords.

Current and Projected Demand for Basswood from Minnesota Timberlands

	Cords
2003 Harvest.....	40,800
• Minnesota Pulpwood Industries.....	14,700
• Pulpwood Export.....	300
• Sawlogs & Other.....	24,500
• Fuelwood.....	1,300
2006 Projected Harvest.....	55,800
• Minnesota Pulpwood Industries.....	31,700
• Pulpwood Export.....	300
• Sawlogs & Other.....	22,500
• Fuelwood.....	1,300

Concerns:

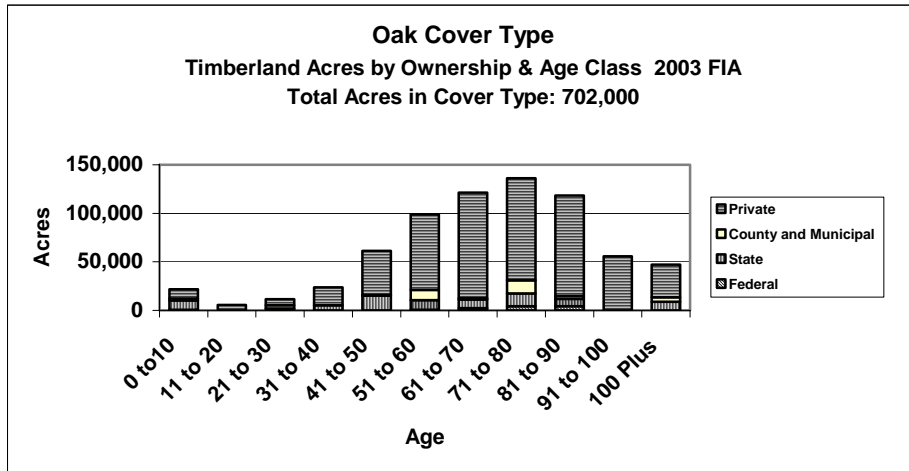
- Promoting good management on non-industrial private lands: with the recent development of a pulpwood market for basswood, it will become critical to prevent the harvest of potential high-quality sawlogs as pulp on productive sites.



Source: 2003 FIA Database provided by USFS, North Central Research Station.

Basswood is capable of producing a large percentage of high-quality sawlog and veneer material on good sites in Minnesota.

Minnesota's Oak Resource

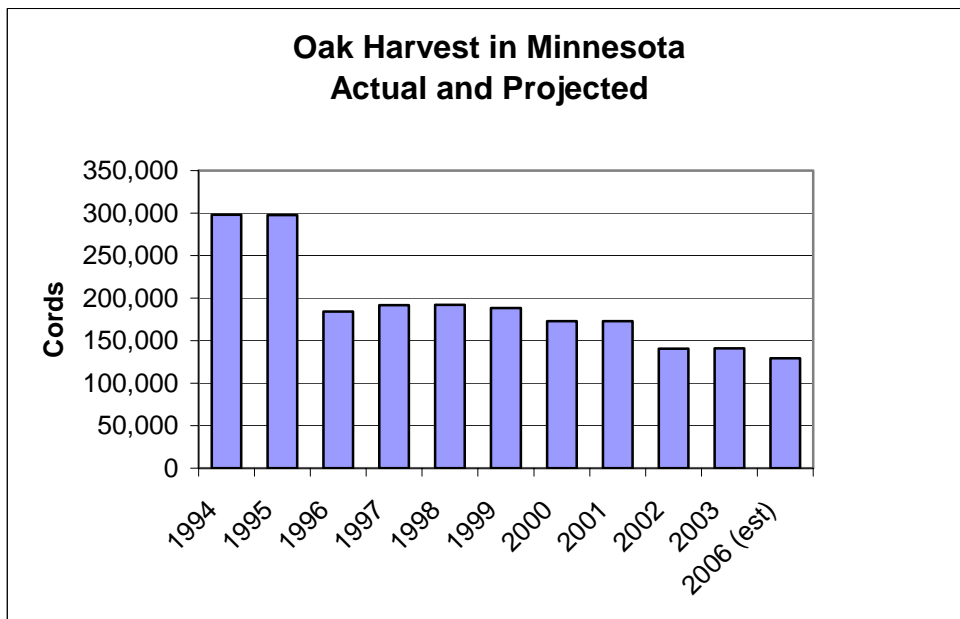


Source: 2003 FIA Database provided by USFS, North Central Research Station

The oak cover type is dominated by late “middle aged” stands (average rotation age = 80 to 100). The oak resource is largely owned by private landowners.

OAK HARVEST IN MINNESOTA: ACTUAL & PROJECTED

Minnesota statewide Timberland, all Ownerships



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

Oak is a tremendously important cover type and species in a large portion of Minnesota. Many wildlife species commonly use acorns as part of their diet, and oaks also can provide excellent den opportunities. Additionally, it is the largest volume species produced by many sawmills, especially those in the southern 2/3 of the state.

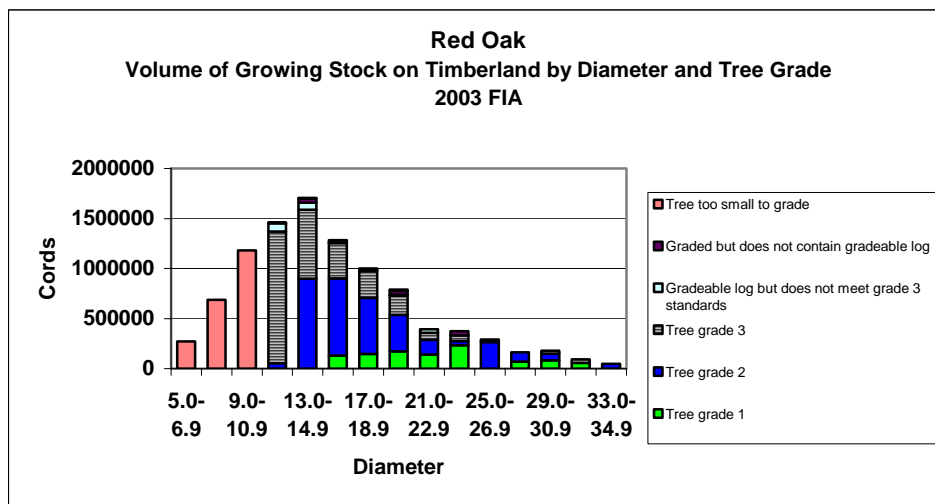
DNR estimated long-term annual sustainable harvest level for oak = 499,300 cords. Estimated net annual oak growth: 793,000 cords, based on 2003 FIA database. Estimated annual oak mortality: 99,000 cords, based on 2003 FIA database .

Current and Projected Demand for Oak from Minnesota Timberlands

	Cords
2003 Harvest.....	140,800
• Minnesota Pulpwood Industries.....	0
• Pulpwood Export.....	500
• Sawlogs & Other.....	94,200
• Fuelwood.....	46,100
2006 Projected Harvest.....	129,300
• Minnesota Pulpwood Industries.....	1,000
• Pulpwood Export.....	1,000
• Sawlogs & Other.....	81,200
• Fuelwood.....	46,100

Concerns:

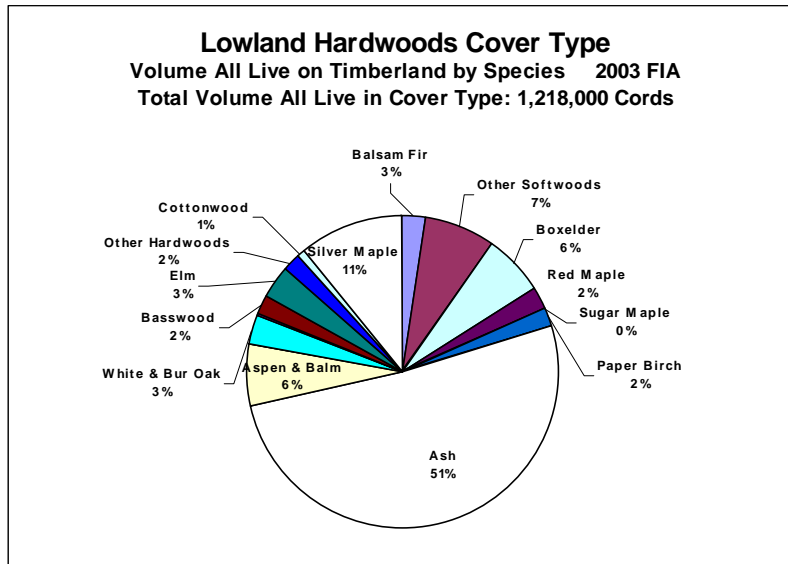
- High quality red oak sawlog resource continues to decline.
- Gypsy moth invasion likely to make it’s way to MN after 2010 will have a negative impact on oak resource.
- There are opportunities to improve future oak volume and quality through investments in intermediate stand treatments on private and public lands.



Source: 2003 FIA Database provided by USFS, North Central Research Station

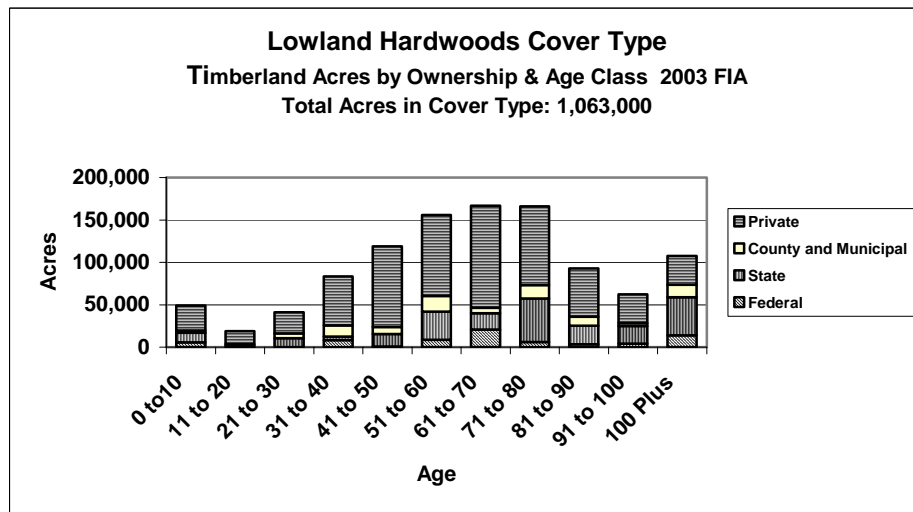
Some high quality sawlog and veneer red oak is grown on good sites in Minnesota.

Minnesota's Lowland Hardwoods Resource



Source: 2003 FIA Database provided by USFS, North Central Research Station

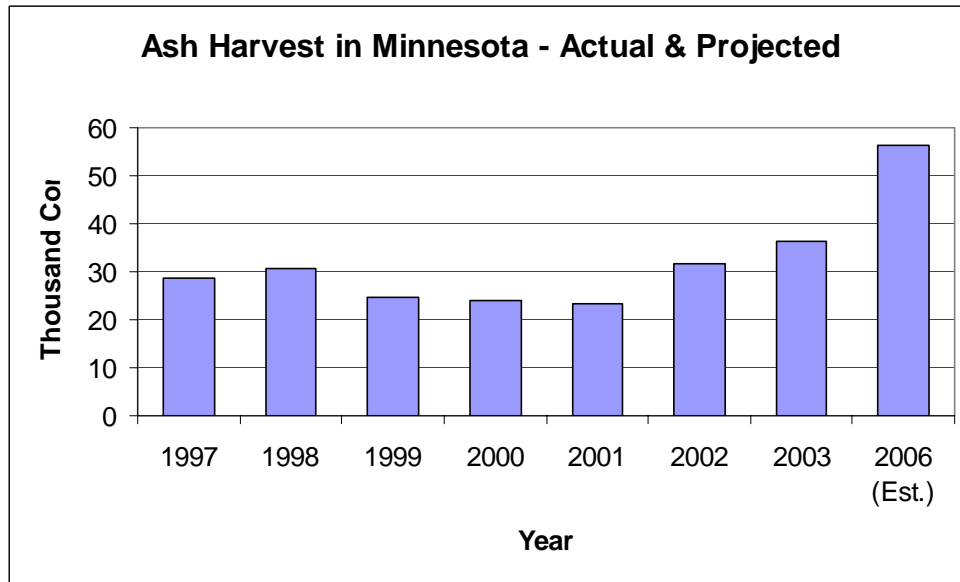
The lowland hardwoods cover type is made up of a variety of species. Most prevalent are black ash, silver maple, green ash and cottonwood.



Source: 2003 FIA Database provided by USFS, North Central Research Station

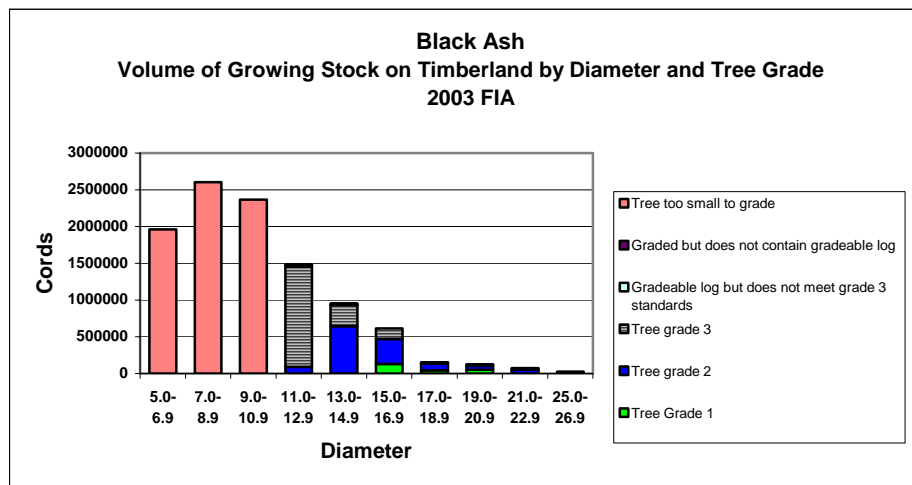
The lowland hardwood cover type is dominated by late “middle age” stands. A common rotation age for black ash is 90 years.

Minnesota's Ash Resource



Source: Harvest data compiled by NCFES & DNR

Ash has not had a pulpwood market until recently, when several pulp & paper mills, and several OSB mills began using it.



Source: 2003 FIA Database provided by USFS, North Central Research Station

Minnesota's ash resource is dominated by smaller diameter material. This has an impact on processing opportunities: specifically, much of the ash resource is a good fit for pulpwood mills. We do grow a modest amount of high quality sawlog and veneer ash in Minnesota. It is important to get the high-quality material to these greater value-added markets.

Of the ash species found in Minnesota (black, green and white) black ash has by far the largest volume.

DNR estimated long-term annual sustainable harvest level for ash = 353,600 cords. Based on the 2003 FIA database, estimated net annual ash growth: 509,000 cords, estimated annual ash mortality: 64,000 cords.

Current and Projected Demand for Ash from Minnesota Timberlands



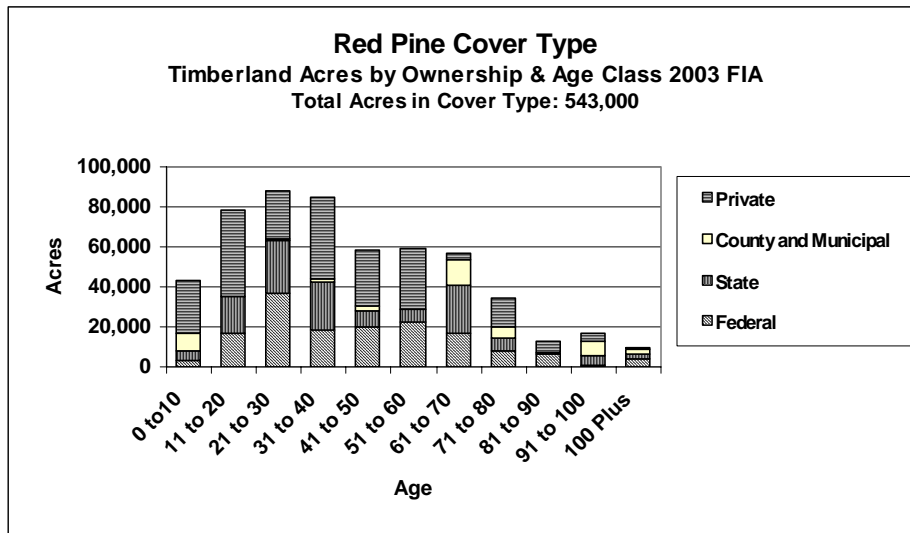
	Cords
2003 Harvest.....	36,400
• Minnesota Pulpwood Industries.....	10,000
• Pulpwood Export.....	200
• Sawlogs & Other.....	10,900
• Fuelwood.....	15,300
 2006 Projected Harvest.....	 56,400
• Minnesota Pulpwood Industries.....	31,000
• Pulpwood Export.....	200
• Sawlogs & Other.....	9,900
• Fuelwood.....	15,300

Concerns:

- Health concerns in black ash.
- Sorting high quality ash for highest value markets.

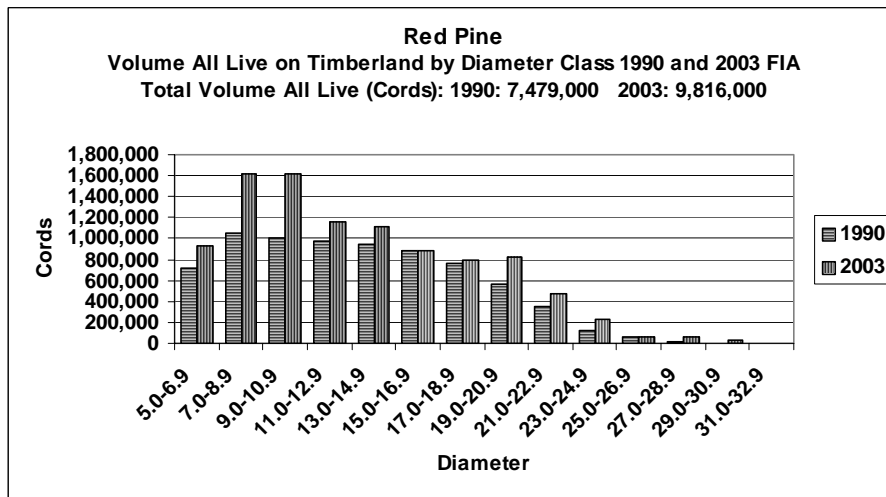
Minnesota's Pine Resource

Red Pine



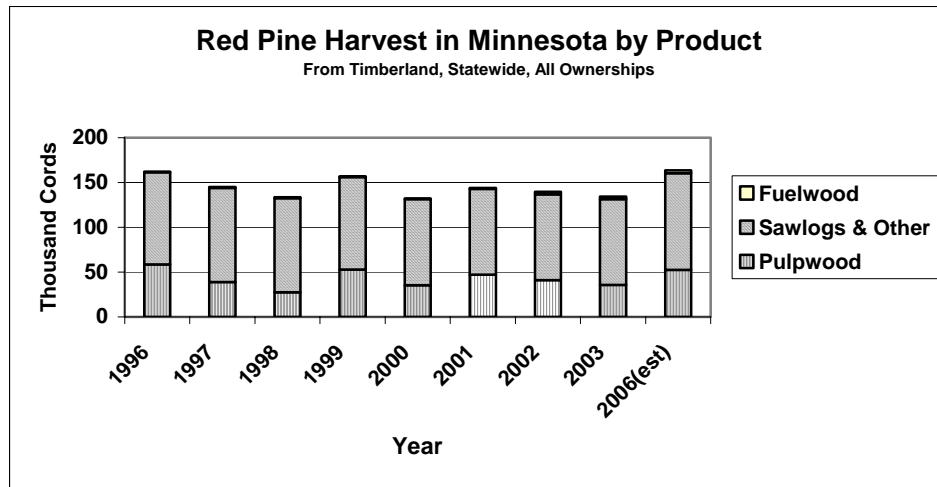
Source: 2003 FIA Database provided by USFS, North Central Research Station

Red pine is a type dominated by young age classes, much of which is in the form of plantations in need of periodic thinning. Much of the resource is owned by the federal government and private landowners.



Source: FIA Database provided by USFS, North Central Research Station

Volume of red pine has increased greatly since 1990 as many plantations have reached merchantable sizes.



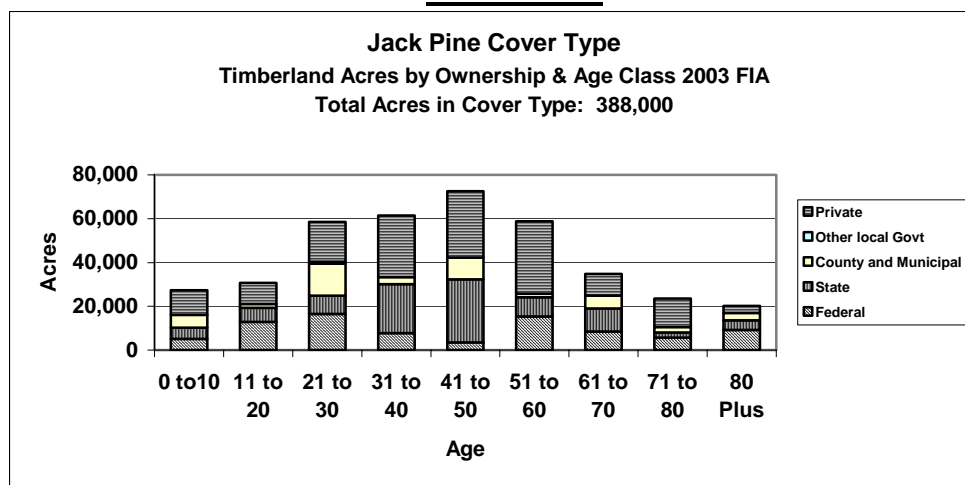
Source: Harvest data compiled by NCFES & DNR

DNR estimated long-term annual sustainable harvest level = 340,000 cords*. Average net annual growth of red pine growing stock: 380,000 cords, based on 2003 USFS FIA database. Average annual mortality of red pine growing stock: 38,000 cords, based on 2003 USFS FIA database.

*It is important to note that due to the age-class structure of red pine (large acreages of young red pine) the short-term harvest level would be lower than the long-term sustainable figure. Short-term figure is approximately 270,000 cords, rising to 356,000 cords by 2012 and then continuing to rise for at least 50 years as the cover type ages and available volume for thinning increases.



Jack Pine



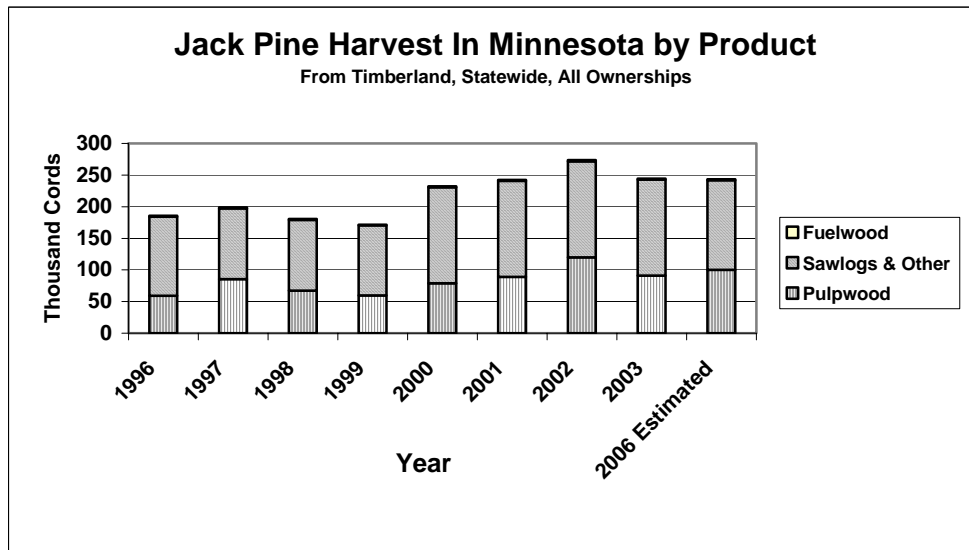
Source: 2003 FIA Database provided by USFS, North Central Research Station

Much of the jack pine resource is owned by the state of Minnesota and by private landowners. The jack pine cover type is heavily weighted to the 41 to 60 year age classes. Many of these older stands are in need of management at the present time. Recent jack pine budworm outbreaks in older stands have resulted in heavy mortality in portions of northwest and east central Minnesota. The age-class imbalance,

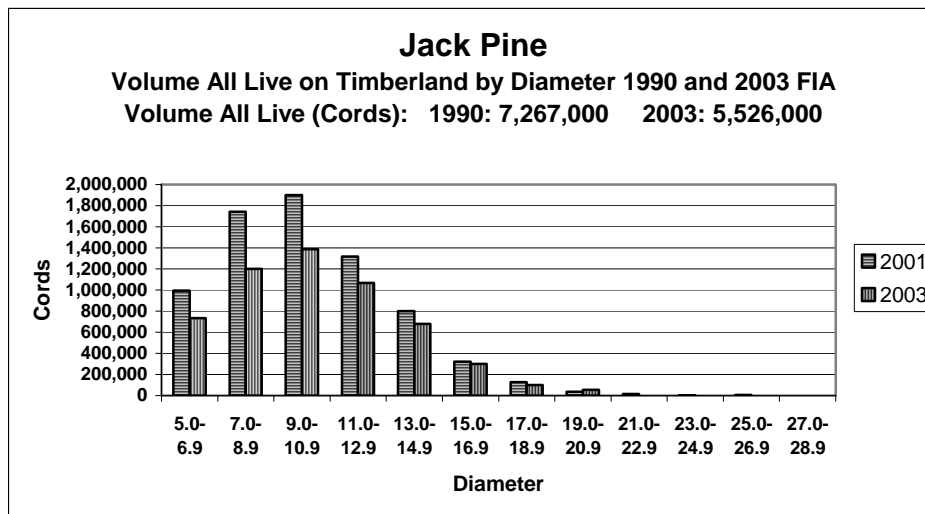
and the need to manage the related forest health issues and the mortality associated with them, have been key reasons for higher jack pine harvest rates of late.

While the accelerated harvest rates of the present have been necessary and prudent for management purposes, they are not sustainable for the long term. Jack pine harvest levels are likely to remain near or above present levels for the next few years, and then will probably begin a downward trend within the next five to ten years. The volume “slack” caused by the coming reduction in available jack pine will need to be made up with increased thinning of the young red pine resource.

Average net annual growth of jack pine growing stock: 98,000 cords, based on 2003 USFS FIA database.
 Average annual mortality of jack pine growing stock: 113,000 cords, based on 2003 USFS FIA database.



Source: Harvest data compiled by NCFES & DNR

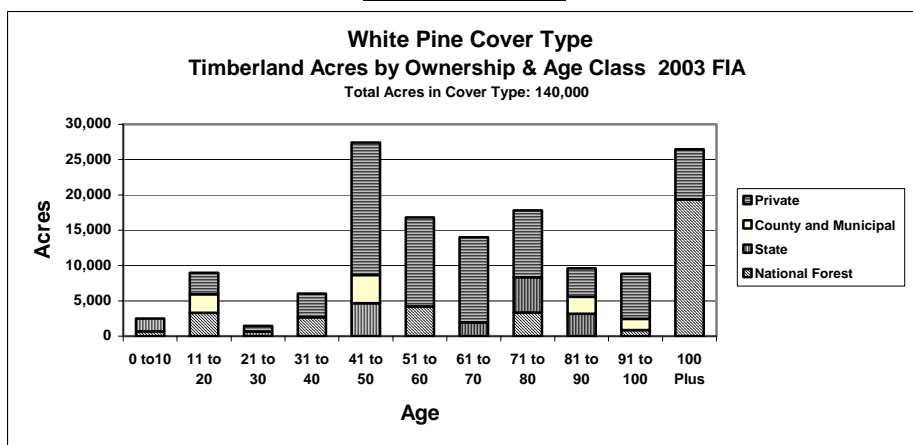


Source: FIA Database provided by USFS, North Central Research Station

Jack pine total volume has rapidly declined since 1990. Total volume of jack pine growing stock has gone from 7,016,000 cords in 1990 down to 5,526,000 cords in 2003 – a 20% decrease.

The vast majority of jack pine is under 15 inches in diameter.

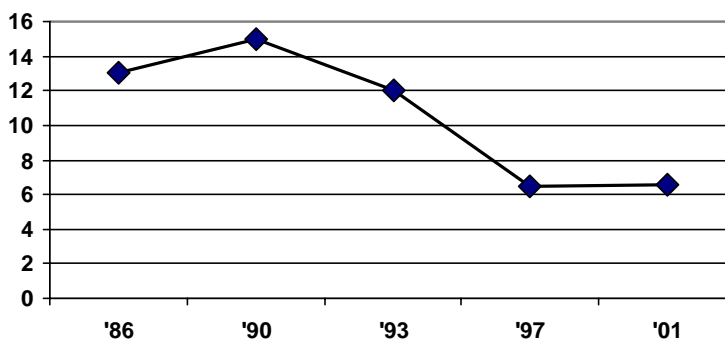
White Pine



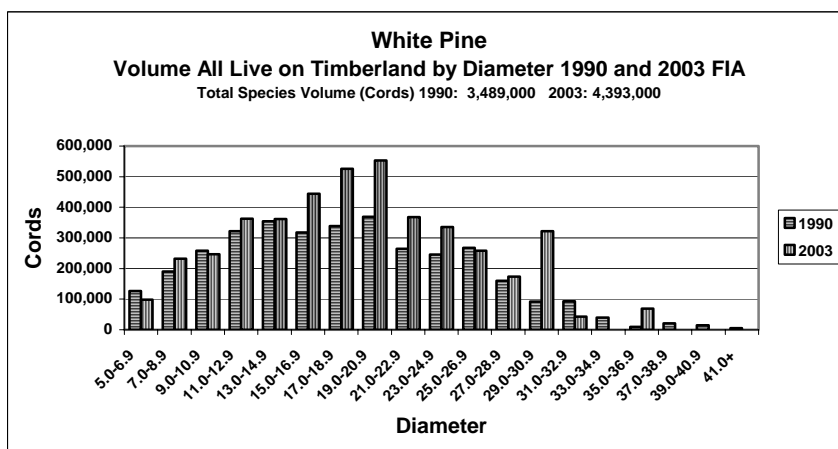
Source: 2003 FIA Database provided by USFS, North Central Research Station

The cover type is heavily weighted to age classes of 60 years plus. National Forests and private landowners are by far the predominant ownership groups for the white pine cover type.

White Pine Sawtimber Harvest in Minnesota 1986 to 2001



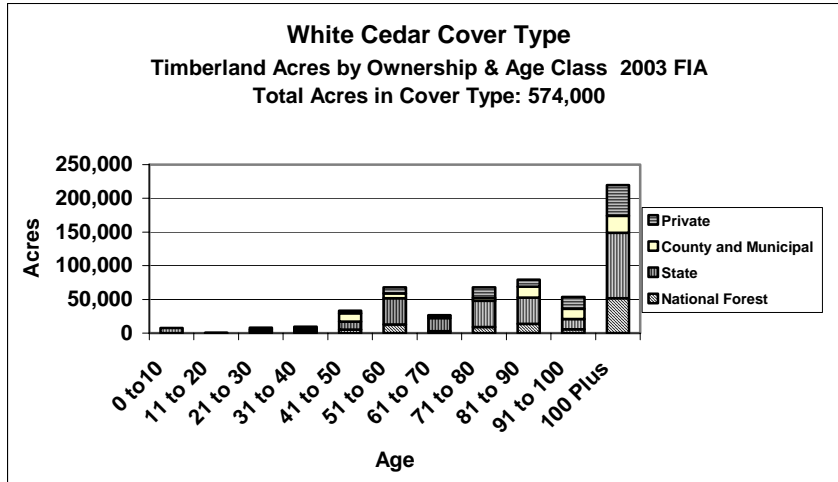
Source: DNR – Division of Forestry. Based on DNR Sawmill Surveys



Source: FIA Database provided by USFS, North Central Research Station

Most white pine volume occurs in the white pine, red pine, aspen and northern hardwoods cover types. The vast majority of white pine volume is in trees with diameters greater than 15 inches. Volume has increased substantially since the 1990 inventory. Average net annual growth of white pine growing stock: 103,000 cords, based on 2003 USFS FIA database. Average annual mortality of white pine growing stock: 27,000 cords, based on 2002 USFS FIA database.

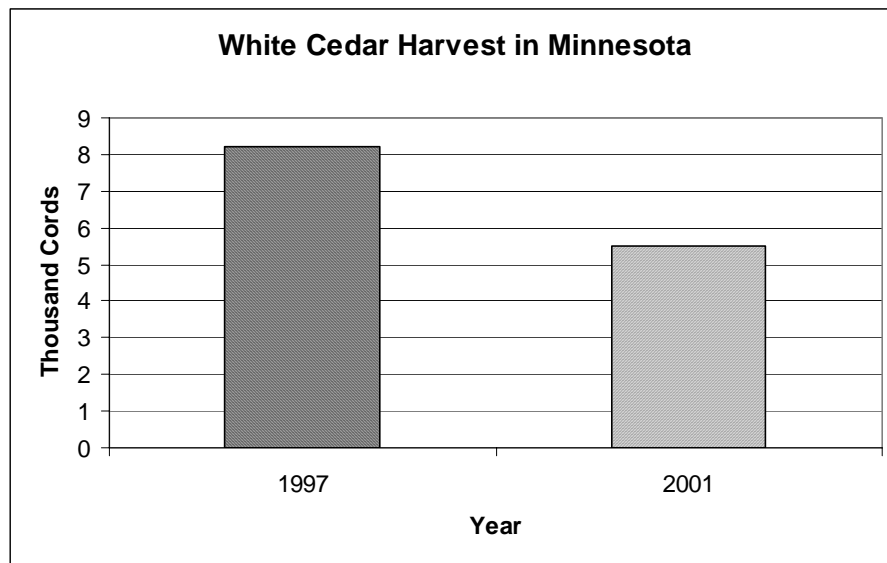
Minnesota's White Cedar Resource



Source: 2003 FIA Database provided by USFS, North Central Research Station

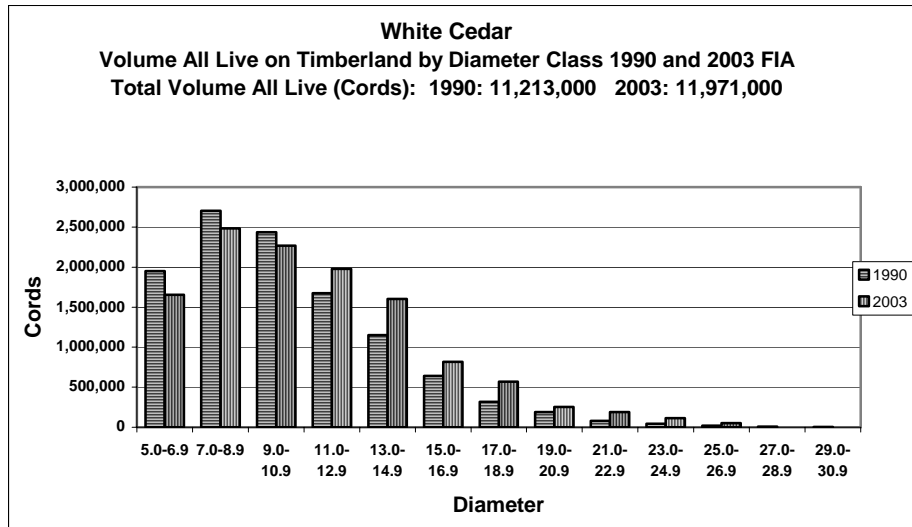
Northern white cedar is a slow-growing, long-lived conifer. The white cedar cover type in Minnesota is located largely in the northeastern 1/3 of the state and is made up of a variety of species. Cover type volume is dominated by white cedar, but includes spruce, tamarack, balsam fir, birch, ash and several other minor species. Significant volumes of cedar can also be found mixed in with other lowland cover types, and it also exists as a minor component of some upland cover types. Cedar is significant because it provides critical wintering habitat for white-tailed deer, it provides habitat for many rare plant species including the threatened ram's head orchid, and it is a potentially valuable timber resource.

White cedar is generally an old resource, and it is getting older: over 205,000 cover type acres exist in stands over age 100, with less than 27,000 cover type acres below age 30. Much of the white cedar resource exists on very wet sites, many of which have low productivity and slow growth. High amounts of heart rot are common in older stands on wet sites. Much of the volume of white cedar is contained in material below 13 inches in diameter.



Source: North Central Forest Experiment Station Pulpwood Surveys, MN DNR Sawmill & Fuelwood Surveys.

With no pulpwood market for cedar, the small amount of utilization is entirely for sawtimber, specialty products and a small amount of fuelwood. Net annual growth for white cedar is approximately 206,000 cords, according to the 2003 FIA inventory. Annual harvest is less than 10,000 cords, so there is a great deal of potential in the resource for more utilization and management, if the regeneration issue can be solved.



Source: FIA Database provided by USFS, North Central Research Station

Issues:

- White cedar has been somewhat of a “neglected” resource for many years. Probably the single biggest reason for this is an inability to consistently regenerate it on many sites. Cedar is in need of greater research efforts in regeneration techniques.
- Use of white cedar for industrial products is very modest. There is no pulpwood market for cedar. The modest amount of utilization in Minnesota is entirely for sawtimber, specialty products and a small amount for fuelwood.
- Cedar has tremendous importance for wildlife habitat and ecological diversity.
- Cedar is very long-lived, but doesn’t often regenerate naturally

Timber Price Information

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**Average Prices Received by product for Stumpage Sold by Public Land Agencies in
Minnesota: 1996-2004**

Average Prices Received for Stumpage Sold by Public Land Agencies in Minnesota: 1996-2004

Notes:

- Average prices based on those reported by Minnesota Counties, Chippewa and Superior National Forests, Bureau of Indian Affairs, and Minnesota DNR-Forestry.
- The various reporting agencies have different fiscal years.
- Some agencies report their data based on timber appraisal estimates, while others report based on actual scale receipts.
- The reported sales data includes numerous different products and units of measure. Conversion factors used: 500 BF/ Cd for hardwoods, 400 BF/ Cd for softwoods.
- *The reader should use caution when comparing prices shown in these tables with actual prices received or expected on any specific timber sale. Individual sale prices will vary significantly from the averages shown in these tables due to variability in both economic and physical conditions.*

Pulpwood (\$'s per cord)*

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aspen	16.09	19.20	20.54	23.40	25.28	28.76	27.36	28.95	37.20
Balm	13.24	13.76	16.95	14.13	25.27	32.06	27.53	25.12	31.71
Birch	7.52	7.88	7.53	7.66	7.69	8.31	8.16	9.04	12.21
Ash	5.00	4.46	5.51	2.28	4.09	3.91	5.86	3.62	5.51
Oak	4.37	5.64	8.98	10.76	9.27	7.74	5.77	4.35	8.28
Basswood	4.01	4.27	4.88	5.67	5.68	5.48	6.51	6.05	6.58
Balsam Fir	14.35	12.65	14.12	12.09	14.84	14.61	13.99	13.46	21.12
W. Spruce	19.06	12.8	19.18	26.62	32.63	29.90	30.51	21.87	31.80
B. Spruce	22.90	18.40	21.16	20.61	22.23	29.17	27.05	31.96	31.50
Tamarack	7.25	6.71	7.29	5.79	5.67	6.40	4.11	4.56	6.42
W. Cedar	10.55	11.27	7.31	6.83	8.46	6.74	7.06	4.68	4.60
J. Pine	23.48	23.59	24.72	24.32	21.94	21.63	22.18	21.37	29.46
R & W Pine	21.18	23.35	15.63	17.02	18.61	20.79	20.99	19.55	19.18

Sawtimber (\$ per Thousand Board Feet)*

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aspen	71.22	93.83	100.54	85.09	102.28	114.11	103.19	109.91	128.77
Birch	52.31	36.60	39.78	36.12	43.17	50.48	55.87	72.34	94.41
Ash***	147.18	108.93	97.09	48.70	71.39	81.97	66.85	76.60	99.56
Elm	60.08	107.20	53.31	56.50	---	44.10	69.00	62.08	53.82
Oak**	177.30	155.97	140.20	146.00	109.53	118.72	151.77	150.04	145.57
Basswood	105.37	107.07	81.15	74.77	70.25	81.24	80.43	94.47	112.30
Balsam Fir	61.49	71.61	88.30	80.82	120.65	144.20	136.32	145.47	167.74
W. Spruce	73.47	83.23	78.34	81.91	90.00	91.27	94.95	101.81	131.34
W. Cedar	42.58	37.00	38.64	39.13	19.96	30.46	29.43	24.73	27.34
J. Pine	108.37	115.46	121.84	124.00	114.86	154.35	155.76	135.43	168.66
R & W Pine	163.64	174.34	161.01	198.99	176.01	170.13	153.78	153.10	139.41

**Oak sawtimber prices mainly from public lands in northern Minnesota

***Black ash includes veneer

Salvage from July 1999 windstorm included in price for stumpage in 1999 and 2000.

Sold as Pulp & Bolts in Combination*
(\$'s per cord)

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004
Aspen	19.05	22.85	25.39	26.35	28.66	34.33	30.80	34.52	40.94
Balm	15.48	16.01	19.51	18.04	25.41	32.57	28.35	28.21	34.15
Birch	9.51	9.03	9.40	8.97	9.45	10.40	10.18	12.61	16.28
Ash	28.65	26.70	18.45	7.09	10.01	11.52	10.01	9.84	13.42
Oak	35.48	30.71	24.58	34.00	25.35	24.33	32.32	34.50	26.26
Basswood	18.69	30.17	17.80	17.65	17.00	18.87	16.94	18.34	19.46
Balsam Fir	15.68	14.97	17.49	15.60	19.87	24.01	20.53	23.04	26.76
W. Spruce	26.51	27.78	26.56	29.83	34.25	33.84	34.88	35.86	41.67
B. Spruce	23.03	19.05	21.16	21.28	23.04	30.01	27.65	31.96	32.88
Tamarack	7.78	6.96	8.18	6.97	6.60	7.37	4.55	5.21	6.96
White Cedar	12.53	12.05	9.29	10.24	8.32	8.68	7.91	6.16	5.98
J. Pine	31.27	31.97	33.83	32.78	30.39	37.95	36.76	38.20	41.75
R & W Pine	44.78	44.71	48.81	57.93	53.35	43.89	40.01	39.13	39.76

A bolt is defined as a short log, usually 100" length, with a specific minimum diameter, generally sawn for lumber

Glossary and Conversion Factors

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 four of a five-year effort to update its FIA, which is a cooperative effort between the USDA Forest Service and Minnesota DNR. The inventory will be complete in late 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.

Rotation Age - Age at which a stand is generally considered mature and ready for harvest.

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

Glossary (continued)

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 or law.

USDA – United States Department of Agriculture.

USFS – United States Forest Service.

Conversion Factors

Conversion factors used in the preparation of this publication:

1 cord = 500 board feet

1 cord = 79 cubic feet

