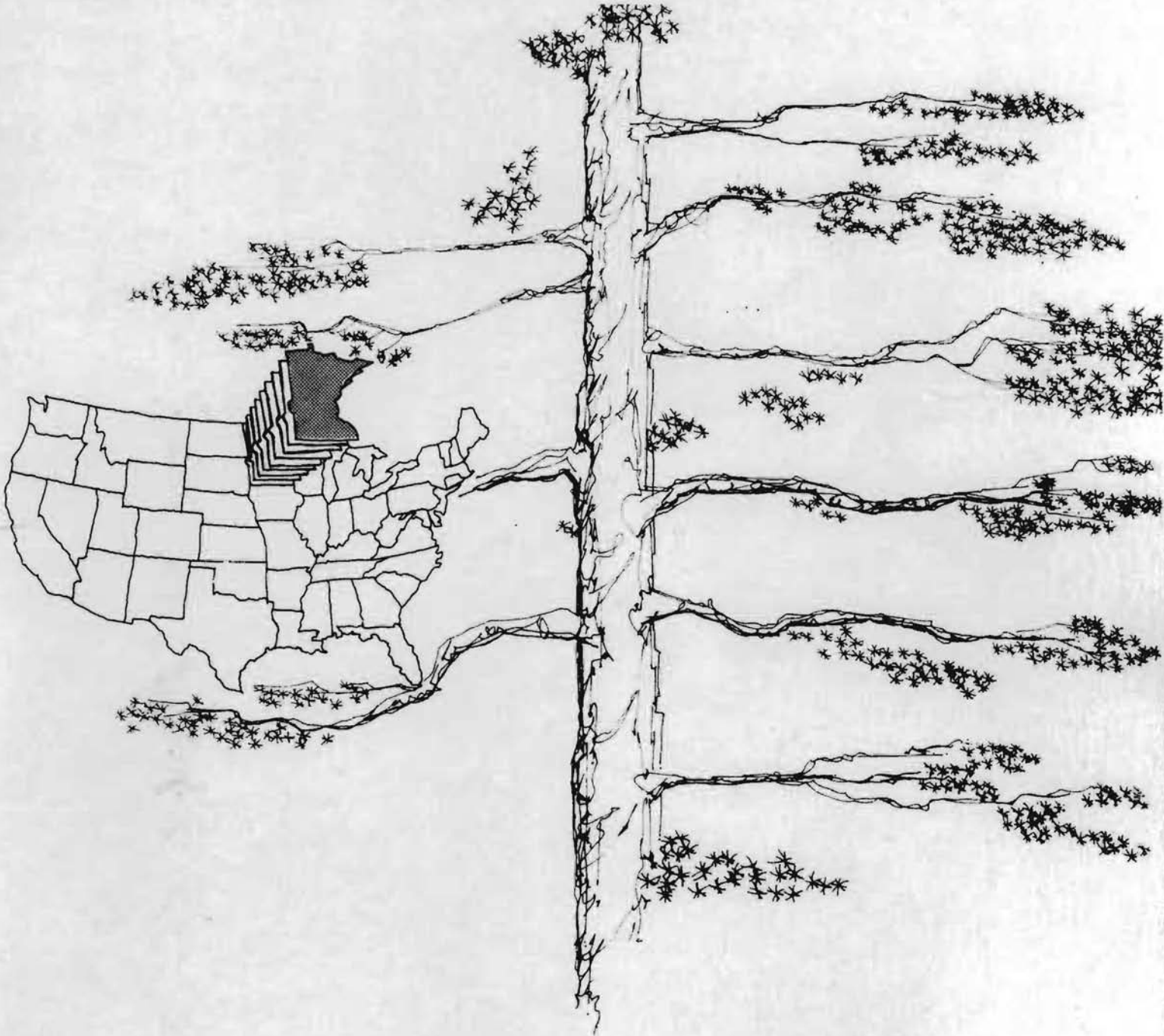


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MINNESOTA'S FOREST RESOURCES



Department of Natural Resources
Division of Forestry
November 1997

500 Lafayette Road
St. Paul, Minnesota 55155

Minnesota Wood Industry - 1996

Annual Economic Impact:

- ✻ Value of Forest Products Manufactured = \$7.5 billion *\$ 2.000 in 1995*
- ✻ 3rd Largest Manufacturing Industry in Minnesota Based on Employment
 - #1 = Machinery and computer equipment
 - #2 = Electronic equipment and instruments
- ✻ Generates 11.8% of Dollars of all Manufacturing *11.8%*

Employment:

- ✻ *61,500* 57,200 Employees
 - Primary Processing = 26,000
 - Secondary Manufacturing = 31,200
- ✻ *2.8* \$2.8 Billion Payroll

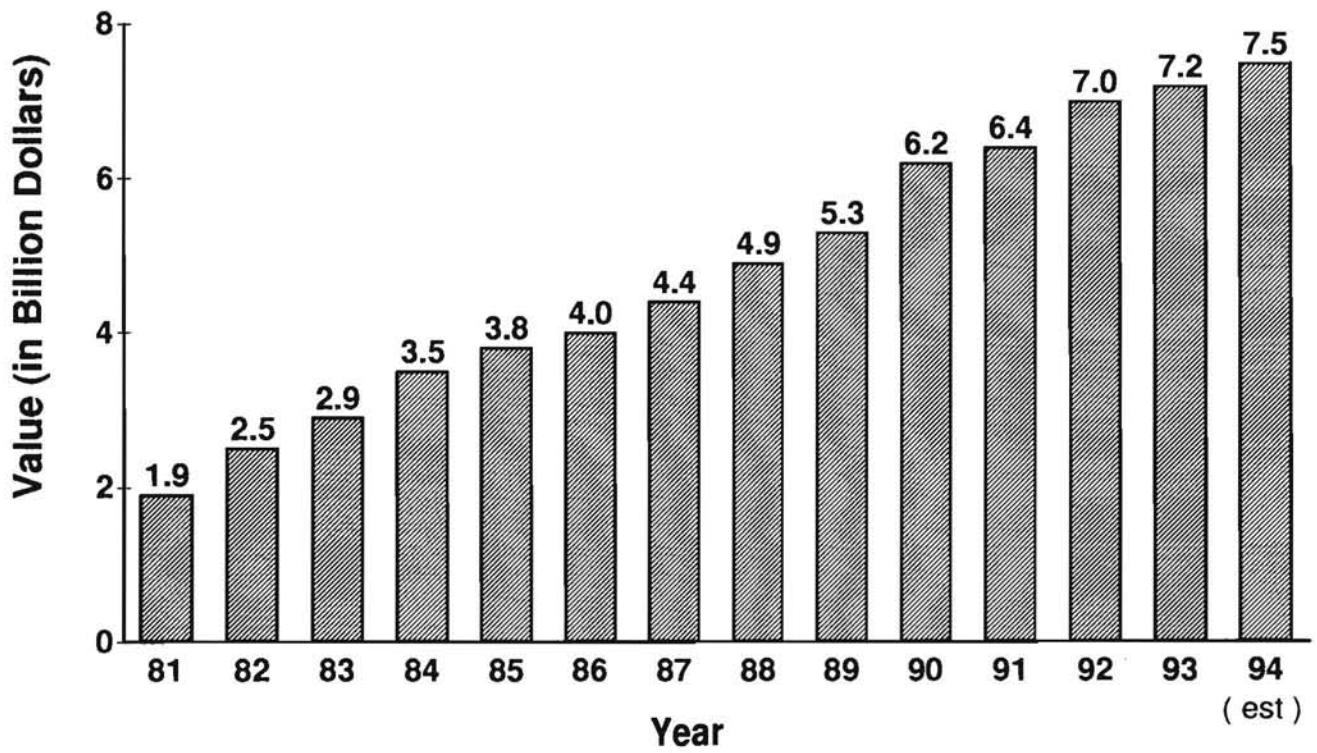
Annual Volume of Timber Harvested:

- ✻ Pulpwood = 2,900,000 cords
- ✻ Saw Logs = 310 million board feet
- ✻ Fuelwood = 752,000 cords
- ✻ Veneer = 12.5 million board feet (domestic)
= 3.0 million board feet (exported)
- ✻ Chips = 9,160 cords (fuel and mulch)
- ✻ Shavings = 13,980 cords (animal bedding)
- ✻ Posts and Poles = 9,100 cords

Industry:

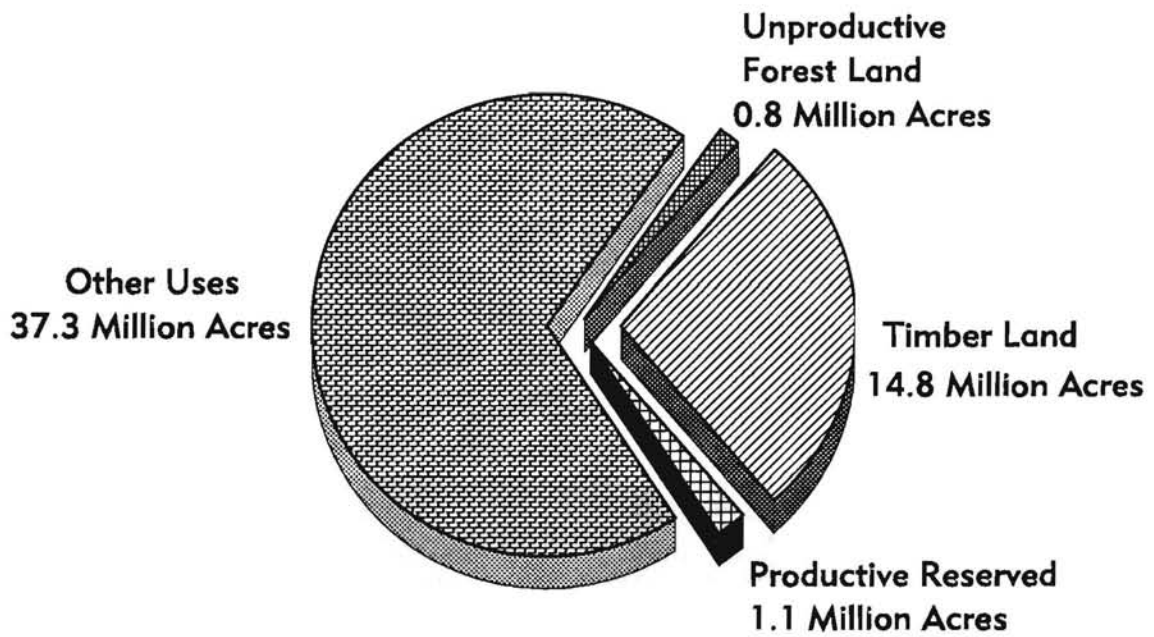
- ✻ 7 Pulp & Paper
- ✻ 3 Recycled Pulp & Paper
- ✻ 4 Hardboard & Specialty
- ✻ 6 Oriented Strand Board
- ✻ 700 Sawmills
- ✻ 150 Associated Industries
- ✻ Over 850 Secondary

Value of Forest Products Manufactured in Minnesota



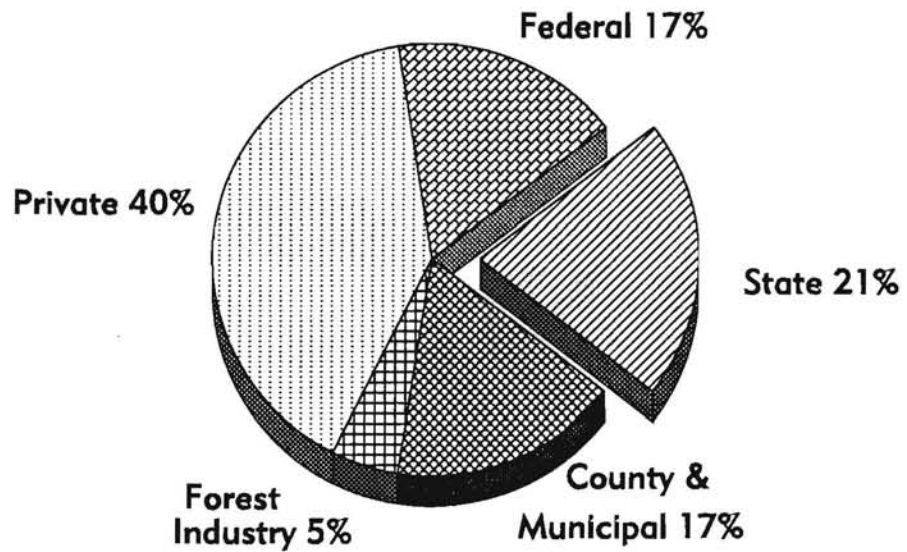
MINNESOTA LAND USE

- Total of 54 Million Acres -



MINNESOTA TIMBERLAND by OWNERSHIP

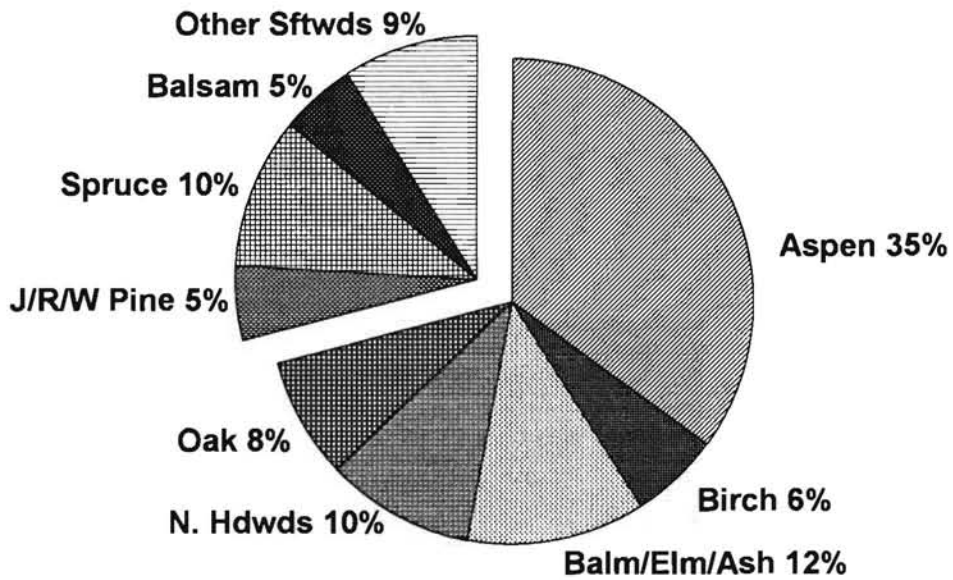
- 14.8 Million Acres -



**Area of Timberland in Minnesota
by Forest Type
—1990—**

Forest Type	Acres (000's)
Jack Pine	447.5
Red Pine	301.6
White Pine	63.2
Balsam Fir	734.3
White Spruce	93.8
Black Spruce	1,322.1
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

MINNESOTA TIMBERLAND by COVER TYPE
- State of Minnesota -
14.8 Million Acres



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

Minnesota Forest Statistics, Resource Bulletin NC-141, 1990.

**Total Wood Harvest in Minnesota by Species
- Timberland -
(Pulpwood: 1996; Sawtimber: 1993; Fuelwood: 1995-96)
(in thousand cords)**

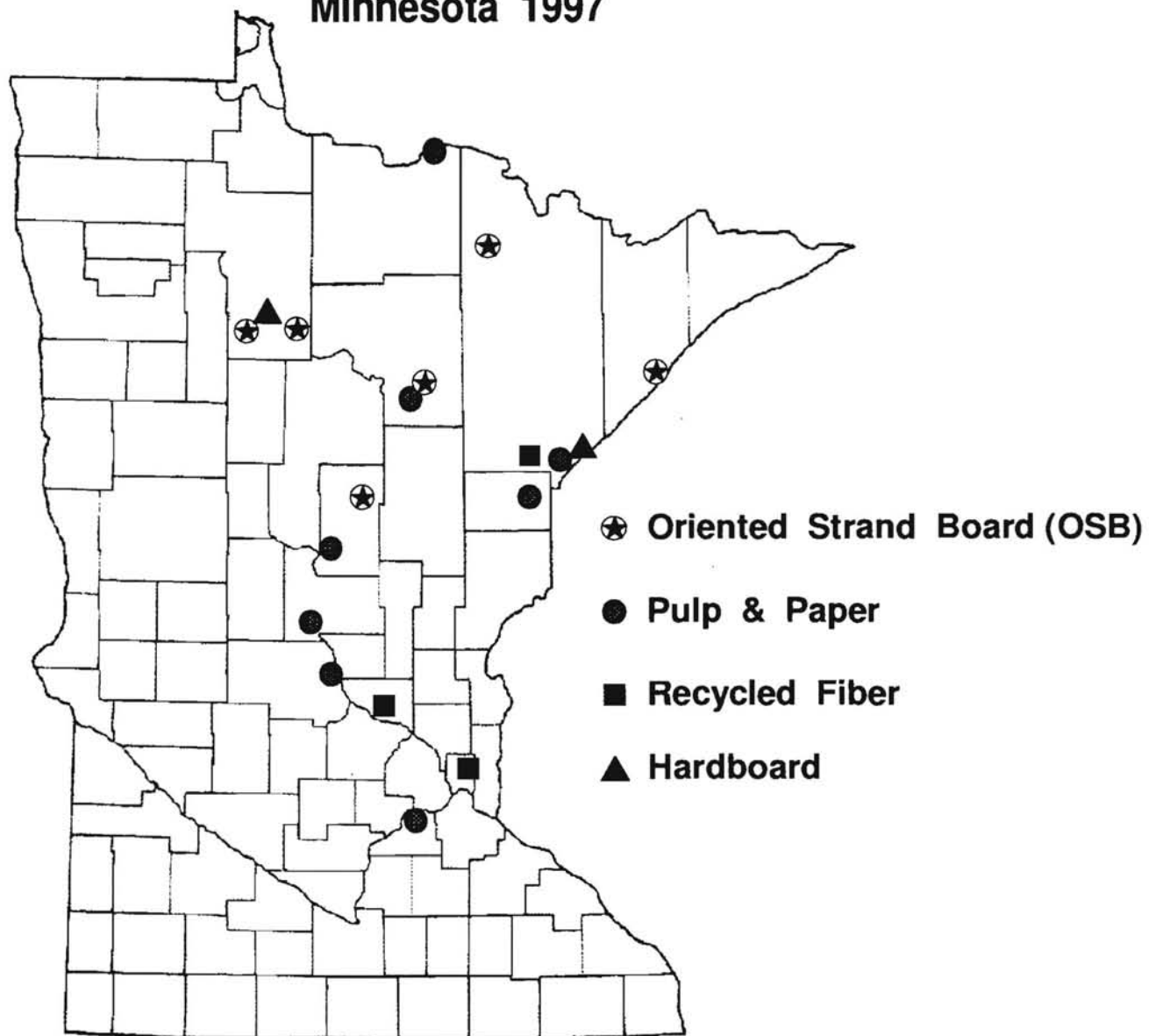
Species	Pulpwood*	Sawlogs & Other	Fuel		Total
			Residential **	Commercial	
Aspen	2,098.3	193.7	29.0	.6	2,321.6
Birch	109.4	50.5	40.3	6.3	206.5
Balm of Gilead	90.1	1.6	—	.1	91.8
Ash	1.7	15.8	11.5	.2	29.2
Oak	.1	105.5	77.6	1.0	184.2
Elm	—	5.4	8.4	—	13.8
Basswood	.1	30.7	3.2	—	34.0
Maple	8.7	8.6	11.4	4.7	33.4
Cottonwood	—	10.9	—	—	10.9
Other Hardwoods	.1	6.1	4.7	—	10.9
Sub-Total Hardwood	2,308.5	428.8	186.1	12.9	2,936.3
Pine					
Red Pine	58.5	102.8	1.0	—	162.3
White Pine	.8	24.0	.2	—	25.0
Jack Pine	59.2	125.2	1.3	—	185.7
Spruce	204.1	15.4	.1	—	219.6
Balsam	252.5	7.8	.1	—	260.4
Tamarack	13.5	.2	.6	—	14.3
Cedar	—	5.9	.1	—	6.0
Sub-Total Softwood	588.6	281.3	3.4	—	873.3
Total	2,897.0	710.1	189.5	12.9	3,809.5

* Figures include pulpwood exported to Wisconsin: Spruce: 100,000 cds.; Balsam: 60,000 cds.; and Aspen: 88,000 cds.

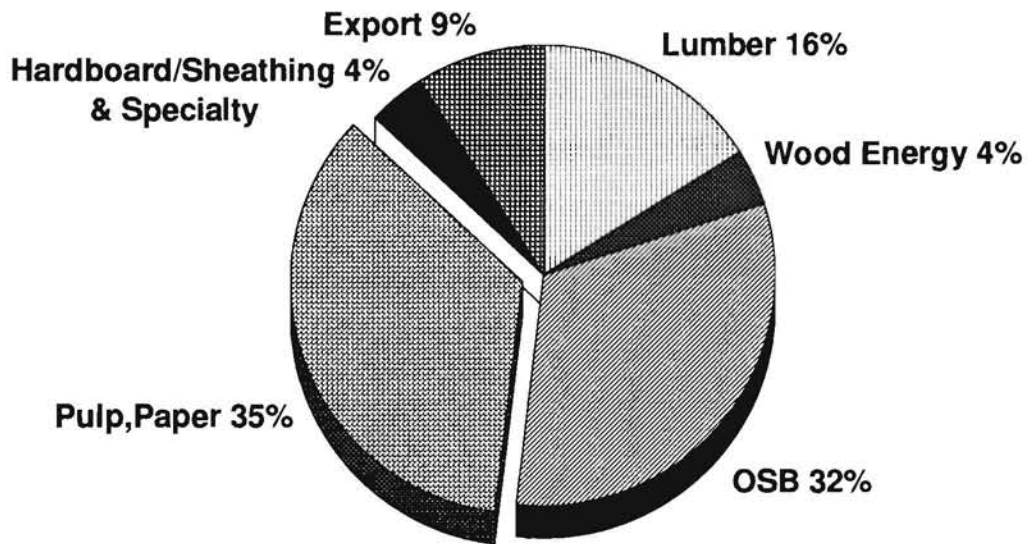
** This is fuelwood removed from growing stock, winter 1995-96.

OSB, PULP & PAPER, HARDBOARD and RECYCLING MILLS

Minnesota 1997



WOOD USE by PRODUCT from TIMBER HARVEST in MINNESOTA
- Projected 1996 -
Total 3.81 Million Cords (Includes All Species)

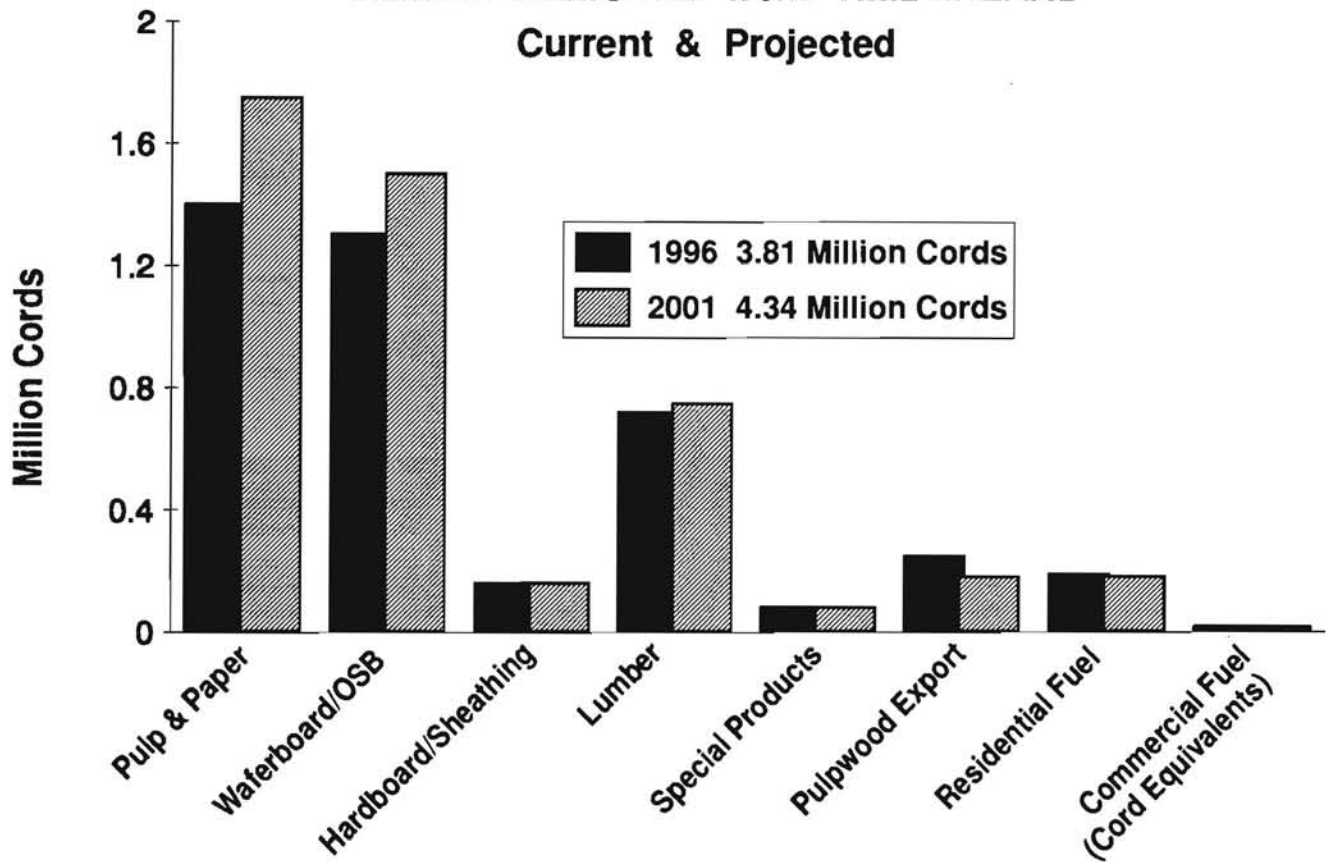


Source : Harvest data compiled by NCFES & DNR

Special products include veneer, posts & poles, shavings wood, & landscape chips.

DNR 10/97

**MINNESOTA WOOD HARVEST
TIMBER REMOVED from TIMBERLAND
Current & Projected**



Source : Harvest data compiled by NCFES & DNR.
Projected 2001 based on announced expansions & industry interviews.

Minnesota Pulp and Paper —1997—

Firm	Wood Used	Product
Blandin Paper Company Grand Rapids	Aspen, Balsam, Spruce, & Pine	Magazines, Catalogs
Boise Cascade International Falls	Aspen, Pine, Spruce, Balsam, & Tamarack	Business, Xerox, Envelope, Computer
Hennepin Paper Little Falls	Aspen & Recycled Paper	Construction & Speciality
Champion International Sartell	Aspen & Balsam	Magazines, Catalogs
Lake Superior Paper Duluth	Balsam, Spruce, & Pine	Advertising Supplements
Potlatch Corporation (2) Brainerd & Cloquet	Aspen, Balm, Maple, & Pine	Business & Printing
Waldorf Corporation St. Paul	Recycled Paper & Corrugated	Cardboard & Corrugated Boxes
Superior Recycled Fiber Duluth	High Grade Office Paper & Computer Paper	Market Pulp for Paper
Liberty Paper Becker	Recycled Paper & Corrugated	Cardboard & Corrugated Boxes

Minnesota Oriented Strand Board (OSB) —1997—

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 Bemidji	Aspen & Balm	OSB—"Norbord"
Potlatch Bemidji	Aspen, Balm, Birch, Pine, & Maple	OSB—"Oxboard"
Potlatch Cook	Aspen, Balm, Birch, & Maple	OSB—"Oxboard"
Trus Joist MacMillan Deerwood	Aspen	Laminated Structural Lumber "TimberStrand"

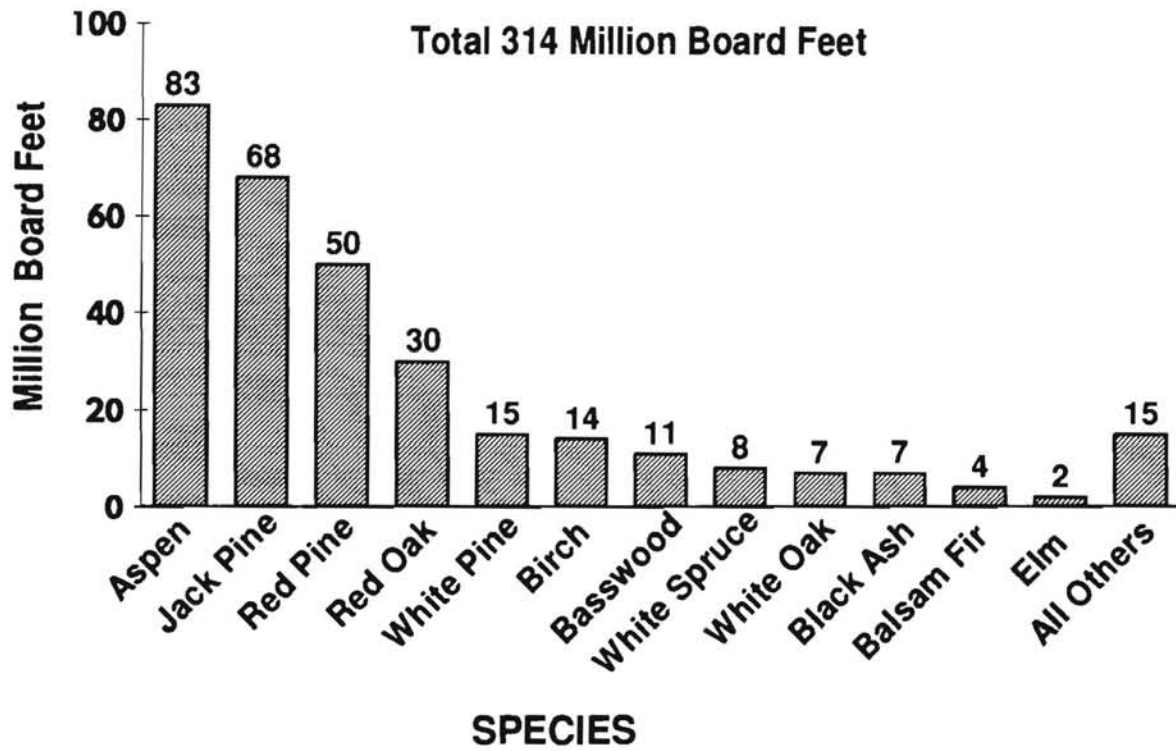
Minnesota Hardboard and Specialty —1997—

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

Source: Minnesota DNR Forestry

LUMBER PRODUCED by SAWMILLS in MINNESOTA

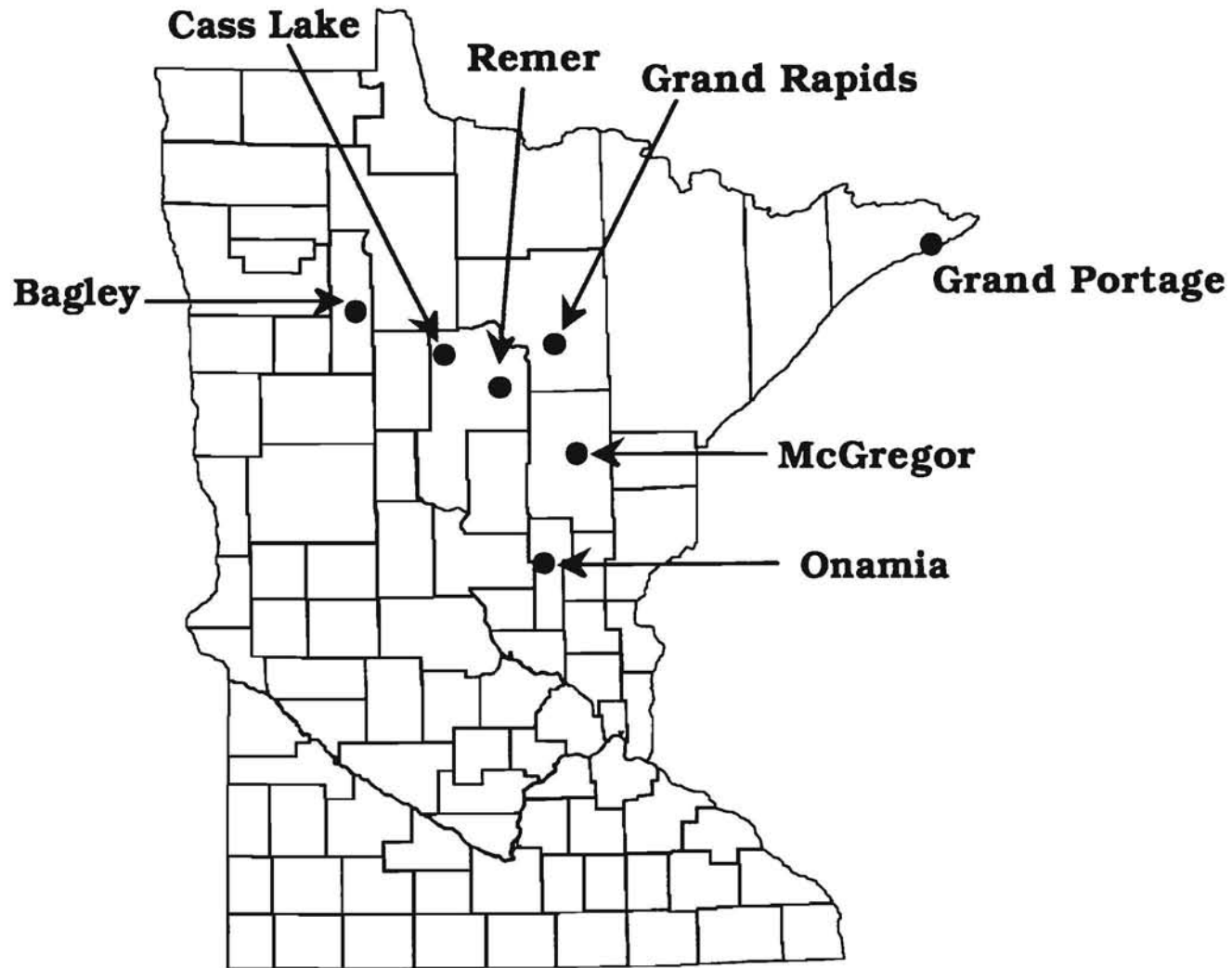
- 1994 -



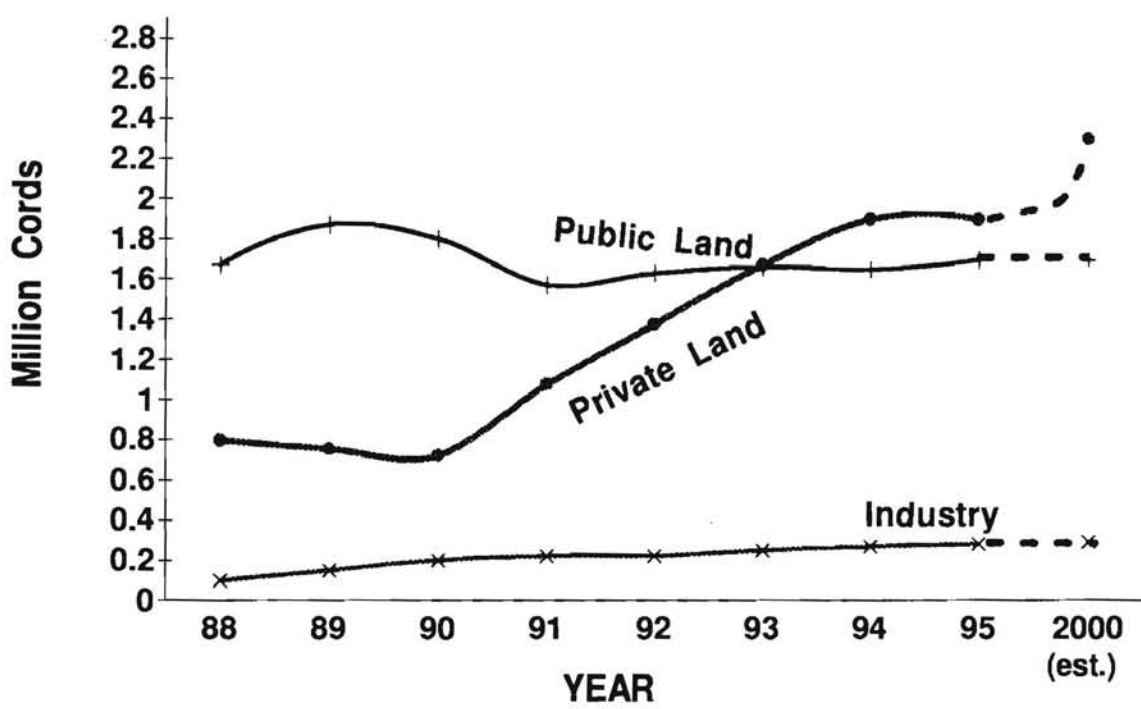
Source : DNR sawmill survey.

MINNESOTA MILLS UTILIZING SMALL HARDWOODS

1996



VOLUME of TIMBER SOLD by OWNERSHIP - MINNESOTA
 (excludes fuelwood)



Public Land : State, Chippewa & Superior Nat'l Forest, BIA, and 15 Counties.
 Source : Volume of timber sold by public land agencies, DNR survey,
 NCFES pulpwood use survey, MFI industry survey.
 Estimated 2000 based on announced industry expansions.

Minnesota—New and Expanding Large Wood Industries

		Add'l. Wood Use	Capital Investment (millions \$)
<u>1975-1985</u>			
Potlatch	Paper	30,000 cords	100
Potlatch	OSB	170,000 cords	40
Potlatch	OSB	170,000 cords	40
Northwood Panelboard	OSB	220,000 cords	45
Champion International	Paper	60,000 cords	250
Blandin (now Potlatch)	OSB	220,000 cords	50
Louisiana Pacific	OSB	90,000 cords	30
		<u>960,000 cords</u>	<u>\$555 million</u>
<u>1986-1989</u>			
Blandin	Paper	138,000 cords	350
Potlatch	Paper	None	100
Lake Superior Paper Ind.	Paper	130,000 cords	404
International Biltrite	Sheathing	25,000 cords	12
		<u>293,000 cords</u>	<u>\$866 million</u>
<u>1990-1992</u>			
Boise Cascade	Paper	340,000 cords	535
Trus Joist MacMillan	***PSL	135,000 cords	70
Potlatch	OSB	160,000 cords	35
Potlatch	Lumber	120,000 cords	22
		<u>755,000 cords</u>	<u>\$662 million</u>
<u>1993-2000</u>			
* Potlatch	Pulp Mill	420,000 cords	400
** Unannounced	OSB	150,000 cords	60
		<u>570,000 cords</u>	<u>\$460 million</u>

* Under construction; start-up 2000.

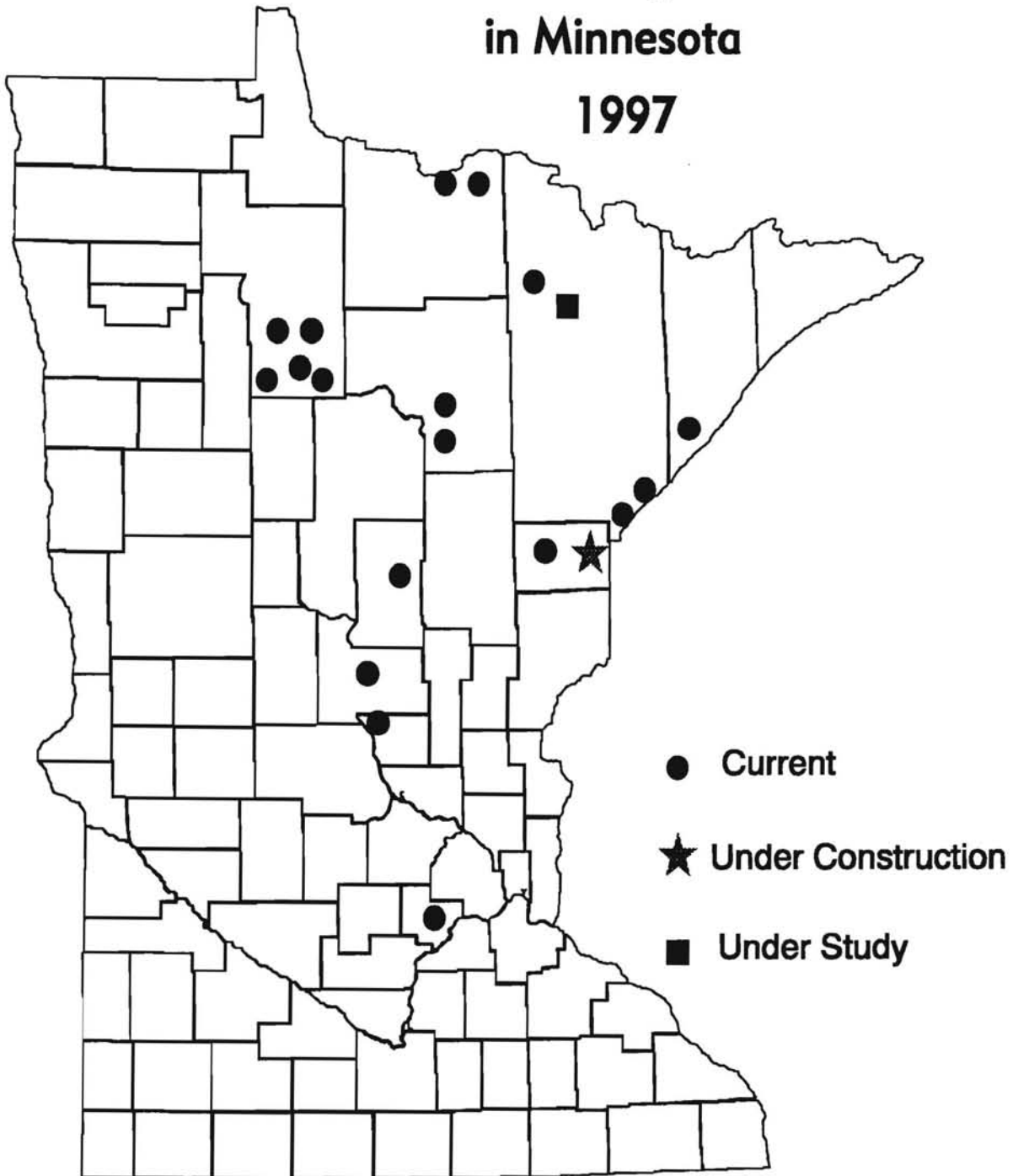
** Under Study.

*** Parallel Strand Lumber.

Source: MN DNR-Forestry

Current & Projected Large Wood Using Industries in Minnesota

1997

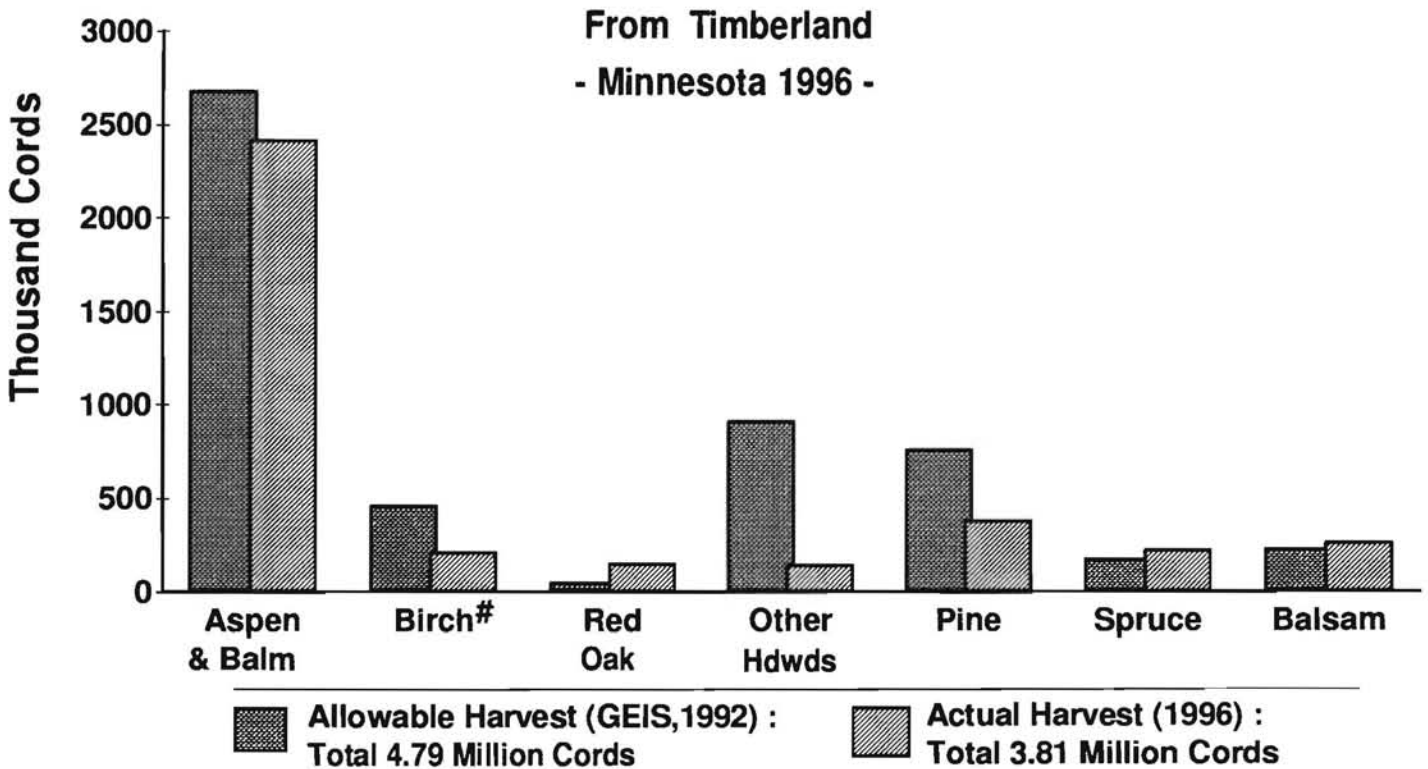


**Current and Projected Wood Harvest from
Timberland
—Minnesota Statewide—**

Species	(In Thousand Cords)	
	1996	Projected 2001
Aspen/Balm-of-Gilead	2,413.4	2,580
Birch	206.5	365
Ash	29.2	30
Oak	184.3	190
Elm	13.8	15
Basswood	34.0	60
Maple	33.4	135
Cottonwood	10.9	10
Other Hardwoods	10.9	10
Pine	373.0	490
Spruce	219.6	192
Balsam	260.4	237
Tamarack	14.3	20
Cedar	6.0	6
Total	3,809.5	4,340

Source: 1996 Harvest Data compiled by NCFES and DNR.
Projected 2001 based on announced expansions and industry interviews.

ESTIMATED ALLOWABLE HARVEST & ACTUAL HARVEST



Source: Table 6.25, GEIS, medium level, Dec. 92.

Birch volume based on DNR sustainable harvest model .

Harvest data compiled by NCFES & DNR.

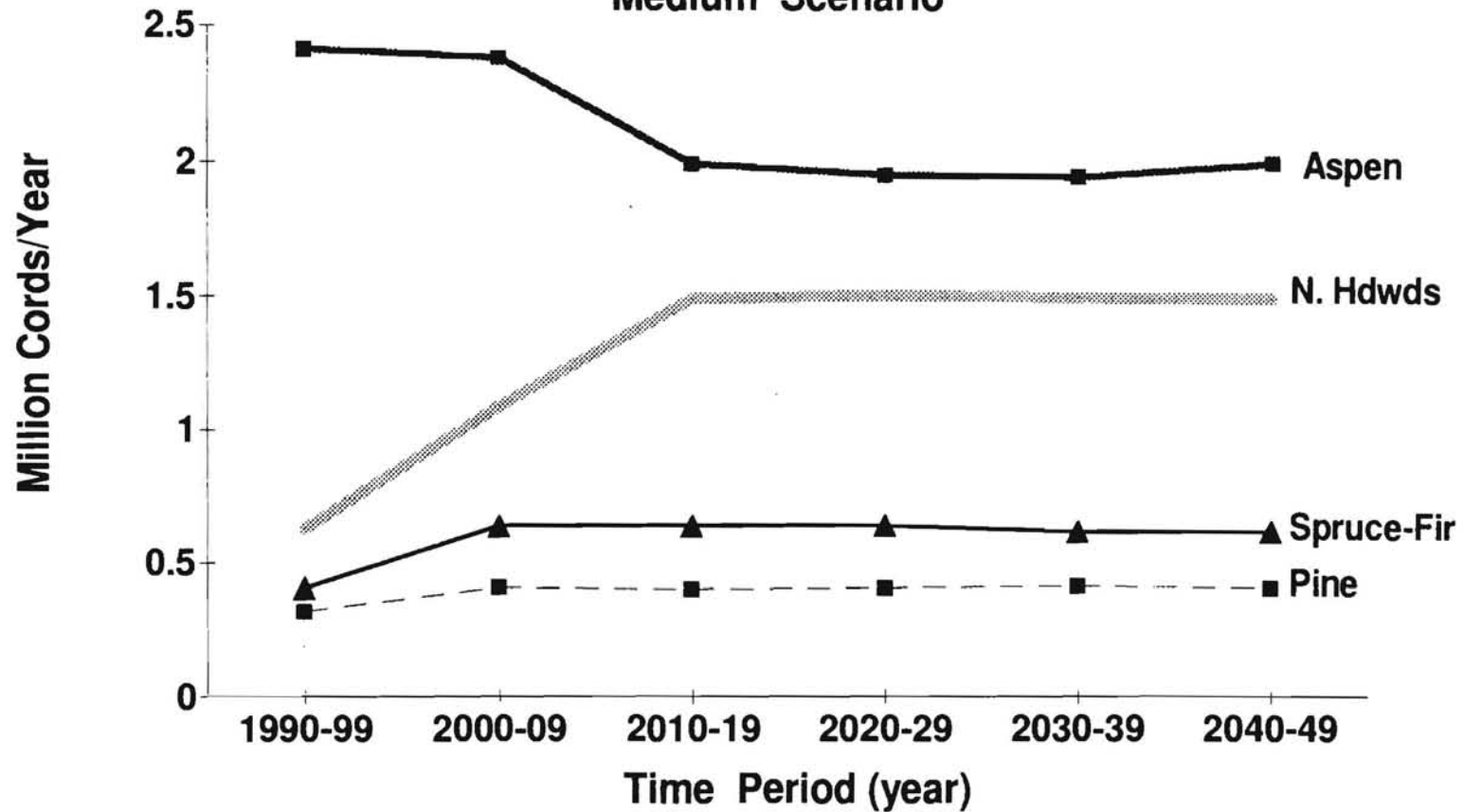
DNR 10/97

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 higher or lower than the long-term sustained yield.

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

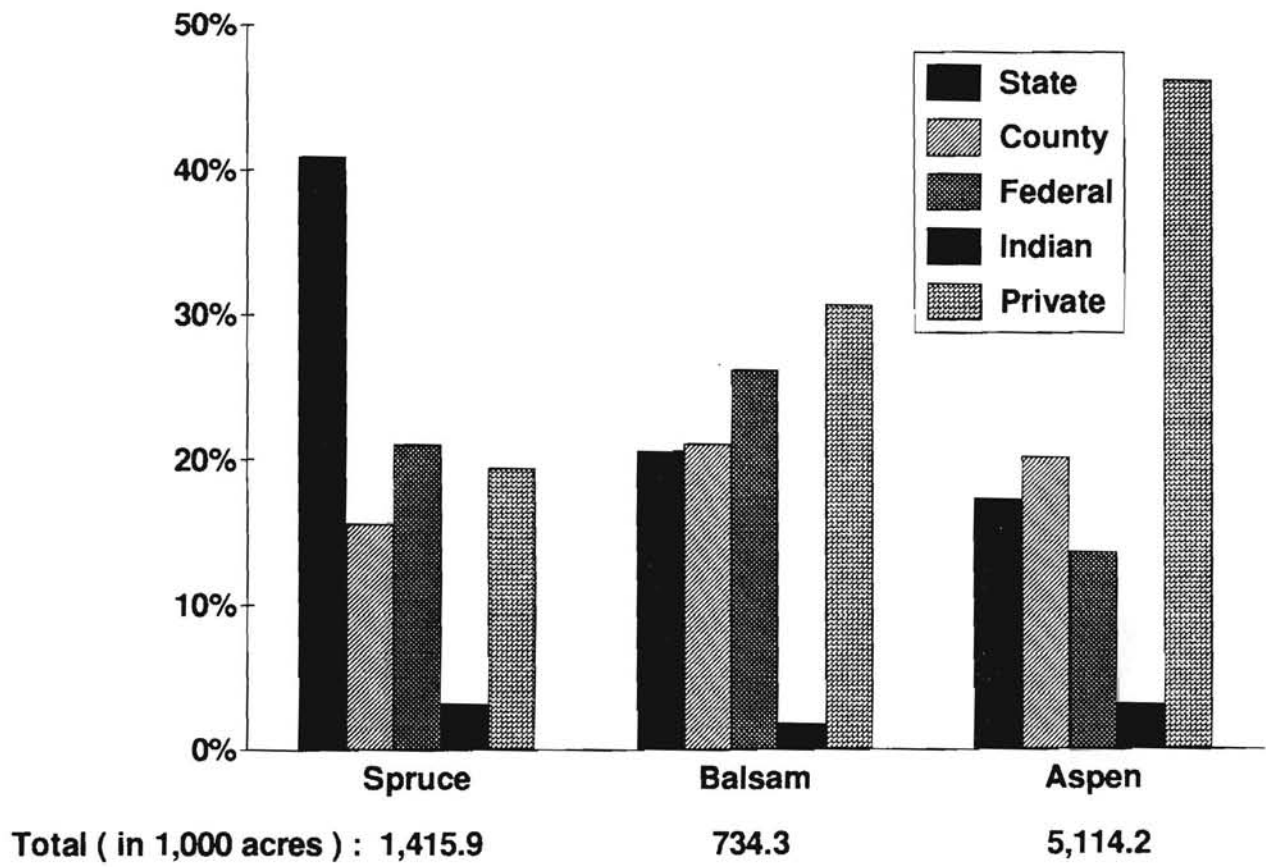


Source : GEIS table 6.8 medium scenario, 2nd run (p210 of M.P. & F. Reso. Base, 12/1992)

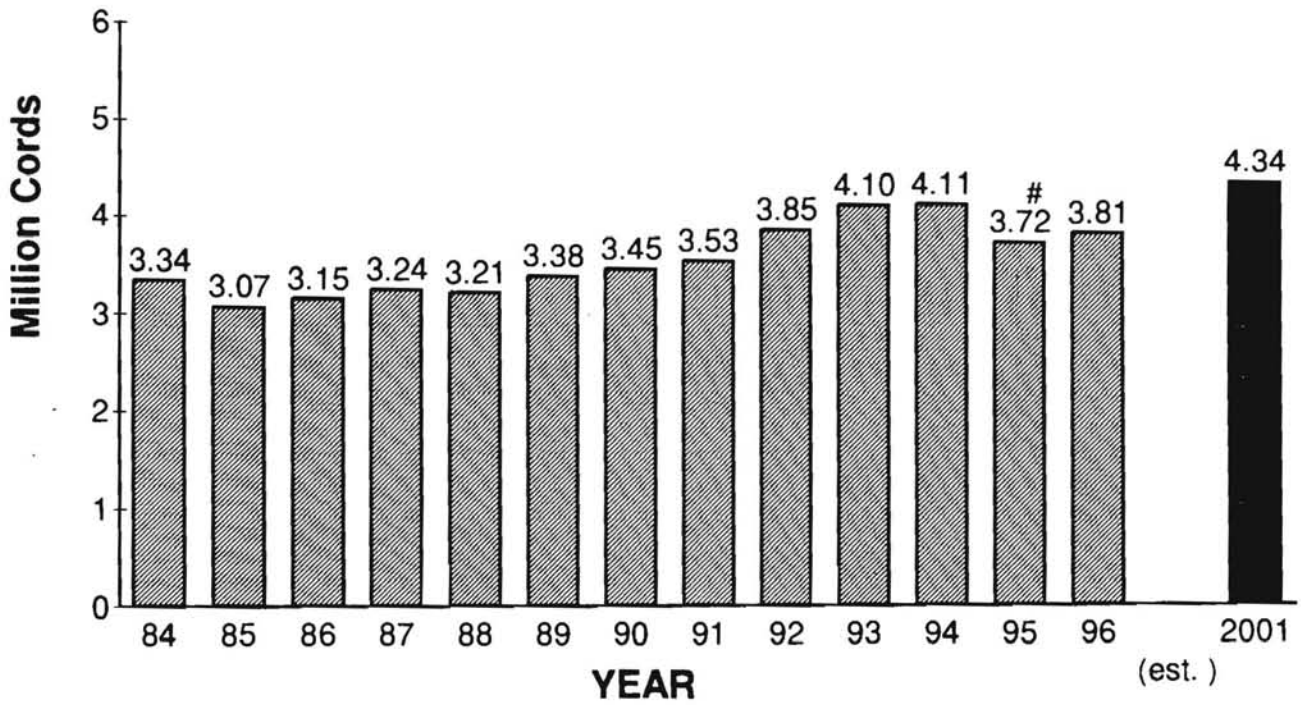
Assumptions used : Ownership constraints (riparian lands & old growth forests, etc.)

Objective : To harvest every stand at least once during a rotation with the goal to achieve a sustainable harvest level from a regulated forest at some point.

OWNERSHIP of SPRUCE, BALSAM & ASPEN TYPES in MINNESOTA



ACTUAL & PROJECTED TIMBER HARVEST in MINNESOTA
- from MN Timberland , all Ownerships, all Species -

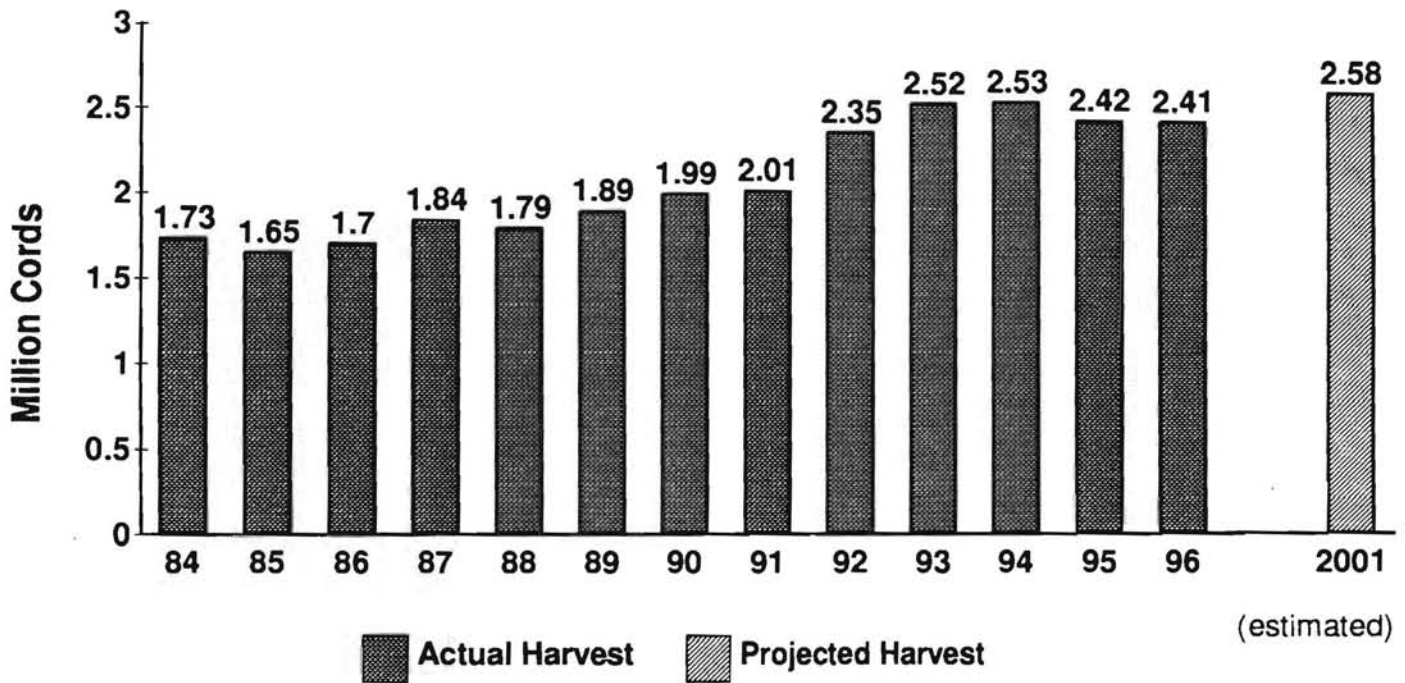


Source : # 1995 adjustment due to decrease in fuelwood use since 1989/90
 ## Harvest Data Compiled by NCFES and DNR.

ASPEN & BALM HARVEST in MINNESOTA : ACTUAL & PROJECTED

Long-Term Annual Sustainable Yield = 2.68 million cords⁽¹⁾

(includes Pulpwood, Sawtimber, & Wood for Energy)

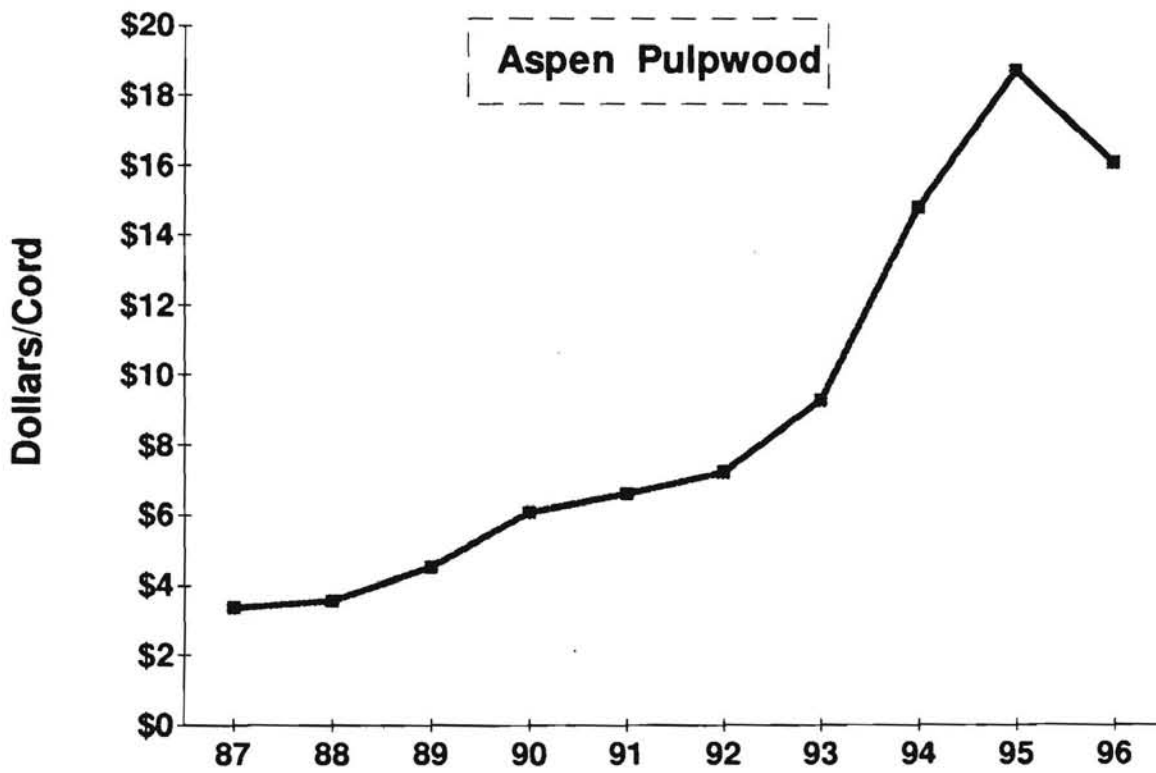


1) Table 6.25, GEIS, medium level, Dec, 92

2) Harvest data compiled by NCFES & DNR

3) 1996 harvest includes 88,000 cds exported to Wisconsin.

**AVERAGE PRICES RECEIVED for STUMPAGE SOLD by
PUBLIC LAND AGENCIES in MINNESOTA : 1986 - 1996**



* Not adjusted for inflation

Aspen/Balm-of-Gilead

Present and Projected Demand

1996 Harvest 2,413,000 cds.

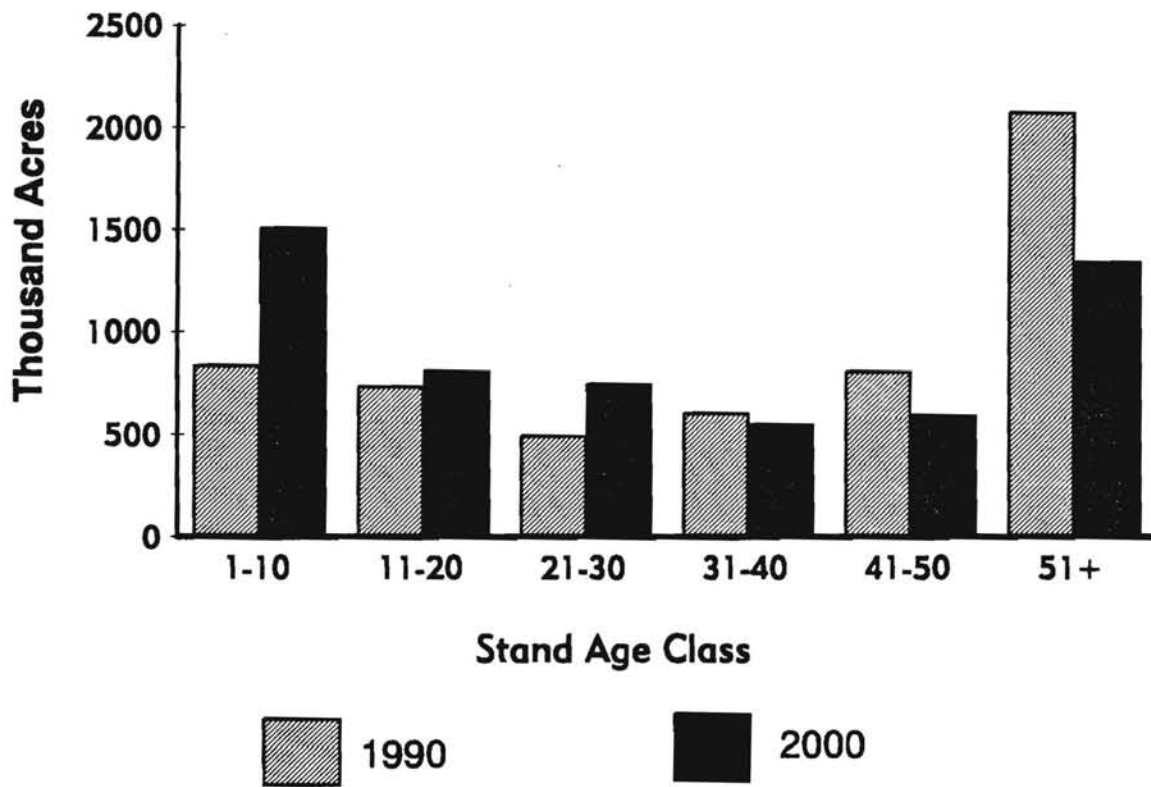
- Minnesota Pulpwood Industries:
 - Pulp & Paper 841,000 cds.
 - OSB, Hardboard, Sheathing 1,259,400 cds.
- Pulpwood Export 88,000 cds.
- Sawlogs & Other 194,000 cds.
- Fuelwood (from growing stock) 30,000 cds.

2001 Projected Harvest . . 2,580,000 cds.

- Minnesota Pulpwood Industries:
 - Pulp & Paper 900,000 cds.
 - OSB, Hardboard, Sheathing 1,396,000 cds.
- Pulpwood Export 60,000 cds.
- Sawlogs & Other 194,000 cds.
- Fuelwood (from growing stock) 30,000 cds.

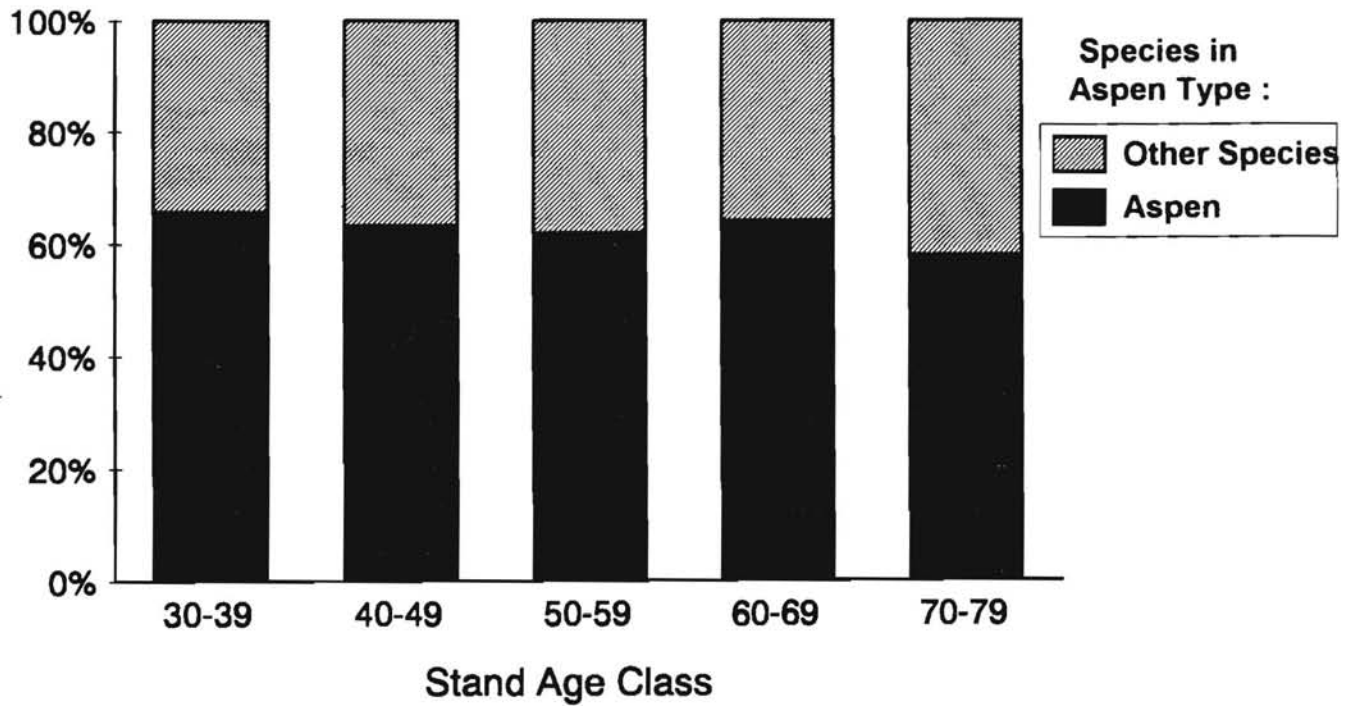
Figures include a projected OSB expansion and a shift to the use of alternative species by present OSB industries.

ASPEN & BALM TYPE AGE DISTRIBUTION - 1990 vs 2000
Minnesota Statewide



% of SPECIES VOLUME in ASPEN TYPE

Minnesota Timberland, All Ownerships



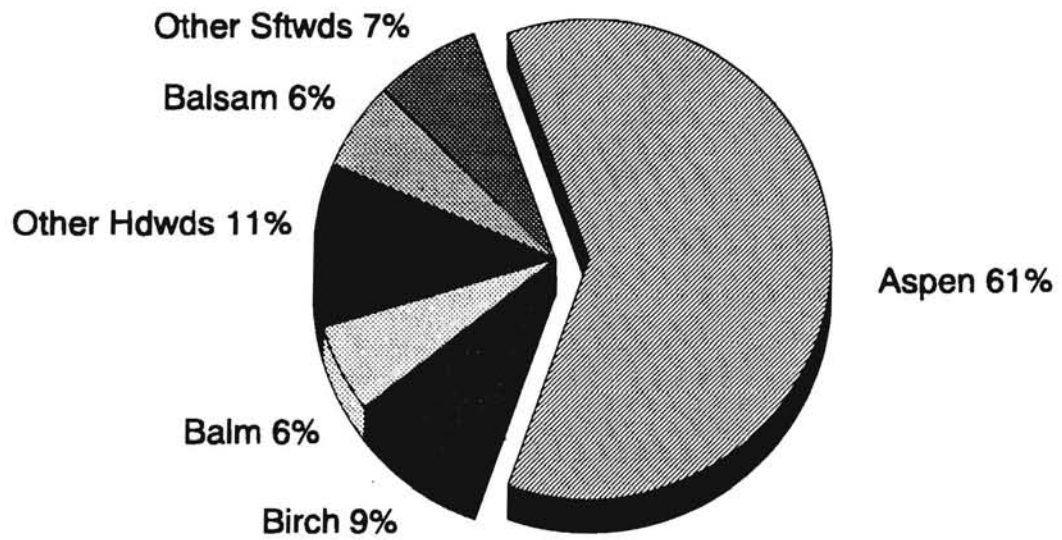
Source : 1990 FIA (USFS, N.C. Eastwide Database, 2/94)

DNR 11/94

MINNESOTA : ASPEN TYPE by SPECIES COMPOSITION

(5.1 Million Acres Aspen Type)

- 1990 Forest Survey -

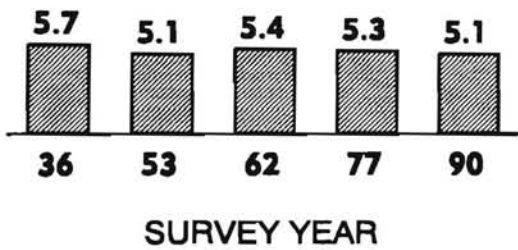


ASPEN TYPE ACREAGE & ASPEN SPECIES VOLUME & HARVEST

Minnesota Statewide

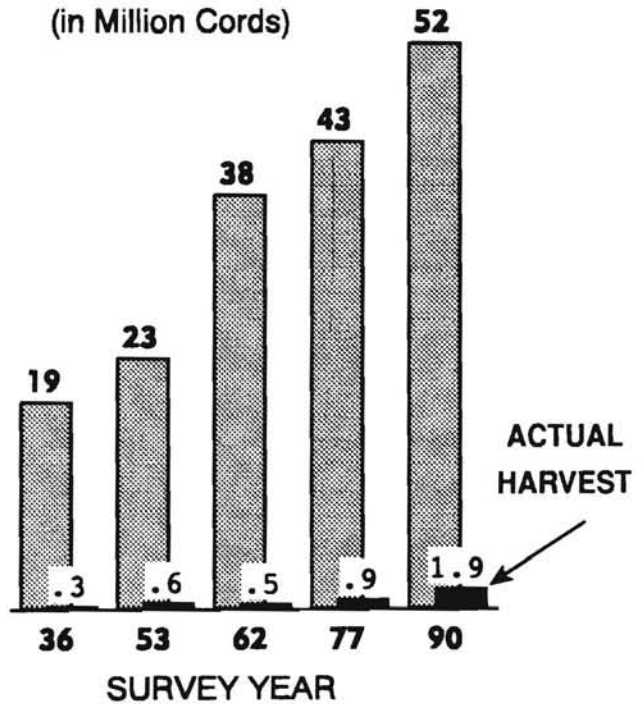
Aspen Type Acreage

(in Million Acres)



Aspen Species from all Cover Types Growing Stock Volume

(in Million Cords)



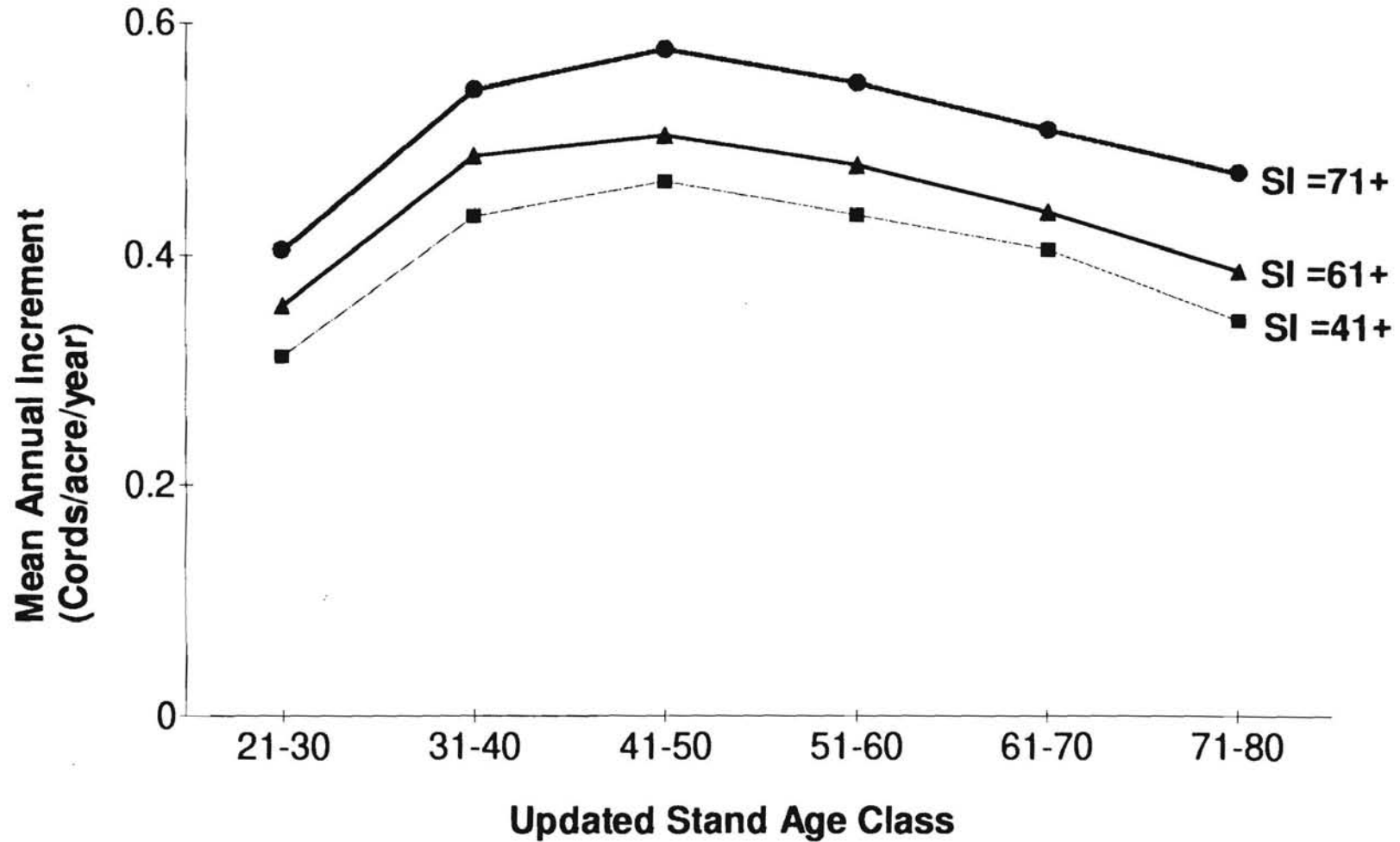
Cover Type : A classification of Forest land based on the species forming a plurality of live tree stocking.

Source : NCFES survey.

DNR 11/94

Aspen Type Mean Annual Increment by Updated Age

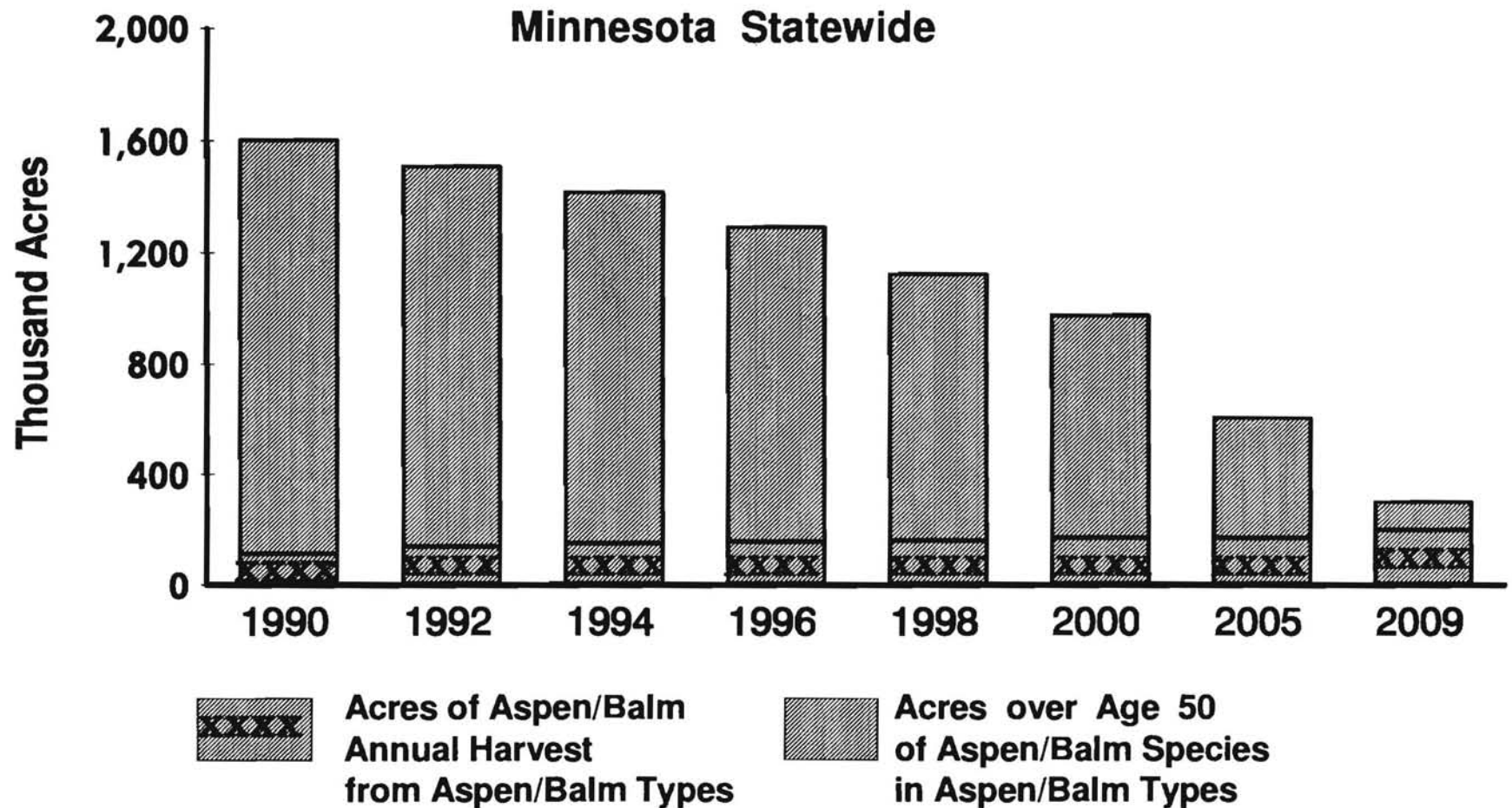
CSA Statewide: State Forestry & Wildlife Land, Timber Status=1,2,6 & 8
Based on Volume Yield Model * (Built on CSA)



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

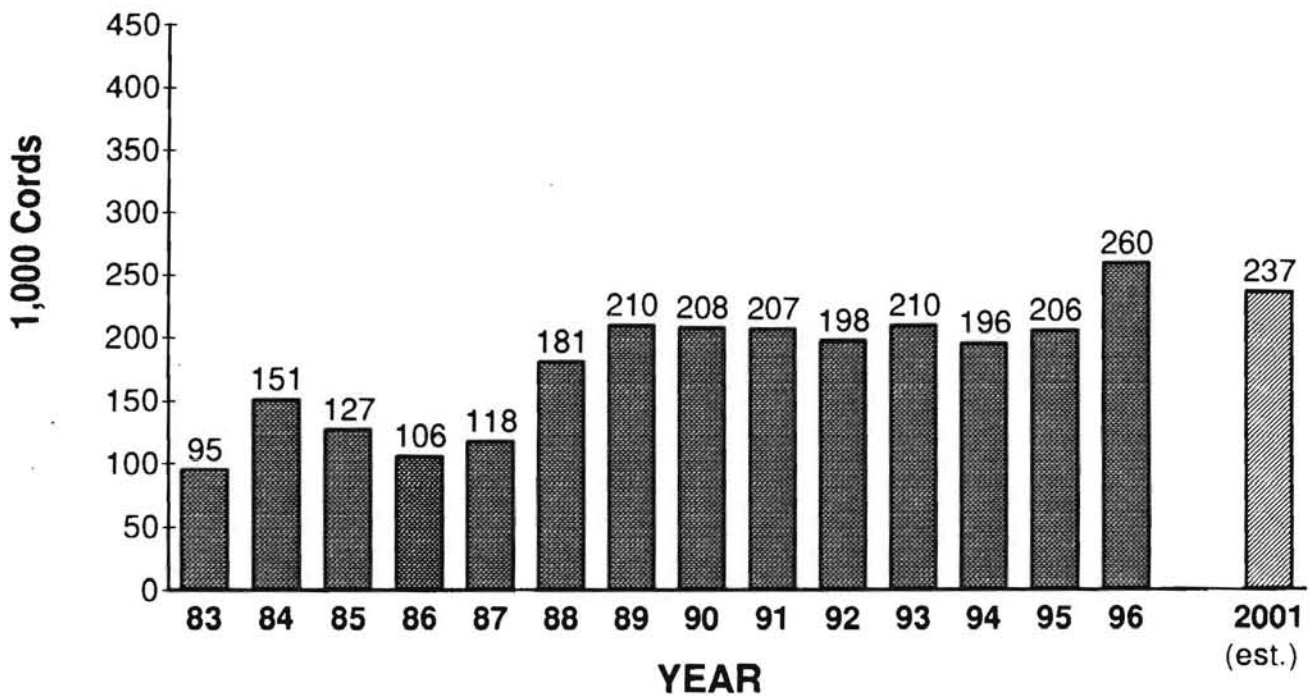
DNR-Forestry 11/30/95

ASPEN & BALM TYPES : ANNUAL HARVEST VS ACRES over AGE 50



- Assumptions :
1. Harvest 23 cords/acre from the aspen/balm types
 2. Aspen/balm in aspen/balm types : 70% in 1990 and declines to 51% in 2009
 3. 90% of aspen/balm harvest from aspen/balm types

**BALSAM FIR HARVEST in MINNESOTA : ACTUAL & PROJECTED
COMPARED to AN ESTIMATED ALLOWABLE HARVEST
- from Timberland -**



- 1) Based on DNR's method sustainable harvest = 433,000 cords/year
- 2) Harvest data compiled by NCFES & DNR
- 3) 1996 harvest includes 60,000 cds exported to Wisconsin.

Balsam Fir

Present and Projected Demand From Minnesota

1996 Harvest 260,000 cds.

- Minnesota Pulpwood Industries . . . 192,500 cds.
- Pulpwood Export 59,600 cds.
- Sawlogs & Other 7,900 cds.

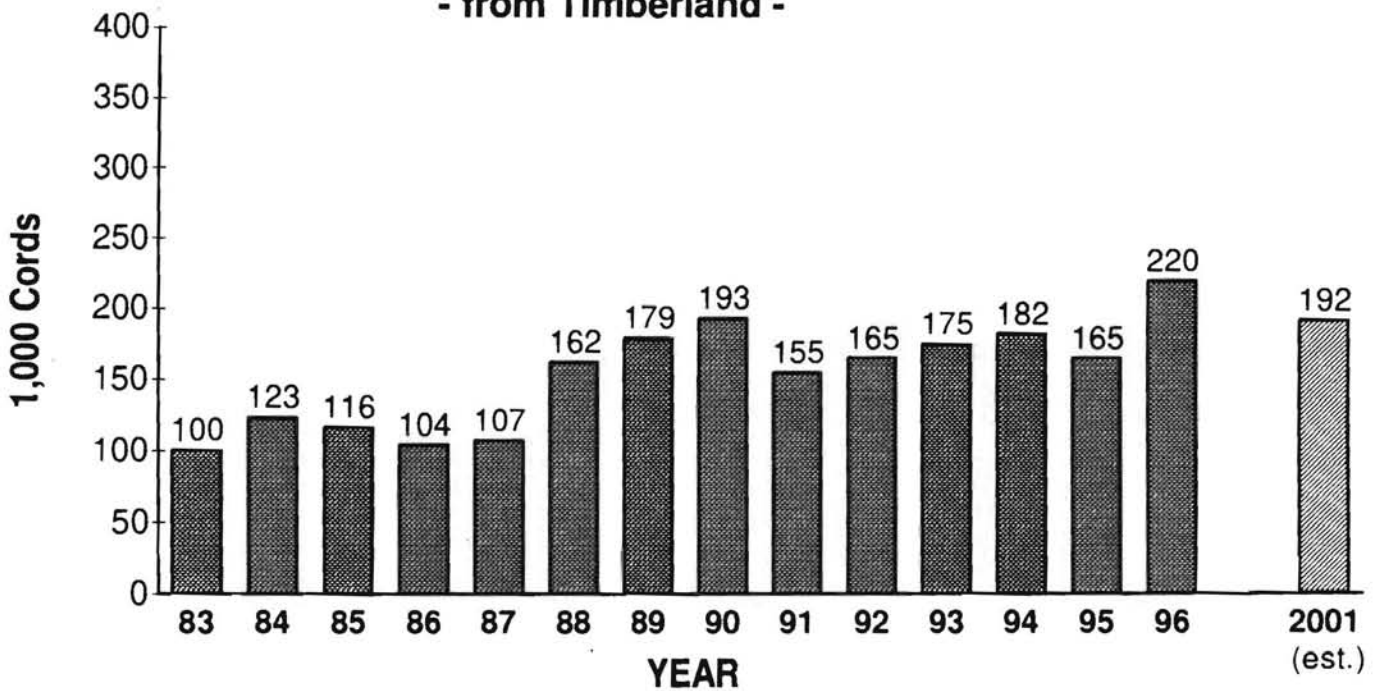
2001 Projected Harvest 237,000 cds.

- Minnesota Pulpwood Industries . . . 192,000 cds.
- Pulpwood Export 30,000 cds.
- Sawlogs & Other 15,000 cds.

Concerns:

- Balsam availability dependent upon 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.

**SPRUCE HARVEST in MINNESOTA : ACTUAL & PROJECTED
 COMPARED to AN ESTIMATED ALLOWABLE HARVEST
 - from Timberland -**



1) Based on DNR's method sustainable harvest = 334,000 cords/yr.
 (black spruce 202,600 cords. white spruce 131,700 cords)

2) Harvest data compiled by NCFES & DNR

3) 1996 harvest includes 100,000 cds exported to Wisconsin.

9/97

Spruce

Present and Projected Demand From Minnesota

1996 Harvest 219,600 cds.

- Minnesota Pulpwood Industries . 104,100 cds.
- Pulpwood Export 100,000 cds.
- Sawlogs & Other 15,500 cds.

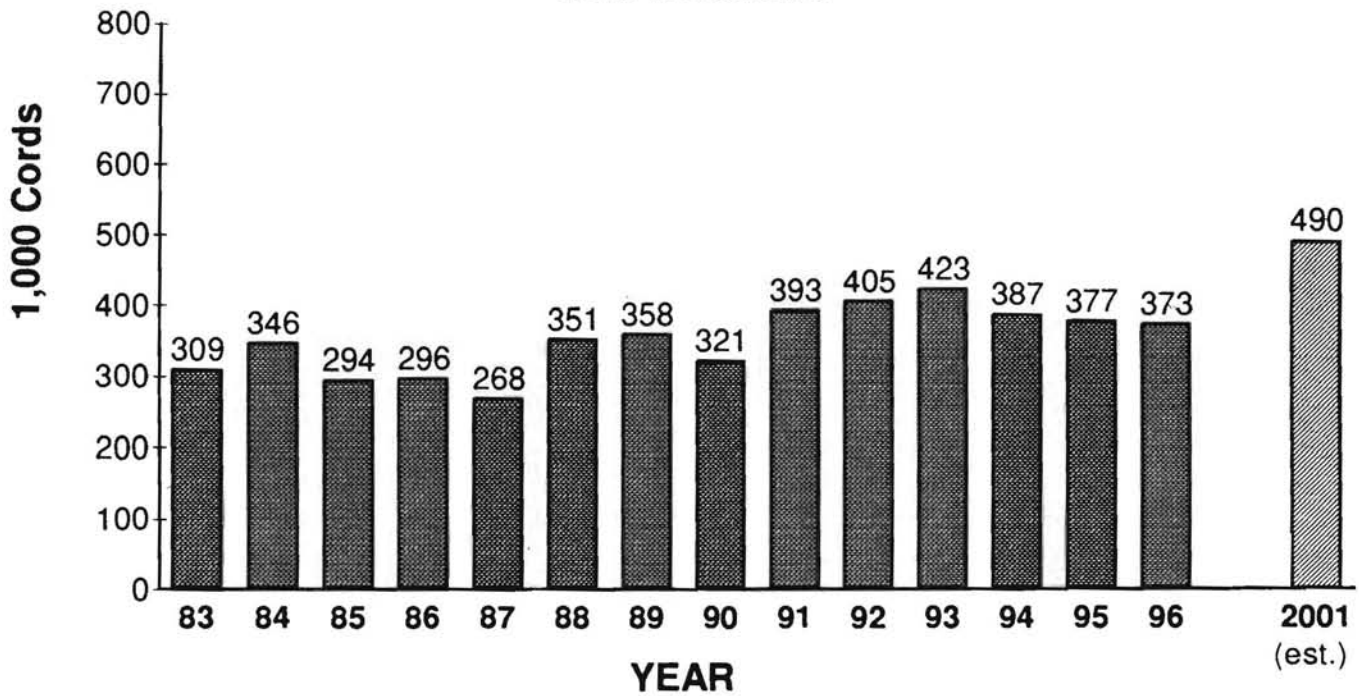
2001 Projected Harvest 192,000 cds.

- Minnesota Pulpwood Industries . 110,000 cds.
- Pulpwood Export 57,000 cds.
- Sawlogs & Other 25,000 cds.
- Utilization to 3" top increases availability by at least 10%
- Thinning white spruce plantations could increase availability by 5%

Concerns:

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

**PINE HARVEST in MINNESOTA : ACTUAL & PROJECTED
 COMPARED to AN ESTIMATED ALLOWABLE HARVEST
 - from Timberland -**



1) Based on DNR's Method, Sustainable Harvest = 590,000 cords/yr .

2) Harvest Data Compiled by NCFES & DNR

Pine

Present and Projected Demand

1996 Harvest 373,000 cds.

- Minnesota Pulpwood Industries . . . 78,800 cds.
- Pulpwood Export 39,700 cds.
- Sawlogs & Other 254,500 cds.

2001 Projected Harvest 490,000 cds.

- Minnesota Pulpwood Industries:
 - Pulp & Paper 176,000 cds.
 - OSB 35,000 cds.
- Pulpwood Export 12,000 cds.
- Sawlogs & Other 267,000 cds.

Anticipate 20% to 25% volume from red and white pine plantation thinnings.

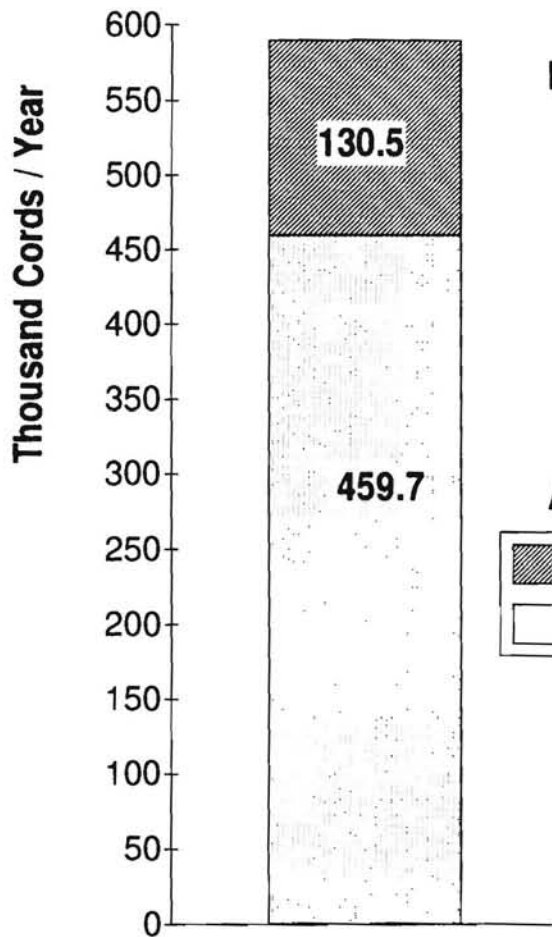
PINE SUSTAINABLE HARVEST

(1990 - 2000)

Minnesota Statewide, all Ownerships

- Based on 1990 Survey -

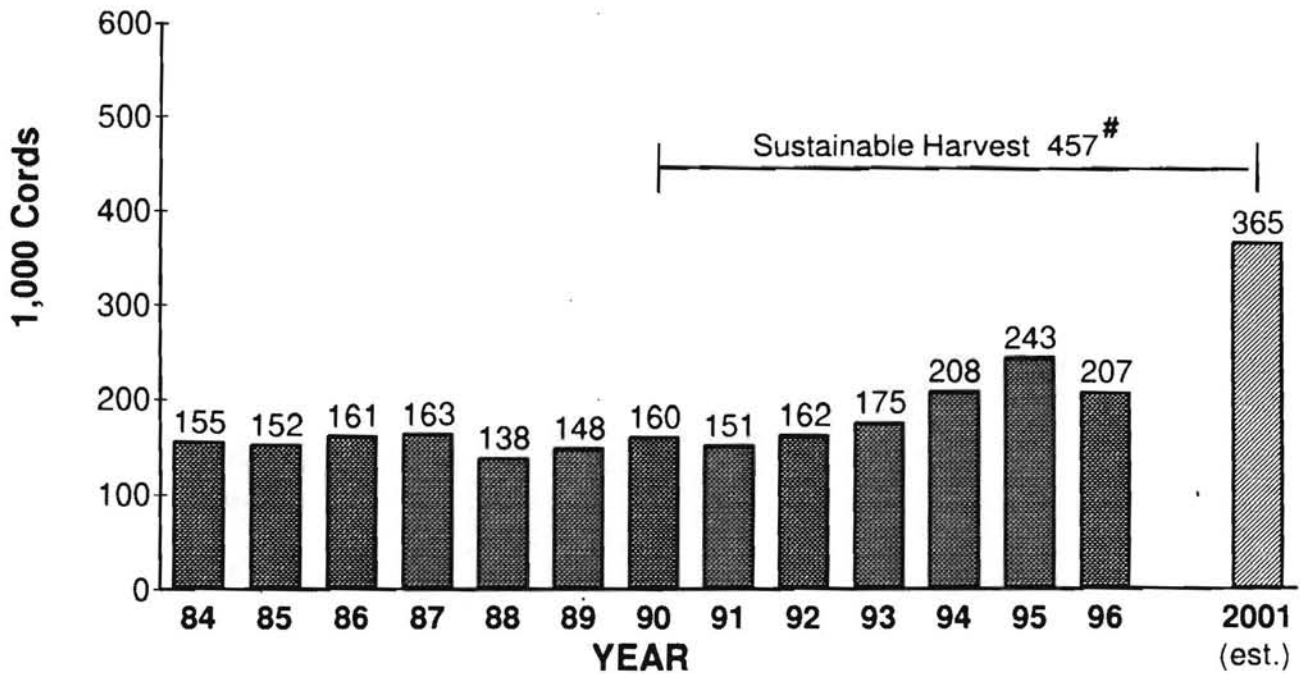
Total : 590.2 Thousand Cords / Year
from all Cover Types



Annual Sustainable Harvest (Net Volume) :

-  Volume Available from Thinnings (Age 31-100)
-  All Live Trees

BIRCH HARVEST in MINNESOTA : ACTUAL & PROJECTED
- from MN Statewide Timberland, all Ownerships -



DNR's method : Area regulations with growth contribution (adjusted 30% due to mortality).

Birch

Present and Projected Demand

1996 Harvest 206,5000 cds.

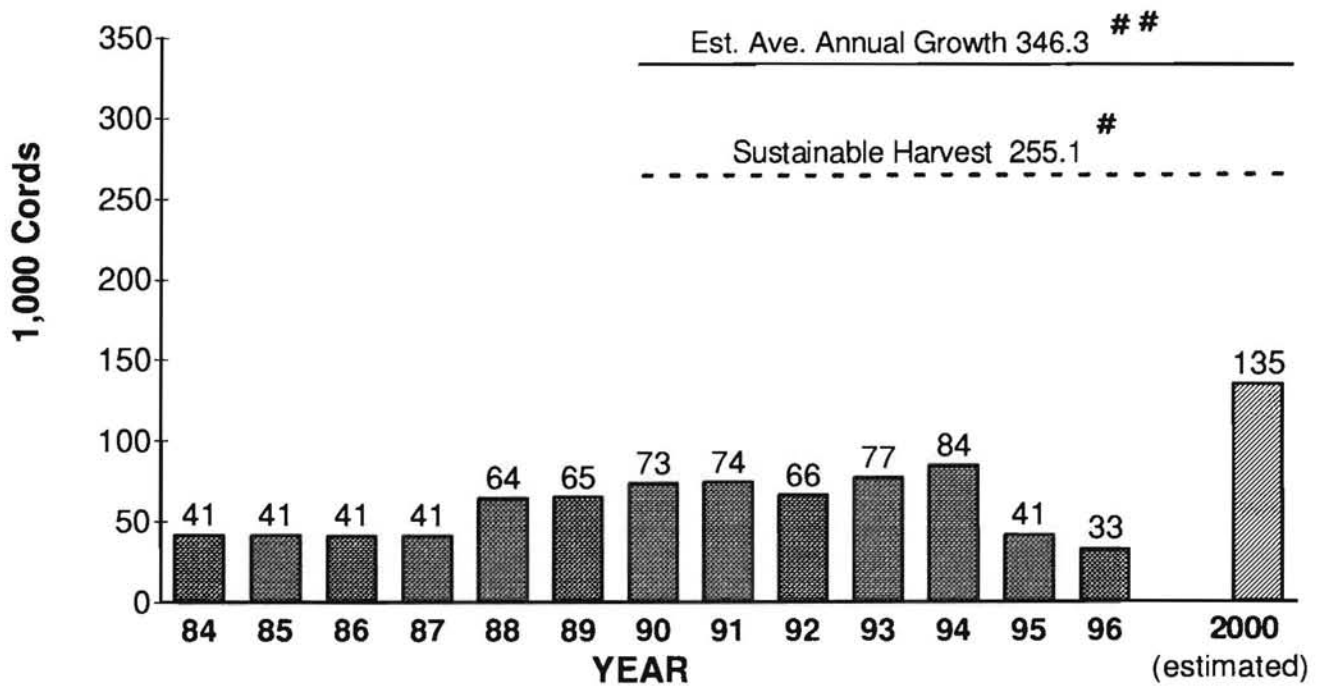
- Minnesota Pulpwood Industries:
 - OSB & Hardboard 69,800 cds.
- Pulpwood Export 38,200 cds.
- Sawlogs & Other 51,500 cds.
- Fuelwood (from growing stock) . . 47,000 cds.

2001 Projected Harvest 365,000 cds.

- Minnesota Pulpwood Industries:
 - Pulp & Paper 120,000 cds.
 - OSB & Hardboard 70,000 cds.
- Pulpwood Export 52,000 cds.
- Sawlogs & Other 66,000 cds.
- Fuelwood (from growing stock) . . 57,000 cds.

Figures include a pulp and paper mill expansion and an increase in OSB use by present companies.

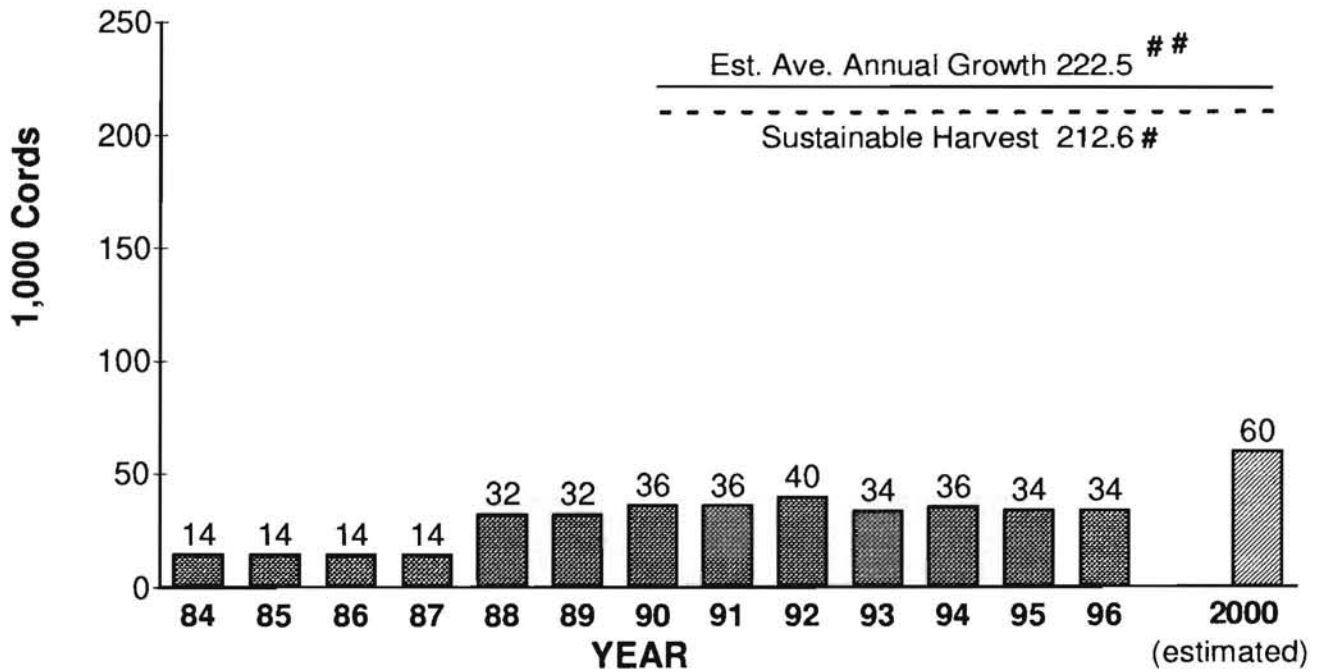
**MAPLE HARVEST in MINNESOTA : ACTUAL & PROJECTED
 COMPARED to SUSTAINABLE HARVEST & AVE. GROWTH
 - from MN Statewide Timberland, all Ownerships -**



DNR's method : Area regulations with growth contribution of all live trees (based on MN FIA 90)

Based on MN Forest Statistics, 1990 (USDA FS Reso.Bull. NC-141, table #21)

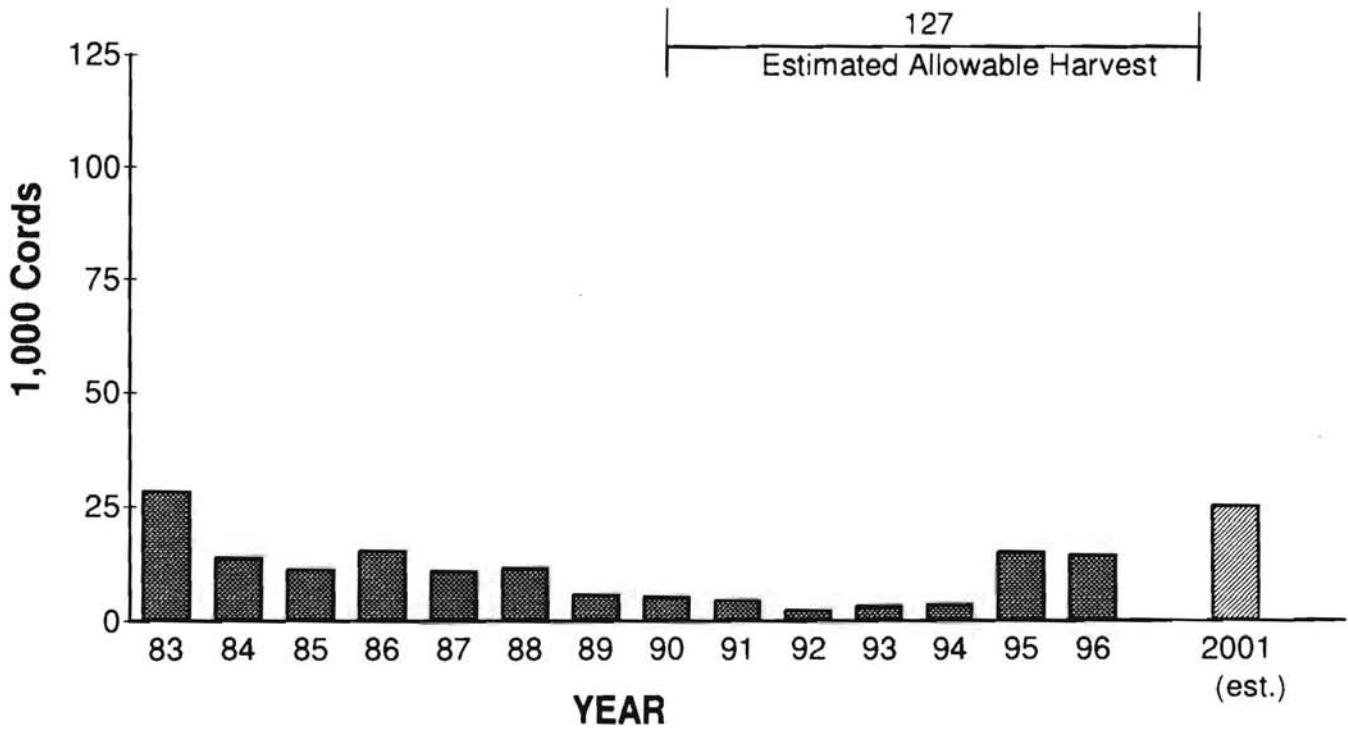
**BASSWOOD HARVEST in MINNESOTA : ACTUAL & PROJECTED
 COMPARED to SUSTAINABLE HARVEST & AVE. GROWTH
 - from MN Statewide Timberland, all Ownerships -**



DNR's method : Area regulations with growth contribution of all live trees (based on MN FIA 90)

Based on MN Forest Statistics, 1990 (USDA FS Reso.Bull. NC-141, table #21)

**TAMARACK HARVEST in MINNESOTA : ACTUAL & PROJECTED
 COMPARED to ESTIMATED ALLOWABLE HARVEST
 - from Timberland -**



Estimated allowable harvest based on DNR method.

Tamarack

Present and Projected Demand From Minnesota

1996 Harvest 14,300 cds.

- Minnesota Pulpwood Industries . . . 2,600 cds.
- Pulpwood Export 10,900 cds.
- Sawbolts & Other 800 cds.

2001 Projected Harvest 20,000 cds.

- Minnesota Pulpwood Industries . . . 9,300 cds.
- Pulpwood Export 10,000 cds.
- Sawbolts & Other 700 cds.

Concerns:

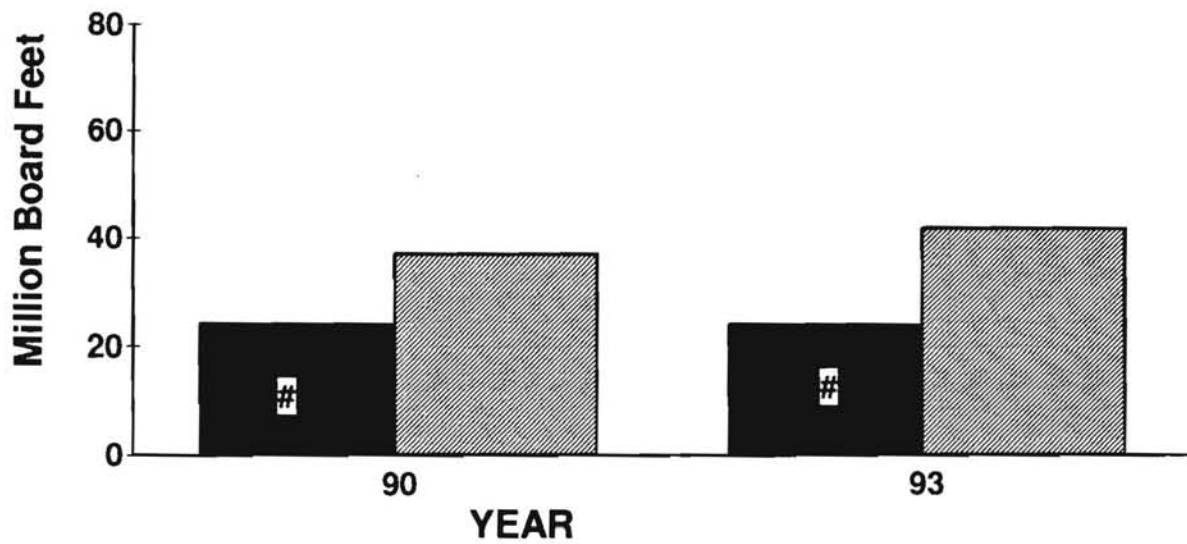
- Volume tied up in types not harvestable
- Forest types with low volume/acre of tamarack
- Some small, poor site stands
- Winter access only


Available Annual Surplus:

- 2000 50,000 to 60,000 cds.

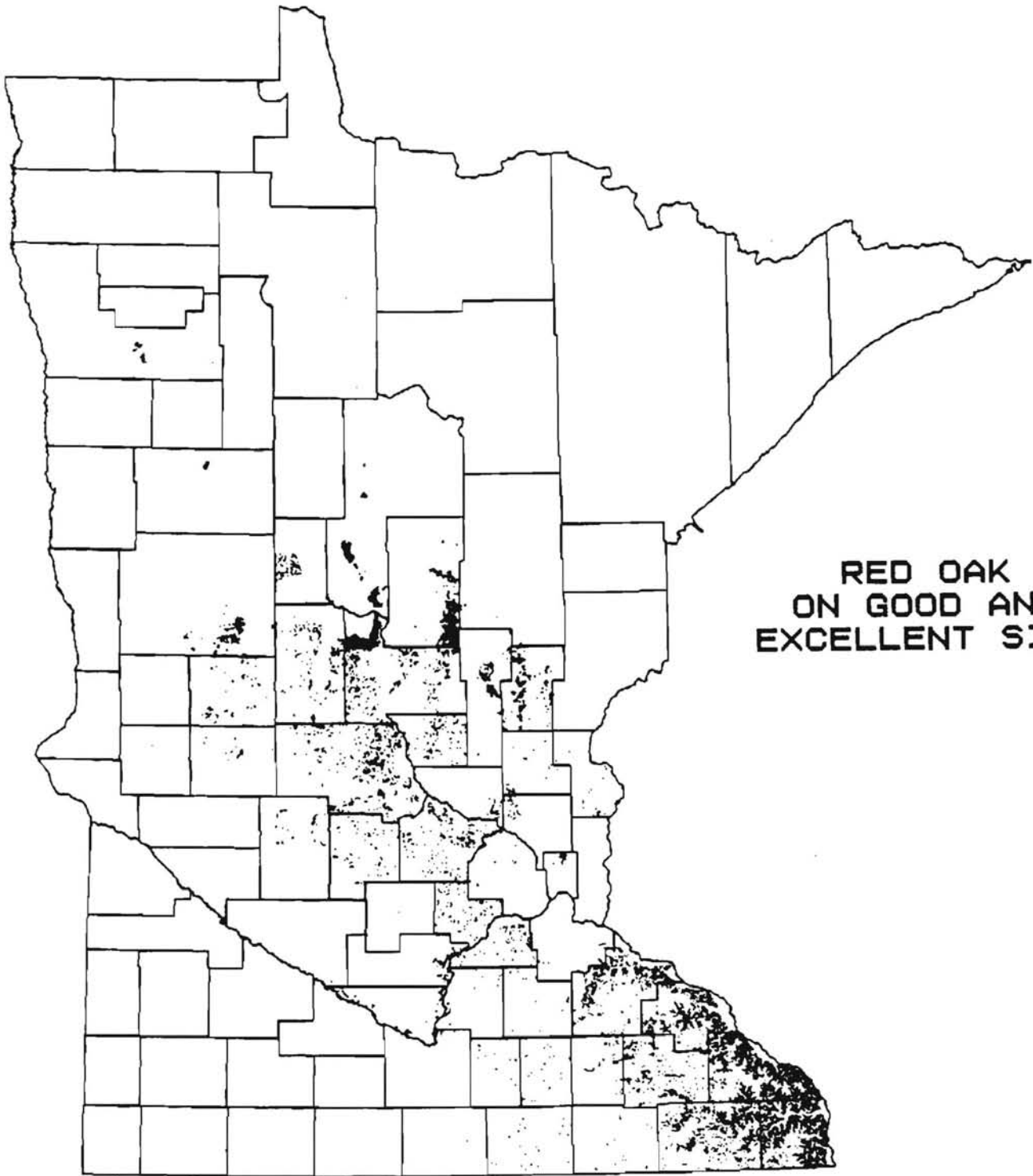
RED OAK SAWTIMBER HARVEST & GROWTH

- Minnesota Statewide -



 Estimated Allowable Harvest based on Table 6.25, GEIS, Dec. 1992 (medium level)

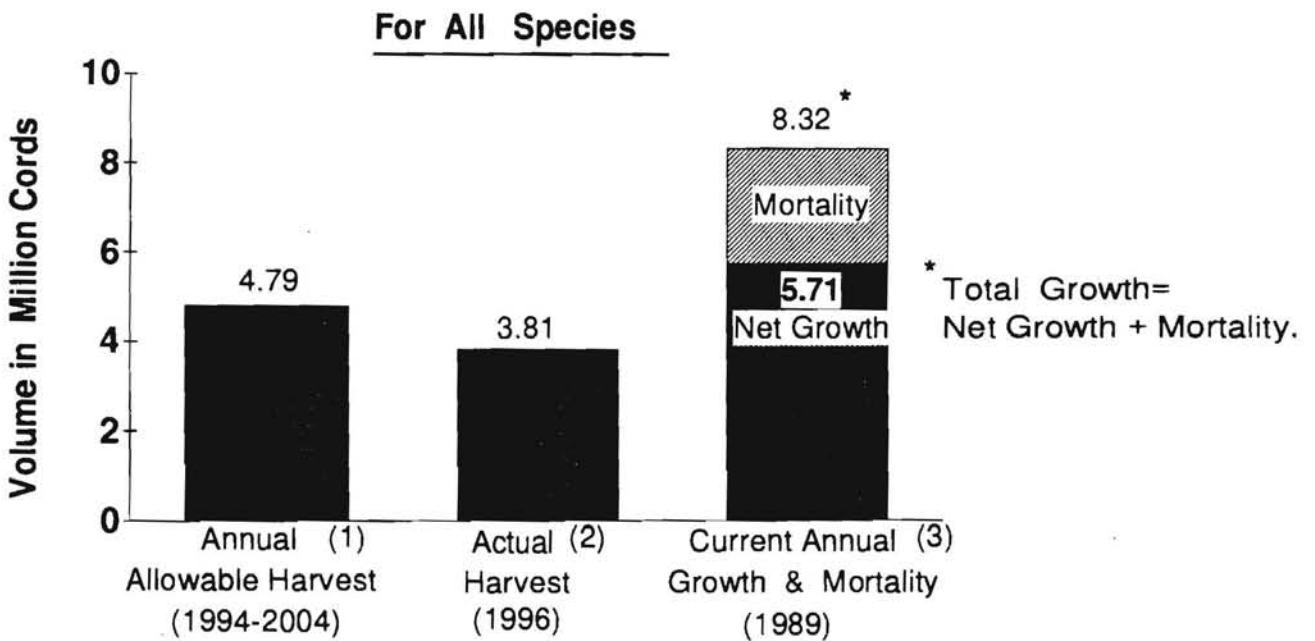
 Annual Harvest



**RED OAK
ON GOOD AND
EXCELLENT SITES**

**COMPARISON of AN ESTIMATED ALLOWABLE HARVEST LEVEL ,
ACTUAL HARVEST , CURRENT ANNUAL GROWTH & MORTALITY**

- Minnesota Statewide Timberland , all Ownerships -

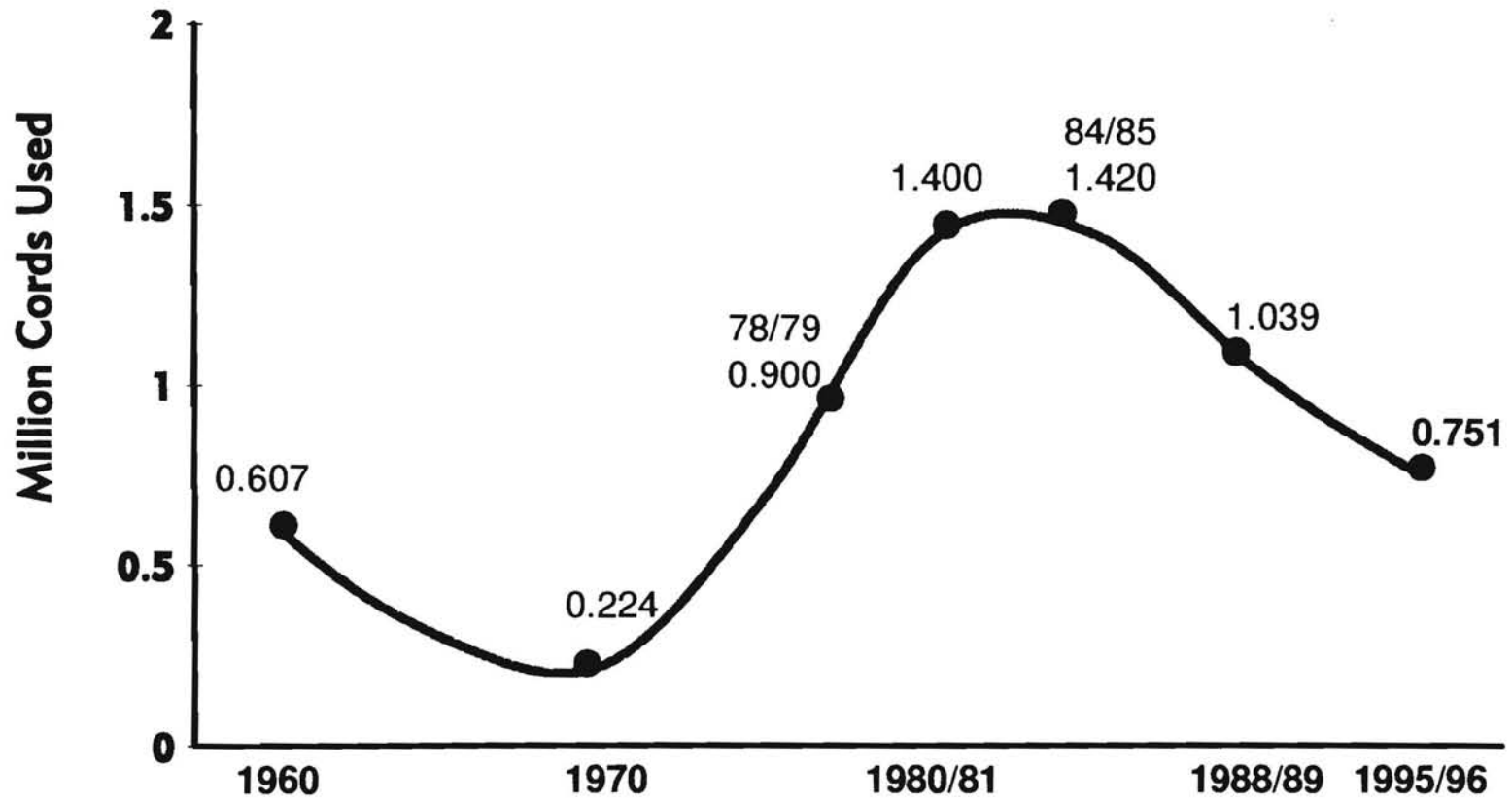


Source :

- 1). Table 6.25, GEIS, Medium Level : Maintaining Productivity & Forest Resource Base Tech. Pap., Dec 92 ;
- 2). NCFES 96 Pulpwood Harvest, 92-93 DNR Sawtimber Survey, 95-96 Statewide Fuelwood Use Survey.
- 3). Table #63 of NCFES Resource Bulletin, NC-141, Aug. 92.

FUELWOOD DEMAND in MINNESOTA

1960 - 1995/96



Total Minnesota Hardwood Harvest by Species by Year From Timberland (Thousand Cords)

Year	Aspen	Birch	Balm/ Gilead	Ash	Oak	Elm	Bass- wood	Maple	Cotton- wood	Other Hard- woods	Total Hard- woods
1980	982.2	133.5	46.5	49.4	250.3	91.5	12.1	43.1	6.0	?	1,614.6
1981	1,084.1	129.4	51.7	49.2	250.3	91.2	12.2	42.8	6.0	?	1,716.9
1982	1,148.7	121.7	55.0	52.3	250.5	91.3	12.1	42.7	6.0	?	1,780.3
1983	1,655.9	154.8	69.6	81.7	327.8	195.6	14.3	41.4	9.7	?	2,550.8
1984	1,793.2	154.2	63.1	81.8	327.8	195.7	14.3	41.4	9.7	?	2,681.2
1985	1,625.5	152.2	49.2	81.6	327.8	195.6	14.3	41.3	9.7	?	2,497.2
1986	1,733.4	160.7	48.0	81.4	327.8	195.5	14.3	41.0	9.7	?	2,611.8
1987	1,842.4	163.4	43.1	81.4	327.8	195.5	14.3	40.9	9.7	?	2,718.5
1988	1,737.5	137.4	46.9	73.1	299.6	97.8	32.3	64.1	7.3	2.2	2,498.2
1989	1,846.4	147.5	47.8	71.0	299.6	97.8	32.3	64.7	7.4	2.2	2,616.7
1990	1,938.5	159.8	53.4	71.5	282.0	87.8	36.3	73.4	7.6	2.8	2,713.1
1991	1,978.1	150.6	69.9	71.4	282.0	87.8	36.2	74.3	7.6	2.8	2,760.7
1992	2,265.0	162.0	86.0	75.0	282.0	88.0	40.0	66.0	8.0	3.0	3,075.0
1993	2,433.4	174.7	93.3	69.9	297.7	87.2	33.8	77.0	10.9	6.1	3,284.5
1994	2,404.6	207.7	123.8	71.9	298.1	87.1	35.6	84.4	10.9	6.1	3,330.2
1995*	2,326.6	207.8	97.8	27.5	184.3	13.8	34.0	41.4	10.9	11.9	2,956.0

(Includes pulpwood, sawtimber, and fuelwood.)

*1995 adjustment due to decrease in fuelwood use since 1989/1990.

Total Minnesota Softwood Harvest by Species by Year From Timberland (Thousand Cords)

Year	Spruce	Balsam	Tamarack	Cedar	Red Pine	White Pine	Jack Pine	Total Soft-Woods
1980	180.0	131.1	45.0	26.4	79.7	20.3	220.0	702.5
1981	137.5	120.8	32.5	26.4	81.1	24.8	210.6	633.7
1982	143.3	125.9	47.1	26.4	84.0	27.3	237.2	691.2
1983	100.4	95.9	28.4	16.2	103.2	41.4	156.6	542.1
1984	123.0	151.4	13.8	16.2	122.1	39.2	188.2	653.9
1985	116.3	127.6	11.3	16.2	105.4	30.2	162.5	569.5
1986	103.7	106.8	15.2	16.2	112.4	33.8	153.4	541.5
1987	106.6	118.2	10.8	16.2	102.5	30.5	138.6	523.4
1988	162.2	181.9	11.5	8.2	133.6	43.5	170.7	711.6
1989	179.4	209.8	5.7	8.2	136.8	44.0	177.3	761.2
1990	192.5	207.9	5.3	11.9	105.0	35.9	177.0	735.5
1991	154.6	207.4	4.5	7.5	121.5	32.7	238.3	766.5
1992	164.9	197.6	2.3	7.5	134.0	36.1	235.1	777.5
1993	175.3	209.8	3.2	6.6	133.2	28.4	261.6	818.1
1994	182.4	195.9	3.6	6.6	127.2	27.8	232.1	775.6
1995	165.5	205.6	13.0	6.0	127.9	25.0	223.6	766.6

(Includes pulpwood, sawtimber, and fuelwood.)

Total Minnesota Wood Harvest of Hardwoods and Softwoods by Year From Timberland (Thousand Cords)

Year	Hardwoods	Softwoods	Total
1980	1,614.6	702.5	2,317.1
1981	1,716.9	633.7	2,350.6
1982	1,780.3	691.2	2,471.5
1983	2,550.8	542.1	3,092.9
1984	2,681.2	653.9	3,335.1
1985	2,497.2	569.5	3,066.7
1986	2,611.8	541.5	3,153.3
1987	2,718.5	523.4	3,241.9
1988	2,498.2	711.6	3,209.8
1989	2,616.7	761.2	3,377.9
1990	2,713.1	735.5	3,448.6
1991	2,760.7	766.5	3,527.2
1992	3,073.3	777.5	3,850.8
1993	3,284.5	818.1	4,102.6
1994	3,330.2	775.6	4,105.8
1995	2,956.0	766.6	3,722.6

(Includes pulpwood, sawtimber, and fuelwood.)

Stumpage Value of Minnesota's 1993 Timber Harvest

Softwood	Pulpwood			Sawlogs/Sawbolts			Veneer Logs			Value of all Products
	(Thousands) Cords	Value/ /Cd.	Total Value	MBF	Value/ MBF	Total Value	MBF	Value/ MBF	Total Value	
Red Pine	40.7	10.40	423,280	43,739	133.00	5,817,287	55	200.00	11,000	6,251,567
White Pine	2.4	10.40	24,960	11,911	133.00	1,584,163	100	200.00	20,000	1,629,123
Jack Pine	140.0	16.00	2,240,000	56,620	84.00	4,756,080	--	--	--	6,996,080
Spruce	157.9	12.00	1,894,800	7,692	48.00	369,216	--	--	--	2,264,016
Balsam Fir	199.0	10.40	2,069,600	3,912	34.00	133,008	--	--	--	2,202,608
Tamarack	2.5	4.40	11,000	123	19.00	2,337	--	--	--	13,337
Cedar	2.3	8.40	19,320	1,768	34.00	60,112	--	--	--	79,432
Mixed Softwd	--	--	--	1,049	130.00	136,370	--	--	--	136,370
Subtotal	544.8		6,682,960	126,814	--	12,858,573	155	--	31,000	19,572,533
Hardwoods										
Aspen	2,302.6	9.25	21,299,000	82,643	37.00	3,057,791	1,903	65.00	123,695	24,480,486
Birch	47.6	3.25	154,700	14,136	26.00	367,536	8,389	65.00	545,285	1,067,521
Red Oak	1.0	5.25	5,250	40,872	200.00	8,174,400	825	700.00	577,500	8,757,150
White Oak	0.9	5.25	4,725	9,114	200.00	1,822,800	928	1,000.00	928,000	2,755,525
Walnut	--	--	--	351	250.00	87,750	758	750.00	568,500	656,250
Maple	22.0	5.00	110,000	3,555	50.00	177,750	294	100.00	29,400	317,150
Basswood	1.0	2.10	2,100	12,531	100.00	1,253,100	2,788	400.00	1,115,200	2,370,400
Elm	0.1	1.70	170	2,281	90.00	205,290	402	200.00	80,400	285,860
Ash	0.1	3.60	360	6,928	107.00	741,296	927	1,000.00	927,000	1,668,656
Cottonwood	0.2	9.00	1,800	4,788	50.00	239,400	545	100.00	54,500	295,700
Hickory	--	--	--	308	150.00	46,200	--	--	--	46,200
Mixed Hardwds	--	--	--	1,831	39.00	71,409	--	--	--	71,409
Mixed Species	--	--	--	3,699	150.00	554,850	--	--	--	554,850
Fuelwood	535.2	5.00	2,676,000	--	--	--	--	--	--	2,676,000
Subtotal	2,375.5	--	21,578,105	183,037	--	16,799,572	17,759	--	4,949,480	43,327,157
Total	3,455.5	--	30,937,065	309,851	--	29,658,145	17,914	--	4,980,480	65,575,690

Mill Delivered Value of Minnesota's 1993 Timber Harvest

	Pulpwood			Sawlogs/Sawbolts			Veneer Logs			Value of all Products
	(Thousands) Cords	Value/Cd.	Total Value	MBF	Value/MBF	Total Value	MBF	Value/MBF	Total Value	
Softwood										
Red Pine	40.7	57.00	2,319,900	43,739	180.00	7,873,020	55	350.00	19,250	10,212,170
White Pine	2.4	57.00	136,800	11,911	190.00	2,263,090	100	350.00	35,000	2,434,890
Jack Pine	140.0	57.00	7,980,000	56,620	170.00	9,625,400	--	--	--	17,605,400
Spruce	157.9	80.00	12,632,000	7,692	182.00	1,399,944	--	--	--	14,031,944
Balsam Fir	199.0	72.00	14,328,000	3,912	140.00	547,680	--	--	--	14,875,680
Tamarack	2.5	54.00	135,000	123	98.00	12,054	--	--	--	147,054
Cedar	2.3	55.00	126,500	1,768	100.00	176,800	--	--	--	303,300
Mixed Softwd	--	--	--	1,049	180.00	188,820	--	--	--	188,820
Hardwoods										
Aspen	2,302.6	47.00	108,222,200	82,643	120.00	9,917,160	1,903	165.00	313,995	118,453,355
Birch	47.6	44.00	2,094,400	14,136	190.00	2,685,840	8,389	200.00	1,677,800	6,458,040
Red Oak	1.0	45.00	45,000	40,872	365.00	14,918,280	825	1,200.00	990,000	15,953,280
White Oak	0.9	45.00	40,500	9,114	368.00	3,353,952	928	1,500.00	1,392,000	4,786,452
Walnut	--	--	--	351	375.00	131,625	758	1,250.00	947,500	1,079,125
Maple	22.0	45.00	990,000	3,555	180.00	639,900	294	250.00	73,500	1,703,400
Basswood	1.0	45.00	45,000	12,531	208.00	2,606,448	2,788	550.00	1,533,400	4,184,848
Elm	0.1	45.00	4,500	2,281	190.00	433,390	402	350.00	140,700	578,590
Ash	0.1	45.00	4,500	6,928	173.00	1,198,544	927	2,000.00	1,854,000	3,057,044
Cottonwood	0.2	45.00	9,000	4,788	175.00	837,900	545	250.00	136,250	983,150
Hickory	--	--	--	308	275.00	84,700	--	--	--	84,700
Mixed Hardwds	--	--	--	1,831	180.00	329,580	--	--	--	329,580
Mixed Species	--	--	--	3,699	180.00	665,820	--	--	--	665,820
Fuelwood	535.2	70	37,464,000	--	--	--	--	--	--	37,464,000
Total	3,455.5	--	186,577,300	309,851	--	59,889,947	17,914	--	9,113,395	255,580,642

Average Prices Received for Stumpage Sold by Public Land Agencies in Minnesota: 1988-1996

(Compiled by Doug Ford, Forest Economist, DNR-Forestry)

Pulpwood (\$s per cord)

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996 ^a
Aspen	\$3.55	\$4.53	\$6.09	\$6.61	\$7.25	\$9.28	\$14.82	\$18.69	16.09
Balm	2.31	2.88	3.35	3.58	4.51	6.43	12.73	16.48	13.24
Birch	1.96	2.64	3.69	2.95	4.19	3.23	5.45	3.52	7.52
Ash	3.05	3.76	3.82	4.19	3.96	3.60	3.42	4.46	5.00
Oak	3.88	4.66	4.89	3.79	3.57	5.24	5.27	4.51	4.37
Mixed Hardwoods	2.37	2.77	5.58	3.34	4.32	6.35	10.96	10.07	5.67
Balsam	3.49	4.15	6.49	6.69	8.09	10.36	15.15	18.76	14.35
W. Spruce	9.29	10.61	12.42	13.27	16.46	12.16	15.66	26.18	19.06
B. Spruce	9.39	9.72	11.88	12.32	12.78	11.96	20.54	23.65	22.90
Tamarack	4.67	4.50	4.61	4.13	4.29	4.38	4.90	7.73	7.25
Cedar	6.83	7.76	9.76	9.39	9.98	8.37	9.92	10.48	10.55
J. Pine	9.69	9.75	11.34	12.79	14.65	15.99	24.81	32.08	23.48
R. & W. Pine	7.48	14.79	13.04	14.06	8.14	10.39	24.57	17.49	21.18

Sawtimber (\$s per MMBF)

Species	1988	1989	1990	1991	1992	1993	1994	1995	1996
Aspen	\$15.90	\$17.83	\$23.34	\$23.66	\$28.53	\$37.20	\$64.67	68.93	71.22
Birch	18.70	18.87	20.87	24.24	26.38	26.34	43.12	50.67	52.31
Ash ^c	38.75	36.52	49.44	63.37	90.63	106.62	132.52	151.28	147.18
Elm	34.25	35.12	38.77	36.26	36.93	48.90	50.68	47.02	60.08
Oak ^b	60.50	74.11	73.40	64.45	73.99	91.69	110.67	156.88	177.30
Basswood	NA	NA	NA	NA	NA	66.80	90.60	120.91	105.37
Balsam	11.80	16.97	20.54	23.29	25.39	34.30	52.95	55.10	61.49
W. Spruce	35.65	38.94	54.34	42.58	45.48	48.04	72.45	77.79	73.47
Cedar	25.50	25.32	29.63	33.19	29.69	33.88	37.59	38.55	42.58
J. Pine	43.50	53.43	62.83	62.72	72.96	83.59	120.51	136.55	108.37
R. & W. Pine	66.85	88.90	93.55	101.13	108.84	132.83	183.95	171.55	163.64

^a Pulpwood prices based on 1.34 million cords sold; sawtimber based on 136 MMBF.

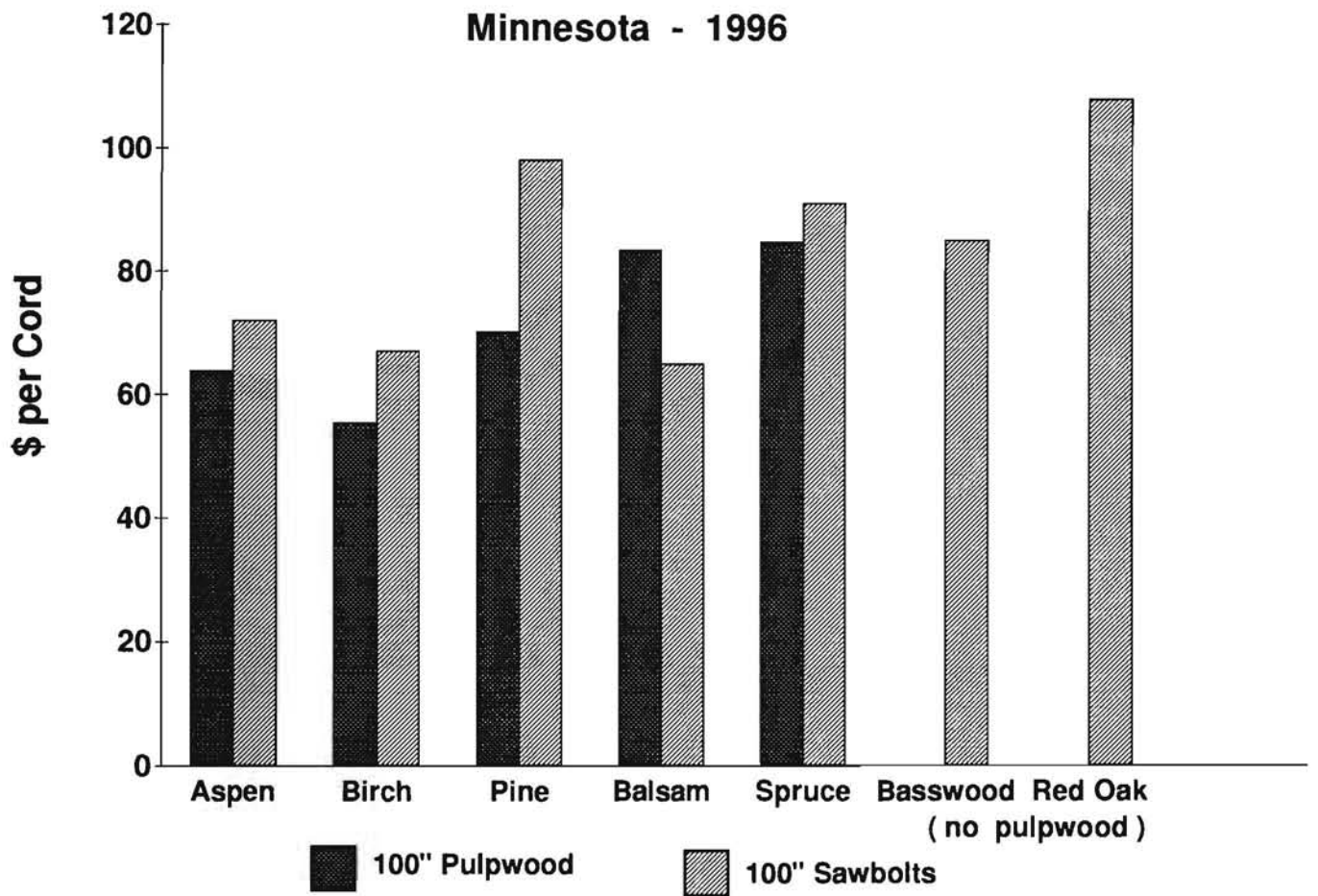
^b Oak sawtimber prices mainly from public lands in northern Minnesota.

^c 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.

MILL DELIVERED PRICES

Minnesota - 1996



FACTORS AFFECTING FUTURE WOOD SUPPLY in MINNESOTA

1) Improved Utilization Standards

- use trees to 3" top diameter
- untapped stagnant black spruce
- thin kerf sawing technology

2) Technology Improvements

- cut - to - length systems
- other low impact logging
- recycled paper pulp
- wood fiber / plastic composites

3) Insects and Diseases

- spruce budworm
- gypsy moth

4) Other Fiber supplies

- Canadian mill expansions
- alternative species :
birch, maple, tamarack
- thinnings from aspen, white spruce,
and pine
- Wisconsin forest resources
- hybrid and native cottonwood
plantations
- seasonal availability

5) Management Policies

- extended rotation forests (ERF)
- old growth
- riparian considerations
- best management practices (BMP's)
- Aitkin county public land assessment