

Minnesota West Central Landscape

# Current Conditions and Trends Assessment

Draft, March 2001

Minnesota  
Forest  
Resources  
Council  
Landscape Program

Minnesota Forest Resources Council Document  
Landscape Technical Document, Draft, March 2001 (LT-0301d)  
©Copyright 2001, Minnesota Forest Resources Council

This document is on the Internet at **[www.iic.state.mn.us/finfo/landscap/3/wc.html](http://www.iic.state.mn.us/finfo/landscap/3/wc.html)**  
Information about the Minnesota Forest Resources Council and the Landscape Program can be found at  
**[www.frc.state.mn.us](http://www.frc.state.mn.us)**. Information on the Landscape Program also is located at the Interagency Information  
Cooperative Internet site, **[www.iic.state.mn.us](http://www.iic.state.mn.us)**.

Equal opportunity to participate in and benefit from Minnesota Forest Resources Council programs is available to all individuals regardless of race, color, creed, religion, national origin, sex, marital status, status with regard to public assistance, age, sexual orientation, or disability. Discrimination inquiries should be sent to the Minnesota Forest Resources Council, 2003 Upper Buford Circle, St. Paul, MN 55108; or the Equal Opportunity Office, Department of the Interior, Washington, D.C. 20240.

This information is available in an alternative format upon request.

Project Leader - Chad Skally, Minnesota Forest Resources Council  
Document Formatting - Sally Ruckmar, Minnesota Department of Natural Resources  
Social and Economic Data Collected by - Scott Wiedemer

## Table of Contents

Table of Contents.....	3
List of Tables.....	5
List of Figures.....	7
References.....	8
Introduction.....	9
Background.....	10
Definitions.....	11
Historical Conditions.....	12
Findings.....	12
Comparisons of pre-settlement vegetation to current vegetation.....	13
Observations.....	13
Natural Resources and Ecological Conditions and Trends.....	18
Findings.....	18
Recent extent of forestlands.....	19
Observations.....	19
Structure of timberland.....	21
Observations.....	21
Riparian areas.....	26
Observations.....	26
Vascular plants and wildlife species.....	29
Observations.....	29
Social and Economic Conditions and Trends.....	35
Findings.....	35
Land Use and Ownership.....	36
Observations.....	36
Demographics.....	45
Observations.....	45
Employment.....	51
Observations.....	51
Economic Production.....	62
Observations.....	62
Recreation and Tourism.....	73
Observations.....	73

---

Appendix A. Metadata - General Information of Data .....	80
Appendix B. Summary of FIA Sampling and Estimation Procedures .....	83

# List of Tables

Table 1. Summary of Rare Natural Features, by Landscape and Feature Type..... 12

Table 2. Difference between Bearing Tree data and 1990 FIA data rounded to the nearest percent) ..... 16

Table 3. Area (acres) of Land Use in the West Central Landscape, 1977 and 1990 ..... 20

Table 4. Ratio of Forestland to Nonforestland for the West Central Landscape, 1977 and 1990 ..... 20

Table 5. 1977 FIA Acrea (acres) by Timberland Type & Stand Size Class for the West Central Landscape..... 24

Table 6. 1990 FIA Acrea (acres) by Timberland Type & Stand Size Class for the West Central Landscape..... 25

Table 7. Density of Waterways, by Ecological Subsection, in the West Central Landscape .... 28

Table 8. Wetlands in the West Central Landscape..... 28

Table 9. Richness of vascular plants in Owenby and Morley (1991) by MFRC Landscape ..... 30

Table 10. Numbers of vascular plants in Owenby and Morley (1991) with recorded occurrence limited to a particular MFRC Landscape ..... 31

Table 11. Richness of forest-associated mammals, amphibians and reptiles, and breeding birds in Minnesota ..... 32

Table 12. Status of Minnesota’s forest-associated endangered, threatened and special concern vertebrate wildlife, 1984 ..... 33

Table 13. Status of Minnesota’s forest-associated endangered, threatened and special concern vertebrate wildlife, 1996 ..... 34

Table 14. Area of land by GAP ownership groups for the West Central Landscape ..... 38

Table 15. Area of Ownership Classes for the West Central Landscape, 1977 and 1990 ..... 39

Table 16. Area of Ownership by Public and Private for the West Central Landscape, 1977 and 1990 ..... 40

Table 17. Area of land use classes for the West Central Landscape ..... 43

Table 18. Population of Minnesota and Counties in the West Central Landscape ..... 46

Table 19. Population Projections for Minnesota and counties in the West Central Landscape..... 47

Table 20. Population by age group for Minnesota and the West Central Landscape ..... 48

Table 20. Population by age group for Minnesota and the West Central Landscape .....	48
Table 21. Persons with incomes below poverty level in the West Central Landscape .....	49
Table 22. Per capita personal income for Minnesota and the West Central Landscape and counties .....	50
Table 23. 1998 Distribution of Employees by Industry for the West Central Landscape.....	52
Table 24. 1998 Distribution of Weekly Wages by Industry for the West Central Landscape ..	53
Table 25. Total Wages by Industry for the West Central Landscape Landscape in 1998 .....	58
Table 26. Unemployed for Minnesota and counties in the West Central Landscape1999 ....	59
Table 27. Statewide summary of perecent of total income by source .....	60
Table 28. 1999 Property Tax Information by County in the West Central Landscape .....	63
Table 29. 1995 Property tax refunds per capita, by County in the West Central Landscape .	64
Table 30. 1994 Individual Income Tax Payments per Capita, by County in the West Central Landscape .....	65
Table 31. Sawmills, Paper Mills, ect. per County in the West Central Region .....	66
Table 32. Average Prices received for Pulpwood (\$'s per Cord) Sold by Public Land Agencies in Minnesota: 1990 and 1998 .....	69
Table 33. Average Prices received for Sawtimber (\$'s per MBF) Sold by Public Land Agencies in Minnesota: 1990 and 1998 .....	71
Table 34. Distribution of Hunting Licenses by Type for the Counties in the West Central Landscape.....	74
Table 35. 1996 Total Sales from Hotels, Motels, Resorts and Other Lodging Places per County in the West Central Landscape (In Thousands of Dollars) .....	75

## List of Figures

Figure 1. Ecological subections in the West Central Landscape .....	9
Figure 2. Forest Change in the West Central Landscape, 1800's to 1990's .....	15
Figure 3. Acres of timberland by forest type groups for the West Central Landscape .....	22
Figure 4. Acres of timberland by stand-size for the West Central Landscape.....	23
Figure 5. Wetlands and Waterways in the West Central Landscape .....	27
Figure 6. Ownership in the West Central Landscape .....	37
Figure 7. Reserved Lands and Forests in the West Central Landscape .....	41
Figure 8. Land Use from Remotely Sensed data for the West Central Landscape.....	42
Figure 9. Distribution of nonindustrial private forestland (NIPF) acres statewide by ownership class size, 1990 .....	44
Figure 10. Earnings by major industry for Minnesota, 1970-1995. ....	54
Figure 11. Projected earnings by major industry for Minnesota, 1998-2045. ....	55
Figure 12. Number of employees by major industry for Minnesota, 1970-1995. ....	56
Figure 13. Projected employment by major industry for Minnesota, 1998-2045 .....	57
Figure 14. The Minnesota Forest Products Industry.....	67
Figure 15. Trends in hardwood and soft wood harvesting statewide, 1980-1997 .....	68
Figure 16. Average stumpage prices received by public agencies for sawtimber, 1987-1997 .....	70
Figure 17. Average stumpage prices received by public agencies for pulpwood, 1987-1997 .....	72
Figure 18. Economic impact of domestic travel, 1988-1995 .....	76
Figure 19. Major Roads in the West Central Landscape.....	77
Figure 20. Road mileage statewide in Minnesota, 1989-1999 .....	78
Figure 21. Trail mileage statewide in Minnesota, 1984-1996 .....	79

## References

- Almendinger, J. C. Minnesota's Bearing Tree Database. Minnesota Department of Natural Resources. St. Paul, MN, 1996.
- Generic Environmental Impact Statement (GEIS) Study on timber Harvesting and Forest Management in Minnesota.* Minnesota Environmental Quality Board. 1994.
- Green, J. C. "Birds and Forests: A Management and Conservation Guide." MN Dept. of Natural Resources. St. Paul, MN, 1995.
- Jakes, P. The fourth Minnesota forest inventory: area. Resource Bull. NC-54. USDA Forest Service, North Central Forest Experiment Station. St. Paul, MN, 1980.
- Heinselman, M. L. "Interpretation of Francis J. Marschner's Map of the Original Vegetation of Minnesota." USDA Forest Service North Central Forest Experiment Station. St. Paul, MN, 1974.
- Murray, P. Forest Statistics for Minnesota's Northern Pine Unit, 1990. USDA Forest Service, North Central Forest Experiment Station. St. Paul, MN, 1991.
- Miles, P. D., C. M. Chen, & E. C. Leatherberry. Minnesota Forest Statistics, 1990, Revised. USDA Forest Service North Central Forest Experiment Station. St. Paul, MN, 1995.
- Minnesota Department of Natural Resources. "Checklist of Endangered and Threatened Animal and Plant Species of Minnesota." St. Paul, MN, 1984.
- Minnesota Department of Natural Resources. "Minnesota's List of Endangered, Threatened and Special Concern Species." St. Paul, MN, 1996.
- Minnesota Department of Natural Resources, Trails and Waterways Unit. Minnesota Registry of Public Recreational Trail Mileages. St. Paul, MN, 1996.
- Minnesota Forest Resources Council. Status of Minnesota Timber Harvesting and Silvicultural Practice in 1996. St. Paul, MN, 1996
- Owenby, G. B. and T. Morley. Vascular Plants of Minnesota: A Checklist and Atlas. Minneapolis: U of MN Press, 1991.
- Tester, J. R. Minnesota's Natural Heritage. St. Paul: U of MN Press, 1995.

# Introduction

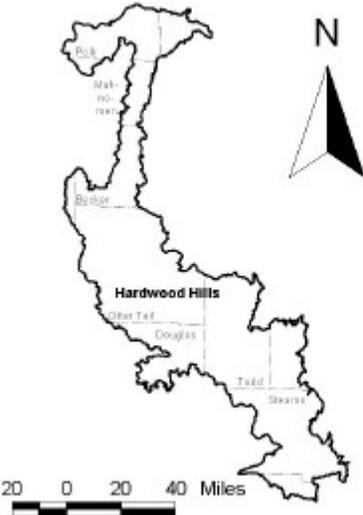
The process for conducting assessments of landscape conditions and trends for the East Central landscape of Minnesota (see Figure 1) is explained in the background section below. At the time of this writing, the following sections of the assessment are completed:

- Historical Conditions
- Natural Resource and Ecological Conditions and Trends
- Social and Economic Conditions and Trends

The information in this assessment will serve as

the starting point for establishing a regional forest resource committee in the East Central landscape, which includes all of Douglas, Kandiyohi, Meeker, Otter Tail, Pope, Stearns, Todd, and Wadena counties. As additional ecological and social/economic data becomes available, it will be analyzed and presented to the regional committee for its consideration in determining desired future conditions, goals, and strategies for the landscape.

Figure 1. Ecological subsections in the West Central landscape.



Source: DNR

## Background

Subdivision 2 of Minnesota's 1995 Sustainable Forest Resources Act (SFRA) authorizes the establishment of citizen-based regional forest resource committees to foster landscape-based forest resource planning.

The SFRA defines landscape-level planning as long-term, broad-based efforts that may require extensive analysis and planning over large areas and that may require extensive coordination among all landowners in a region. Regional committees provide the opportunity to involve private citizens, forestry professionals, and members of various interest groups in implementing landscape-level planning to promote forest sustainability. The SFRA charges the regional committees to:

- include representative interests;
- serve as a forum to discuss issues;
- identify and implement an open and public process whereby landscape-level strategic planning can occur;
- identify sustainable forest resource goals for the landscape and strategies to achieve those goals; and
- provide a regional perspective on forest sustainability to the Minnesota Forest Resources Council.

The landscape program follows a general planning process in each landscape region. The regional forest resource committees use this five-step process to gather, share, and communicate information. It is:

- prepare an assessment of current conditions and

trends (ecological, social, and economic) in the landscape;

- determine a vision, goals, and issues that address existing and potential forest resource conditions considered desirable for the region;
- develop strategies for implementing the vision and goals, and resolve issues in the region;
- encourage voluntary implementation of the strategies by coordination among landowners; and
- conduct an evaluation to determine how well the strategies accomplish the vision and goals and resolve issues.

This "Current Conditions and Trends Assessment: West Central Landscape Region" represents the first step in the general planning process for southeastern Minnesota. Resource managers from the Minnesota Forest Resources Council, Department of Natural Resources, United States Forest Service, and county land departments have analyzed the natural resources and ecological conditions and trends and prepared their findings. Although this assessment is a work in progress, it contains enough information to get the regional committee started on the steps in the general planning process. As additional ecological and social/economic data becomes available it will be presented to the regional committee to use in determining desired future conditions, goals, and strategies for the forest resources in the landscape.

---

## Definitions

**Observations:** Significant points about the information presented in the graphs and tables. At the beginning of each section in the assessment there are basic observations about the data presented

**Findings:** A general theme that emerges from a set of observations. Overall findings from the assessment are noted in this document's introduction; findings about specific topics are listed at the beginning of that section.

**Issues:** An area of concern based on the interpretation of the findings and people's values. Some issues regarding forest resources in southeastern Minnesota are listed in the introduction to this document.

**Goals:** A benchmark to strive towards in resolving the issues. Goals are not listed in this assessment; the Southeast Regional Forest Resource Committee will set goals for addressing each issue.

**Strategies:** Methods to meet goals. These also are not listed in the assessment but will be part of the regional forest resource committee's work.

## Historical Conditions and Trends

### Findings

There is less forest than historically (Figure 2).

## Comparison of Pre-settlement vegetation to today

### Observations

Compared to pre-settlement not as much of the region is still forested (Figure 2).

There has been a noticeable decrease in tamarack, and increase in box elder (Table 2).

Table 1. Summary of Rare Natural Features, by Landscape and Feature Type

Feature Type	East Central	Metro	North Central	Northeast	Northern	Prairie	Southeast	West Central	Statewide
Geologic Process	19	3	21	36	18	37	31	8	173
Geologic Time	9	4	2	15		18	19		67
Natural Community	492	224	328	156	572	1,482	1,839	266	5,359
Other -(nesting/breeding sites, bat/mussel sites)	78	61	255	136	197	473	257	33	1,490
Special Animals	1,340	742	1,341	614	1,063	1,558	2,492	275	9,425
Special Plants	804	210	902	1,078	847	1,445	2,384	168	7,838
<b>Total</b>	<b>2,742</b>	<b>1,244</b>	<b>2,849</b>	<b>2,035</b>	<b>2,697</b>	<b>5,013</b>	<b>7,022</b>	<b>750</b>	<b>24,352</b>

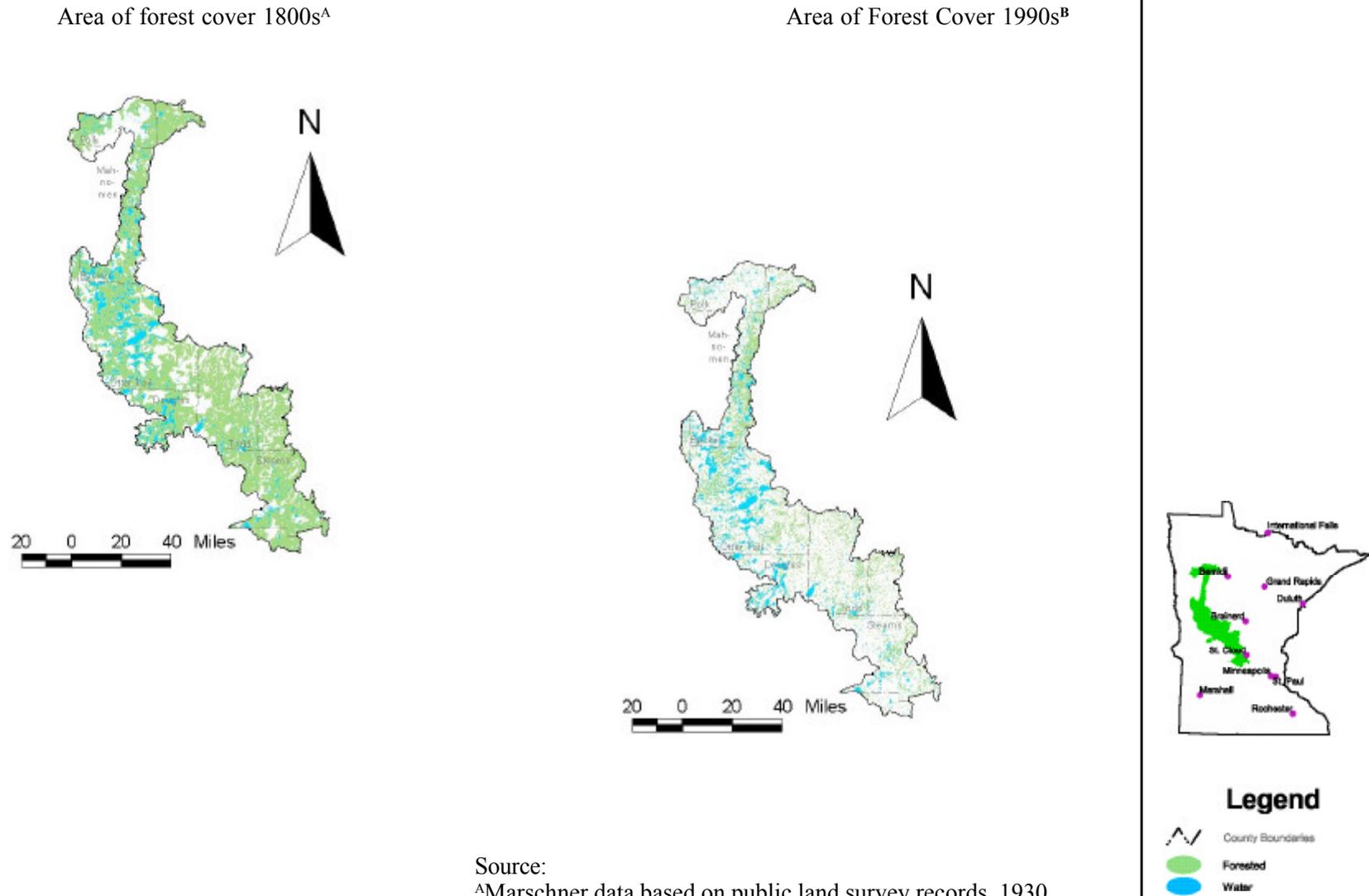
Examples of feature types:

- Geologic process: fault, fold, groundwater deposit, glacial formations (esker, ame)
- Geologic time: rock outcrop (igneous, metamorphic, sedimentary), fossils
- Natural Community: prairie, fen, forests
- Other: nesting/breeding sites, bat/mussel sites
- Special Animals: animals listed as endangered, threatened, or special concern (see table 15)
- Special Plants:

Source: Copyright 2000 MNDNR. Rare features data have been provided by the Natural Heritage and Nongame Research Program of the Section of Ecological Services, MNDNR and were current as of 7/31/2000. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present. In addition, there may be inaccuracies in the data, of which MNDNR is not aware and shall not be held responsible for.



Figure 2. Forest Change in the West Central Landscape, 1800's to 1990's



Source:

<sup>A</sup>Marschner data based on public land survey records, 1930.

<sup>B</sup>Remotely sensed data, 1988-1996.

Table 2. Difference between Bearing Tree data and 1990 FIA data (rounded to the nearest percent)

Name	Percent Difference	Proportional Difference
Alder-- <i>Alnus incana</i> , <i>A. viridis</i>	0	0
Ash-- <i>Fraxinus nigra</i> , <i>F. pennsylvanica</i> , <i>F. americana</i>	4	2
Aspen-- <i>Populus tremuloides</i> , <i>P. grandidentata</i> , <i>P. balsamifera</i> (in lesser part)	-3	-1
Balm-of-Gilead-- <i>Populus balsamifera</i> (in greater part)	1	2
Beech-- <i>Fagus grandifolia</i> (unknown from Minn. possibly <i>Carpinus caroliniana</i> )	0	0
Birch-- <i>Betula papyrifera</i> , <i>B. cordifolia</i>	1	1
Black Birch-- <i>Betula nigra</i> , <i>B. alleghaniensis</i> (in part ?)	0	0
Black Oak-- <i>Quercus nigra</i> , <i>Q. ellipsoidalis</i> (in part)	0	0
Black Walnut-- <i>Juglans nigra</i>	0	0
Blue Beech-- <i>Carpinus caroliniana</i>	0	0
Box-Elder-- <i>Acer negundo</i>	3	124
Bur Oak-- <i>Quercus macrocarpa</i>	3	1
Butternut-- <i>Juglans cinerea</i>	0	2
Cherry-- <i>Prunus serotina</i> , <i>P. pennsylvanica</i>	0	2
Cottonwood-- <i>Populus deltoides</i>	0	5
Elm-- <i>Ulmus americana</i> , <i>U. rubra</i> , <i>U. thomasii</i>	2	1
Fir-- <i>Abies balsamea</i>	0	2
Hackberry-- <i>Celtis occidentalis</i>	0	8
Hawthorn-- <i>Crataegus</i> spp.	0	0
Hickory-- <i>Carya cordiformis</i> , <i>C. ovata</i>	0	0
Illegible or Not Recorded--equivalent unknown	0	0
Ironwood-- <i>Ostrya virginiana</i>	-1	-2
Jack Oak-- <i>Quercus ellipsoidalis</i>	0	-2
Jack Pine-- <i>Pinus banksiana</i>	0	4

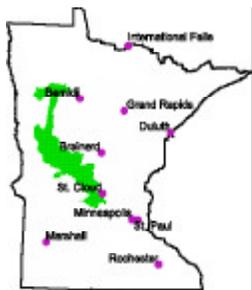


Table 2. Difference between Bearing Tree data and 1990 FIA data (rounded to the nearest percent) Continued

Name	Percent Difference	Proportional Difference
Juniper or Red Cedar-- <i>Juniperus virginiana</i>	0	15
Linden or Basswood-- <i>Tilia americana</i>	6	2
Maple-- <i>Acer rubrum</i> , <i>A. saccharum</i> , <i>A. saccharinum</i>	-2	-4
Mountain Ash-- <i>Sorbus decora</i> , <i>S. americana</i>	0	0
Oak-- <i>Quercus rubra</i> , <i>Q. macrocarpa</i> , <i>Q. ellipsoidalis</i> , <i>Q. velutina</i> , <i>Q. alba</i> , <i>Q. bicolor</i>	-16	0
Pine-- <i>Pinus strobus</i> , <i>P. resinosa</i> , <i>P. banksiana</i>	-1	0
Plum--probably <i>Prunus americana</i>	0	0
Red Elm-- <i>Ulmus rubra</i>	1	0
Red Oak -- <i>Quercus rubra</i> , <i>Q. ellipsoidalis</i> (in part or as hybrid)	7	3
Red, Norway, or Yellow Pine-- <i>Pinus resinosa</i>	0	4
Spruce-- <i>Picea mariana</i> , <i>P. glauca</i>	0	-2
Sugar Maple-- <i>Acer saccharum</i>	1	1
Tamarack-- <i>Larix laricina</i>	-5	-3
Thorn--probably <i>Crataegus</i> spp.	0	0
White Cedar-- <i>Thuja occidentalis</i>	0	0
White Pine-- <i>Pinus strobus</i>	0	-1
Willow-- <i>Salix</i> spp.	0	1
Witch Hazel-- <i>Hamamelis virginiana</i>	0	0
Yellow Birch-- <i>Betula alleghaniensis</i>	0	8

Source: Public Land Survey Bearing Tree Data, late 1800s, and 1990 US Forest Service Forest Inventory and Analysis. Summary produced by John C. Almendinger, MNDNR. 8/1997.



## Natural Resources and Ecological Conditions and Trends

### Findings

The region is mostly non-forested. Areas containing timberland have slightly increased (Recent Forest and Structure of Timberland Observations).

The area is mostly upland, with a higher density of intermittent streams versus perennial streams, and ditches (Riparian Observations).

## Recent Extent of Forestland

### Observations

This area is mostly non-forested (Tables 3 and 4).

Table 3. Area (1000 acres) of Land Use in the West Central Landscape, 1977 and 1990



Land Use	1977		1990		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Forestland	589	16.8%	613	17.5%	24	0.7%
Nonforestland	2,917	83.2%	2,891	82.5%	-26	-0.7%
Total	3,506	100.0%	3,504	100.0%	-2	0.0%

Table 4. Ratio of Forestland to Nonforestland for the West Central Landscape, 1977 and 1990



1977	1990
1/5	1/5

Source: Chung M. Chen, MNDNR, summarizing 1990 and 1977 FIA detailed database from the USFS N.C. & Landscape Regions from MFRC 9/20/00. On the average one plot represents about 1.25 thousand acres.

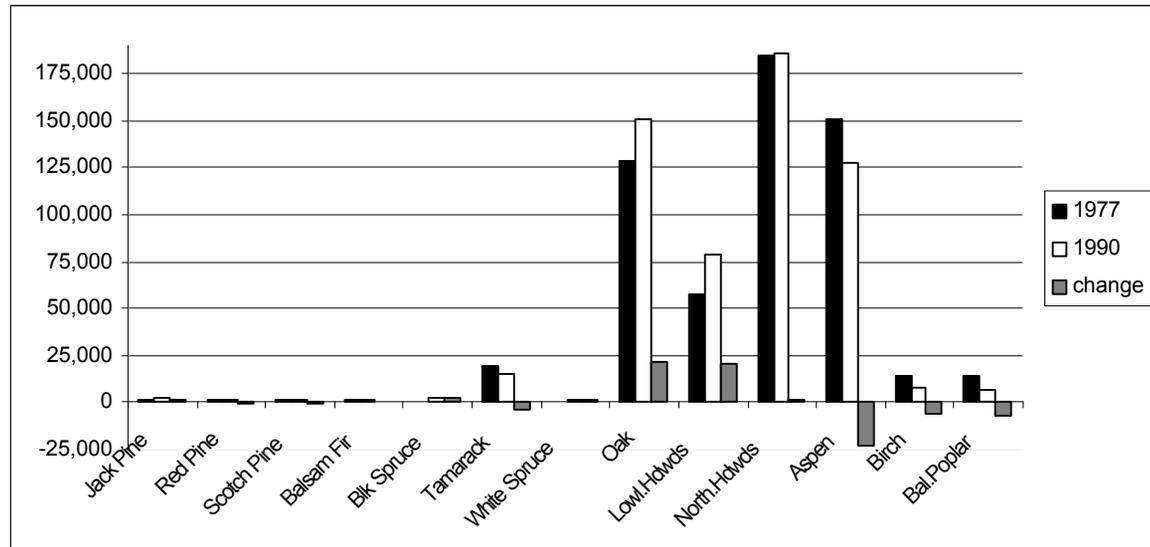
## Structure of Timberland

### Observations

Oak and Hardwoods timberland types have increased since 1977 while aspen, birch, poplar, and tamarack have gone down (Figure 3, Tables 5 and 6).

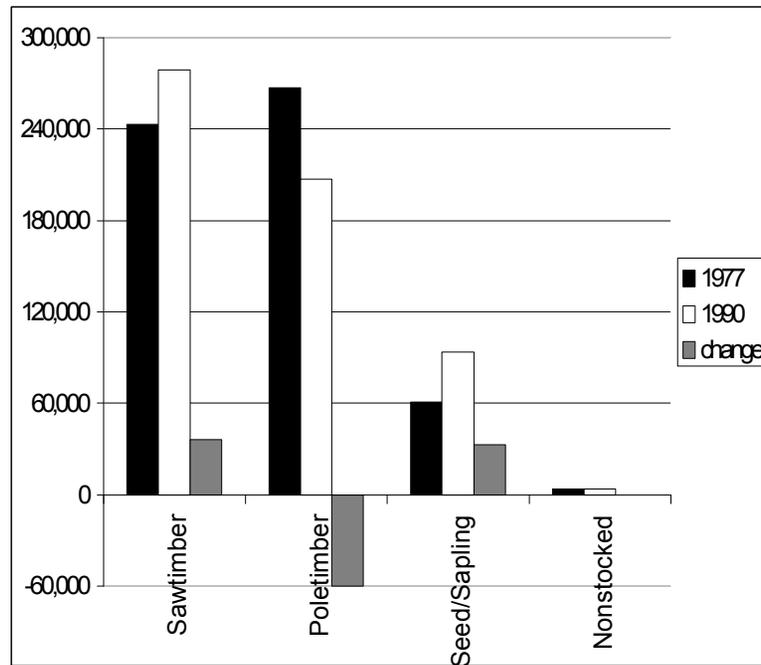
All size classes have increased since 1977 except poletimber (Figure 4).

Figure 3. Acres of timberland by forest type groups for the West Central landscape.



Source: Chung M. Chen, MNDNR, summarizing 1990 and 1977 FIA detailed database from the USFS N.C. & Landscape Regions from MFRC 9/20/00. On the average one plot represents about 1.25 thousand acres.

Figure 4. Acres of timberland by stand-size for the West Central landscape.



Source: Chung M. Chen, MNDNR, summarizing 1990 and 1977 FIA detailed data-base from the USFS N.C. & Landscape Regions from MFRC 9/20/00. On the average one plot represents about 1.25 thousand acres.



Table 5. 1977 FIA Acrea (acres) by Timberland Type & Stand Size Class for the West Central Landscape

Forest Type	Size Class				Total
	Sawtimber	Poletimber	Seed/Sapling	Nonstocked	
Red Pine	2,000	0	0	0	2,000
Scotch Pine	0	0	2,000	0	2,000
Balsam Fir	0	2,000	0	0	2,000
Blk Spruce	0	0	1,000	0	1,000
White Cedar	0	0	0	0	0
Tamarack	6,000	7,000	4,000	2,000	19,000
Oak	68,000	57,000	4,000	0	129,000
Lowl.Hdwds	19,000	34,000	4,000	0	58,000
North.Hdwds	120,000	59,000	5,000	1,000	185,000
Aspen	29,000	91,000	31,000	0	151,000
Birch	0	8,000	6,000	0	14,000
Bal.Poplar	0	9,000	3,000	2,000	14,000
Total	243,000	267,000	61,000	4,000	576,000



Source: Chung M. Chen, MNDNR, summarizing 1990 and 1977 FIA detailed database from the USFS N.C. & Landscape Regions from MFRC 9/20/00. On the average one plot represents about 1.25 thousand acres.

Table 6. 1990 FIA Acrea (acres) by Timberland Type & Stand Size Class for the West Central Landscape

Forest Type	Size Class Sawtimber	Poletimber	Seed/ Sapling	Nonstocked	Total
Red Pine	2,000	0	0	0	2,000
Scotch Pine	0	0	2,000	0	2,000
Balsam Fir	0	2,000	0	0	2,000
Blk Spruce	0	0	1,000	0	1,000
White Cedar	0	0	0	0	0
Tamarack	6,000	7,000	4,000	2,000	19,000
Oak	68,000	57,000	4,000	0	129,000
Lowl.Hdwds	19,000	34,000	4,000	0	58,000
North.Hdwds	120,000	59,000	5,000	1,000	185,000
Aspen	29,000	91,000	31,000	0	151,000
Birch	0	8,000	6,000	0	14,000
Bal.Poplar	0	9,000	3,000	2,000	14,000
<b>Total</b>	<b>243,000</b>	<b>267,000</b>	<b>61,000</b>	<b>4,000</b>	<b>576,000</b>

Source: Chung M. Chen, MNDNR, summarizing 1990 and 1977 FIA detailed database from the USFS N.C. & Landscape Regions from MFRC 9/20/00. On the average one plot represents about 1.25 thousand acres.



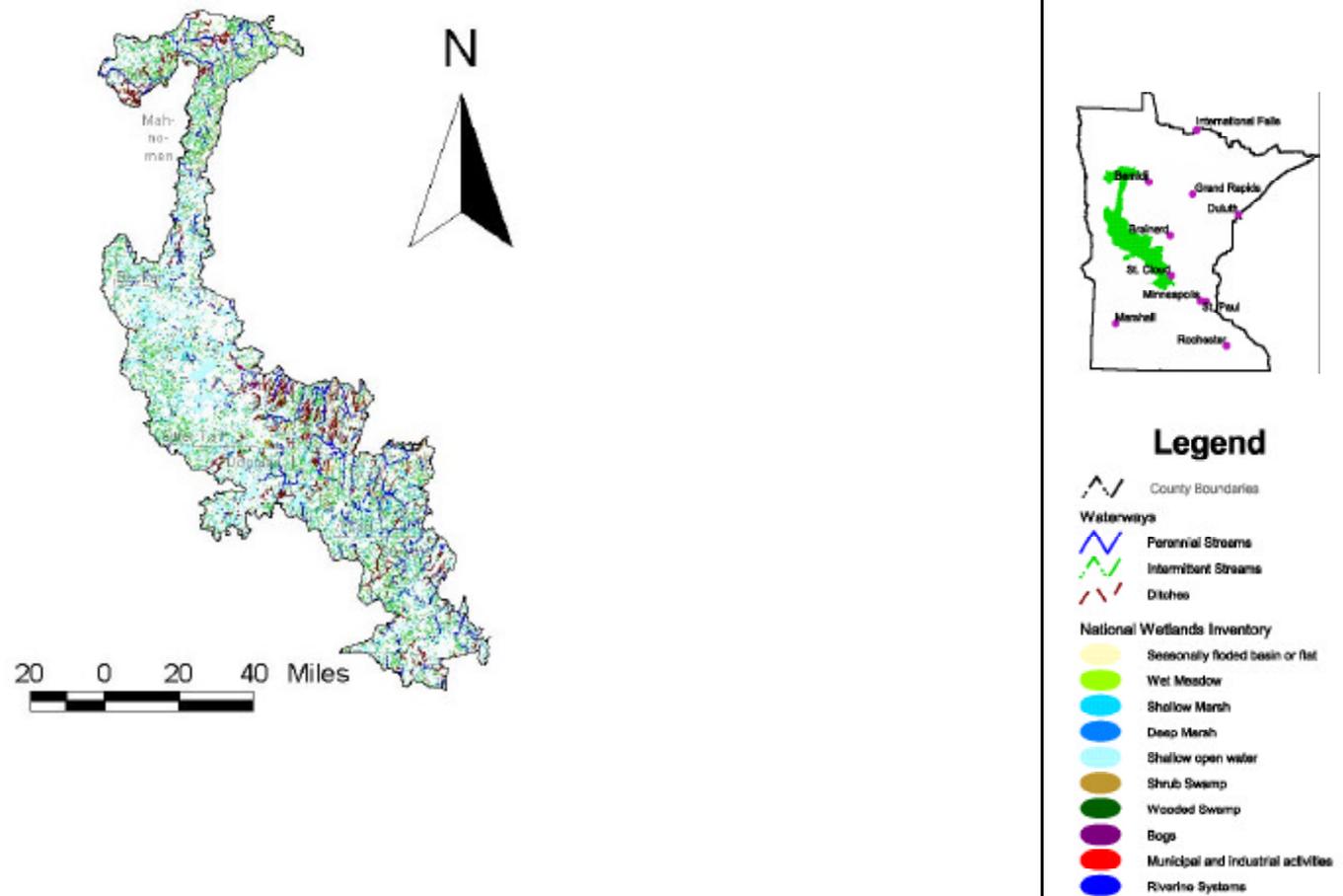
## Riparian Areas

### Observations

There is a higher density of intermittent streams than perennial streams and ditches (Figure 5, and Table 7).

A majority of the area is considered upland (Table 8).

Figure 5. Wetlands and Waterways in the West Central Landscape



Source: Aerial photography, 1979-1988, and USGS quadrangle maps.

Table 7. Density of Waterways, by Ecological Subsection, in the West Central Landscape

Perennial	Intermittent	Ditch
0.19	0.53	0.16

Table 8. Wetlands in the West Central Landscape

Wetland Type	percent
Seasonally flooded basin or flat	0.5%
Wet meadow	0.5%
Shallow marsh	8.4%
Deep marsh	0.3%
Shallow open water	8.6%
Shrub swamp	3.1%
Wooded swamps	1.3%
Bogs	0.5%
Municipal and industrial activities, water regime	0.0%
Riverine systems, system	0.4%
Uplands, system	76.4%
Area outside Minnesota, system	0.0%

Source: MNDNR GIS data derived from 1980 USGS quadrangle maps.  
 Note: Density equals miles of waterway divided by miles square of subsection.

## Vascular Plants and Wildlife Species

### Observations

Compared to other regions of the state there are few endangered and threatened vascular plants (Tables 9 and 10).

Table 9. Richness of vascular plants in Owenby and Morley (1991) by MFRC Landscape

MFRC Regional Landscapes	Number of species <sup>A</sup>	1996 State List of Endangered, Threatened, Special Concern Species <sup>B</sup>		
		Endangered	Threatened	Special Concern
Northeast	1,201	16	19	50
Northern	1,014	1	8	30
West Central	1,066	2	4	19
North Central	1,186	3	11	29
East Central	1,356	12	10	38
Southeast	1,395	21	34	51
Metro	1,088	11	6	19
Prairie	1,199	12	13	45
Statewide	1,887	55	64	125



Source:

<sup>A</sup>Owenby and Morley, 1991.

<sup>B</sup>Minnesota Department of Natural Resources, 1996

Table 10. Numbers of vascular plants in Owenby and Morley (1991) with recorded occurrence limited to a particular MFRC Landscape.

MFRC Regional Landscapes	Number of species <sup>A</sup>	1996 State List of Endangered, Threatened, Special Concern Species <sup>B</sup>		
		Endangered	Threatened	Special Concern
Northeast	82	14	12	23
Northern	3	0	1	1
West Central	6	1	0	0
North Central	7	1	3	0
East Central	14	2	2	2
Southeast	82	11	20	15
Metro	9	2	0	0
Prairie	56	8	6	15

Source:

<sup>A</sup>Owenby and Morley, 1991.

<sup>B</sup>Minnesota Department of Natural Resources, 1996.



Table 11. Richness of forest-associated mammals, amphibians and reptiles, and breeding birds in Minnesota

	All habitats Statewide	Forest associated Statewide
Mammals <sup>A</sup>	80	65
Amphibians and reptiles <sup>A</sup>	49	43
Breeding birds <sup>B</sup>	245	151



Source:

<sup>A</sup>Owenby and Morley, 1991.

<sup>B</sup>Minnesota Department of Natural Resources, 1996

Table 12. Status of Minnesota's forest-associated endangered, threatened, and special concern vertebrate wildlife, 1984.

Endangered	Threatened	Special concern	
Mammals —	Mammals 1. Gray wolf	Mammals 1. Least shrew 2. Mountain lion 3. Wolverine 4. Marten 5. Rock vole 6. Woodland vole 7. Northern myotis 8. Heather vole 9. Eastern pipistrelle 10. Caribou 11. Eastern spotted skunk 12. Northern bog lemming	Amphibians and Reptiles 1. Northern cricket frog 2. Snapping turtle 3. Racer 4. Timber rattle snake 5. Rat snake 6. Fox snake 7. Western hognose snake 8. Eastern hognose snake 9. Milk snake 10. Massasauga 11. Bullfrog 12. Fickereel frog
Birds —	Birds 1. Bald eagle 2. Loggerhead shrike	Birds 1. Red-shouldered hawk 2. Osprey 3. Louisiana waterthrush	
Amphibians and reptiles 1. Five-lined skink	Amphibians and reptiles 1. Wood turtle 2. Blanding's turtle		

Source: MNDNR



Table 13. Status of Minnesota's forest-associated endangered, threatened, and special concern vertebrate wildlife, 1996.

Endangered	Threatened	Special concern	
Mammals —	Mammals 1. Eastern spotted skunk	Mammals 1. Gray wolf 2. Least shrew 3. Mountain lion 4. Woodland vole 5. Least weasel 6. Northern myotis 7. Heather vole 8. Eastern pipistrelle 9. Smokey shrew 10. Northern bog lemming	Birds 1. Red-shouldered hawk 2. Cerulean warbler 3. Acadian flycatcher 4. Bald eagle 5. Louisiana waterthrush 6. Hooded warbler
Birds —	Birds 1. Loggerhead shrike		
Amphibians and reptiles 1. Northern cricket frog 2. Massasauga	Amphibians and reptiles 1. Wood turtle 2. Timber rattle snake 3. Blanding's turtle		Amphibians and Reptiles 1. Smooth softshell 2. Snapping turtle 3. Racer 4. Rat snake 5. Five-lined skink 6. Western hognose snake 7. Four-toed salamander



Source: MNDNR

## Social and Economic Conditions and Trends

### Findings

We see a drastic change in population composition in Minnesota and the region for the years to come. The number of young people (up to 24 years old) is expected to decrease by 10.2% in Minnesota and by 14.9 percent in the west central region. Middle-aged people, representing the productive work force (ages 25-64) will increase in the population by 15.5% for the state, and increase roughly 10 percent in this region. Of most consequence, the state and region will see dramatic increases (79.7% and 55.9% respectively) in the population of senior citizens (over the age of 65). This can be largely attributed to increases in life expectancy rates, but other explanations are possible. An attractive retirement environment and the maturing of the "baby-boom" generation are other possible reasons. This is a very important observation, as a drastic shift in population composition can significantly affect the needs (such as health care), values, and recreational activities of the community. Rapid expansion of the services sector of the economy is one likely result (see Demographics Observations).

Timber harvesting and the relative price of wood has increased greatly since the mid-1980's. An increase in wood harvesting is a good indication of an overall growth in the forest and timber products sector. Several explanations exist for the significant increases in stumpage price that have occurred during the past decade. First and most important, is the observation that harvesting has

increased significantly since 1980. Greater demand on a limited resource will always cause the price to rise. Inflation also causes price level rise, but this explains only a limited amount of the observed growth. Steady advancement in conservation management, environmental concern, and social responsibility may also contribute to price upsurge as the supply of timber has been tightened by inclinations to protect privately owned and public land. However, this theory is largely speculative (see Economic Production Observations).

Remarkable growth in the tourism industry has occurred in Minnesota since the late 1980's. Figure 18 illustrates this tremendous increase in which annual gross receipts grew from about 4 billion in 1988 to nearly 8 billion by 1995. (see Tourism Observations).

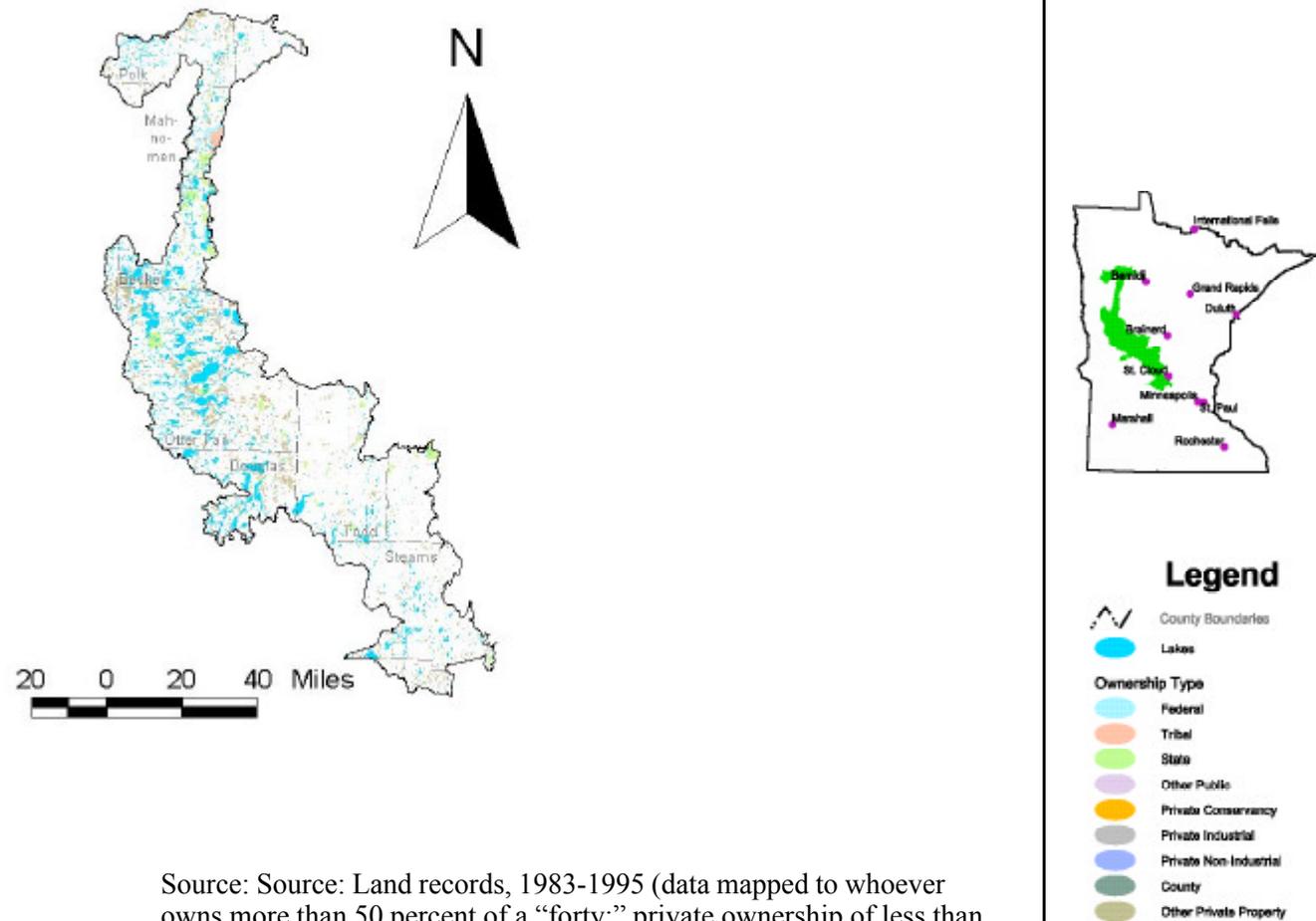
## Land Use and Ownership

### Observations

Almost all of the land is privately owned (Figure 6, and Tables 14, 15, and 16).

About  $\frac{1}{4}$  of the land is forested, more than half is agriculture/hay/pasture/grassland, and one eighth water/bog/marsh/fen (Figure 8 and Table 17).

Figure 6. Ownership in the West Central Landscape



Source: Source: Land records, 1983-1995 (data mapped to whoever owns more than 50 percent of a “forty;” private ownership of less than 1000 acres not mapped).

Table 14. Area of land by GAP ownership groups for the West Central Landscape

County	0	0.00%
Federal	29,476	0.84%
Other private property	198,500	5.68%
Other Public	0	0.00%
Private Conservancy	82	0.00%
Private Industrial, more than 1000 acres owned within affected county	14,560	0.42%
Private Non-Industrial Business or Trust, more than 1000 acres owned within affected county	2,088	0.06%
State, including tax-forfeited lands under county stewardship	96,520	2.76%
Tribal	12,284	0.35%
Total classified	(353,510)	(10.11%)
Unknown (not classified)	3,155,700	90.24%
Total land	3,496,926	100.00%



Source: Land records, 1983-1995 (data mapped to whoever owns more than 50 percent of a “forty”).

Table 15. Area of Ownership Classes for the West Central Landscape, 1977 and 1990

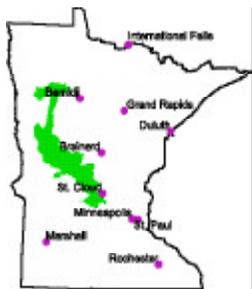
Ownership Class	1977		1990		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Bureau of Land Mgmt	0	0.0%	0	0.0%	0	0.0%
County & Municipal	21	0.6%	27	0.8%	6	0.2%
Indian Lands	11	0.3%	12	0.3%	1	0.0%
Misc Federal	6	0.2%	19	0.5%	13	0.4%
National Forest	0	0.0%	0	0.0%	0	0.0%
Private	622	17.7%	617	17.6%	-5	-0.1%
State	27	0.8%	25	0.7%	-2	-0.1%
Unknown	2,818	80.4%	2,803	80.0%	-15	-0.4%
<b>Total</b>	<b>3,505</b>	<b>100.0%</b>	<b>3,503</b>	<b>100.0%</b>	<b>-2</b>	<b>0.0%</b>



Source: Chung M. Chen, MNDNR, summarizing 1990 and 1977 FIA detailed database from the USFS N.C. & Landscape Regions from MFRC 9/20/00. On the average one plot represents about 1.25 thousand acres.

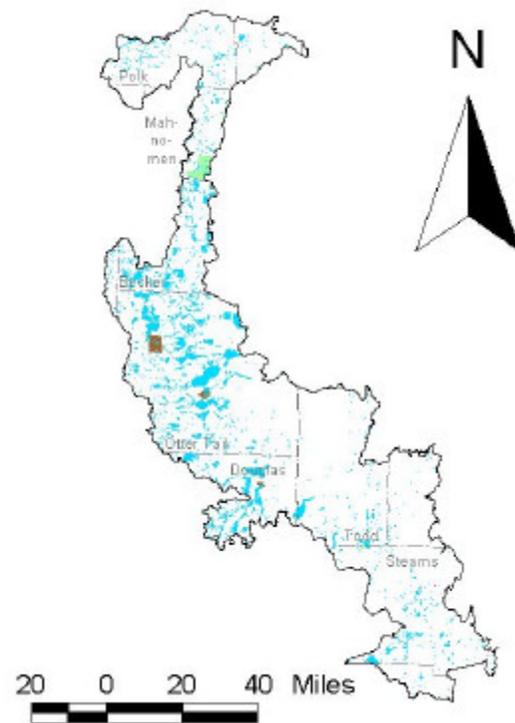
Table 16. Area of Ownership by Public and Private for the West Central Landscape, 1977 and 1990

Ownership	1977		1990		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Public	65	1.9%	83	2.4%	18	0.5%
Private	3,440	98.1%	3,420	97.6%	-20	-0.5%
<b>Total</b>	<b>3,505</b>	<b>100.0%</b>	<b>3,503</b>	<b>100.0%</b>	<b>-4</b>	<b>0.0%</b>



Source: Chung M. Chen, MNDNR, summarizing 1990 and 1977 FIA detailed database from the USFS N.C. & Landscape Regions from MFRC 9/20/00. On the average one plot represents about 1.25 thousand acres.

Figure 7. Reserved Lands and Forests in the West Central Landscape

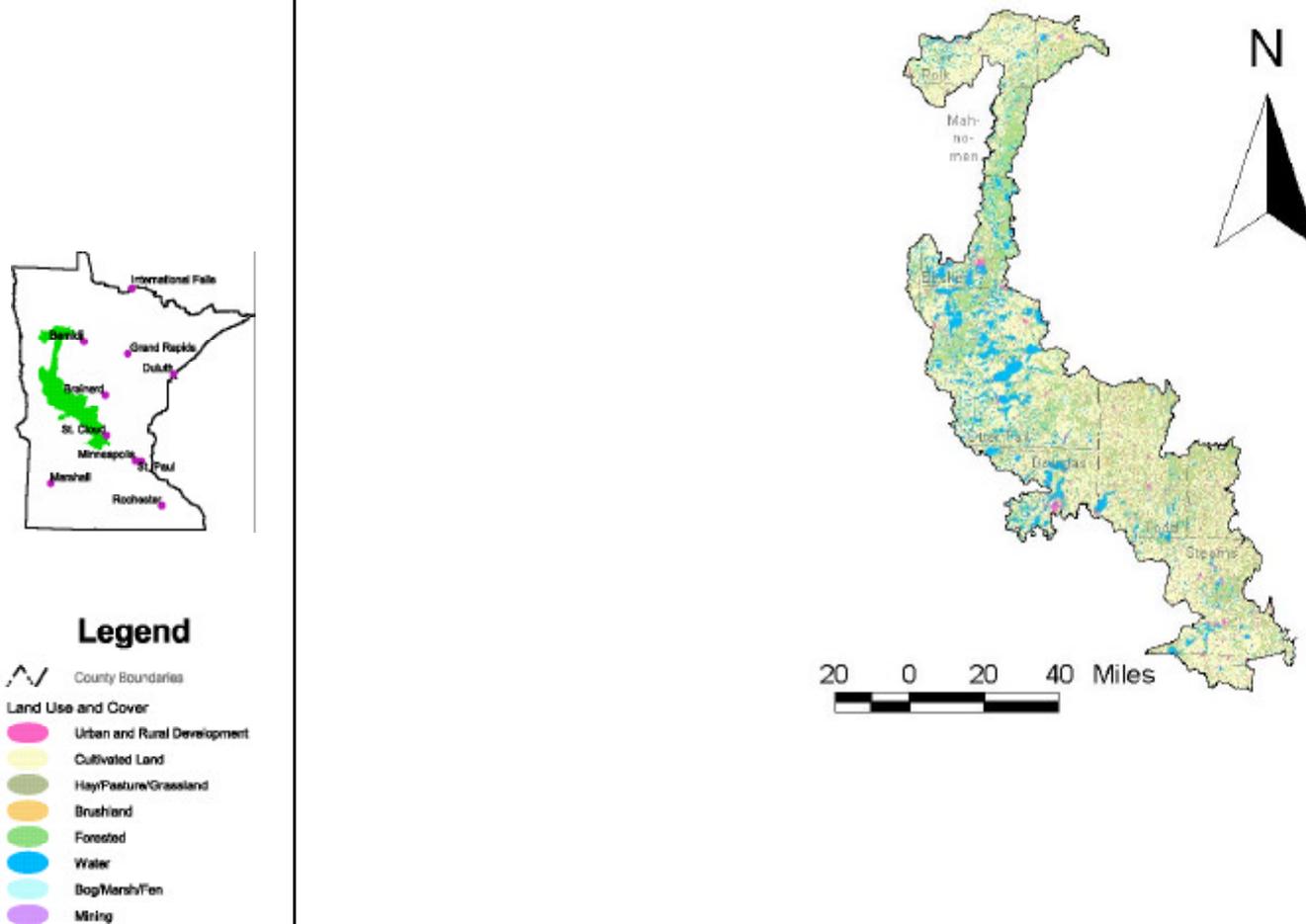


**Legend**

- County Boundaries
- Lakes
- Scientific and Natural Areas
- State Parks
- State Forests
- National Forests

Source: DNR

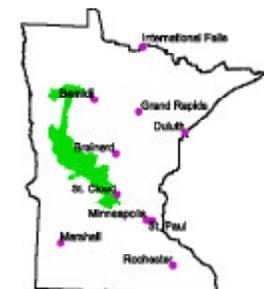
Figure 8. Land Use from Remotely Sensed data for the West Central Landscape



Source: Classified Satellite and aerial photographs from the 1990's.

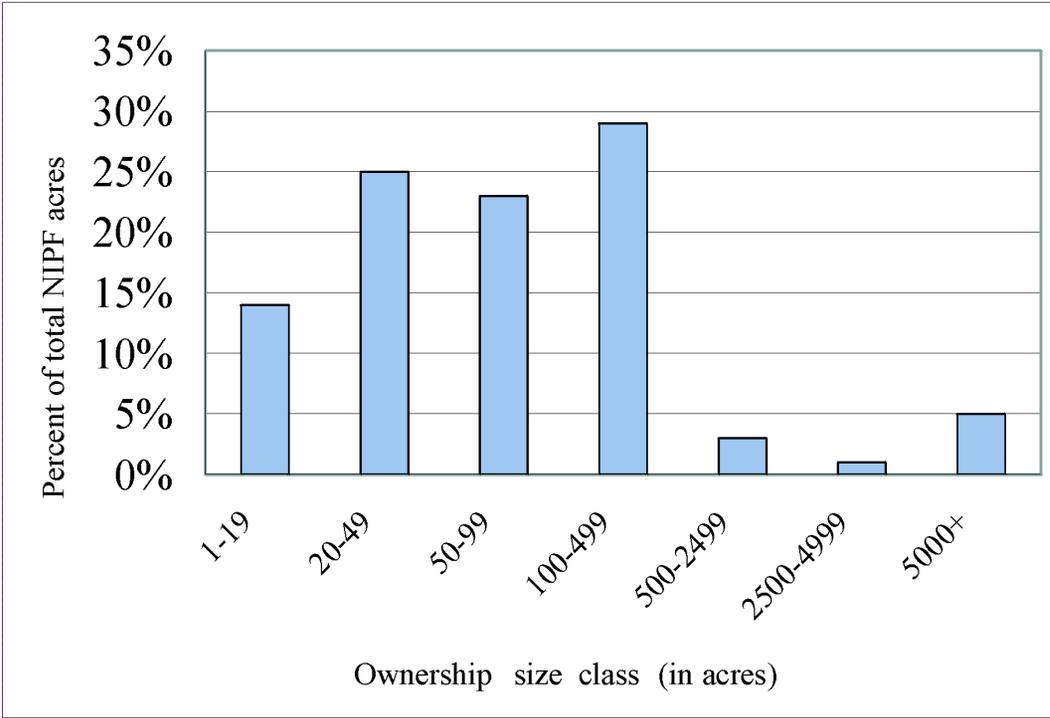
Table 17. Area of land use classes for the West Central Landscape.

LULC	Acres	Percent
Urban-Rural Dev.	84,940	2.43%
Cultivated Land	1,556,272	44.50%
Hay/Pasture/Grassland	548,458	15.68%
Brushland	96,900	2.77%
Forested	745,230	21.31%
Water	316,891	9.06%
Bog/Marsh/Fen	144,598	4.13%
Mining	3,672	0.10%
<b>Total</b>	<b>3,496,961</b>	<b>100.00%</b>



Source: Classified Satellite and aerial photographs from the 1990's.

Figure 9. Distribution of nonindustrial private forestland (NIPF) acres statewide by ownership class size, 1990



Demographics

Observations

About 330,000 people live in the West Central Landscape Region (Table 18).

Personal income is significantly lower than the state average throughout the region (Table 22).

The region is moderately populated, with a population density just over half of the state average (Table 18).

Kandiyohi has the highest per capita income and Wadena has the lowest (Table 22).

Stearns County is the most densely populated and has the greatest population, while Pope County is the least dense with the least population (Tables 18 and 19).

The populations of Stearns and Douglas are increasing the most in this region (Tables 18, and 19).

The populations of Pope, Todd, Wadena, and Meeker are projected to decline (Table 19).

The distribution and composition of the population is changing significantly, but minimal net growth is occurring (Table 20). Specifically there is a projected decrease of individuals ages 0-24, and increase of individuals ages greater than 65.

The counties in the west central region have higher levels of poverty in relation to the 8.7% state average (Table 21).

Todd County has the leading poverty rate in the region at 15.1% (Table 21).

Table 18. Population of Minnesota and Counties in the West Central Landscape

	1970	1980	1990	80-'90 % Change	1998	90-'98 % Change	1998 Pop. Density
Minnesota	3,806,103	4,075,970	4,375,099	7.34	4,782,745	9.32	60.07
West Central Region	258,975	296,134	305,048	3.01	329,988	8.18	43.93
Douglas	22,910	27,839	28,674	3	31,481	9.79	49.63
Kandiyohi	30,548	36,763	38,761	5.43	41,782	7.79	52.48
Meeker	18,387	20,594	20,846	1.22	21,911	5.11	36
Otter Tail	46,097	51,937	50,714	-2.35	54,404	7.28	27.48
Pope	11,107	11,657	10,745	-7.82	10,979	2.18	16.38
Stearns	95,400	108,161	118,791	9.83	131,981	11.1	98.16
Todd	22,114	24,991	23,363	-6.51	23,994	2.7	25.47
Wadena	12,412	14,192	13,154	-7.31	13,456	2.3	25.13



Source: Minnesota State Demographic Center and U.S. Census Bureau

Table 19. Population Projections for Minnesota and counties in the West Central Landscape

	1995	2025	1995-2025 % Change
Minnesota	4,626,514	5,282,840	14.19
West Central Region	320,644	343,820	7.23
Douglas	30,424	33,790	11.06
Kandiyohi	41,167	45,860	11.4
Meeker	21,352	20,950	-1.88
Otter Tail	52,847	53,430	1.1
Pope	10,906	9,580	-12.16
Stearns	126,912	144,980	14.24
Todd	23,742	22,500	-5.23
Wadena	13,294	12,730	-4.24

Source: Minnesota State Demographic Center



Table 20. Population projection by age group for Minnesota and the West Central Landscape

Age Group	Minnesota			West Central Region		
	1995	2025	1995-2025 %Change	1995	2025	1995-2025 %Change
0-24	1,678,036	1,506,309	-10.2	123,823	105,360	-14.9
25-64	2,369,249	2,735,390	15.5	147,954	162,360	9.7
65+	579,229	1,041,060	79.7	48,867	76,160	55.9
<b>Total</b>	<b>4,626,514</b>	<b>5,282,840</b>	<b>14.2</b>	<b>320,644</b>	<b>343,880</b>	<b>7.2</b>



Source: Minnesota State Demographic Center

Table 21. Persons with incomes below poverty level in the West Central Landscape

	<b>% Population Below Poverty Level in 1995</b>
Minnesota	8.7
Douglas	9.3
Kandiyohi	11.6
Meeker	8.6
Otter Tail	11.3
Pope	10.8
Stearns	9
Todd	15.1
Wadena	16



Source: U.S. Census Bureau

Table 22. Per capita personal income for Minnesota and the West Central Landscape and counties

	1990	1997	% Growth '90-'97
Minnesota	19,348	26,243	35.60%
Douglas	14,640	20,369	39.10%
Kandiyohi	15,996	21,709	35.70%
Meeker	15,496	19,251	24.20%
Otter Tail	14,800	19,119	29.20%
Pope	13,696	18,326	33.80%
Stearns	14,977	19,806	32.20%
Todd	12,356	15,241	23.30%
Wadena	12,173	17,307	42.20%



Source: Minnesota State Demographic Center

## Employment

### Observations

Manufacturing, Trade (retail and wholesale), Services and Government are the leading industries in Minnesota (Table 27).

The services industry has experienced the highest growth rate over the past several decades and this trend is expected to continue (Figures 10, 11, 12, and 13).

The farming sector of Minnesota's economy is currently shrinking and should continue to contract (Figures 10, 11, 12, and 13).

The services, manufacturing, government and trade sectors are the dominant industries in the region (Table 23, and 25).

The trades and services sector generally pays low wages (Table 24).

There are about 168,000 people in the regional labor force (Table 26).

West Central region unemployment is about the same as the state and lower than the national averages at 3% of the labor force (Table 26).

Wadena has a very high rate of unemployment (Table 26).

Workers in Stearns generally earn the highest weekly wages in the region, while Pope County has low wages (Tables 24, and 25).

The timber industry accounts for 2.5% of statewide personal income (Table 27).

Table 23. 1998 Distribution of Employees by Industry for the West Central Landscape

	Average Monthly Employment per Industry								
	All Industries	Agric., Forestry and Fishing	Mining	Construction	Manufacturing	Trans., Comm., and Utilities	Trade (All Forms)	Services	Government
West Central Region	148,509	714	107	6,143	27,339	6,240	42,125	33,428	24,604
Douglas	14,698	Na	Na	863	2,665	711	4,445	2,975	2,473
Kandiyohi	20,861	Na	Na	1,007	3,515	610	5,293	4,820	4,118
Meeker	6,358	Na	Na	309	1,590	289	1,556	968	1,247
Otter Tail	20,777	Na	Na	911	3,467	1,280	5,508	4,909	3,540
Pope	3,574	Na	Na	115	535	133	1,019	774	746
Stearns	70,526	645	107	2,656	12,707	2,787	22,112	16,732	9,803
Todd	5,938	Na	Na	150	1,834	180	1,146	872	1,342
Wadena	5,777	69	0	132	1,026	250	1,046	1,378	1,335



Source: Minnesota Department of Economic Security

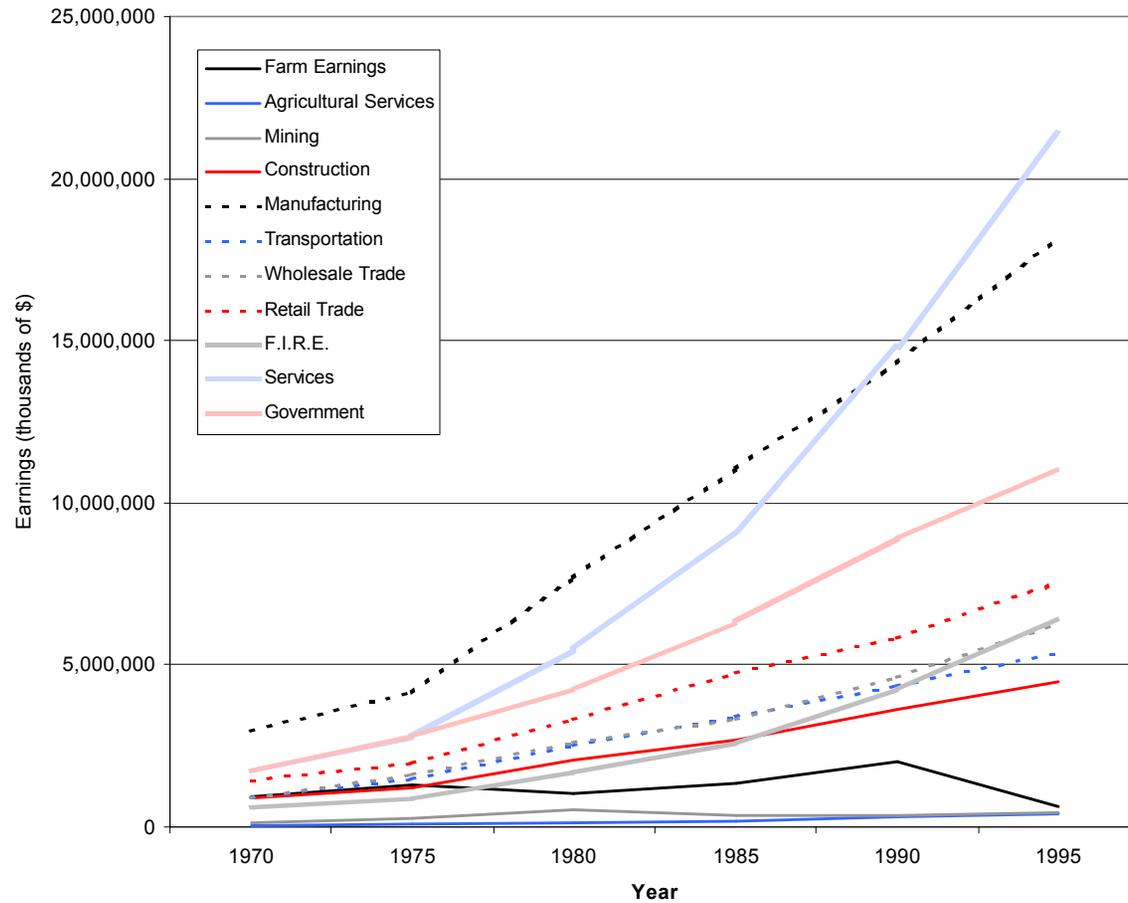
Table 24. 1998 Distribution of Weekly Wages by Industry for the West Central Landscape

	Average Weekly Wages per Industry (given in dollars)								
	All Industries	Agric., Forestry and Fishing	Mining	Construction	Manufacturing	Trans., Comm., and Utilities	Trade (All Forms)	Services	Government
Douglas	428	Na	Na	668	587	561	271	349	506
Kandiyohi	449	Na	Na	651	502	486	320	391	580
Meeker	419	Na	Na	644	526	412	314	310	453
Otter Tail	401	Na	Na	501	482	646	256	334	513
Pope	392	Na	Na	464	526	325	350	269	479
Stearns	512	430	654	637	580	553	426	473	625
Todd	420	Na	Na	515	552	435	233	341	448
Wadena	394	302	Na	447	460	469	323	363	427

Source: Minnesota Department of Economic Security



Figure 10. Earnings by major industry for Minnesota, 1970-1995

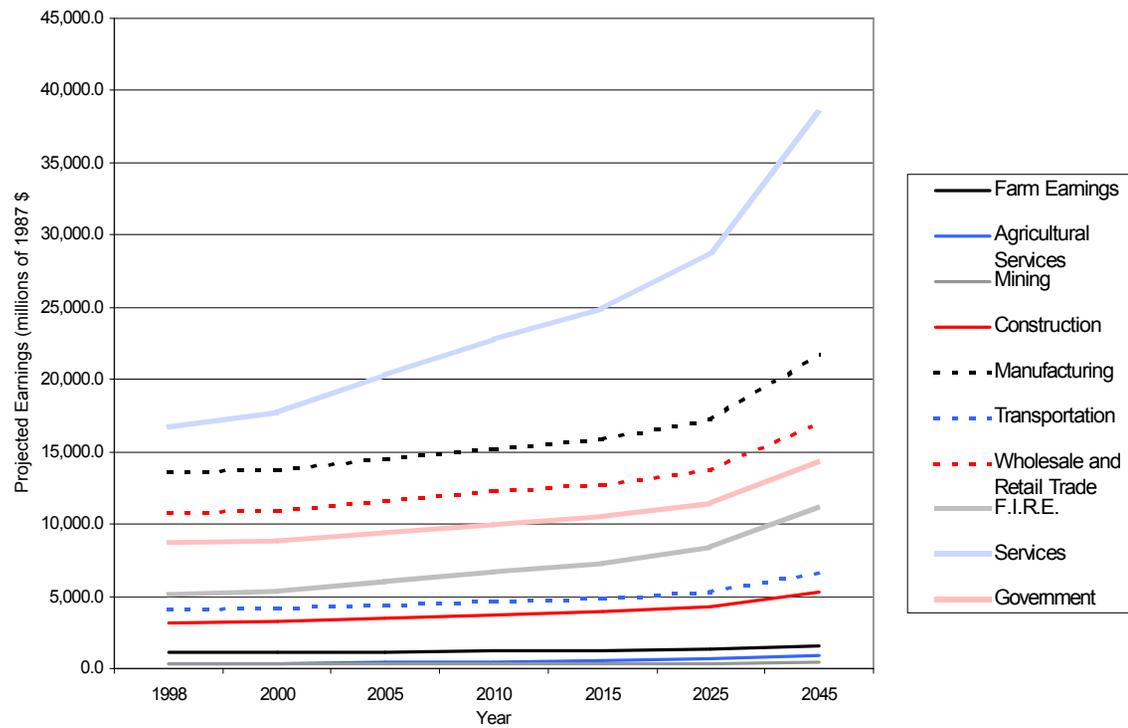


Source: Regional Economic Information System, Table CA05, Bureau of Economic Analysis

Note: As growth is shown monetarily rather than proportionally, these differences in growth are misleading. However, this diagram is useful in illustrating that farm earnings have decreased significantly since 1990.



Figure 11. Projected earnings by major industry for Minnesota, 1998-2045

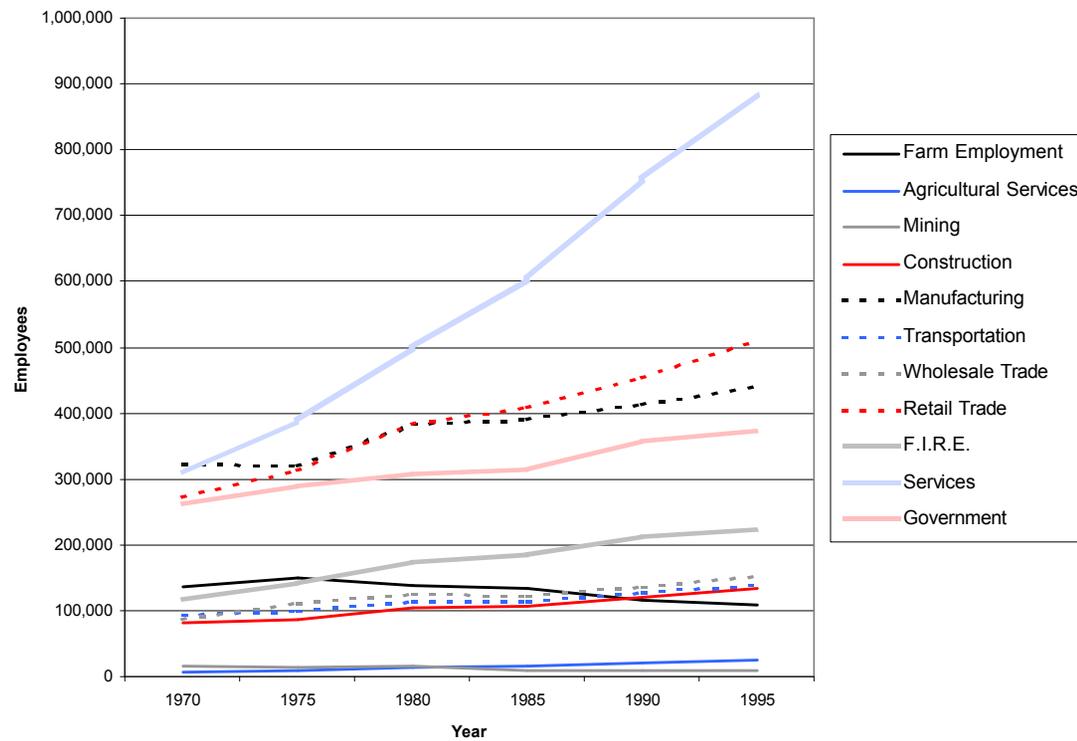


Source: Regional Economic Information System, Bureau of Economic Analysis

Note: It is difficult to distinguish real earnings growth from inflationary growth in this figure



Figure 12. Number of employees by major industry for Minnesota, 1970-1995

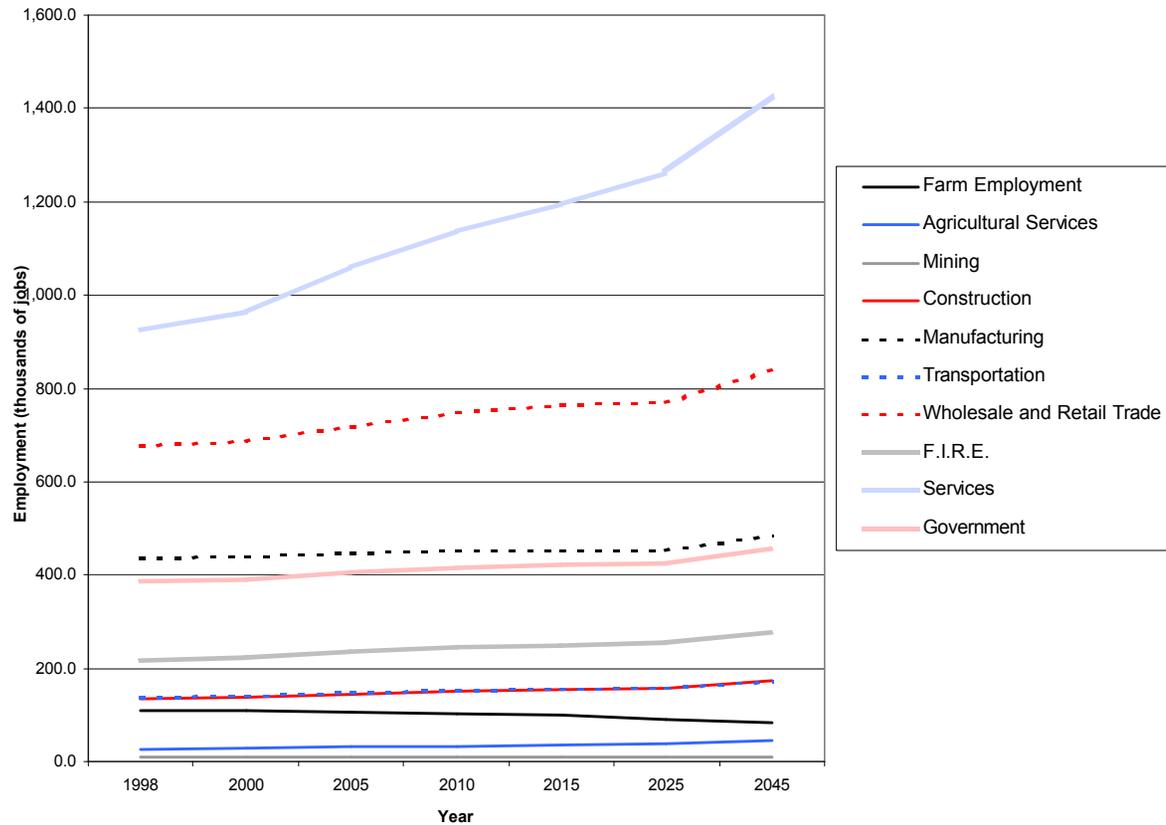


Source: Regional Economic Information System, Table CA25, Bureau of Economic Analysis

Note: As expected, Employment by industry closely mirrors Earnings by industry over the same time period.



Figure 13. Projected employment by major industry for Minnesota, 1998-2045



Source: Regional Economic Information System, Bureau of Economic Analysis

Note: Greater efficiency and tightened competition are possible explanations for relative farming declines in earnings and employment. It should be recognized that land use industries, such as mining, agriculture and farming, have intrinsic growth limitations due to land and resource availability and ownership.



Table 25. Total Wages by Industry for the West Central Landscape in 1998

	Total Annual Wages per Industry (given in Thousands of Dollars).								
	All Industries	Agric., Forestry and Fishing	Mining	Construction	Manufacturing	Trans, Comm., and Utilities	Trade (All Forms)	Services	Government
West Central Region	3,583,548	15,493	3638	195,959	778,282	177,940	795,892	716,483	711,385
Douglas	327,265	na	na	29,985	81,290	20,746	62,603	54,029	65,054
Kandiyohi	487,066	na	na	34,101	91,682	15,402	87,955	98,015	124,236
Meeker	138,678	na	na	10,342	43,464	6,199	25,457	15,625	29,367
Otter Tail	433,024	na	na	23,739	86,873	43,011	73,335	85,227	94,520
Pope	72,830	na	na	2,777	14,641	2,249	18,553	10,841	18,575
Stearns	1,876,789	14,411	3,638	87,931	383,212	80,162	490,354	411,259	318,712
Todd	129,608	na	na	4,014	52,601	4,074	13,858	15,477	31,281
Wadena	118,288	1,082	0	3,070	24,519	6,097	23,777	26,010	29,640



Source: Minnesota Department of Economic Security

Table 26. Unemployed for Minnesota and counties in the West Central Landscape 1999

	Labor Force	Employment	Unemployment	Unemployment Rate
US	139,368,000	133,488,000	5,880,000	4.20%
Minnesota	2,698,511	2,623,058	75,453	2.80%
West Central Region	168,824	163,740	5,084	3.00%
Douglas	16,148	15,639	509	3.20%
Kandiyohi	21,393	20,838	555	2.60%
Meeker	8,998	8,599	399	4.40%
Otter Tail	26,134	25,073	1,061	4.10%
Pope	5,356	5,224	132	2.50%
Stearns	75,245	73,534	1,711	2.30%
Todd	8,927	8,541	386	4.30%
Wadena	6,623	6,292	331	5.00%

Source: Minnesota Department of Economic Security

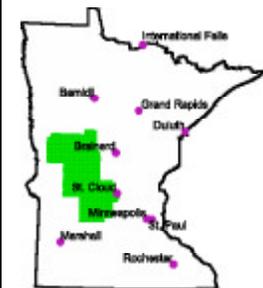
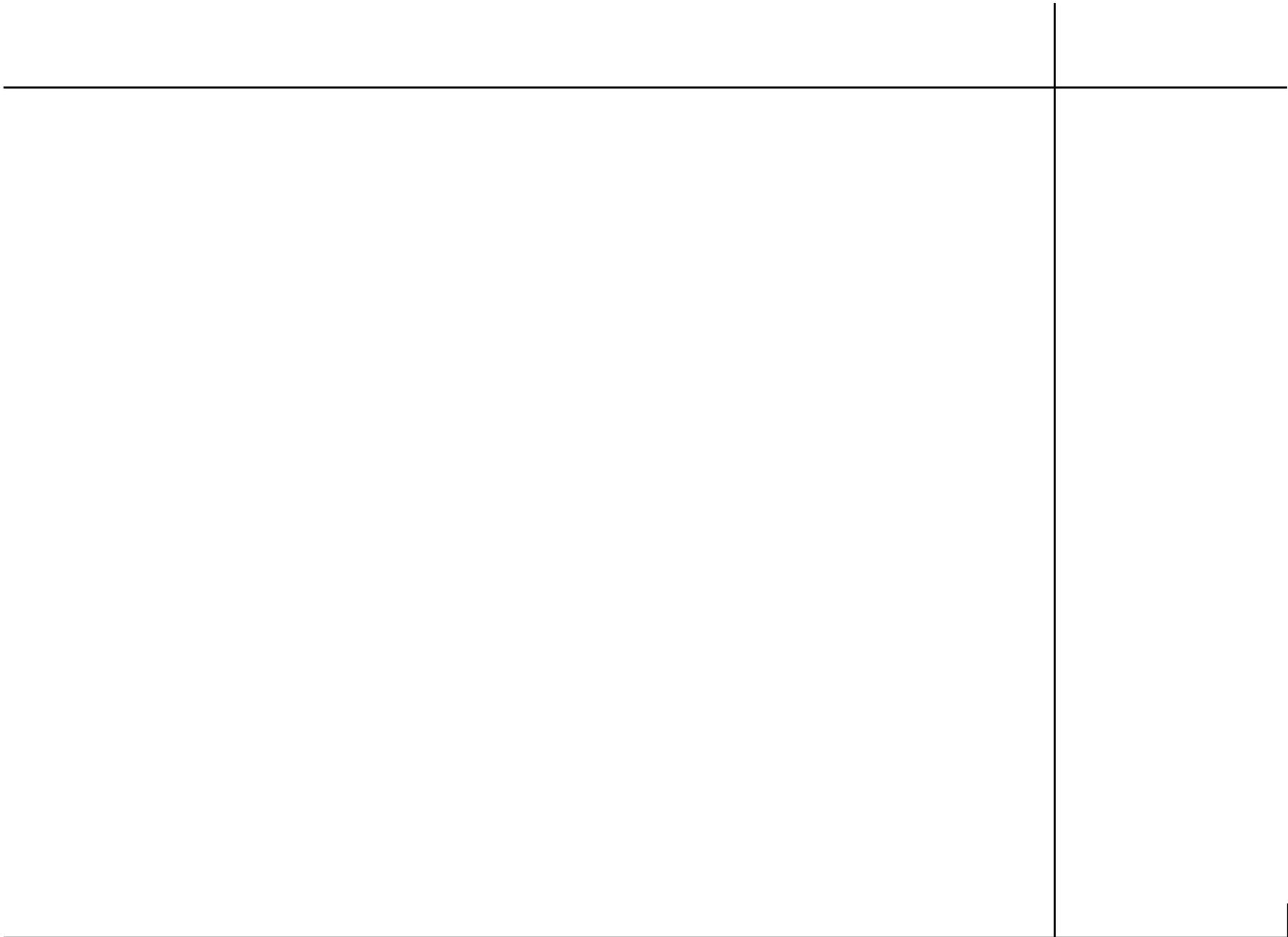


Table 27. Statewide summary of percent of total income by source

Source	Percent of Total Income
Farming and ag. services	1.7
Mining	0.4
Timber-related	2.5
Construction	4
Manufacturing (non-wood)	12.6
Transportation & public utilities	4.5
Wholesale trade	5.6
Retail trade	6.3
Finance, insurance, and real estate	5.8
Services	18.1
Government	9.2
Non-labor income <sup>a</sup>	30
<b>Total</b>	<b>100.7</b>

<sup>a</sup>This "non-labor income" includes dividends, interest and rent from investments, Social Security, pension from home equity gains, and other payments.  
 Source: U.S. Bureau of Economic Analysis, 1998





## Economic Production

### Observations

Overall, the range of property tax rates is very widespread and inconsistent in the region with Pope and Wadena being low, and Stearns high (Table 28).

The region pays low income taxes compared to the state average (Table 30).

1999 Property taxes reached nearly \$223,000,000 in the region (Table 28).

The volume of annual timber harvesting has increased greatly over the past twenty years (Figure 24).

The price of wood has risen dramatically throughout the past decade (Tables 30 and 31, and Figures 25 and 26).

The prices received for Aspen, Balsam and Balm wood have risen faster than other species (Tables 30 and 31).

The volume of annual timber harvesting has increased greatly over the past twenty years (Figure 15).

The price of wood has risen dramatically throughout the past decade (Tables 32 and 33, and Figures 16 and 17).

The prices received for Aspen, Balsam and Balm wood have risen faster than other species (Tables 32 and 33).

Table 28. 1999 Property Tax Information by County in the West Central Landscape

	<b>Net Property Tax Payable by County</b>	<b>Average Tax Rate (% of Market Value)</b>	<b>Net Tax Credit by County</b>
Minnesota	4,604,137,455	0.093	325,585,713
West Central Region	223,386,647	Na	17,230,821
Douglas	23,981,714	0.015	2,010,880
Kandiyohi	31,988,144	0.048	2,269,778
Meeker	13,974,930	0.049	1,177,871
Otter Tail	37,170,861	0.034	2,841,410
Pope	8,037,243	0.044	512,991
Stearns	88,885,744	0.098	7,048,598
Todd	12,149,081	0.043	877,335
Wadena	7,198,930	0.036	491,958

Source: Minnesota Department of Revenue



Table 29. 1995 Property tax refunds per capita, by County in the West Central Landscape

	Per Capita Property Tax Refunds
Minnesota	\$37
Douglas	\$30-\$55
Kandiyohi	\$30-\$55
Meeker	\$20-\$30
Otter Tail	\$20-\$30
Pope	\$30-\$55
Stearns	\$20-\$30
Todd	\$20-\$30
Wadena	\$30-\$55



Source: Department of Revenue

\*Counties are given a range rather than an accurate value for per capita, property tax refunds

Table 30. 1994 Individual Income Tax Payments per Capita, by County in the West Central Landscape

	<b>Per Capita Income Tax</b>
Minnesota	\$737
Douglas	\$255-\$500
Kandiyohi	\$500-\$700
Meeker	\$255-\$500
Otter Tail	\$255-\$500
Pope	\$255-\$500
Stearns	\$500-\$700
Todd	\$255-\$500
Wadena	\$255-\$500

Source: Department of Revenue

\*Counties are given a range rather than an accurate value for per capita, property tax refunds



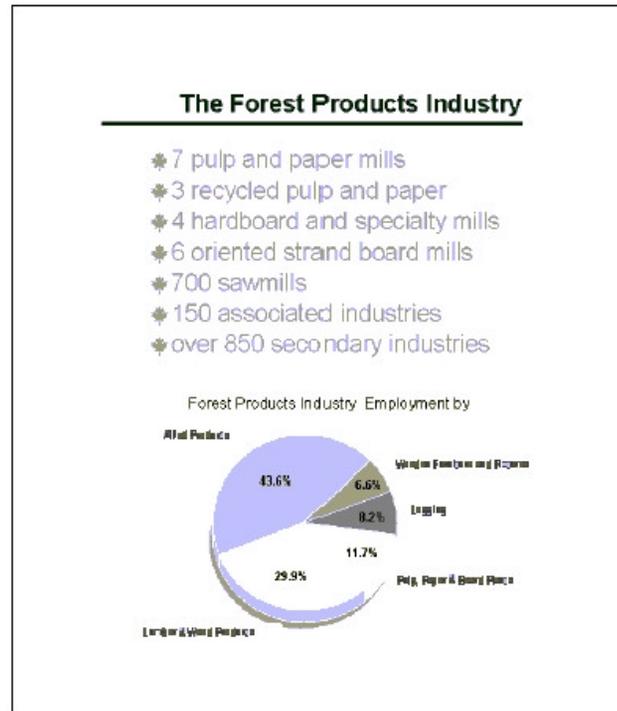
Table 31. Sawmills, Paper Mills, ect. per County in the West Central Landscape

	<b>Number of Timber Mills</b>
West Central Region	18
Douglas	1
Kandiyohi	1
Meeker	0
Otter Tail	5
Pope	0
Stearns	4
Todd	3
Wadena	4



Source: United States Forestry Service (North Central Research Station)

Figure 14. The Minnesota Forest Products Industry



Source: Minnesota Forest Industries.

Note: The forest and timber products industry accounts for 2.5% of statewide personal income and is thus a major component of Minnesota’s economy. Figure 3.1 summarizes the major businesses involved in this industry. Also included below is a pie chart, illustrating the proportion of total labor supplied by each division of the forestry products sector. Allied products (secondary businesses associated with the timber industry) supply the greatest amount of employment in forestry products with 43.6% of net employment. Lumber and wood products account for nearly 30% of employment. Logging, pulp and paper mills, and wooden furniture and fixtures comprise the remaining forest products and timber related jobs in Minnesota.



Figure 15. Trends in hardwood and soft wood harvesting statewide, 1980-1997

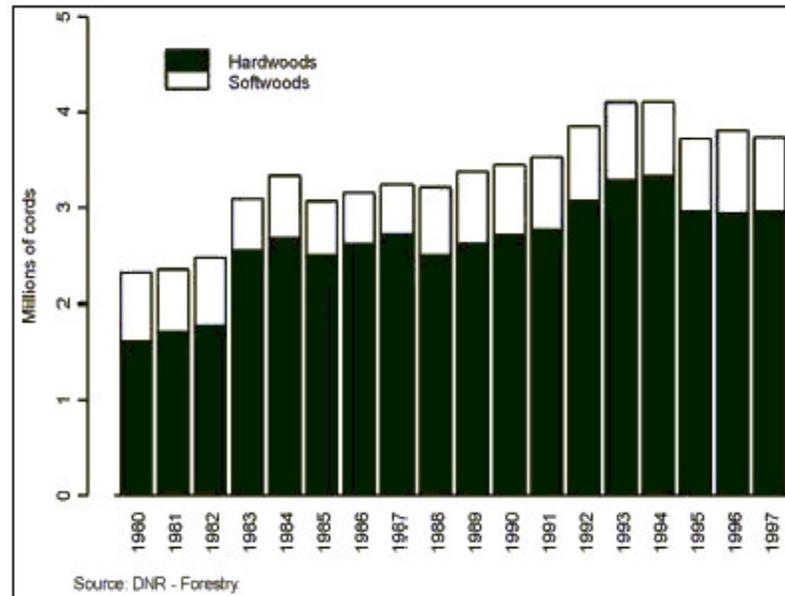


Table 32. Average Prices Received for Sawtimber (\$'s per MBF) sold by Public Land Agencies in Minnesota: 1990 and 1998

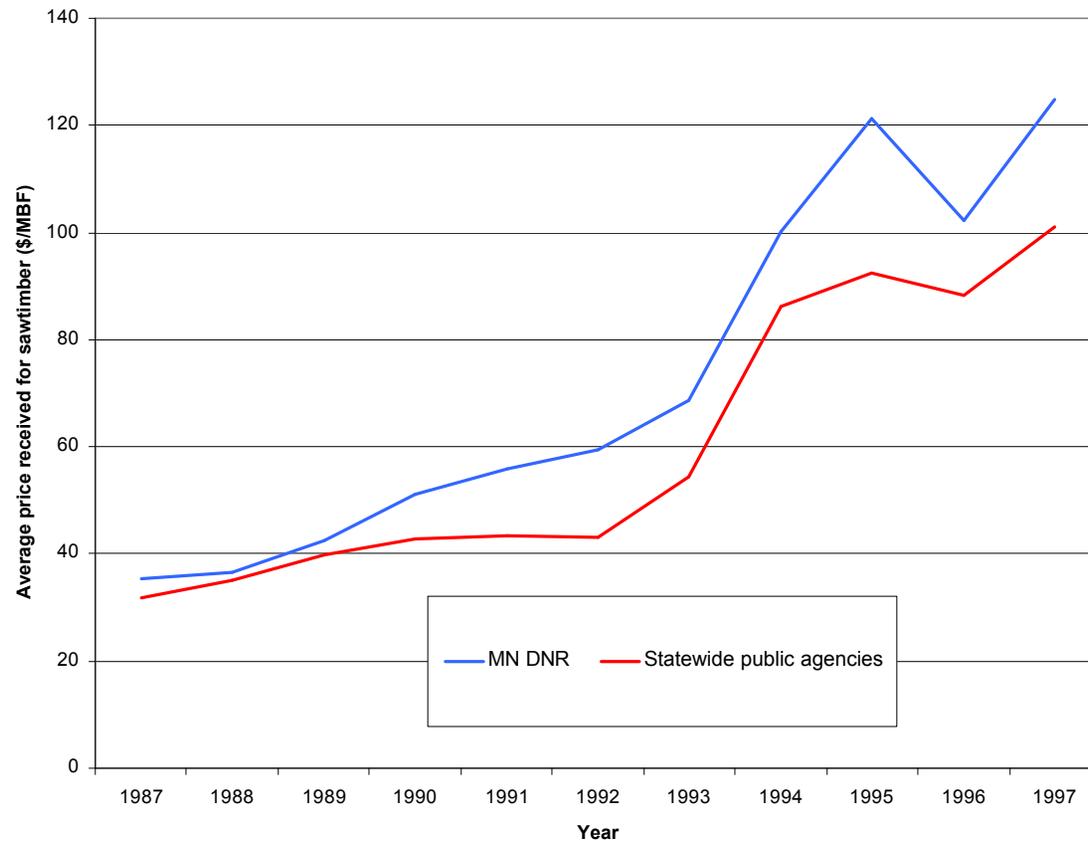
Species	1990	1998	% Increase in Price
Aspen	\$ 23.34	\$ 100.54	331%
Birch	\$ 20.87	\$ 39.78	91%
Ash	\$ 49.44	\$ 97.09	96%
Elm	\$ 38.77	\$ 53.31	38%
Oak	\$ 73.40	\$ 140.20	91%
Balsam	\$ 20.54	\$ 88.30	330%
W. Spruce	\$ 54.34	\$ 78.34	44%
Cedar	\$ 29.63	\$ 38.64	30%
J. Pine	\$ 62.83	\$ 121.84	94%
R & W. Pine	\$ 93.55	\$ 161.01	72%

Source: Department of Natural Resources (Forestry Division).

Note: This data is somewhat misleading, as it fails to account for changes in inflation. With an estimate of 3.5% annual inflation over this time period, the price level would be expected to increase by approximately 32%.



Figure 16. Average stumpage prices received by public agencies for sawtimber, 1987-1997



Source: DNR – Forestry

Note: Although this is statewide stumpage data, these findings apply directly to the northern region because only trivial price differences would be seen across the state.



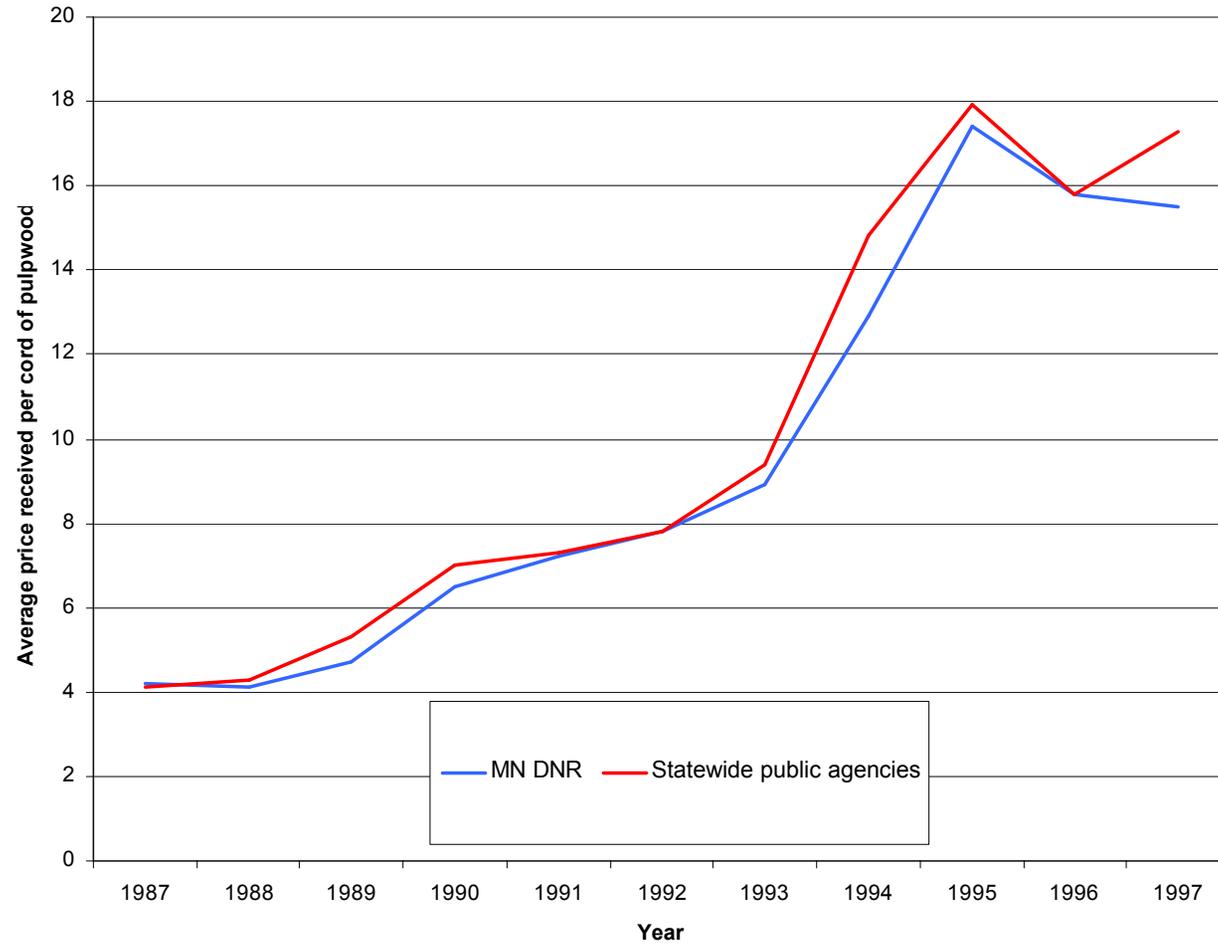
Table 33. Average Prices Received for Pulpwood (\$'s per Cord) sold by Public Land Agencies in Minnesota: 1990 and 1998

Species	1990	1998	% Increase in Price
Aspen	\$ 6.09	\$ 20.54	237%
Balm	\$ 3.35	\$ 16.95	406%
Birch	\$ 3.69	\$ 7.53	104%
Ash	\$ 3.82	\$ 5.51	44%
Oak	\$ 4.89	\$ 8.98	84%
Balsam	\$ 6.49	\$ 14.12	118%
W. Spruce	\$ 12.42	\$ 19.18	54%
B. Spruce	\$ 11.88	\$ 21.16	78%
Tamarack	\$ 4.61	\$ 7.29	58%
Cedar	\$ 9.76	\$ 7.31	-25%
J. Pine	\$ 11.34	\$ 24.72	118%
R & W. Pine	\$ 13.04	\$ 15.63	20%

Source: Department of Natural Resources (Forestry Division)



Figure 17. Average stumpage prices received by public agencies for pulpwood, 1987-1997



Source: DNR - Forestry

Observations

Tourism in Minnesota has grown substantially during the past decade (Figure 18).

Tourism in the region is largely based upon camping, fishing and hunting (Table 34).

Stearns, Otter Tail, and Douglas have the greatest amount of hunting in the region (Table 34).

There is a large amount of major roads systems in this region (Figure 19).

Statewide roads and trails have been increasing for at least the last 10 years (Figures 20 and 21).

Table 34. Distribution of Hunting Licenses by Type for the Counties in the West Central Landscape

	Small Game		Deer Firearms		Deer Archery		Individual Sports	Waterfowl	Goose
	Resident	Nonresiden †	Resident	Nonresiden †	Resident	Nonresident	Resident	Stamp	Permit
Minnesota	120,419	7,158	379,974	8,882	64,141	1,037	101,060	126,822	38,800
West Central Region	10,533	454	46,943	402	9,029	57	12,517	17,987	8,087
Douglas	1,349	90	6,042	49	1,152	5	2,002	2,884	1,428
Kandiyohi	1,607	56	4,492	39	808	11	1,665	2,665	1,284
Meeker	697	12	2,224	6	394	1	645	1,040	508
Otter Tail	1,466	120	6,585	97	995	5	2,036	3,279	1,479
Pope	289	15	1,513	12	281	0	591	669	377
Stearns	3,512	66	15,990	65	3,763	27	3,708	5,411	2,124
Todd	714	40	4,682	67	814	4	1,056	1,094	436
Wadena	899	55	5,415	67	822	4	814	945	451



Source: Department of Natural Resources

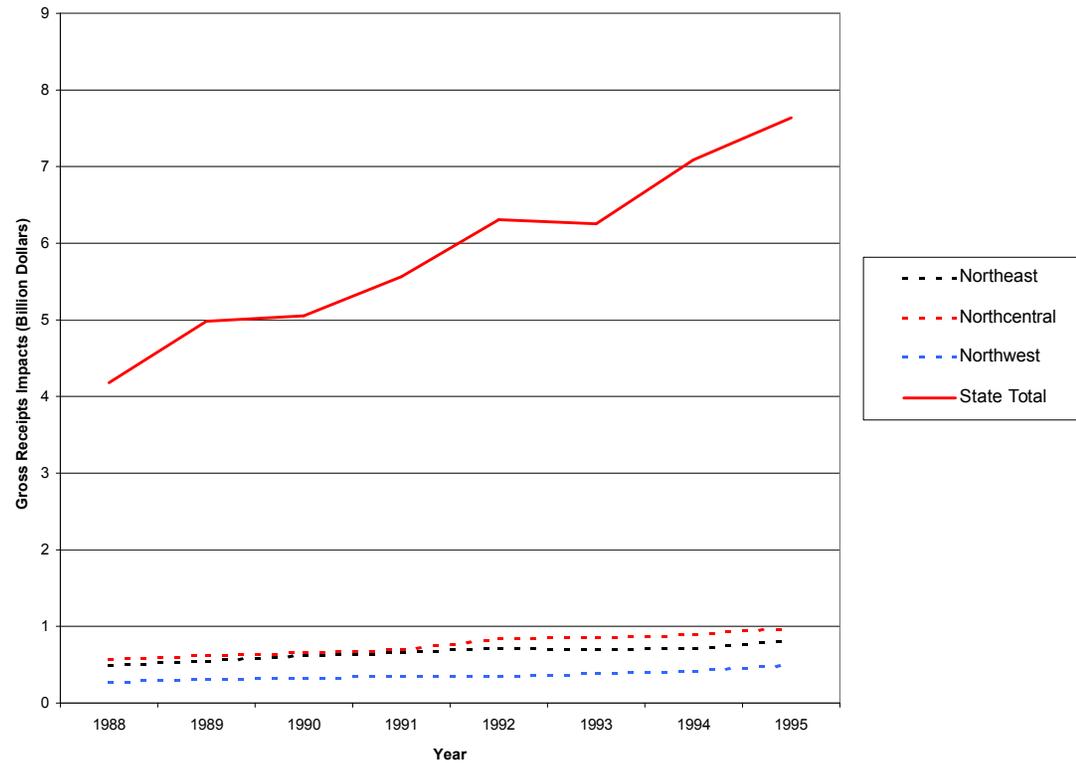
Table 35. 1996 Total Sales from Hotels, Motels, Resorts and Other Lodging Places per County in the West Central Landscape(In Thousands of Dollars)

	1996 Sales for All Lodging Places	% Change From 1995 to 1996
Minnesota	1,142,036	14.00%
West Central Region	68,300	NA
Douglas	20,801	22.30%
Kandiyohi	9,131	16.10%
Meeker	586	1.70%
Otter Tail	9,201	4.70%
Pope	1,999	42.50%
Stearns	24,108	28.90%
Todd	842	6.20%
Wadena	1,632	90.20%



Source: Minnesota Department of Trade & Economic Development  
 \* This data can be used as a proxy for relative tourism levels.

Figure 18. Economic impact of domestic travel, 1988-1995



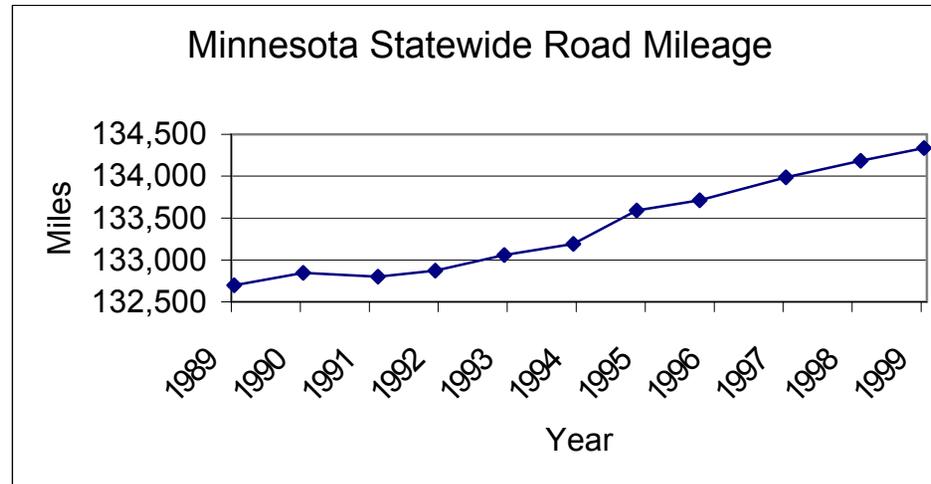
Source: MN Department of Trade and Economic Development, MN Office of Tourism

Notes: The MN Office of Tourism regions include the following counties:  
 Northeast: Aitkin, Carlton, Cook, Isanti, Itasca, Kanabec, Koochiching, Lake, Pine, and St. Louis.  
 Northcentral: Beltrami, Benton, Cass, Crow Wing, Hubbard, Lake of the Woods, Mille Lacs, Morrison, Roseau, Sherburne, Stearns, and Todd.  
 Northwest: Becker, Clay, Clearwater, Douglas, Grant, Kittson, Mahanomen, Marshall, Norman, Otter Tail, Pennington, Polk, Pope, Red Lake, Stevens, Wadena, and Wilkin





Figure 20. Road mileage statewide in Minnesota, 1989-1999

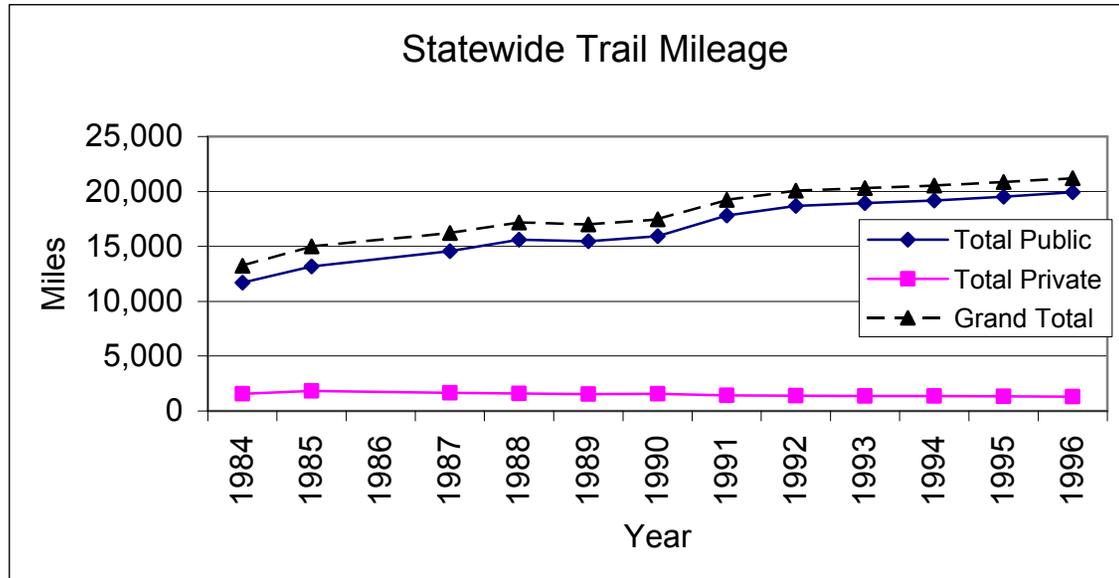


Source: Minnesota Department of Transportation.

Note:

The following route systems are included in the mileage total: interstate trunk, U.S. trunk, Minnesota trunk, county state aid, municipal state aid, county, township, unorganized township, municipal streets, national forest development, Indian reservation, state forest, state park, military, national wildlife refuge, state game preserve, and airport roads.

Figure 21. Trail mileage statewide in Minnesota, 1984-1996



Source: Minnesota Department of Natural Resources Division of Trails and Waterways.



## Appendix A. Metadata: General information about data in the current conditions and trends assessment for the Southeast landscape.<sup>A</sup>

Data	Date(s)	Source	Size of Data Area	Spatial Resolution	Summary	Pros (+) / Cons (-)
<b>Advanced Very High Radiometer Resolution AVHRR<sup>B</sup></b>	1990 to 1996 biweek	Satellite images	Earth	250 acres	AVHRR Satellites initially used for weather purposes, but found to useful in regional/global vegetation analysis.	+ High temporal resolution - Poor spatial resolution
<b>Breeding Birds</b>	1999	J.C. Green	Minnesota, and North central Minnesota	none	Listing of birds in the state and northeast.	+ Complete species list for the state and North central MN - No abundance list
<b>Cooperative Stand Assessment CSA<sup>B</sup></b>	1998	Aerial photos and ground surveys	Minnesota, Stand Level, Public Forest Lands	1 to 3 acres	Public agencies responsible for forest management use this data as their main inventory source.	+ Detailed forest stand information - Only land managed by public agencies for forest management represented
<b>Demographic</b>	1990 1995	U.S. Census Bureau	U.S., states, counties, cities, census tracts, and block groups	none	Survey of all individuals. Demographic data on population, income, housing, and employment by geographic region (place of residence).	+ Complete universe of individuals + Fine level of geographic detail - Updated only every 10 years
<b>Forest Inventory And Analysis FIA<sup>B,C</sup></b> See Appendix B for more information.	1977 1990	Aerial photos and ground surveys	Minnesota, Plot Level	1225 acres represented per plot	A federally funded inventory of the state's forest resources: their type, extent, growth, mortality, and removals.	+ Detailed forest stand information + Represents public and private lands - Poor spatial resolution
<b>GAP Stewardship<sup>B</sup></b>	1995	Land records	Minnesota	40 acres	Provides ownership and administration information for each PLS quarter-quarter section.	+ Provides ownership information for the entire state - Source data is mostly from 1983B85 - Poor spatial resolution

<sup>A</sup>Libraries and numerous Internet sites contain additional information on the above data sources.

<sup>B</sup>Detailed metadata can be found at the Interagency Information Cooperative's web site, [www.iic.state.mn.us](http://www.iic.state.mn.us).

<sup>C</sup>The following Internet site contains information on the FIA program: [srsfia.usfs.msstate.edu/tables.htm](http://srsfia.usfs.msstate.edu/tables.htm).

**Appendix A. Metadata: General information about data in the current conditions and trends assessment for the Southeast landscape.<sup>A</sup>**

<b>Data</b>	<b>Date(s)</b>	<b>Source</b>	<b>Size of Data Area</b>	<b>Spatial Resolution</b>	<b>Summary</b>	<b>Pros (+) / Cons (-)</b>
<b>LandUse<sup>B</sup></b>	1969	air photos	Minnesota	40 acres	Shows land use in Minnesota broken into several different categories.	+ Historical representation - Poor spatial resolution
<b>LandUse/Cover<sup>B</sup></b>	1990	Aerial photos and satellite images	Minnesota	1/4 acre	Shows land use in Minnesota broken into several different categories.	+ High spatial resolution - Different classifications used than in the 1969 land use data
<b>Mammals, Amphibians, Reptiles</b>	1995	J.R. Tester and J.C. Green	Minnesota, and North central Minnesota	none	Listing of mammals, amphibians, and reptiles in the state and North central.	+ Complete species list for the state and North central MN - No abundance data
<b>Marschner Presettlement Vegetation<sup>B</sup></b>	1930	1847-1908 Public Land Survey (PLS)	Minnesota	100's acres	Maps out basic boundaries of forest stands using data from the PLS.	+ Historical representation + Good generalization - Very poor spatial resolution - General cover type classes
<b>Minnesota Legislative reports (state lands)</b>	1951 to 1970	DNR reports	Minnesota	none	Gives information on statutory acreages in different state land areas (parks and forests).	+ Good historical information - Is based on statutory boundaries
<b>MN DNR Trails</b>	1984 to 1996	DNR reports	Minnesota	none	Yearly summaries from 1984 to 1996 on the trail mileages in MN, including both private and public trails.	+ High temporal resolution + Distinctive trail classes - Only DNR trail mileages frequently updated - Overlap in trail mileage counts for multi-use trails
<b>National Resources Inventory<sup>B</sup></b>	1982 1987 1992	Aerial photos and ground surveys	U.S. nonfederal lands	1875 acres represented per plot	A statistically based sample of land use and natural resources conditions and trends on U.S. non-federal land.	+ Includes private land - Does not include federal lands - Main focus is on agricultural land

<sup>A</sup>Libraries and numerous Internet sites contain additional information on the above data sources.

<sup>B</sup>Detailed metadata can be found at the Interagency Information Cooperative's web site, [www.iic.state.mn.us](http://www.iic.state.mn.us).

<sup>C</sup>The following Internet site contains information on the FIA program: [srsfia.usfs.msstate.edu/tables.htm](http://srsfia.usfs.msstate.edu/tables.htm).

**Appendix A. Metadata: General information about data in the current conditions and trends assessment for the Southeast landscape.<sup>A</sup>**

<b>Data</b>	<b>Date(s)</b>	<b>Source</b>	<b>Size of Data Area</b>	<b>Spatial Resolution</b>	<b>Summary</b>	<b>Pros (+) / Cons (-)</b>
<b>Public Land Survey Bearing Tree Data<sup>B</sup></b>	1847 through 1908	Ground surveys	Minnesota	quarter section	A field survey conducted in the late 1800's and early 1900's to ascertain and dispose of lands in the Western Territory.	+ Represents Minnesota before major European settlement and harvesting - Survey was completed over a long period of time
<b>Silvicultural Practices</b>	1996	MFRC	Minnesota	none	Type and event of silviculture and harvesting practices in the state.	+ Shows trends for 1991-96 - No spatial breakdown - Does not account for practices on non-industrial private forest (NIPF) lands
<b>Vascular Plants</b>	1991	Herbarium collections	Minnesota FRC Landscapes	none	Original locations of specimens in the U of MN herbarium	+ Complete species list for the state and the FRC landscapes. - Not a systematic inventory
<b>Employment and Earnings</b>	1969 to 1996	Bureau of Economic Analysis	States and counties	none	Employment and income estimates for over 3,100 U.S. counties, 330 metropolitan areas, and 172 BEA economic areas; gross state product estimates for 1977-94 and regional projections to 2045.	+ Detailed employment and earnings data for major industrial sectors at the county, state, and national level - Since only social security data are used, individual businesses opting out of the social security system are not included. - Data disclosure laws prevent data from being released that would make it possible to identify a specific business within a geographic area.

<sup>A</sup>Libraries and numerous Internet sites contain additional information on the above data sources.

<sup>B</sup>Detailed metadata can be found at the Interagency Information Cooperative's web site, [www.iic.state.mn.us](http://www.iic.state.mn.us).

<sup>C</sup>The following Internet site contains information on the FIA program: [srsfia.usfs.msstate.edu/tables.htm](http://srsfia.usfs.msstate.edu/tables.htm).

## Appendix B. Summary of FIA Sampling and Estimation Procedures.

Chapter 2 from “The Eastwide Forest Inventory Data Base: Users Manual” (<http://www.srsfia.usfs.msstate.edu/ewman.htm>)

Users of the Eastwide Data Base need a basic understanding of FIA sampling and estimation procedures to understand the type of data available. Here, we present a general discussion of these procedures. Specific sampling methods differ among regions and even among States within a region. Publications cited in this manual give more detailed information about methods used by each region. If you need more information about sampling procedures for a specific State, contact the FIA project responsible for that State’s inventory.

Each State inventory begins with the interpretation of an aerial-photo sample that classifies the land by various photo classes. The total area of a sample comes from outside sources (usually Bureau of Census reports). The photo classes used are based on land use (pasture, cropland, urban, etc.). For forested land, more detailed classes are sometimes defined based on criteria such as forest type, volume per acre, stand size, stand density, ownership, and stand age. Then, ground plots are measured to adjust the aerial photo sample for changes since the date of photography and misclassification and to obtain estimates that cannot be

made from the aerial photography. The photo classification of these ground plots, together with the area estimates from the photo sample, is used to assign area expansion factors to all ground plots. These area expansion factors are used to expand values observed on the plot from a per acre basis to a population basis. An area expansion factor is basically the area (in acres) that the plot represents for estimation purposes. The sampling area, or level at which expansion factors are assigned, is different from State to State, as is the scheme used to assign photo-interpretation classes. For the details of how these expansion factors were assigned to the ground plots for a particular State, contact the appropriate FIA project.

FIA plots are designed to cover a 1-acre sample area; however, not all trees on the acre are measured. Various arrangements of fixed radius and variable radius (prism) sample points are used to select sample trees to be measured. Ground plots may be new plots that have never been measured, or remeasurement plots that were measured in the previous inventory. For all plots, several observations are recorded for each sample tree, including its diameter breast height (d.b.h.), species, and other measurements that enable us to predict the tree’s volume, growth rate, and quality. These tree measurements form the basis of the data on the tree records in the EWDB.

Some of the data items in the EWDB come directly from field measurements; others are computed

Current Conditions and Trends Assessment

## Appendix B. Summary of FIA Sampling and Estimation Procedures.

Each FIA project uses some type of volume equation to compute this volume based on d.b.h. and other tree and stand attributes. Although equations differ from State to State, they were all designed to compute the same volume.

One important computed item is the tree expansion factor VOLFAC. This item expresses the number of trees per acre that each sampled tree represents in the current inventory. It is the inverse of the size of the plot the tree was sampled on. For example, if the plot design samples trees under 5 inches d.b.h. on a single one-one hundredth-acre fixed radius plot, this item would have the value 100 trees per acre for a tree less than 5 inches d.b.h. If trees 5 inches d.b.h. and larger are sampled with ten 37.5 BAF (English) prism points, as is common with FIA plots, the expansion factor would depend on the d.b.h. of the tree. Under such a sample, a 14.0-inch tree would have an expansion factor of 3.51 trees per acre, again the inverse of the plot size<sup>1</sup>.

<sup>1</sup> The plot size of a 14.0-inch tree on a single 37.5 BAF (English) prism plot would be:  $(14.02 \times \pi) / (37.5 \times 22 \times 122) = 0.0285$  acres. The plot size of this tree on a 10-point cluster would be 10 times this or 0.285 acres, producing an expansion factor of 3.51.

Two other computed expansion factors are in

the data base: MORTFAC and REMVFAC. They are used to compute mortality and removals. The mortality factor (MORTFAC) expresses an estimate of how many trees per acre of annual mortality are represented by a given sample tree. This factor is the number of trees per acre of annual mortality that the sample tree represents. In sample designs that have remeasurement plots, this value is zero for a tree that did not die over the remeasurement period. For trees that did die, MORTFAC is a function of the tree expansion factor and the remeasurement period. Some State inventories also estimate mortality from new ground plots. In these cases, mortality is estimated from either a mortality prediction equation that predicts the probability that a tree will die over some time period, or from a field estimate of mortality based on the measurement of dead trees and an estimate of when they died.

The removals factor (REMFAC) is computed and used like MORTFAC. REMFAC is the number of trees per acre of annual removals that the sample tree represents. It is computed based on observations of trees cut on either new or re-measured plots, depending on the inventory design. None of the Eastern FIA projects use removals prediction equations to estimate removals.

The items in the plot record are either

## Appendix B. Summary of FIA Sampling and Estimation Procedures.

observations of a specific condition at the plot center or estimates of average conditions on the acre sampled by the plot. Ownership is an example of a specific condition recorded at plot center, rather than averaged over the plot. If a plot area overlaps more than one owner, the ownership at plot center determines the recorded ownership class. Basal area is an example of an item averaged over the entire plot. If the plot falls in two stands with different basal areas, the value recorded in BACUR will represent their average basal area. In some State inventories, plots falling on more than one stand are shifted into one stand. EWDB users concerned about field procedures should check with the FIA project for more information.

We have tried to make the data in the EWDB as consistent as possible from one State to another. Therefore, although differences in field and estimation procedures do exist between States, the data in the EWDB for different States are compatible. The minor differences that do exist should have little or no impact on most uses of this data.

### Accuracy Standards

Forest inventory plans are designed to meet sampling error standards for area, volume, growth, and removals provided in the Forest Service Handbook.

These standards, along with other guidelines, are aimed at obtaining comprehensive and comparable information on timber resources for all parts of the country. In the East, FIA inventories are commonly designed to meet the specified sampling errors at the State level at the 67-percent confidence limit (one standard error). A 3-percent error per 1 million acres of timberland is the maximum allowable sampling error for area. A 5-percent error per 1 billion cubic feet of growing stock on timberland is the sampling error goal for volume, removals, and net annual growth.

Caution: FIA inventories are extensive inventories that provide reliable estimates for large sampling areas. As data are subdivided into smaller and smaller areas, such as a geographic unit or a county, the sampling errors increase and the reliability of the estimates decreases. For example, a State with 5 million acres of timberland would have a maximum allowable sampling error for area of 1.3 percent, a geographic unit within that State with 1 million acres of timberland would have a 3.0 percent maximum allowable sampling error, and a county within that State with 100 thousand acres would have a 9.5 percent maximum allowable sampling error at the 67-percent level.