

# A View from the Minnesota Woods

Eli Sagor  
Cloquet Forestry Center

View slides at <https://z.umn.edu/w420>



UNIVERSITY OF MINNESOTA  
Driven to Discover<sup>SM</sup>

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# Your favorite place in the Minnesota woods



A photograph of a forest with a dirt path leading through tall trees. The path is on the right side, winding through a dense stand of trees. The ground is covered in brown pine needles and some green grass. The trees are tall and thin, with some evergreens and some deciduous trees. The lighting is natural, suggesting a daytime scene.

**Background**

**Forest management**

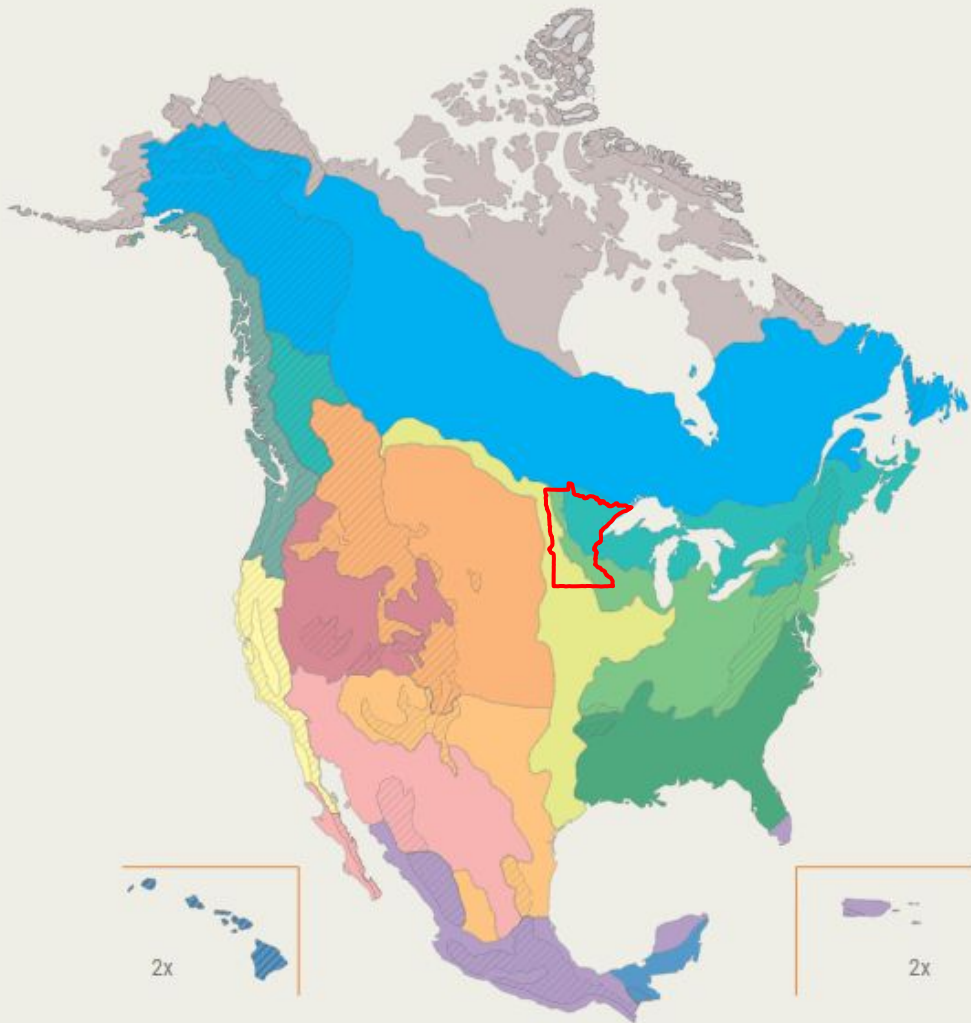
**Carbon**

**Adaptation**

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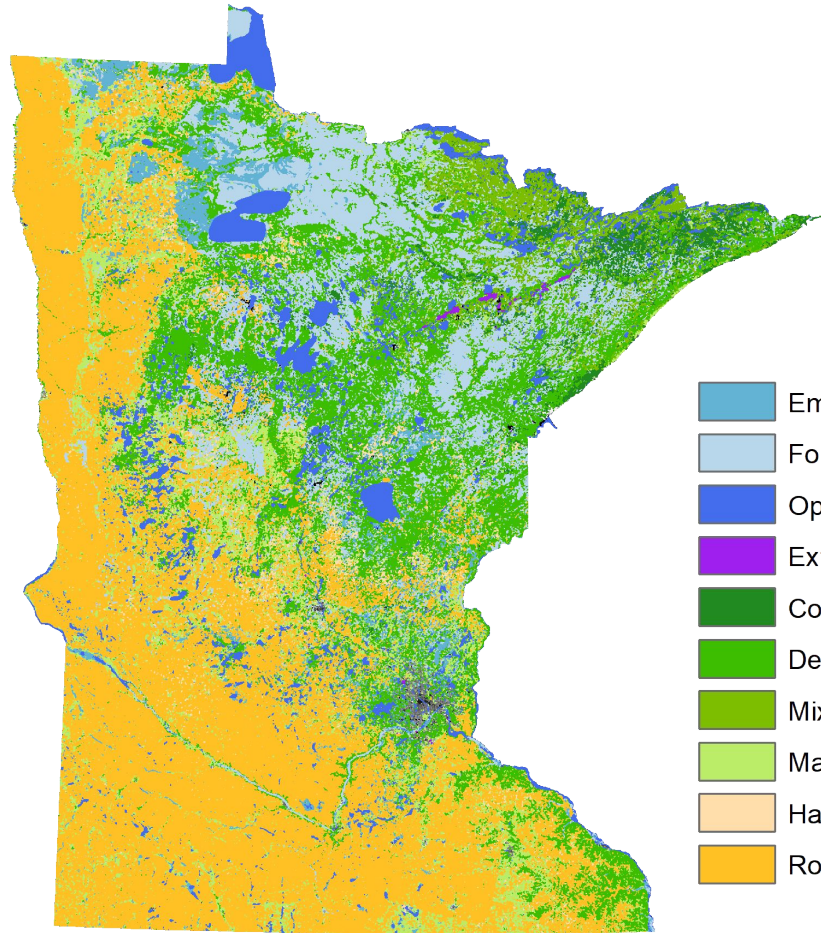
# Context: Forests and Forestry

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Source: USDA Forest Atlas,  
[Ecological Divisions](#)

# 1/3 of MN is Forest



- Emergent Wetland
- Forested and Shrub Wetland
- Open Water
- Extraction
- Conifer Forest
- Deciduous Forest
- Mixed Forest
- Managed Grass/Natural Grass
- Hay and Pasture
- Row Crops

Land cover map by Rampi, Knight, and Bauer (2016). [Source.](#)

# About Minnesota's forests

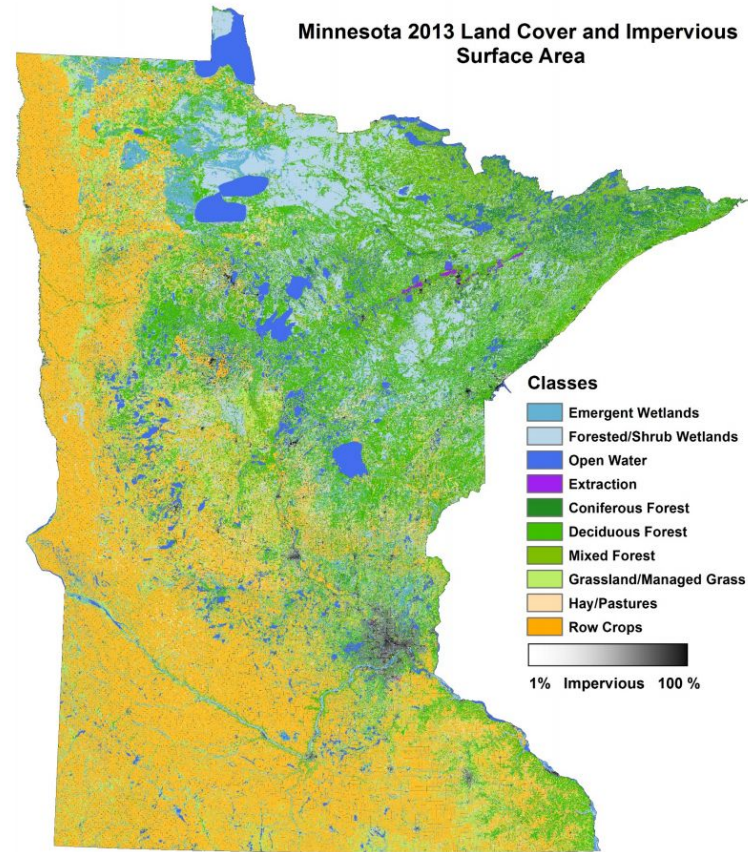
MN's 5th largest manufacturing sector

\$17.8B in gross sales

900 species of wildlife

Recreation

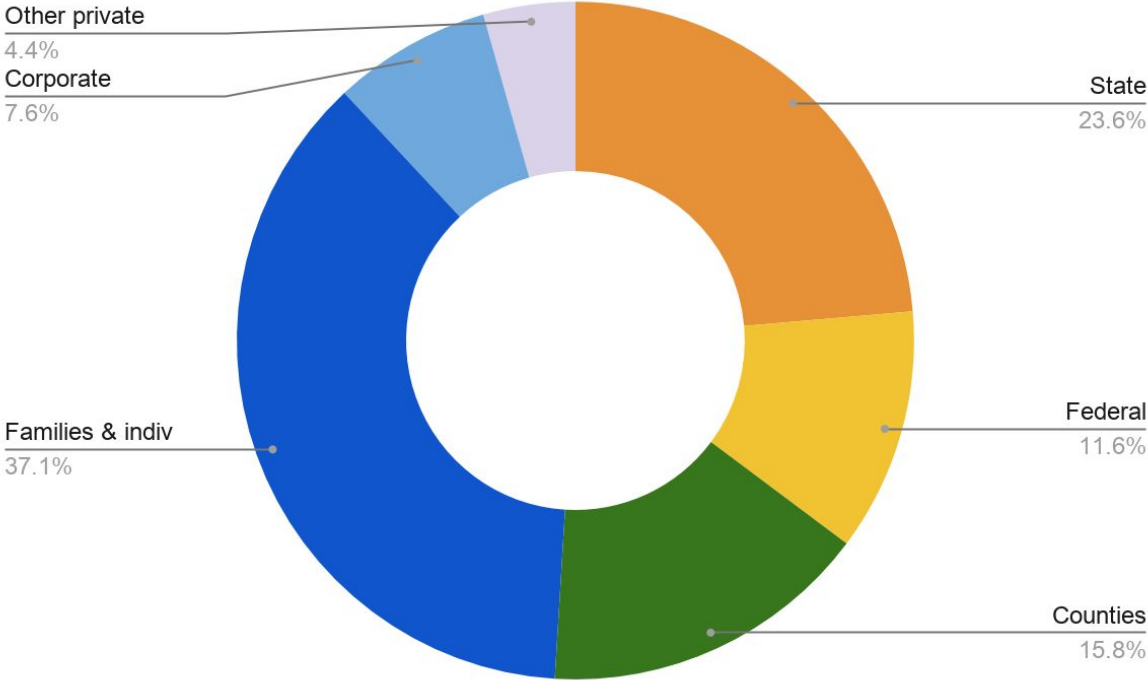
Water quality





# Minnesota forest ownership

~17 million acres total

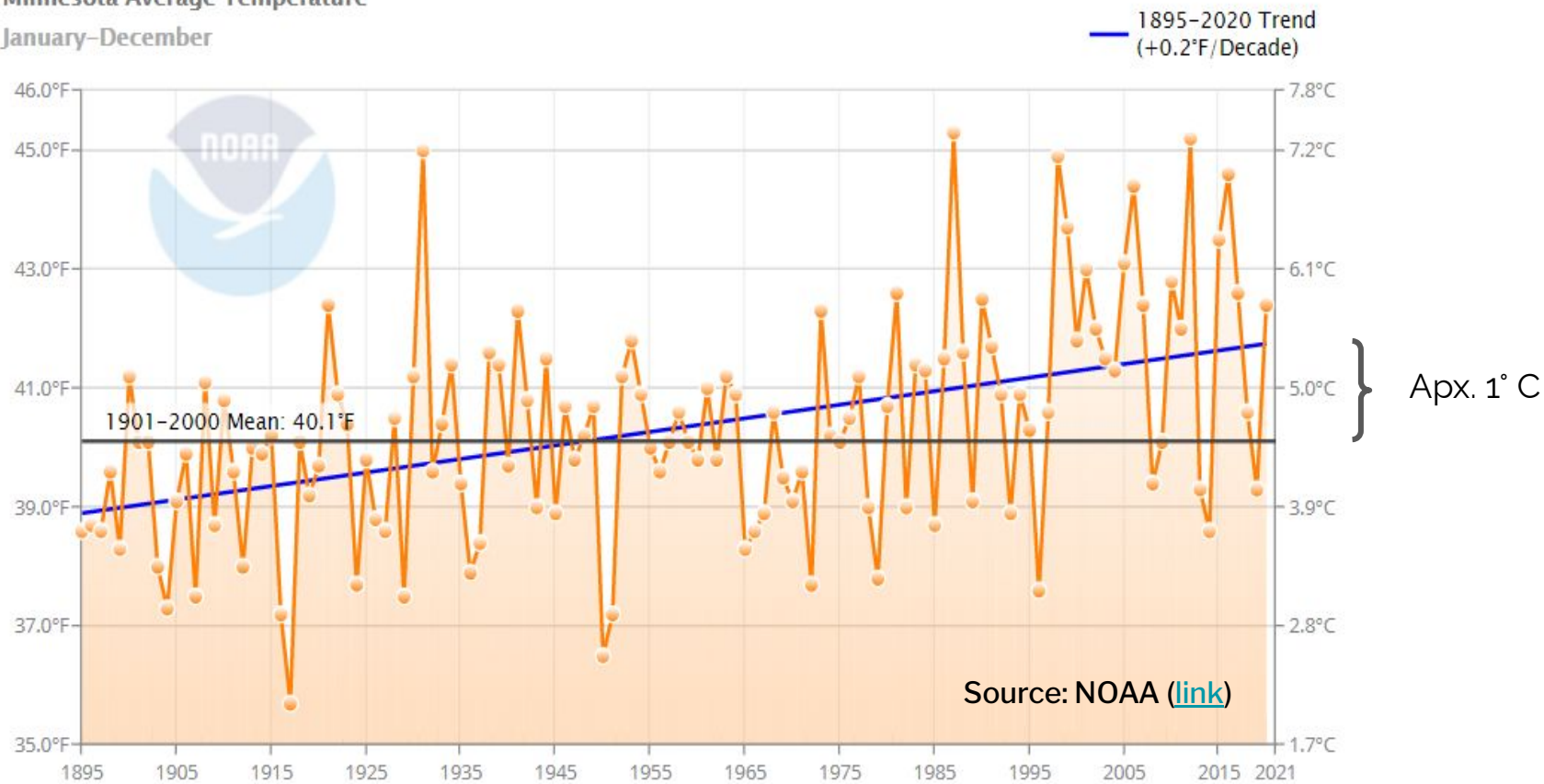


[More on MN forest ownership](#)

# Minnesota mean annual temp, 1895-2021

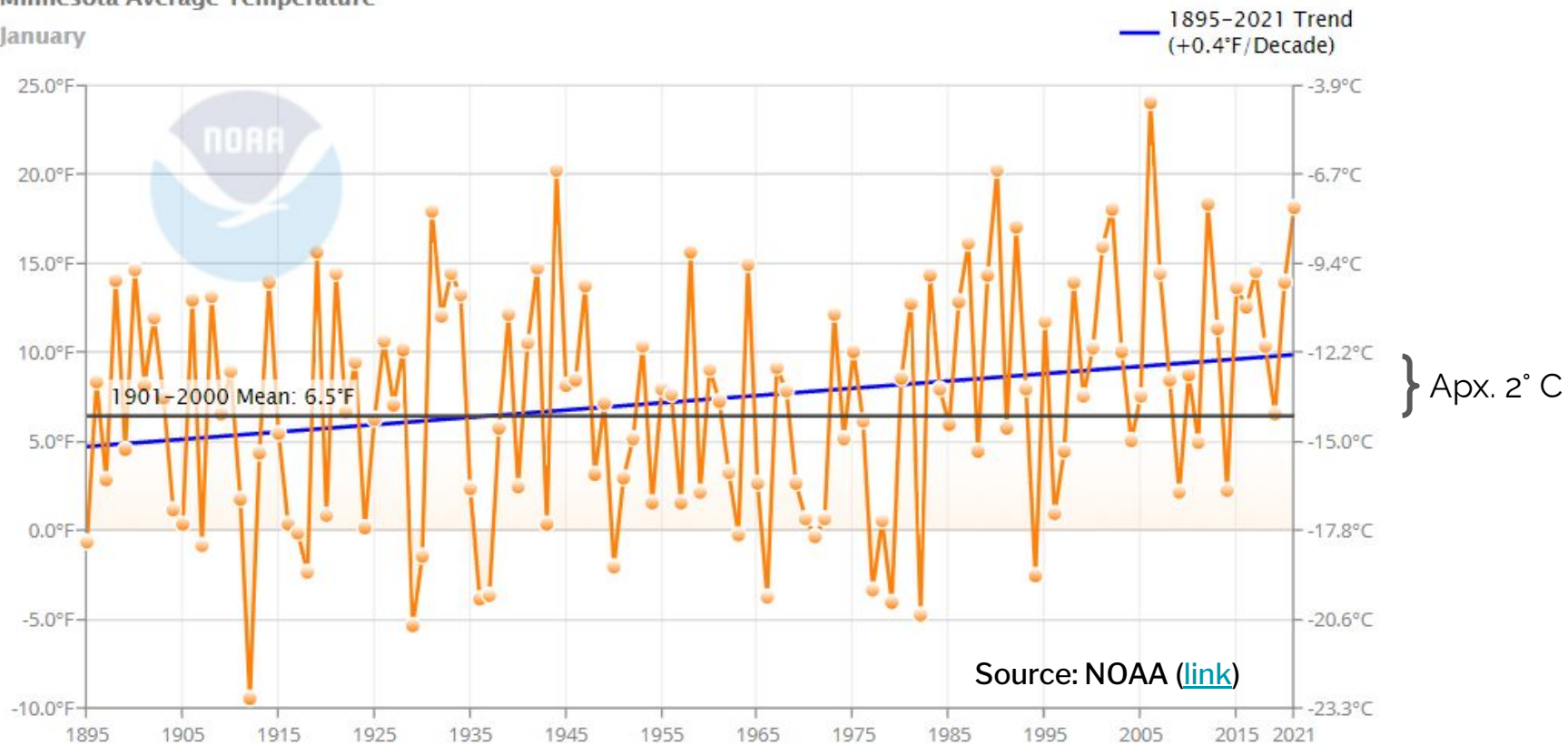
## Minnesota Average Temperature

January–December



# Minnesota mean **January** temp, 1895-2021

Minnesota Average Temperature  
January







Gregory Edge



# Invasive species



# Major invasives

Buckthorn (soybean aphid issue)

Emerald ash borer (EAB)

Eastern larch beetle

Garlic mustard

Gypsy moth

Knapweeds, tansy, etc

Deer, too many others...





# Ecosystem changes

Ecosystem processes have changed:

*Diplodia / Sirococcus*

Earthworms

Deer

Emerald ash borer

Eastern larch beetle

...

*Photo: Diplodia damage on red pine.*



# Ecosystem changes



# Warmer winters

Shorter harvest season

Much of Minnesota  
wood harvest requires  
frozen ground

*Photo by Darin Erickson,  
UPM-Blandin Paper Co.*



**Most of these changes make life  
BETTER for invasive species, and  
WORSE for native forests.**

# Forest Management

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**Forest area: 17,000,000 ac.**

**Timber harvest: 150,000 ac/yr**



**Clearcutting: ~70% of harvest acreage**





**Thinnings & selection ~30% of harvest acreage**

















# Carbon

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**Wood is 50% Carbon by dry weight.**

**All of that Carbon is from the atmosphere.**

**When trees grow, they sequester  
Carbon.**

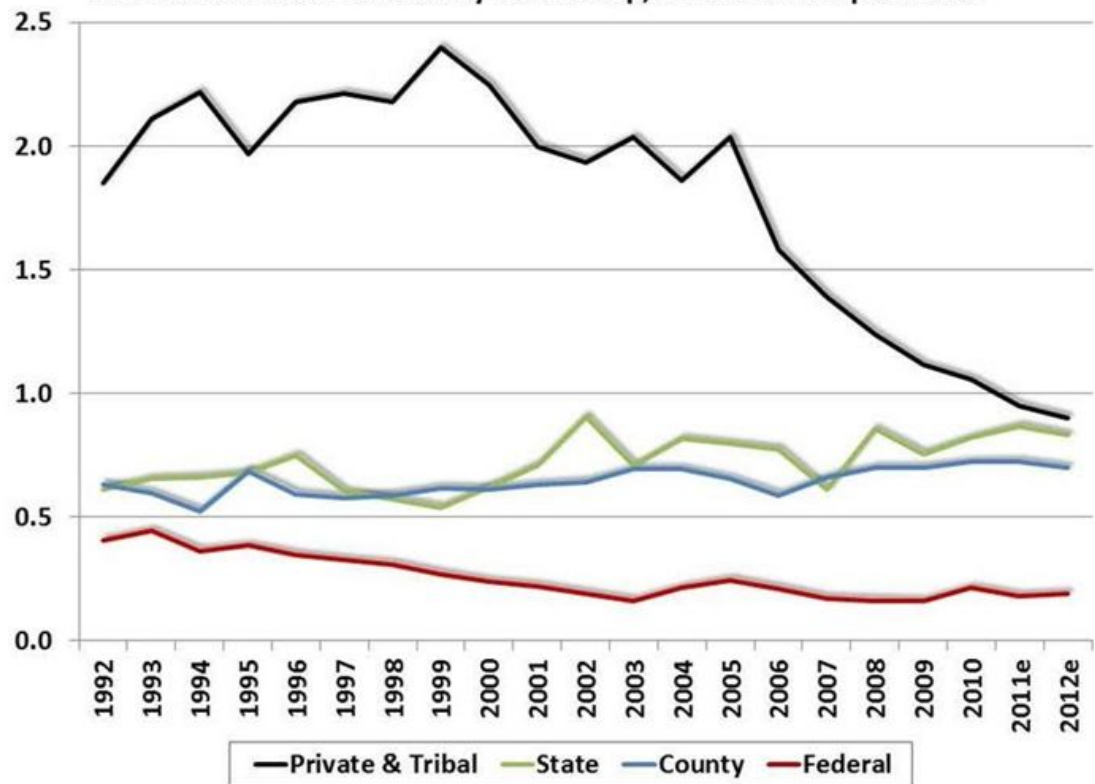
**Growing and harvesting trees can  
be part of a climate solution.**

# Need for Active Forest Management

Invasives, Carbon,  
forest health,  
renewable resources



Minnesota Timber Harvest by Ownership, million cord equivalents



Source:





# Adaptation

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# Adaptation activities

Research and continuing education:  
Projected changes, how to prepare

Managing systems: plant  
community-based silviculture

Attention to forest health threats /  
maintaining process

Resilience through diversity and  
heterogeneity

Managing for uncertainty





# (Wait... What is silviculture?)

The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.



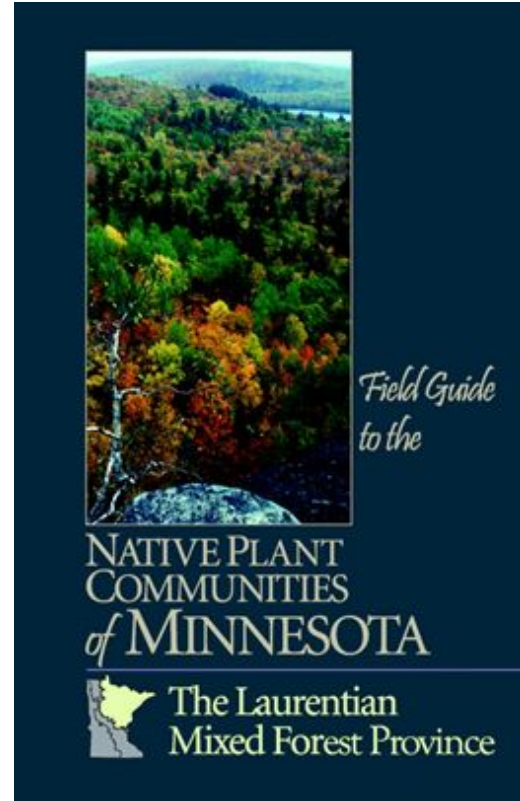
**Care and tending our forests and woodlands**

# Plant community-based silviculture

Away from “cover types,” toward systems.

Ecological classification systems give insight into dynamics in system composition and process, development trajectory, etc.

Good silviculture works with this trajectory.



# Quickly treating forest health threats

Emerald ash borer

Bark beetle outbreaks

*Diplodia* and *Sirococcus*

Others



# Resilience: Planning for uncertainty

Goal is to increase response diversity within the system.

Strategy is to increase diversity and complexity in species, age, stand structure, seed source, etc.

Multiple scales from stand to landscape



# Favoring future-adapted species

Tilting balance / trajectory toward future-adapted natives.

Mostly experimental at this point.  
(Ponderosa pine, black hills spruce, etc)

Increasingly common: Mixed seed lots that include southern / western sources.

*Photo: Ponderosa pine at UMN  
Lamberton ROC by Brian Anderson*



# More applied research



# Great Lakes Silviculture Library

What are others doing and  
learning in the woods?

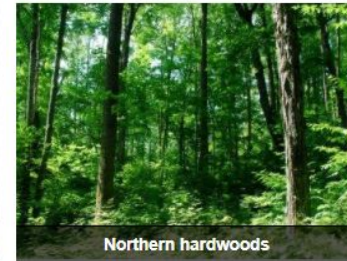
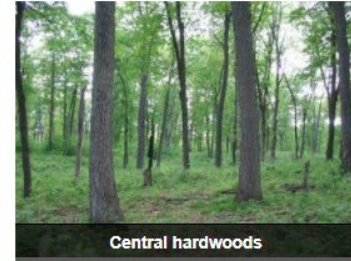
(Free)

<https://silvlib.cfans.umn.edu/>

## Great Lakes Silviculture Library

[Home](#) [Explore Case Studies](#) [Submit a Case Study](#) [About the Project](#) [Resources & Links](#) [Contact](#)

This site is designed to help forest managers from Michigan, Minnesota, Ontario, and Wisconsin exchange silviculture prescriptions, including the outcomes of actual on-the-ground management activities. The cases linked below are real, on-the-ground stories submitted by Lakes States natural resource managers.





# Summary: What it all means

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Forests are important economically, ecologically, socially

Forest are changing

Invasive threats, climate, global markets, disturbance patterns,...

Active management is crucial to maintain healthy, productive forests.

