

Sustaining Northern Forests in the face of *Climate Change*



-Challenges
-Opportunities
-Actions



USDA Forest Service
Northern Research
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What I do:

Research on management approaches that keep forests healthy, while providing wood ...



**USDA Forest Service
Northern Research
Station**

...including research on climate change adaptation strategies

How we work:

Operational-scale experiments that use forest management (timber harvesting, site preparation, planting, thinning...) to create different conditions for tree growth and wildlife response..which we then evaluate.

This is my context for identifying:

**-Challenges
-Opportunities
-Actions**

..as related to climate change in forests

But first...

Climate Change in Itasca County (Laurentian Mixed Forest)

What is predicted to happen by 2070-2099 (compared to 1970-2000)?

Temperature Increases:

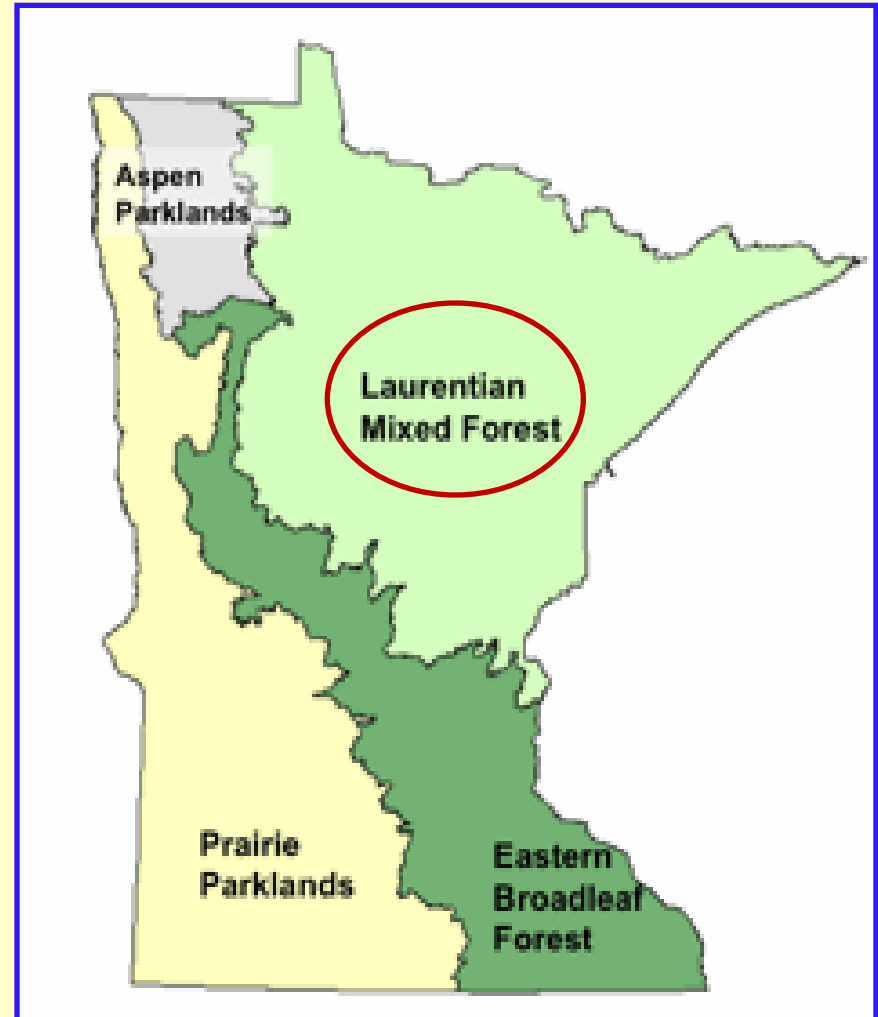
- 3.0 to 8.8° F average annual
- 3.9 to 9.8° F average Winter
- 2.3 to 11.4° F average summer

Precipitation Change:

- 3.0 to -0.4 in. average annual
- 0.5 to -4.8 in. average summer

Summer soil moisture stress:

- Little change to much greater soil moisture deficits





What are the most significant challenges I see (for forests and forestry) associated with a changing climate?



Challenges:

- New tree pests: *Emerald Ash Borer*
- Increasing summer droughts & overly dense pine forests
- Loss of “northern tree” habitat

What opportunities are there to address these challenges to improve local quality of life?

What actions can community members pursue to address challenges or realize opportunities?

Challenge #1: *New Tree Pests--Emerald Ash Borer*



Black Ash in Minnesota

- 1.1 million ac
- 1 billion trees
- Dominates wetland hardwood forests



- EAB is moving north and west;
- Confirmed in Anoka and Superior WI

-Kills all ash trees 1 inch and greater in diameter

-EAB is cold temperature limited, so will become worse with warming winters

Loss of ash forest matters:

- Timber (Forest Industry)
- Habitat (Biodiversity)
- Carbon storage (Atmospheric CO₂)
- Cultural resource (Basket Making)

Also, EAB is a climate change challenge because...several co-occurring “replacement” tree species are projected climate change losers

-Tamarack

-Balsam Poplar

-White Cedar



When all the ash die, the site “swamps out”; too wet to establish new trees

A Future Without Trees in Black Ash Wetlands is Possible

What opportunities are there to address these challenges to improve local quality of life?

We can address this challenge by:

Evaluating forest management strategies to build resilience to EAB and climate change

Forest Adaptation Strategies should:

- keep sites from getting too wet**
- allow new tree species to establish from planting or direct seeding**

Clearcutting (liquidate ash): Sites get too wet, hard to establish trees

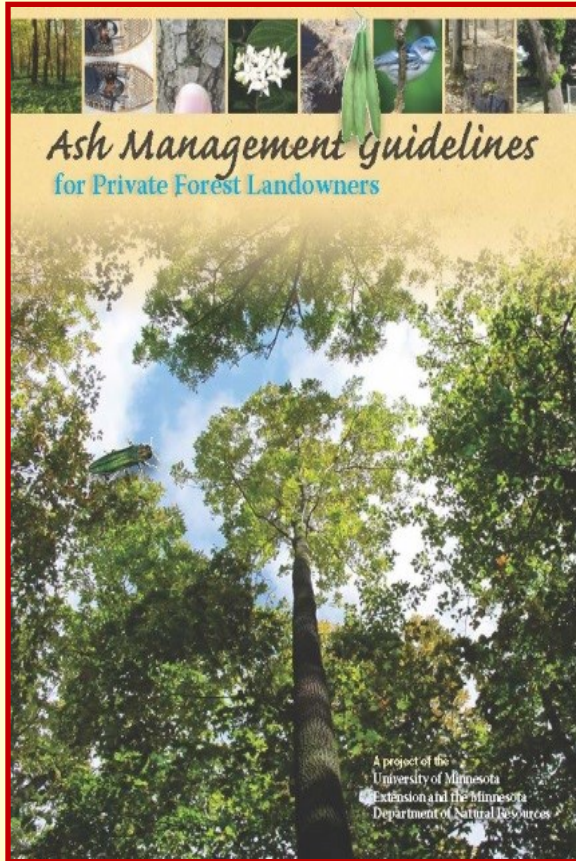


Small patch cutting: Not too wet, trees establish



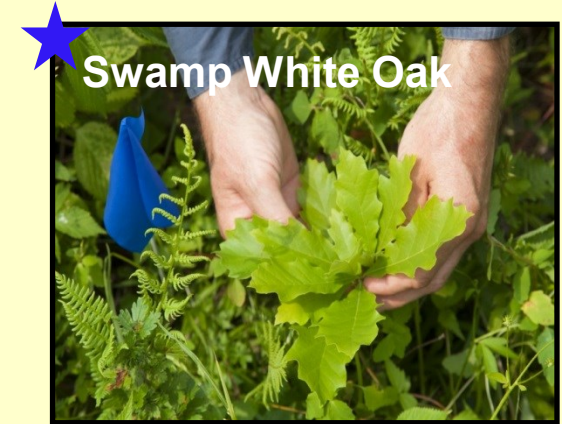
Also,
we can address this challenge by:

Evaluating Replacement Tree Species



Replacement Species:

1. Tamarack ★
2. N. white cedar ★
3. American elm (DED resistant) ★
4. Black spruce ★
5. Balsam poplar ★
6. Yellow birch
7. Balsam fir ★
8. Red maple ★
9. Trembling aspen ★
10. Ash
11. Silver maple ★



★ Swamp White Oak



★ Hackberry



Projected Climate
Change Losers



Future Climate
Adapted!

What actions can community members pursue to address challenges or realize opportunities?



***Action #1:* Encourage private landowners and regional entities (DNR, Counties, Bands, Federal) to implement and evaluate strategies to transition black ash wetlands to replacement tree species**

***Action #2:* Work with legislators and foundations to fund the implementation of adaptation strategy trials**

Challenge #2: Overly Dense Pine Forests/Increasing Drought

Red and White Pines in
NE-NC Minnesota

• 355,000 ac



- Historically grew in open woodlands with lower density of pines
- Now pines often grow in dense stands due to lack of fire, dense planting, and too little thinning

Growth Of Pines Threatened By:

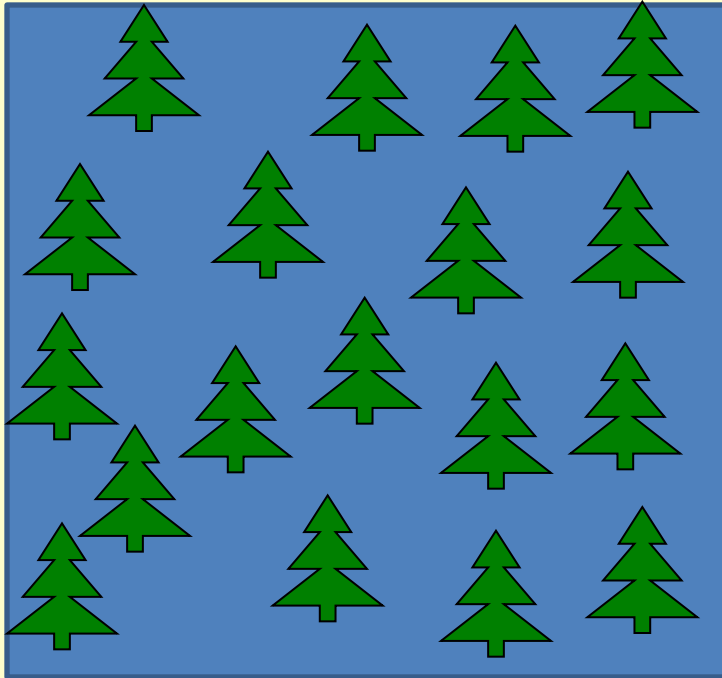
- Increased drought
- Soil moisture deficit in dense stands during drought
- Reduced growth of trees

Growth reductions of pine matter:

- Forest Industry
 - Sawtimber, pulp
 - Utility poles, cabin logs
- Habitat (Biodiversity)
- Recreation/aesthetics: iconic trees

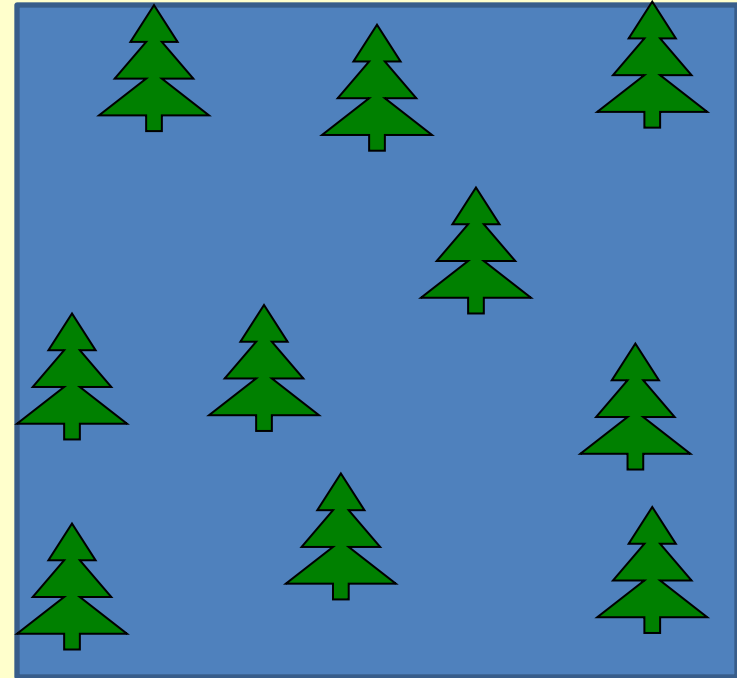
What is Tree Density?

1 acre



More Dense

1 acre



Less Dense

Thinning is used to reduce density of trees

Density management: thinning to increase tree growth

We know that thinning on a regular basis can be used to increase growth of the trees..

Foresters know how to do this.



But what about thinning to control soil moisture stress during drought?

- Thinning increases soil moisture**
- Improves tree health during and after drought?**
- We have good evidence that this works!**

What opportunities are there to address these challenges to improve local quality of life?

We can address this challenge by:

Thinning pine forests on a more regular basis to increase drought resistance



- Thinning on a regular basis maintains lower tree density**
- Trees gain resistance and resilience of growth to drought**
- Thinning provides a steady flow of pine timber to mills**

What actions can community members pursue to address challenges or realize opportunities?



Action #1: Educate stakeholders on thinning strategies to build drought tolerance while also avoiding degrading pine stands

Action #2: Work with lawmakers, foundations, etc. to offer grants, cost-share, reduced interest loans, for equipment purchases by loggers to specialize in thinning

Challenge #3: Loss of “northern tree” habitat

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**Many predicted changes
in tree habitat suitability
by the end of the century**



Predictions:

Reduced Habitat Suitability

Species
Quaking aspen
Balsam fir
Black spruce
Paper birch
Jack pine
Bigtooth aspen
White spruce
Red pine
Northern red oak

These are the trees on which industry depends

These are not so much

There is some evidence that this shift is occurring

The distribution of tree seedlings is shifting farther north of adult trees for many species

Increased Habitat Suitability

Species

Bur oak

Green ash

Red maple

Eastern white pine

White oak

Black cherry

Bitternut hickory

However, there is much uncertainty associated with these predictions ...so what should we do?

What opportunities are there to address these challenges to improve local quality of life?

We can address this challenge by:



Our forestry tends to have a single species focus, e.g., aspen or pine or spruce, rather than managing for a diverse species mixture

-Managing forests so that they contain their full array of native tree species (mixed-species forests)

-Some of which may be future climate adapted

A diverse portfolio:

-lowers the risk from any one species being poorly adapted

-increases opportunities for adaptation to the unknown

Also,

-Evaluating “potential” future climate adapted tree species that are not too far to the south or west, e.g., white oak, hickories

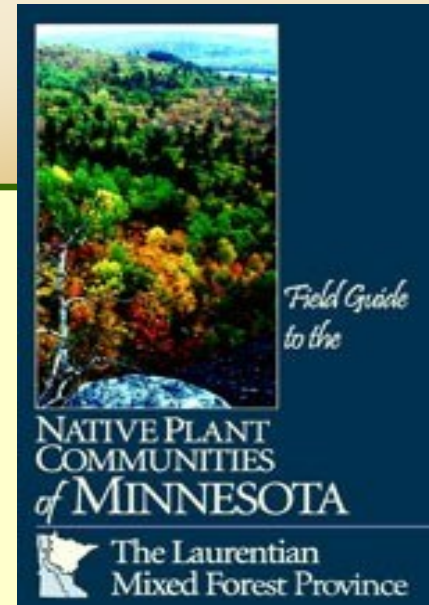
What actions can community members pursue to address challenges or realize opportunities?

Action #1: Encourage use of MN DNR's Native Plant Community guides as a basis for managing mixed-species forests (because some native species are likely to be future-adapted)

Action #2: *Begin to evaluate the potential of future-adapted tree species in forest settings (assisted migration)*

-ask extension agents which species to try and how to manage them

-ask tree nurseries to supply these species



An aside: history suggests that markets will respond to tree species availability (e.g., aspen); as our species mix changes, equipment, facilities, processes, should follow.

The Future is Here for Some of Our Regional Players



Chippewa National Forest

-Implementing climate change adaptation trials in pine and ash forests

UPM Blandin Forestry

-A leader in mixed-species management and marketing



Aitkin County Land Department

-Mixed-species and sustainable management focus

Thank You...Questions?

