

Replacement species in black ash wetlands in Minnesota: anticipating EAB and Climate Change



The Concern: abundant wetlands threatened by EAB, climate change
The Need: maintain trees and associated ecosystem functions
The Prospect: are native adapted species poised to replace black ash?
Adaptation Strategy: silviculture plus assisted migration

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USDA Forest Service
Northern Research Station
State and Private Forestry
Chippewa National Forest

LCCMR

Midwest CASC

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

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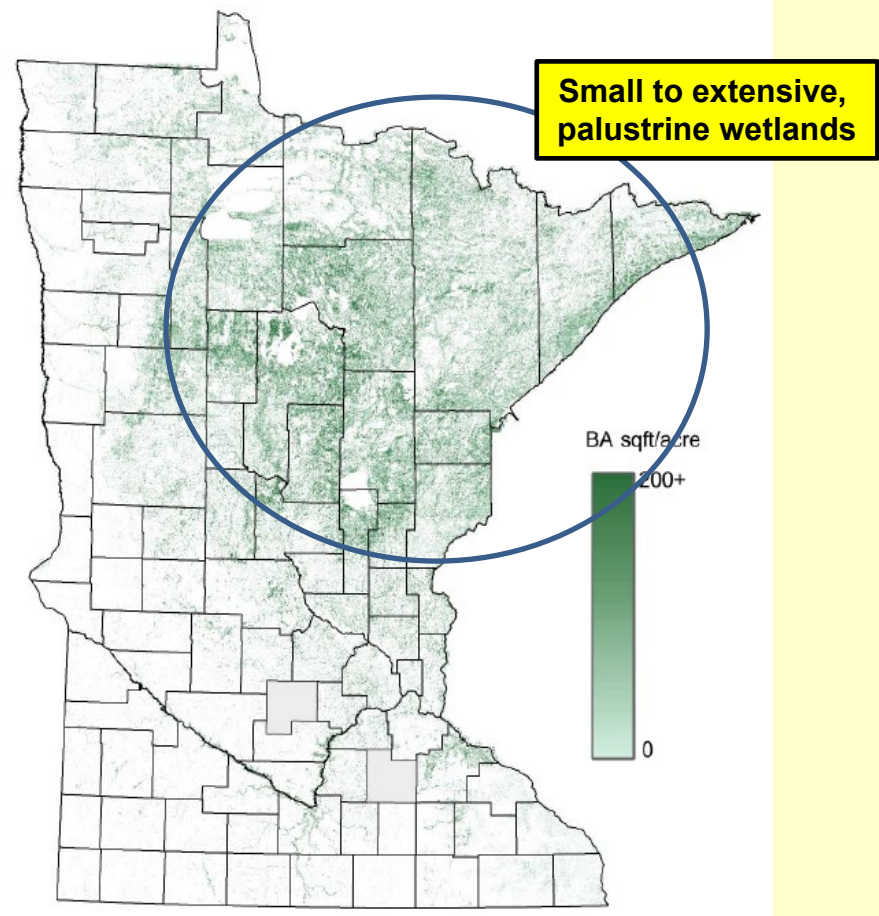
USDA Forest Service
Pacific Northwest Research Station

Natural Resources Research Institute
UNIVERSITY OF MINNESOTA DULUTH
Driven to Discover

The Concern:

1.2 million acres—1 billion trees

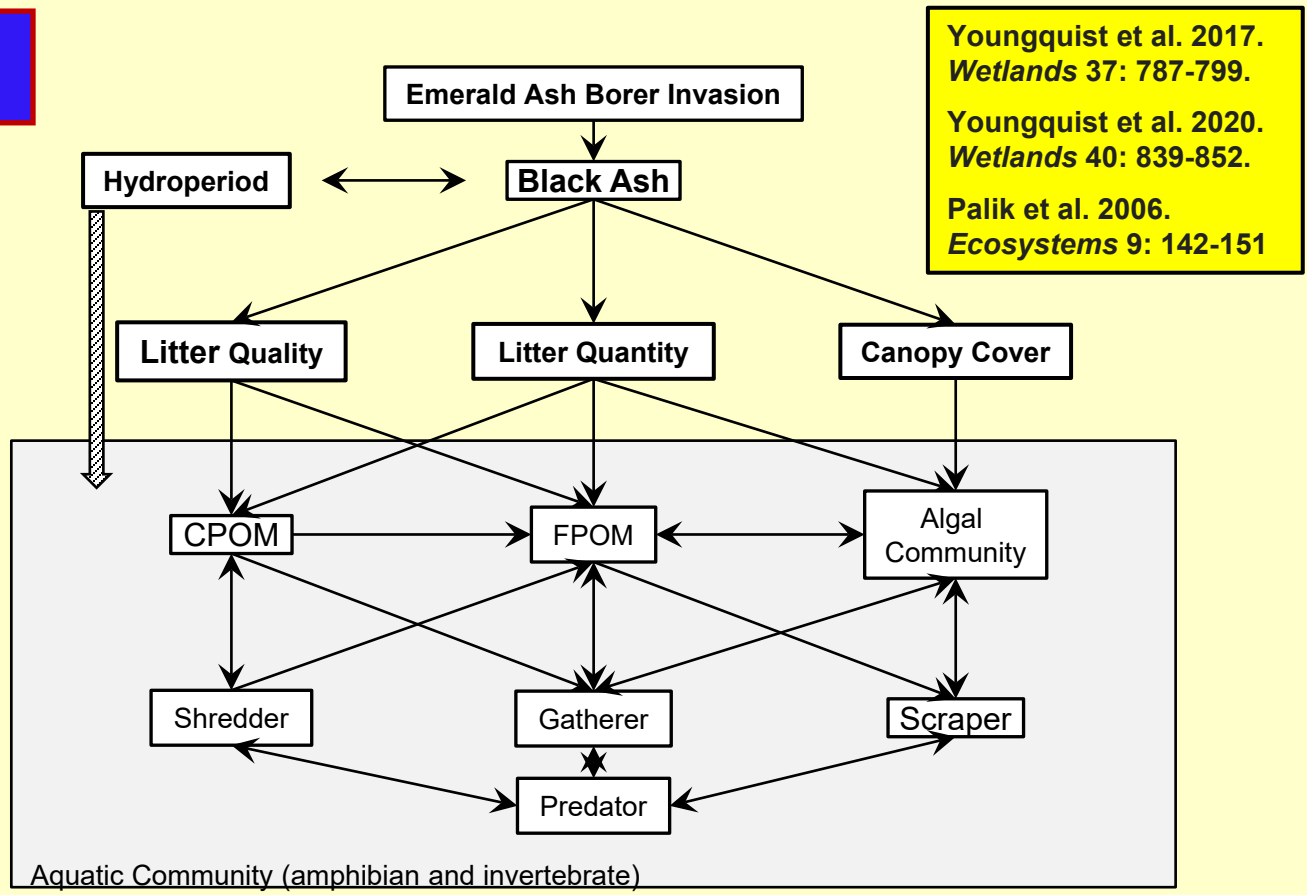
Images courtesy of Trevor Host, UMN Remote Sensing and Geospatial Analysis Lab



**Black Ash--A Foundational Species:
Controls structure and function of the ecosystem**



Photo credit: Melissa Youngquist



Youngquist et al. 2017.
Wetlands 37: 787-799.
Youngquist et al. 2020.
Wetlands 40: 839-852.
Palik et al. 2006.
Ecosystems 9: 142-151

**The entire ecosystem depends on this one species of tree
(due to transpiration and litter quality)**

The Concern:

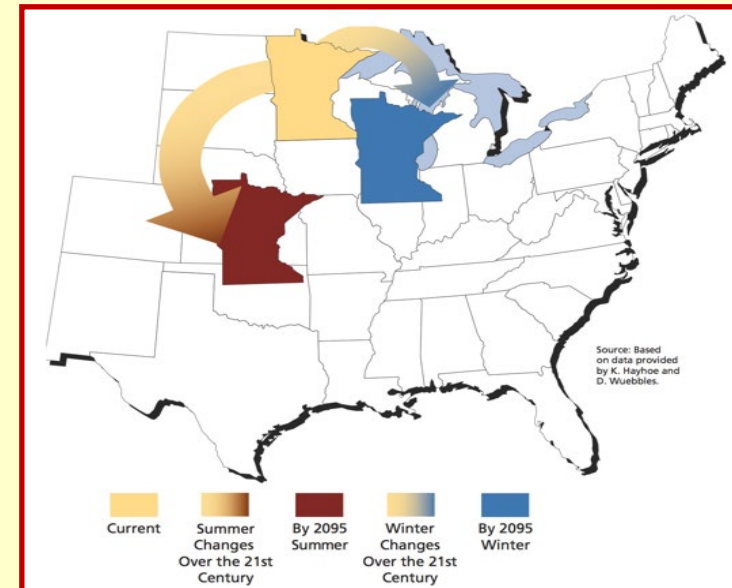


90% mortality of trees over 1 inch diameter by a few years after infestation

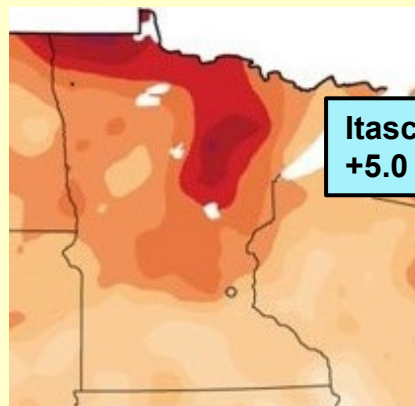
EAB Detected Ash Tree Locations in Minnesota



Climate projections for northern MN



EAB and Climate Change:
Warming winters >> EAB survival



Itasca County MN:
+5.0 °F Mean Annual Temperature (1895-2018)

The Concern:



Without black ash (no trees)...

- wetlands get wetter...and stay wet**
- sedge/shrubs dominate**
- tree establishment becomes difficult**
- loss of ecosystem function, habitat**

Slesak et al. 2014. *CJFR* 44: 961-968.

Looney et al. 2015. *CJFR* 45: 1228-1238.

Diamond et al. 2018. *JEM* 222: 436-446.

Looney et al. 2017. *FEM* 389: 352-363.

Loss of trees= loss of wildlife habitat

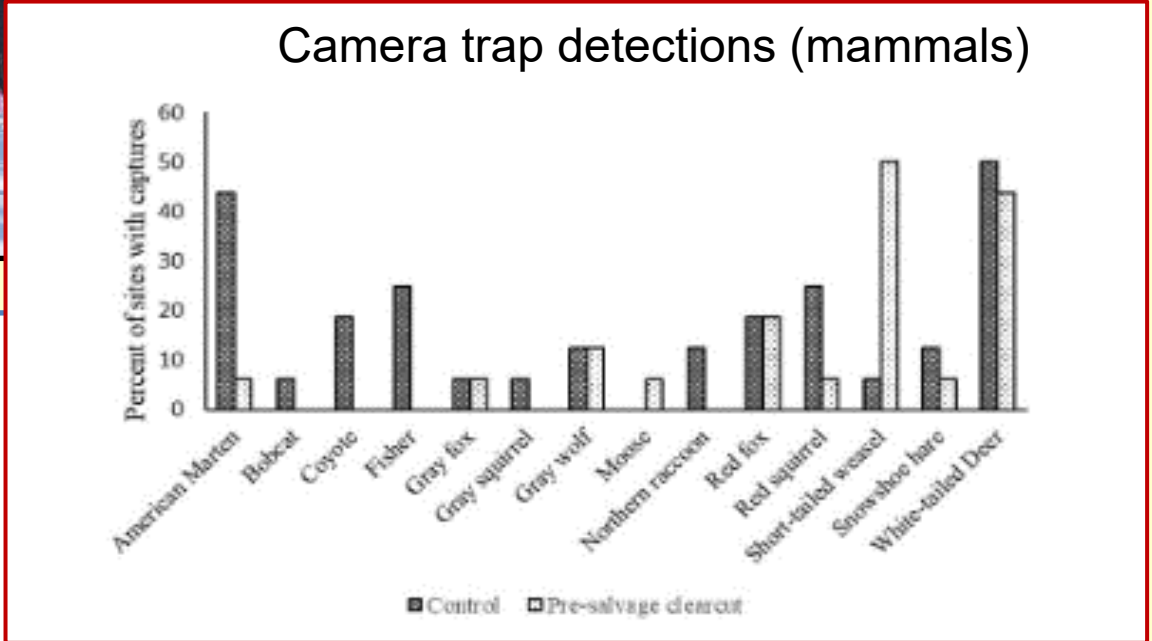
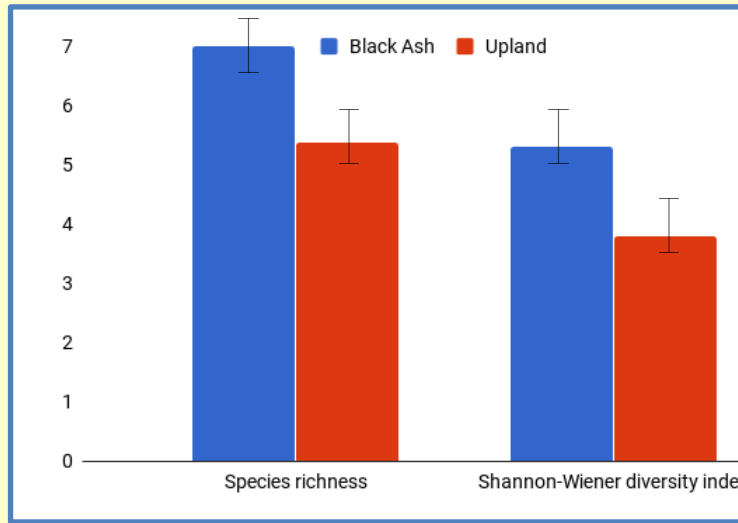
Grinde et al. 2022. *Ecological Applications* 32
 Grinde et al. 2022. *Wetlands* 42



Photo credits: Alexis Grinde



**-Black ash wetlands are unique habitats: birds, mammals, amphibians
 -Loss of ash canopy reduces use by some species...fisher, marten**

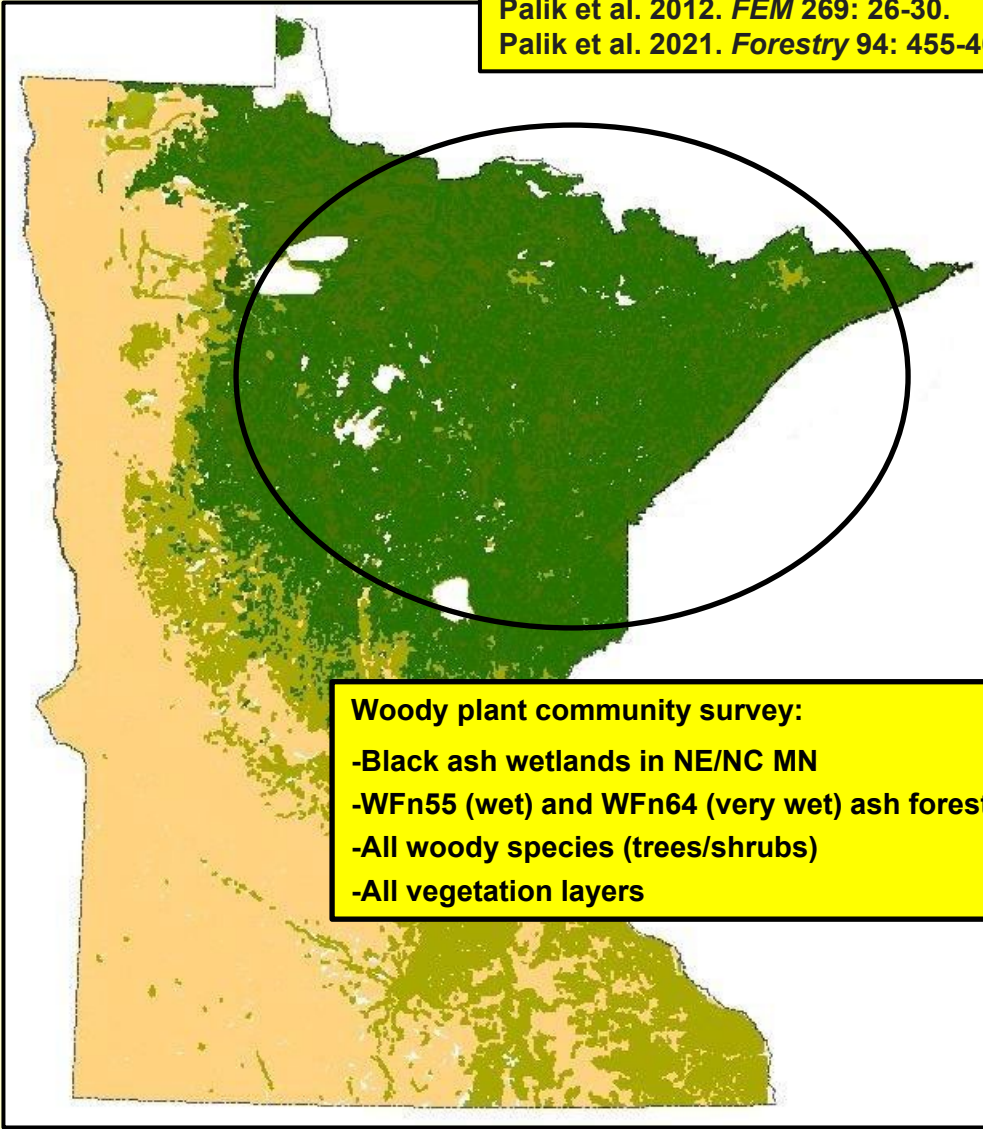


The Need:
 Adaptive strategies, that keep forested wetlands on the landscape....what about natural tree replacement?

The Prospect...for black ash replacement from canopy release or advance regeneration?

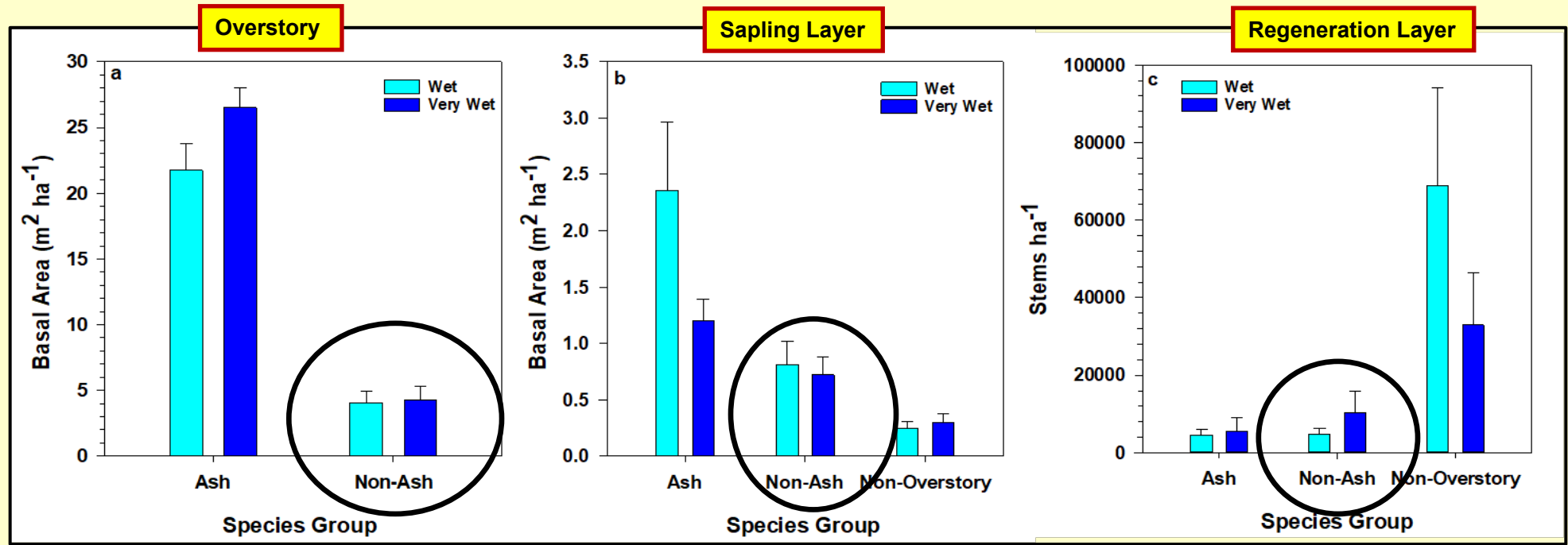


Palik et al. 2012. *FEM* 269: 26-30.
Palik et al. 2021. *Forestry* 94: 455-463.



Woody plant community survey:
-Black ash wetlands in NE/NC MN
-WFn55 (wet) and WFn64 (very wet) ash forests
-All woody species (trees/shrubs)
-All vegetation layers

Replacement potential is poor...throughout the region...few wetlands contain potential replacement species in abundance



red maple, trembling aspen, balsam poplar, northern white cedar, eastern larch, American elm, balsam fir

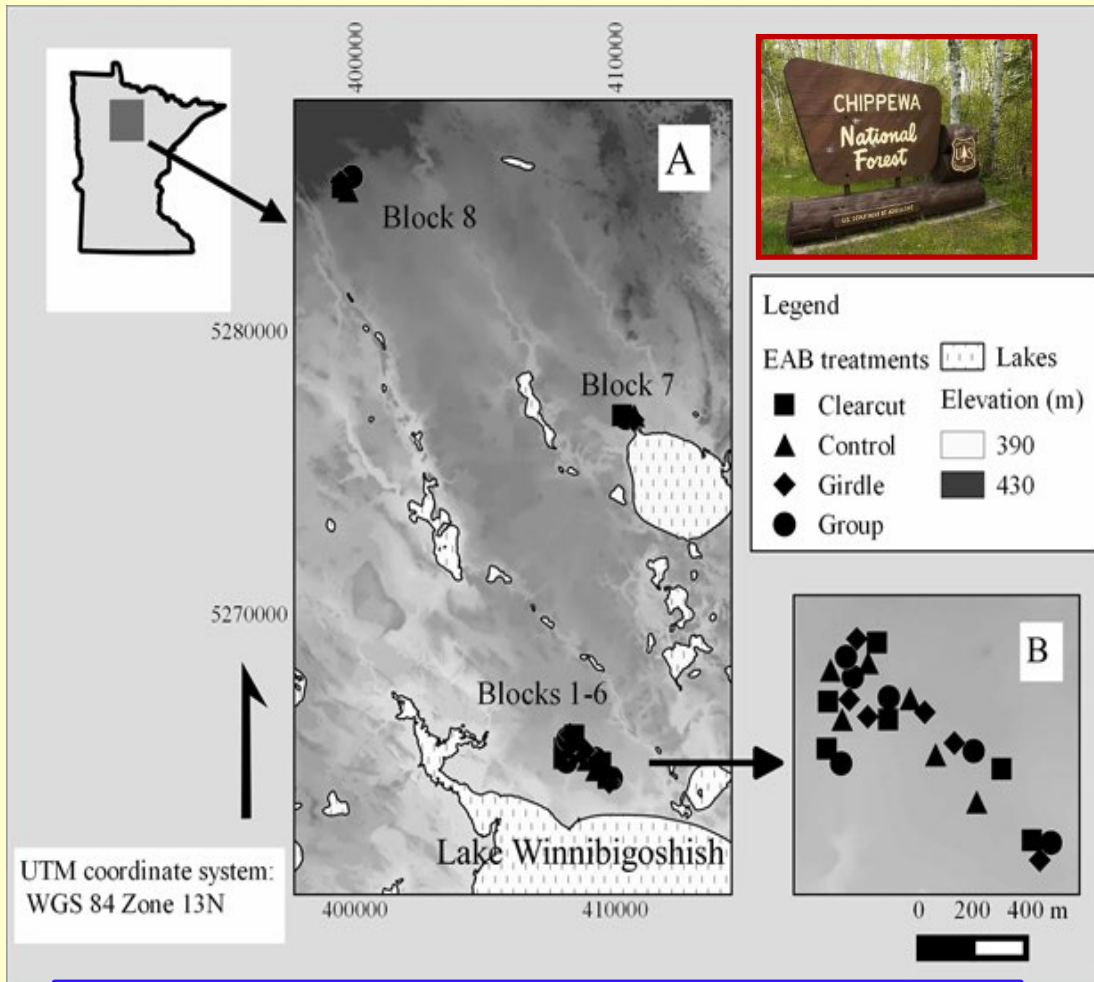
**Worse: most species do not have the characteristics of the ideal replacement...
-obligate wetland, long-lived, pest-free, CC adapted**

**Even worse: projected habitat changes with CC of co-occurring tree species:
-Reduced: 50%
-Neutral: 25%
-Increased: 25%**

D'Amato et al. 2018. Forests 9: 348-358.

**Adaptive strategy:
Silviculture + Artificial Regeneration**

Black Ash Adaption to EAB and Climate Change
Established 2011



-What are impacts of EAB and climate change on function?
-Are there strategies to adapt to EAB and climate change?

- Four treatments
- Eight blocks
- Productivity, regeneration, hydrology, birds, mammals, amphibians
- Artificial regeneration (planting)

What do we know about disturbance/dynamics in black ash wetlands?

- Multi-cohort, uneven-aged structure
- Canopy trees present during regeneration events
- Regeneration in canopy gaps

Fraver et al. 2022.
CJFR 52: 910-919.



So...

- Group selection (1/5 ac gaps, 20% of area)
- Diverse plantings, including assisted migration



- Range of stock types and sizes
- Spring and Fall planting for most
- Survival and growth

Native species:

American elm-population migration

Red maple

Tamarack

Balsam poplar

Black spruce

N. White Cedar

Yellow birch

E. Cottonwood

Trembling aspen

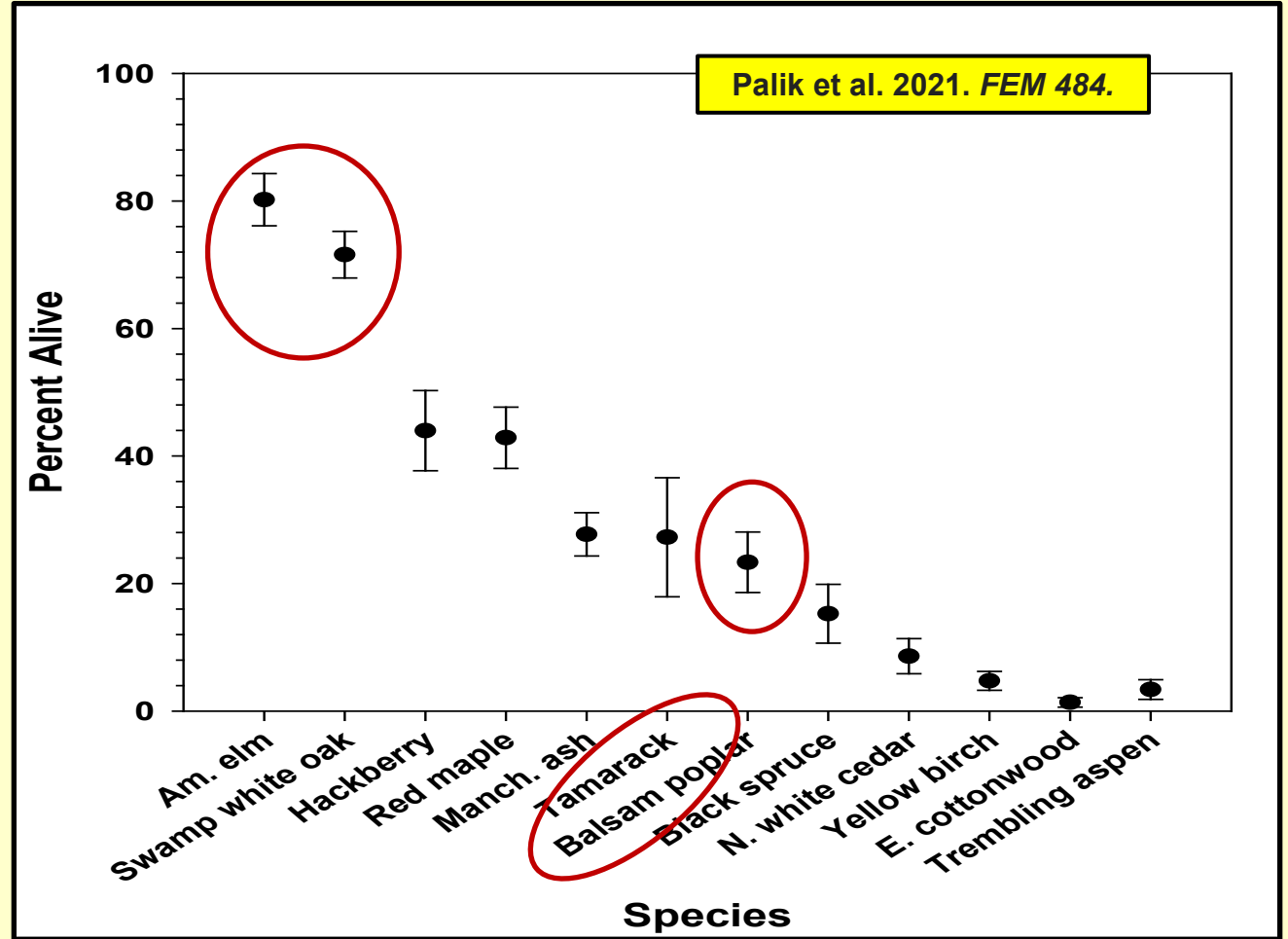
Novel species:

Swamp white oak-range expansion

Hackberry-range expansion

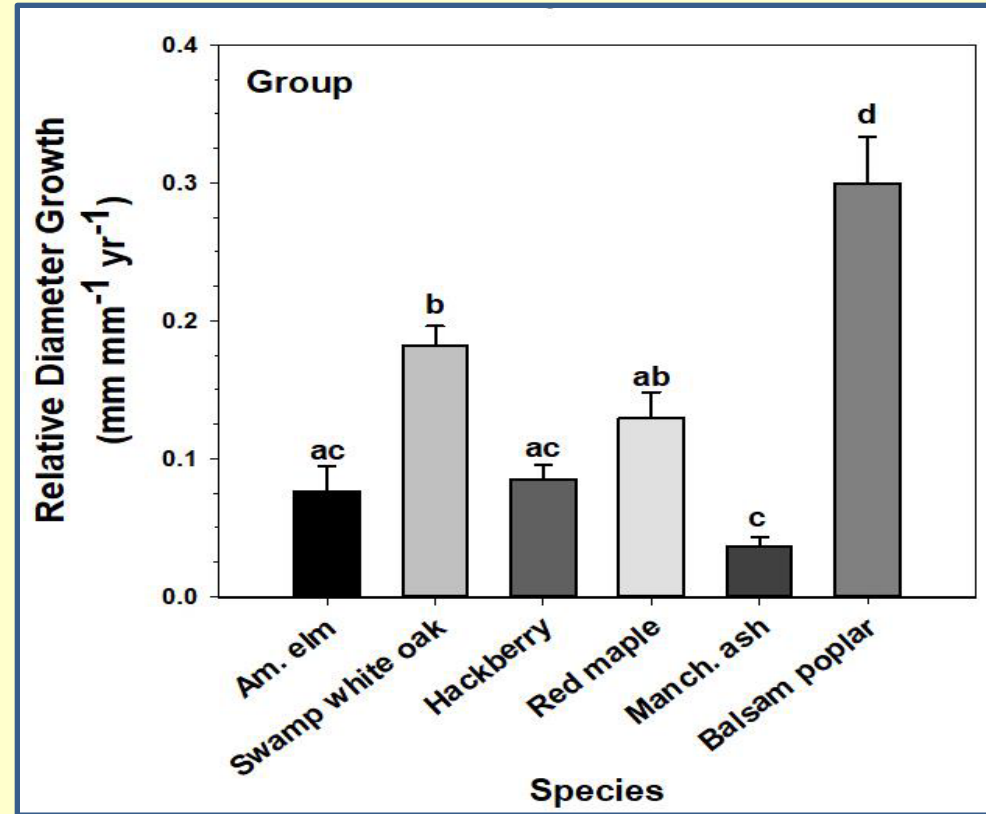
Manchurian ash-species migration

Group Selection 8th year survival



-Highest survival: disease compromised? or moved species
-No difference with planting season...fall planting works

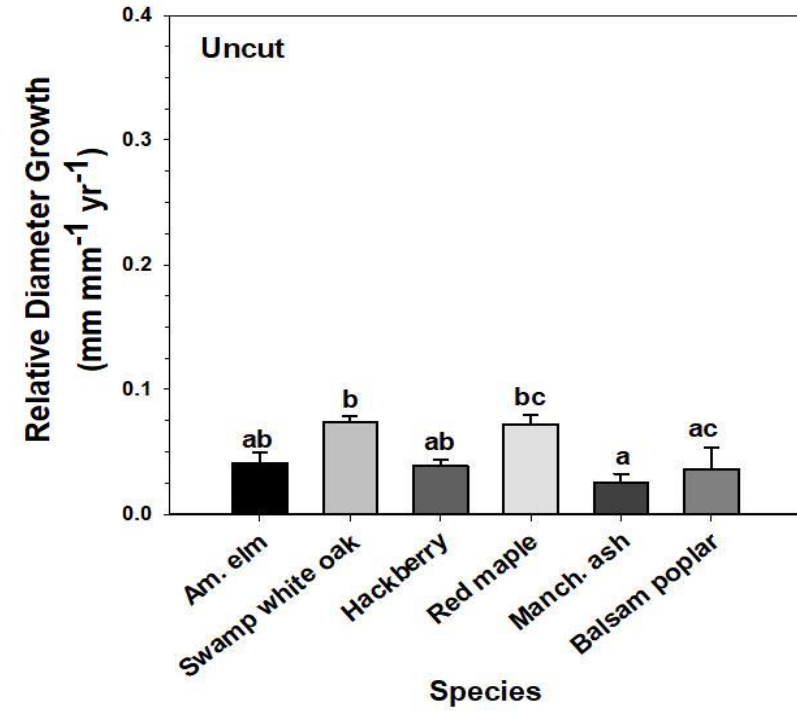
Planted seedling growth



**Swamp white oak: CC adapted, obligate wetland, long-lived, pest free?
Balsam poplar: near term solution?**

Do you have to harvest?

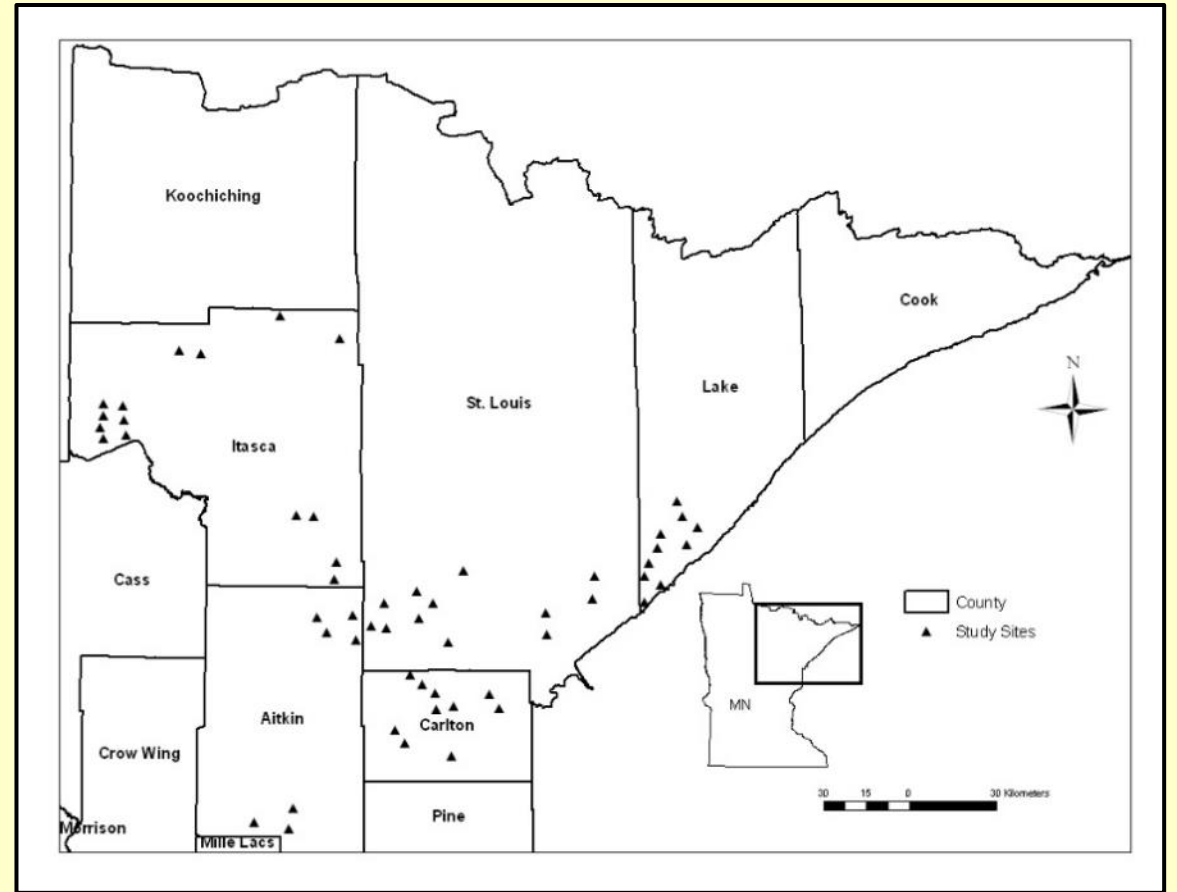
Adaptation strategy: *Passive + artificial regeneration*



Phase II: subset of mature, uncut wetlands in NE MN

American elm
Red maple
Swamp white oak
Silver maple
Balsam poplar (whips)

-Two stock sizes
-With and w/o deer fencing



Currently evaluating survival and growth

Take Home



- **Black ash is a foundational species in northern forest wetlands**
- **With widespread mortality comes loss of habitat and ecosystem function**
- **Adaptive strategies are needed to keep forested wetlands on the landscape**
- **Successional replacement by “ideal species” appears limited across the region**
- **Silvicultural and artificial regeneration....swamp white oak, balsam poplar, silver maple?**

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