



Forest Service
U.S. DEPARTMENT OF AGRICULTURE

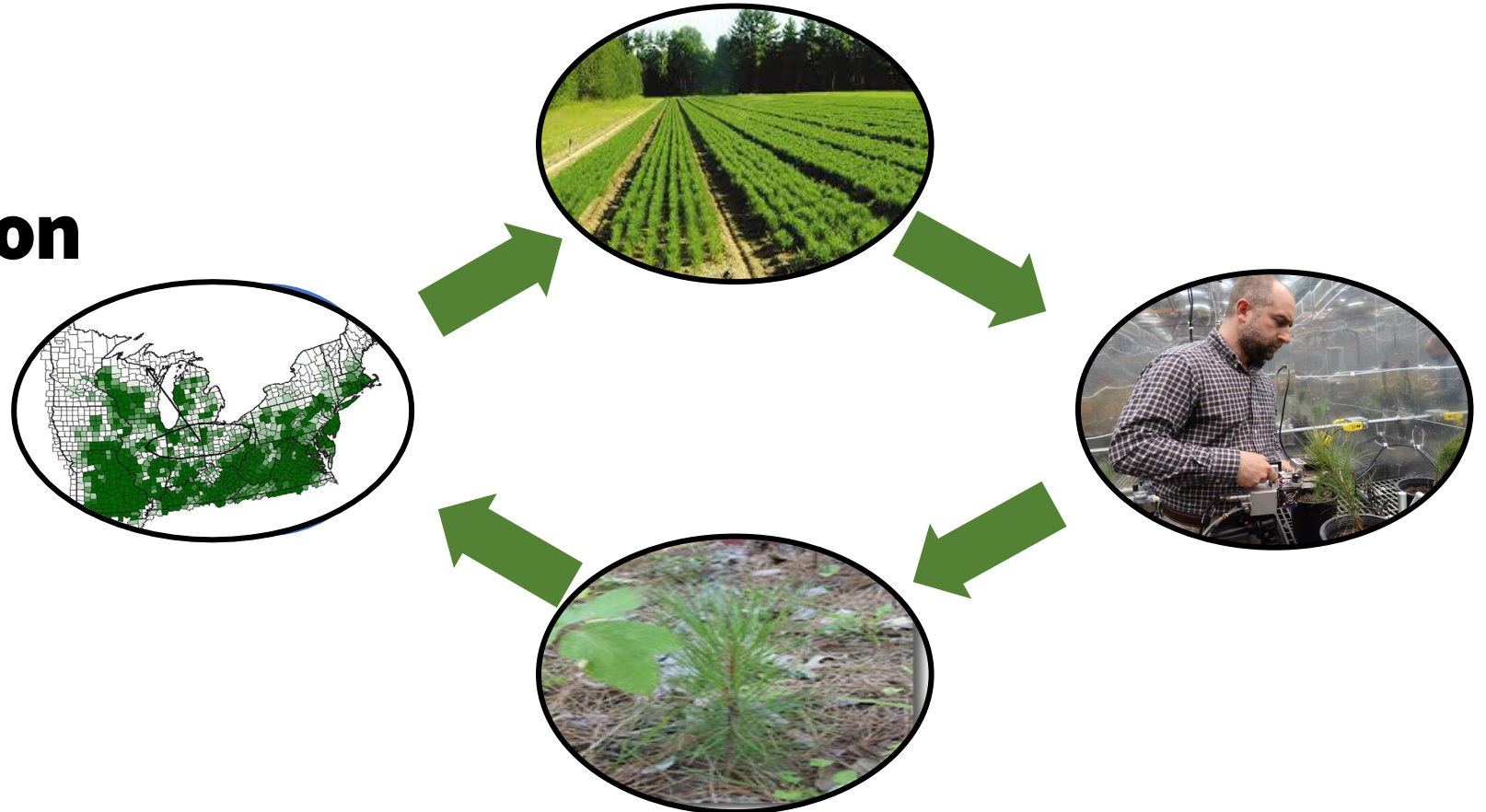


DREAM

dream-forests.org

...an ideation of the future forest through collaborative research and management

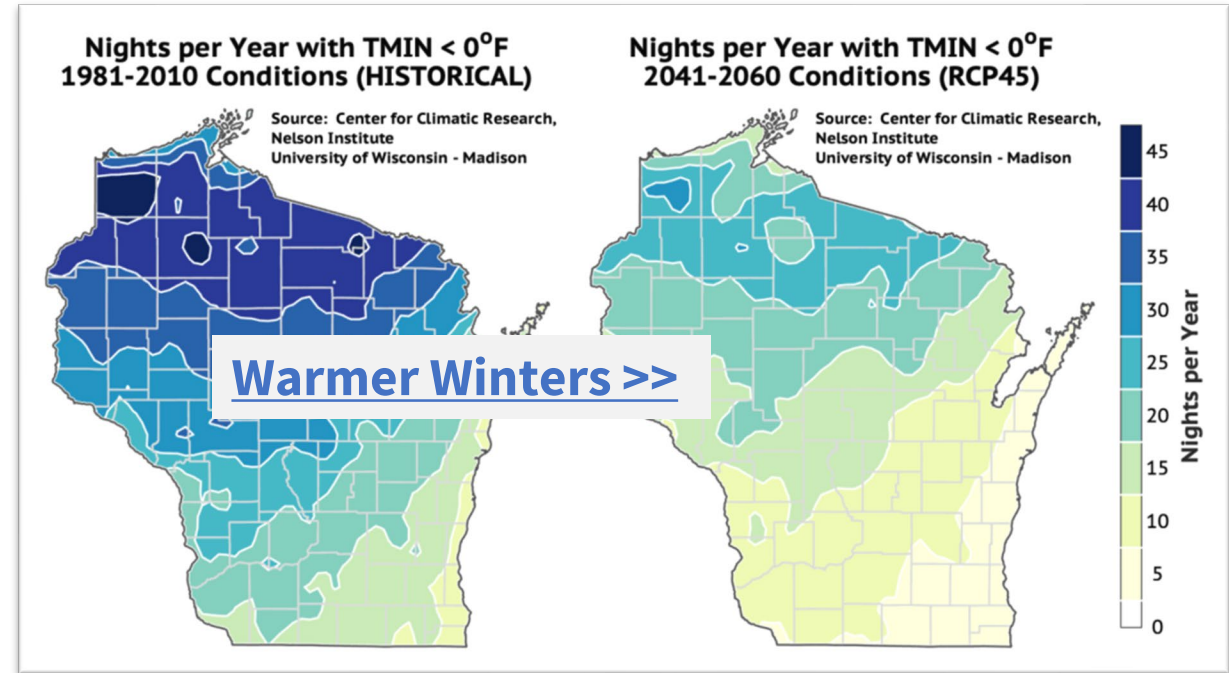
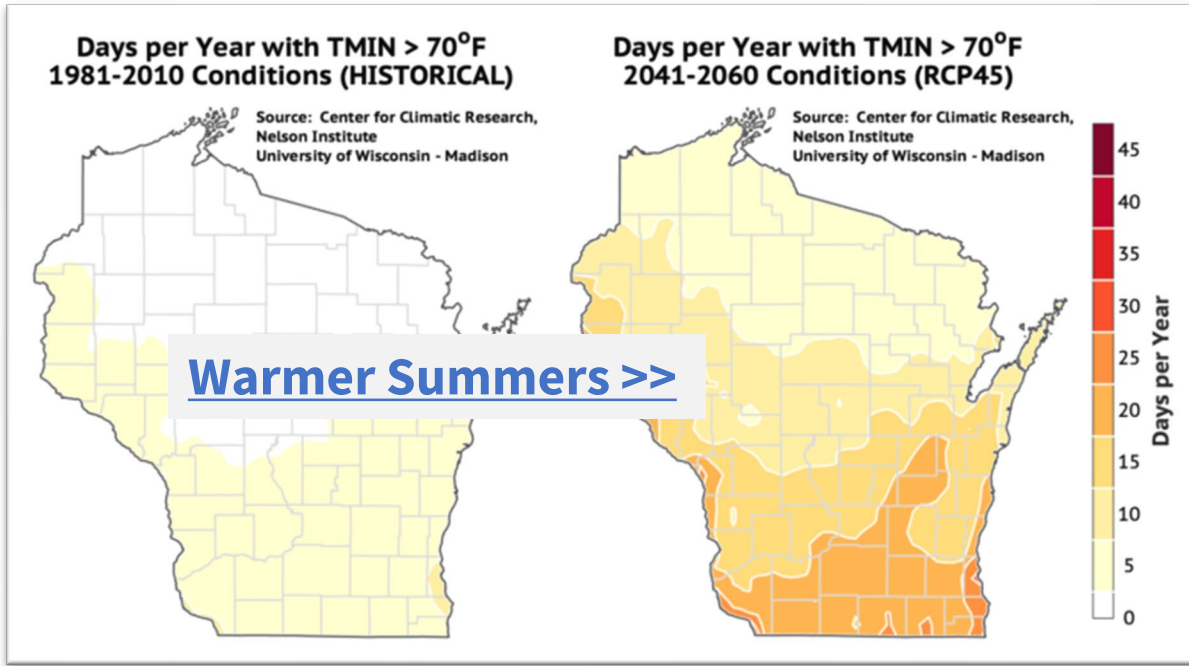
**Desired
REgeneration
through
**Assisted
Migration****



Presented by **Christel C. Kern** in collaboration with A. Royo, P. Raymond, and the Dream Team

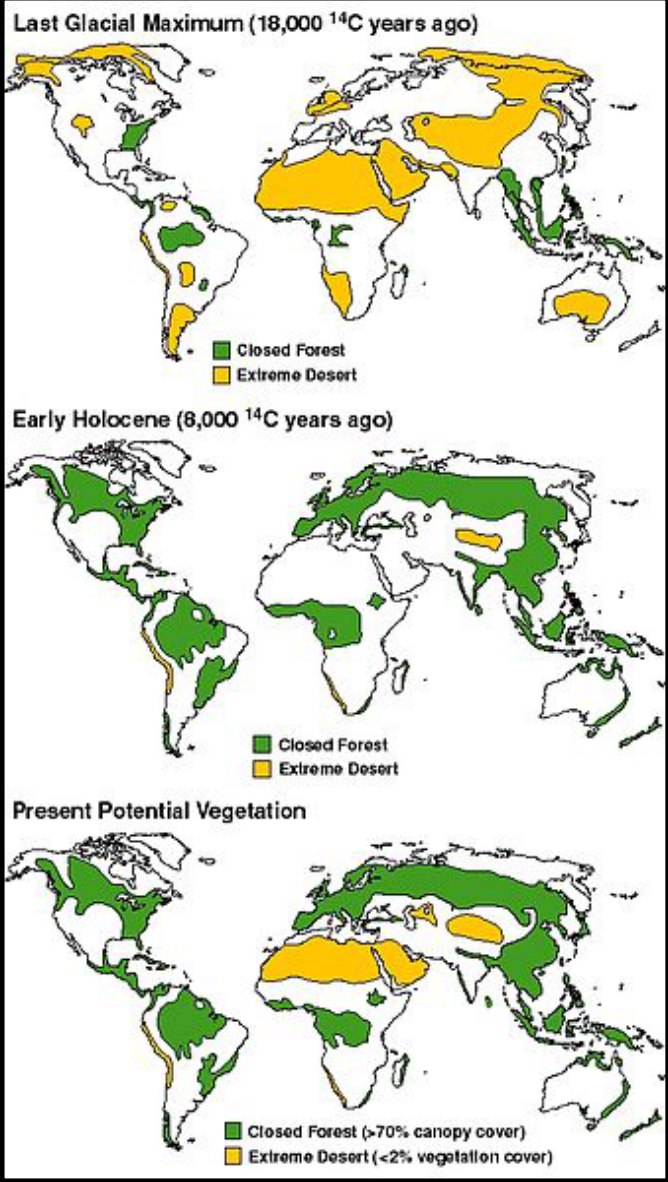


Changing climate

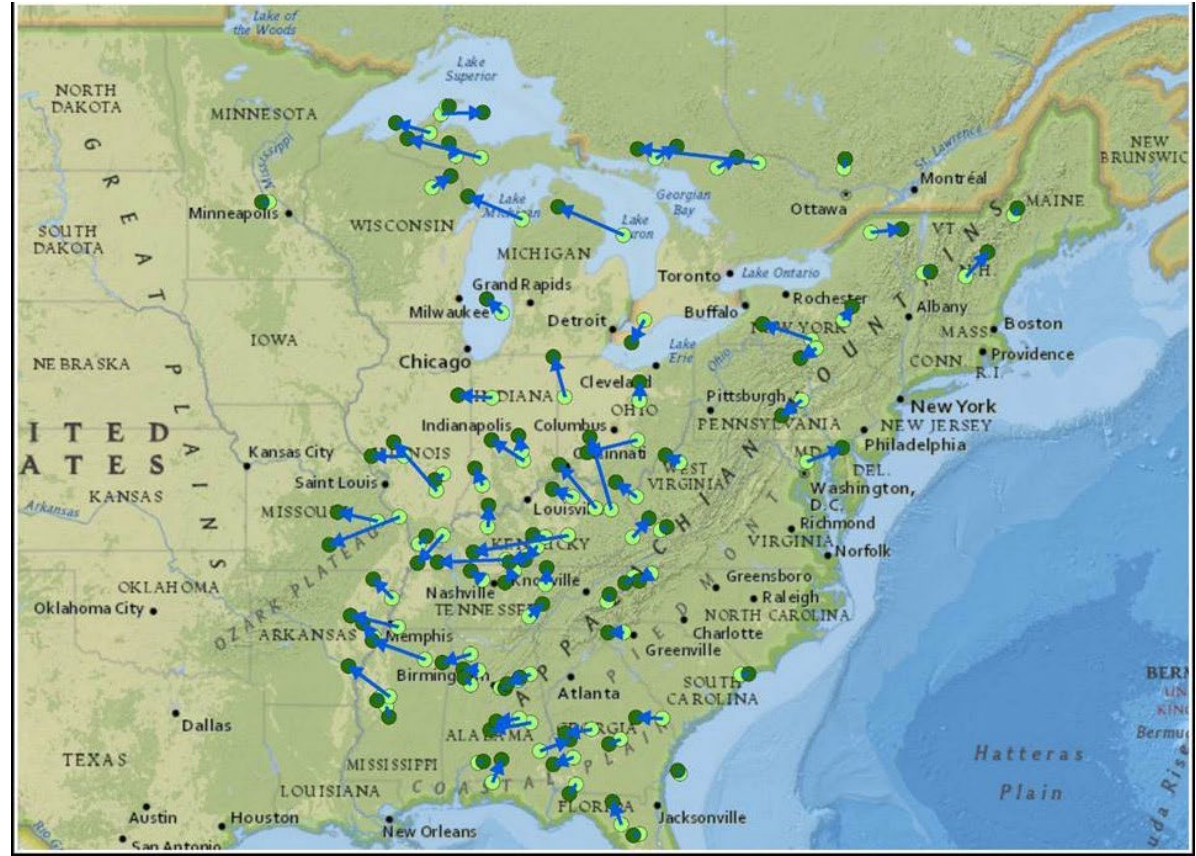


<https://wicci.wisc.edu/wisconsin-climate-trends-and-projections/>

Forests (green) change over geologic time



Forests change too



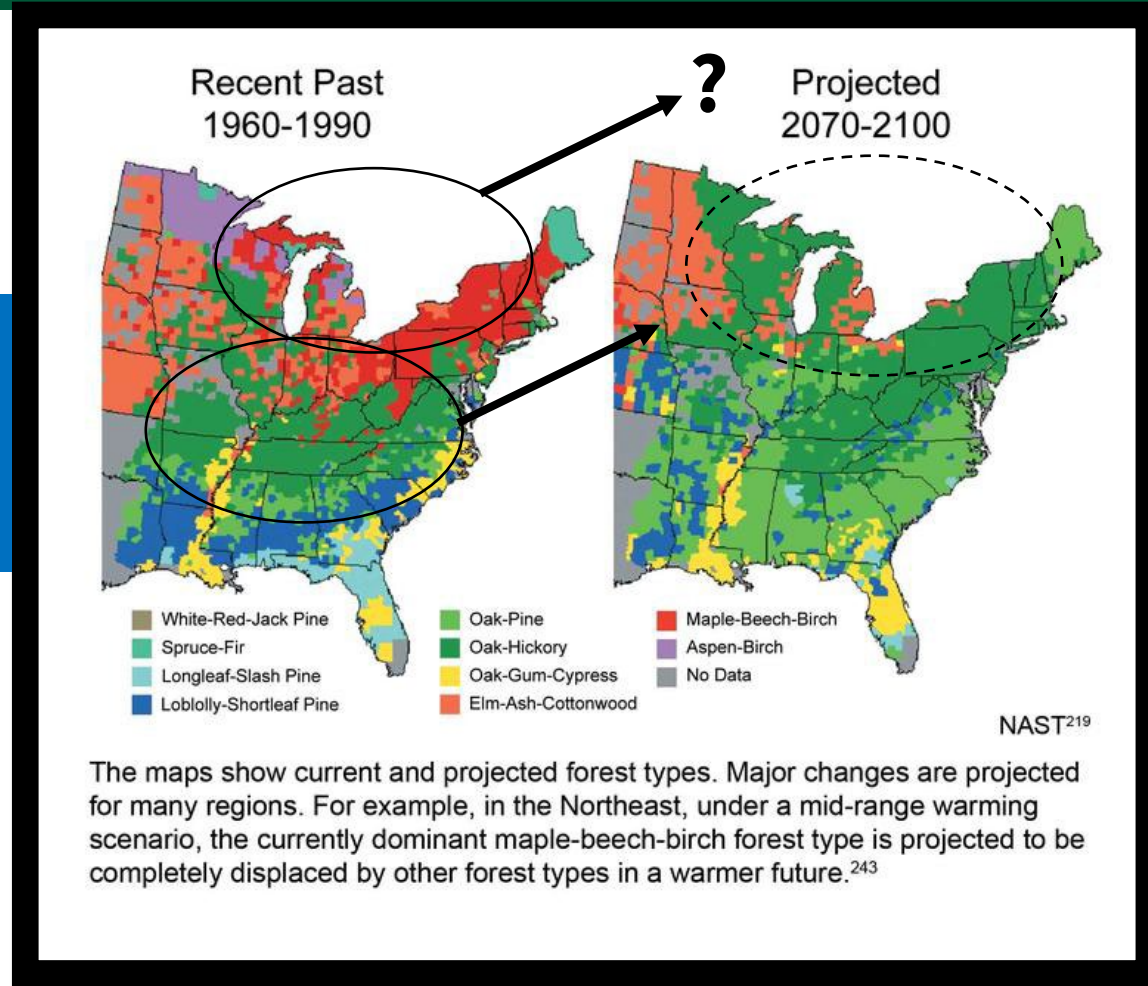
Credit: <https://www.americanforests.org/article/trees-on-the-move/>

Credit: https://nn.m.wikipedia.org/wiki/File:Aridity_ice_age_vs_early_holocene_vs_modern.jpg

Can forests keep up with climate?

Climate is changing faster than natural tree adaption and migration

Credit: <https://nn.m.serc.carleton.edu/eslabs/weather/7a.html>



Who cares?

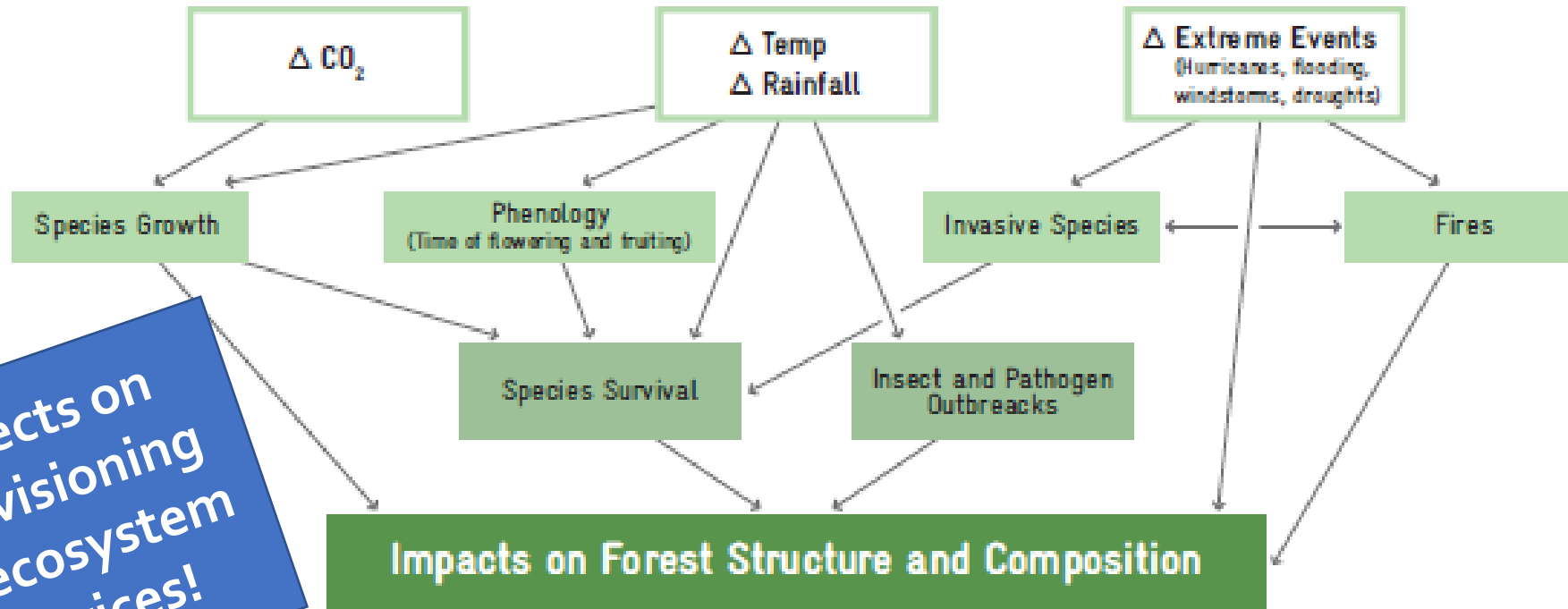


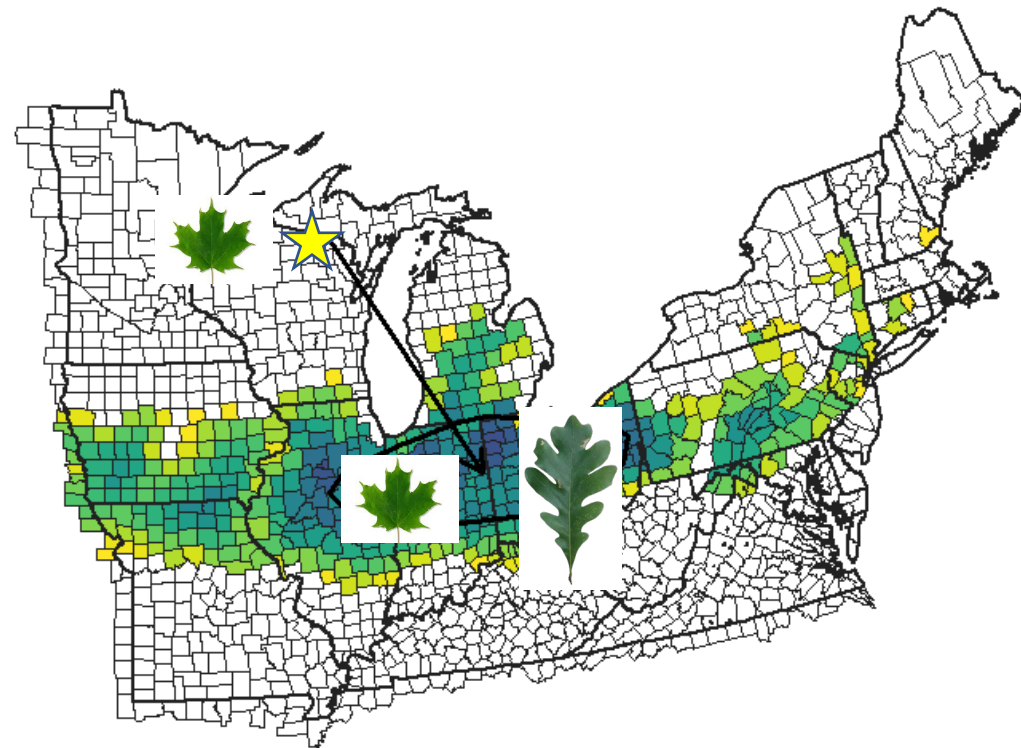
Figure 1: Potential impacts of climate change on forest ecosystems: a complex set of linked factors (CIFOR, World Agroforestry Centre and USAID (2009))



Climate-informed Forestry

What Action Should Managers Take?

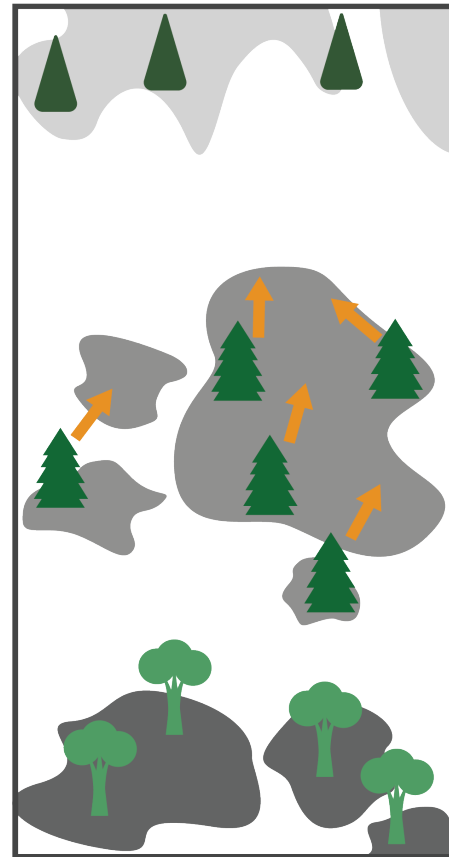
- Maintain current species & genetics
- Maintain current species, but add new genetics
- Incorporate climate-adapted species



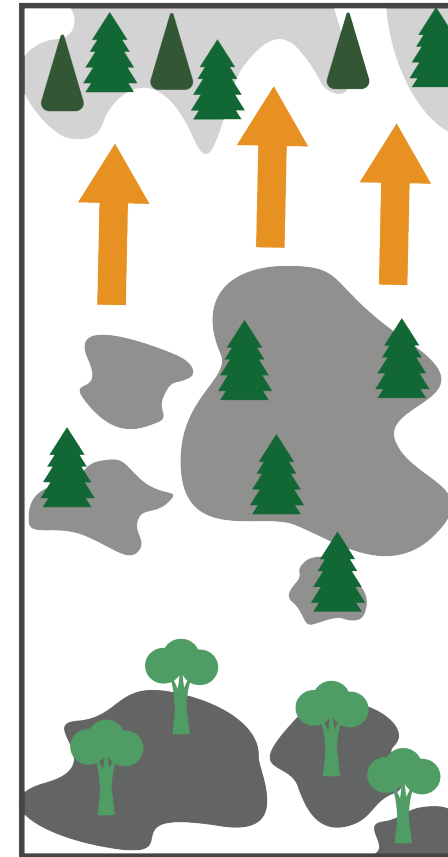
Example of Climate-informed Management

Forest Assisted Migration

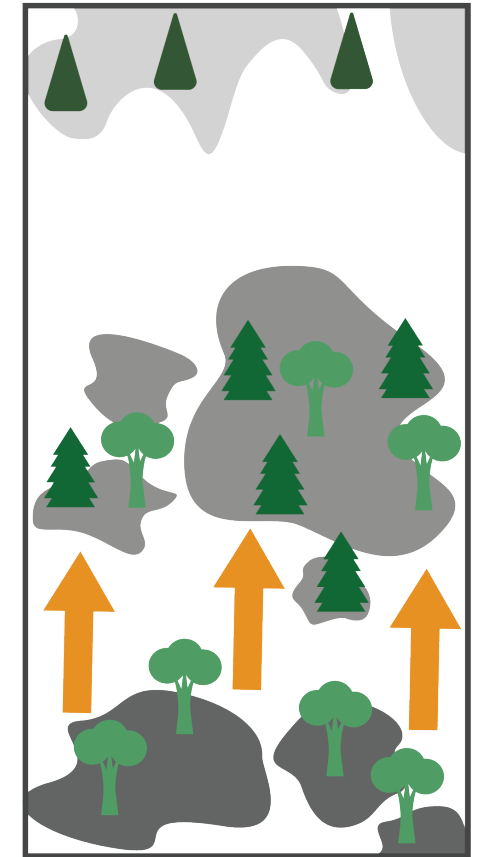
human-assisted relocation of species in response to climate change and may include one of the following components:



Assisted Population Migration



Assisted Range Expansion



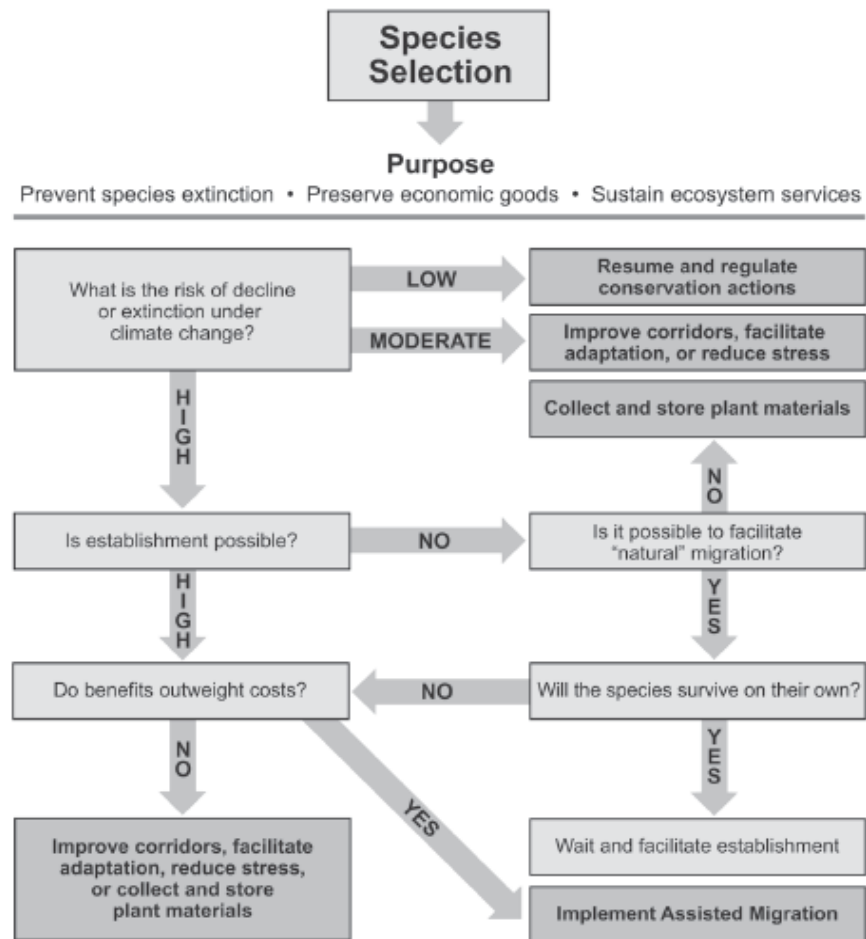
Assisted Species Migration

S.; Pike, C.; St. Clair, B.; 2018. Assisted Migration. USDA Forest Service Climate Change Resource Center. <https://www.fs.usda.gov/ccrc/topics/assisted-migration>



Forest Assisted Migration or Not?

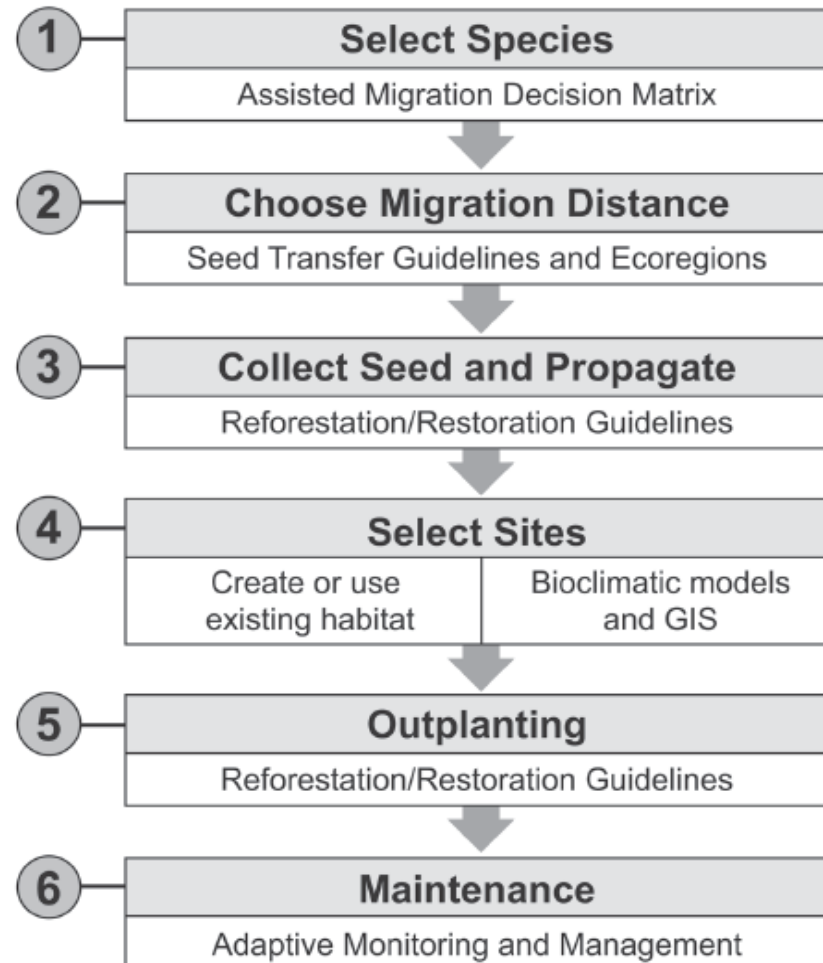
This is not a simple decision!



Williams & Dumroese. (2013). Growing assisted migration: synthesis of a climate change adaptation strategy. USDA Forest Service Proceedings, RMRS-P-69.

Forest Assisted Migration or Not?

This is not a simple process!



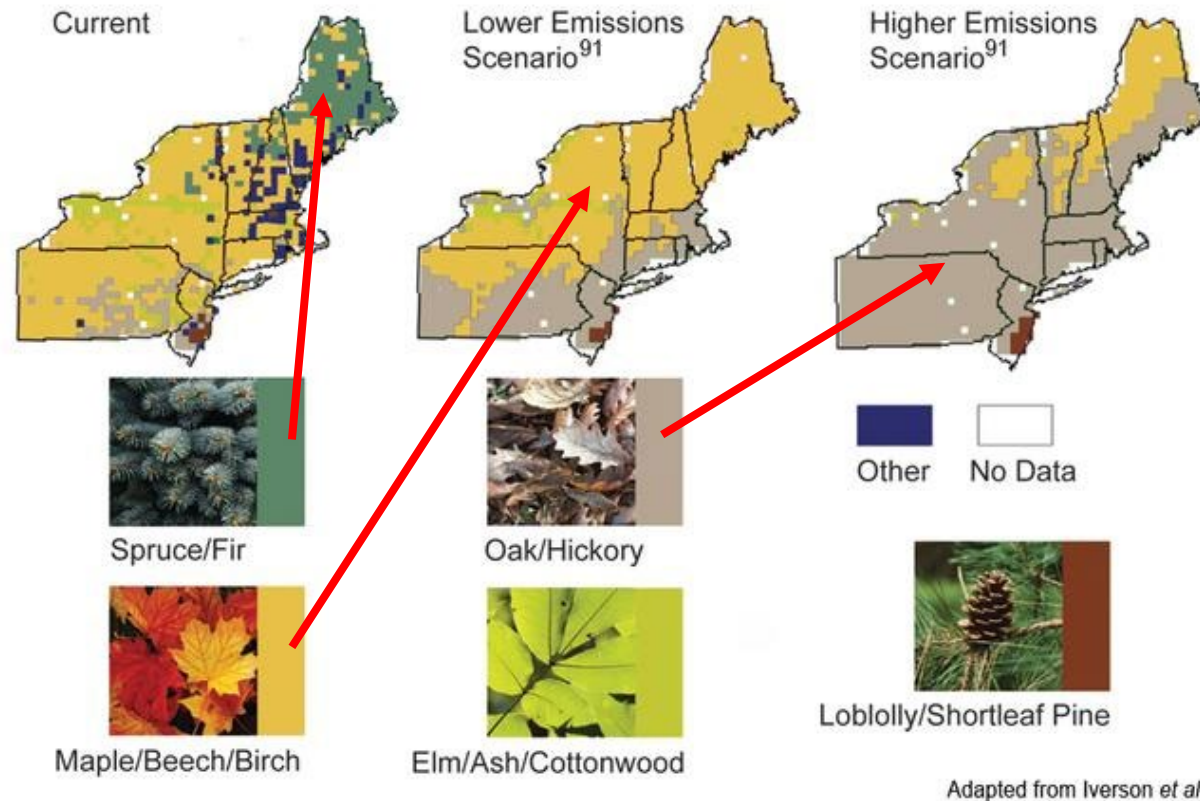
Williams & Dumroese. (2013). Growing assisted migration: synthesis of a climate change adaption strategy. USDA Forest Service Proceedings, RMRS-P-69.



Tools: Climate Change Tree Atlas

Predicted suitable habitat

<https://www.fs.usda.gov/nrs/atlas/>



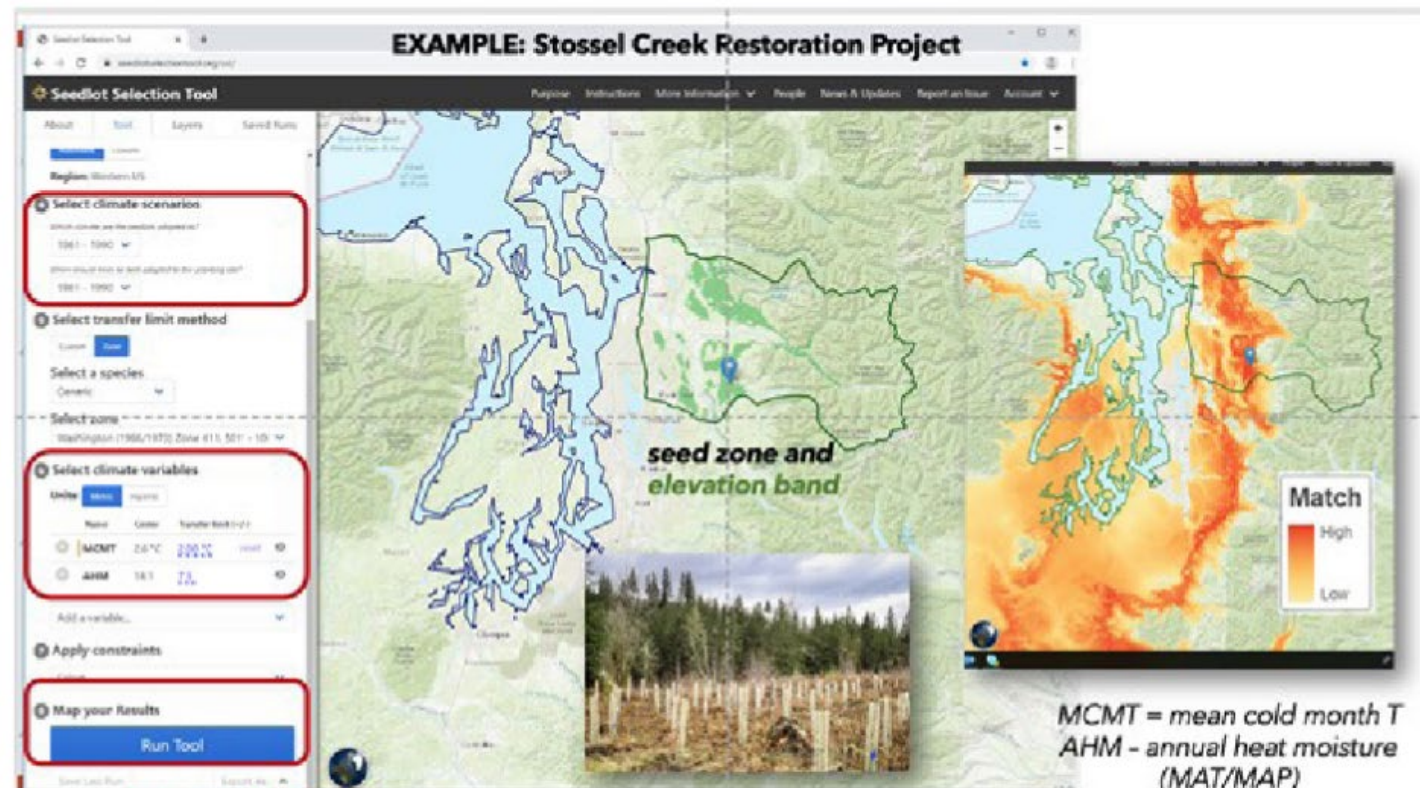
<https://serc.carleton.edu/eslabs/weather/7a.html>



Tools: Seedlot Selection Tool

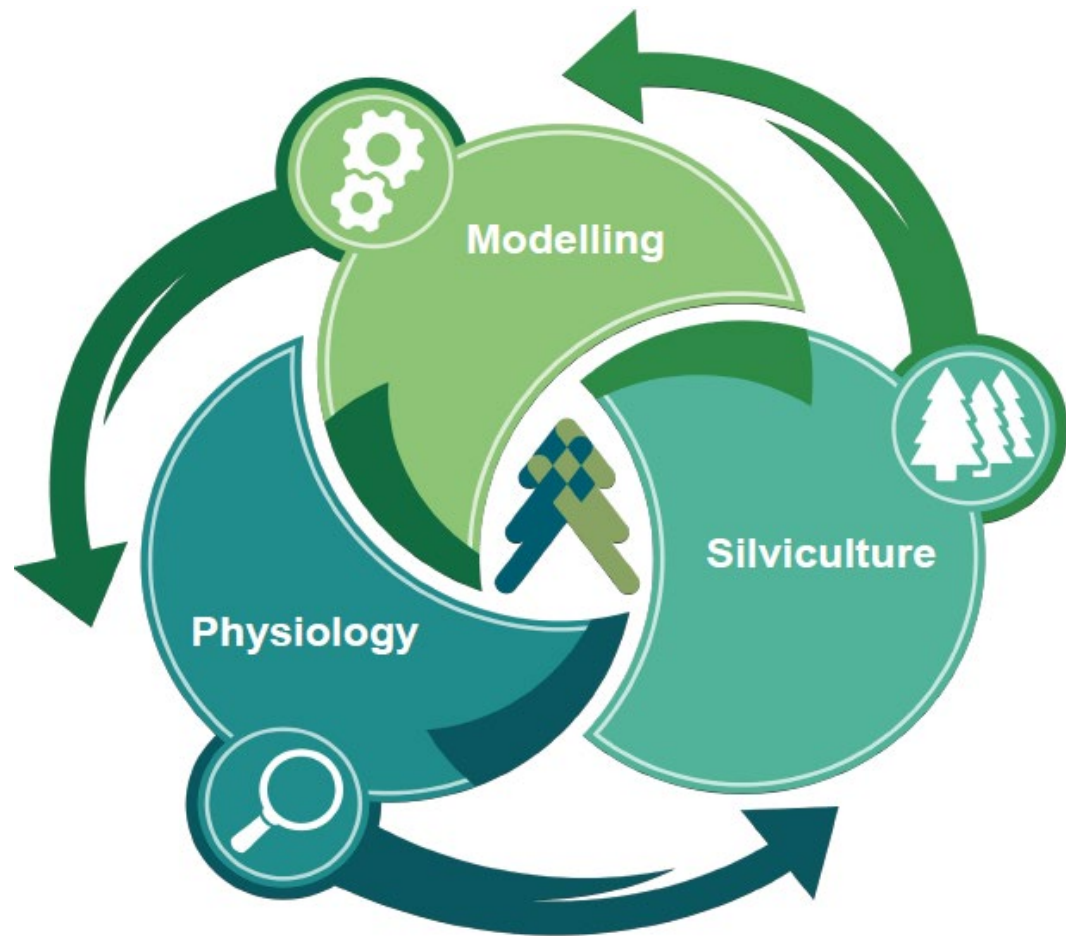
Match seedlots to climate info

<https://seedlotselectiontool.org/sst/>



https://www.b-e-f.org/wp-content/uploads/2021/04/BEF_Watersheds_newsletter242102_2-1.pdf

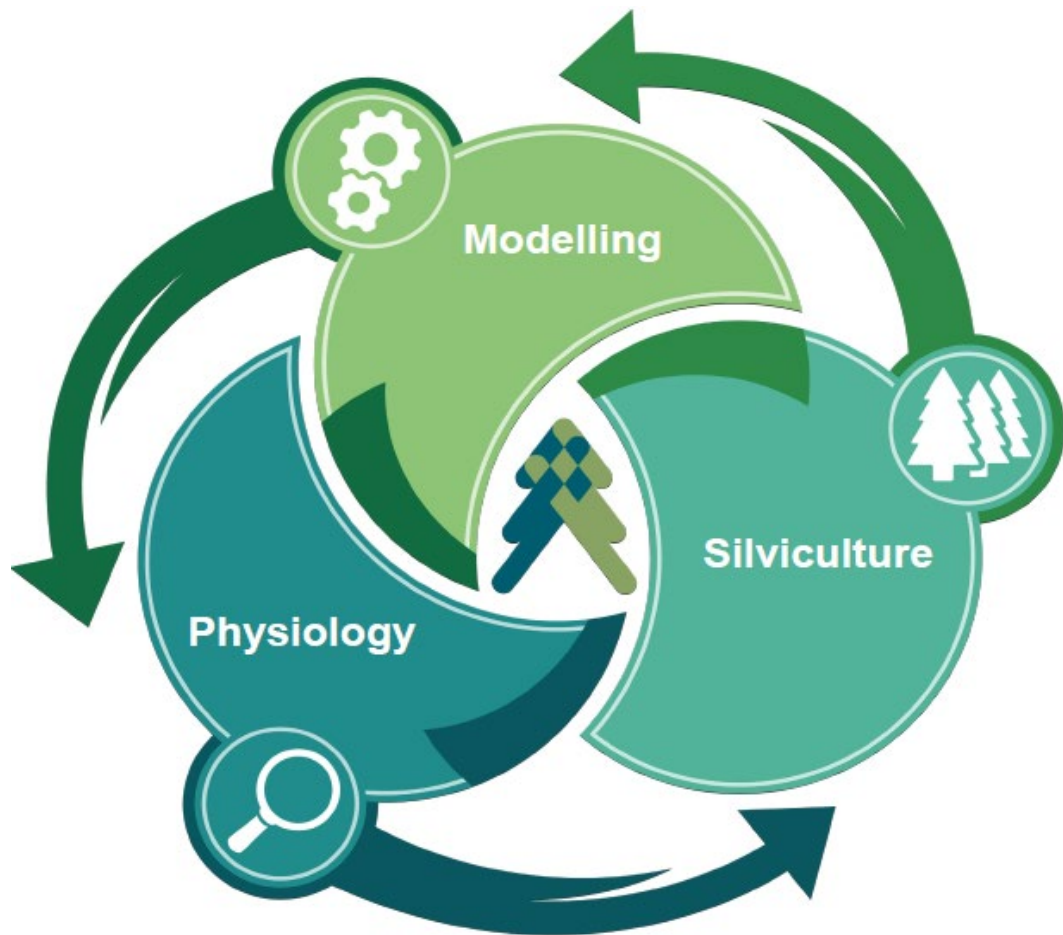
DREAM: What It Is



Structured and self-strengthening approach to forest assisted migration

- Create models and tools to target seed sourcing.
- Test the ecophysiological limits of sourced seedlings.
- Discern role of multiple drivers to derive silvicultural practices.
- Forecast dynamics of climate-adaptive plantings

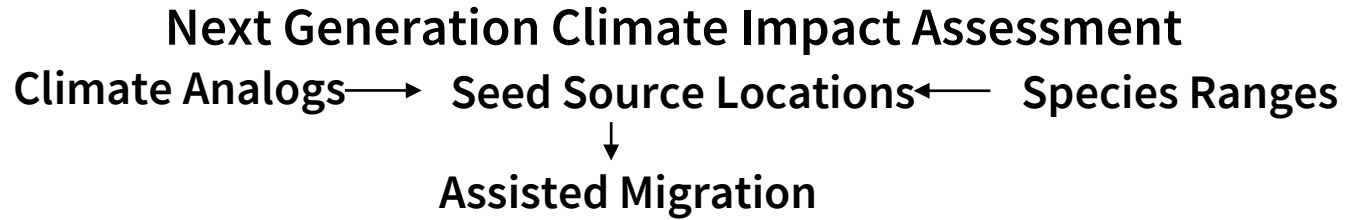
DREAM: What It Is



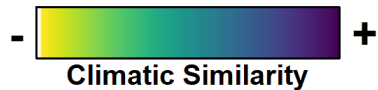
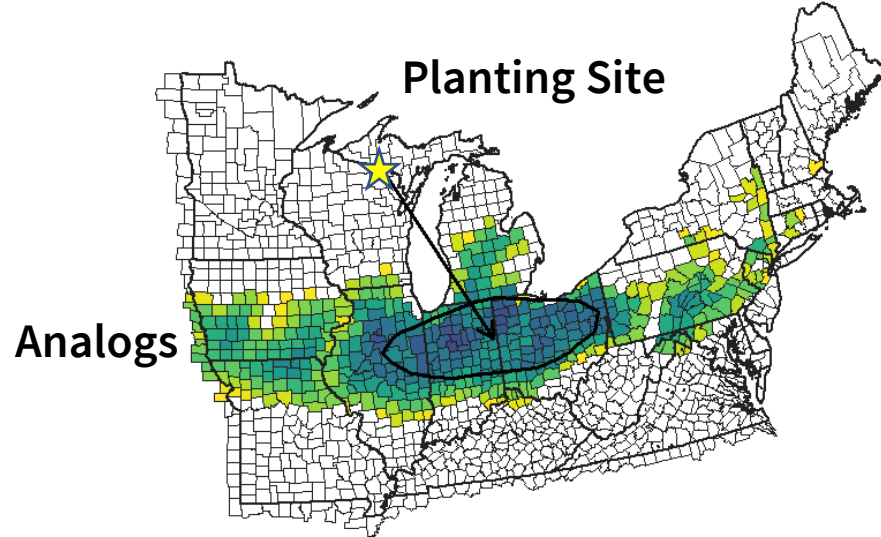
Collaborative and co-produced approach to forest assisted migration

- State: Wisconsin DNR & Michigan State.
- NFS: Chequamegon-Nicolet.
- NFS Region: Toumey Nursery, Timber Strike Team, ORSO.
- FS State and Private Forestry.
- NFS WO: Advising new FAM task force
- International: Ministry of Natural Resources and Forests; Laval University – Quebec.

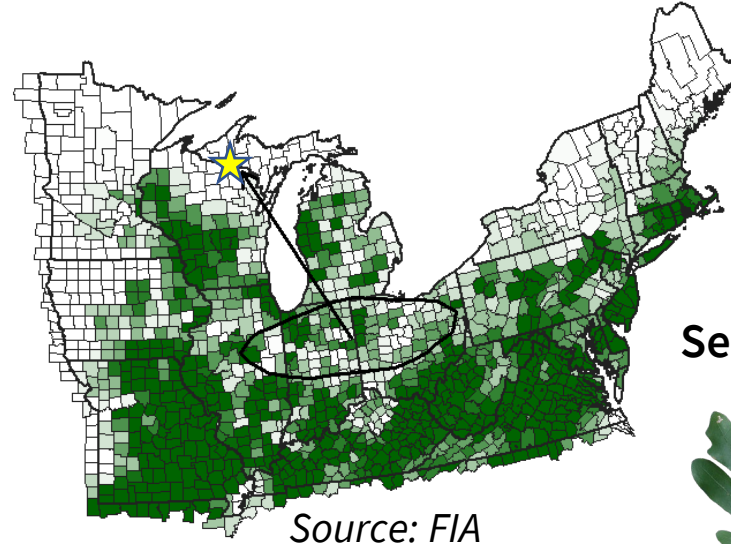
Step 1a: Model – Climate analogues



Late-century (2071-2100) – High Emissions Scenario



White Oak Relative Abundance



Seed





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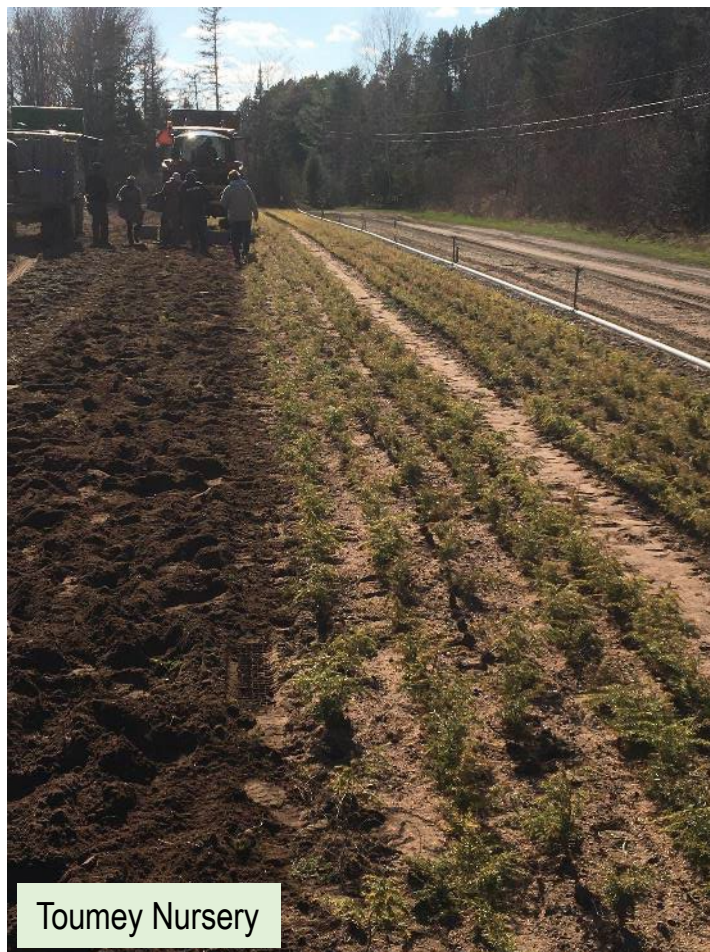
Step 1b: Collect Seeds & Propagate Seedlings



5433067



Oconto River Seed Orchard



Toumey Nursery

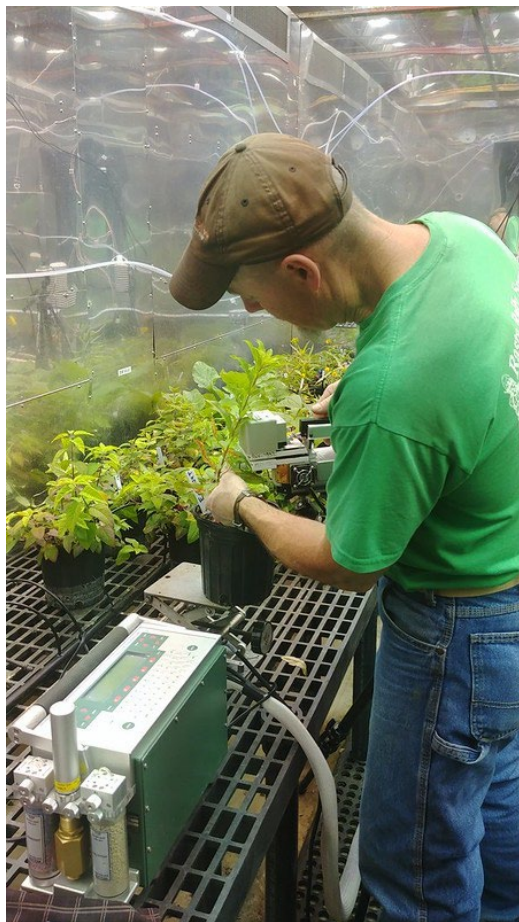
Need to act now to adapt to
changing climate

Infrastructure currently lacking

Collaborative opportunity with
research

**Ramping up Reforestation
in the United States:
A Guide for Policymakers
March 2021**

Step 2: Test Seedlings - Ecophysiology



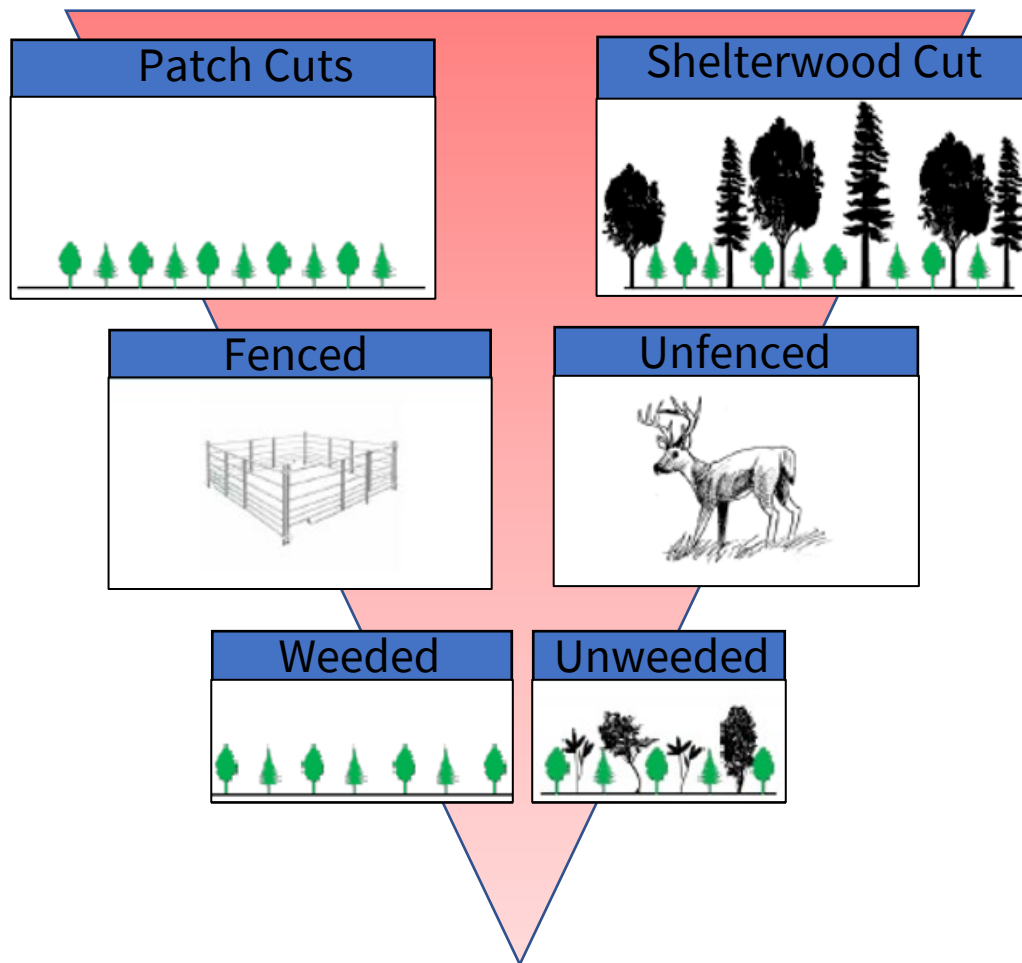
Test putative
adaptability to
conditions within the
expected range of
variation at planting site

Critical Missing Link



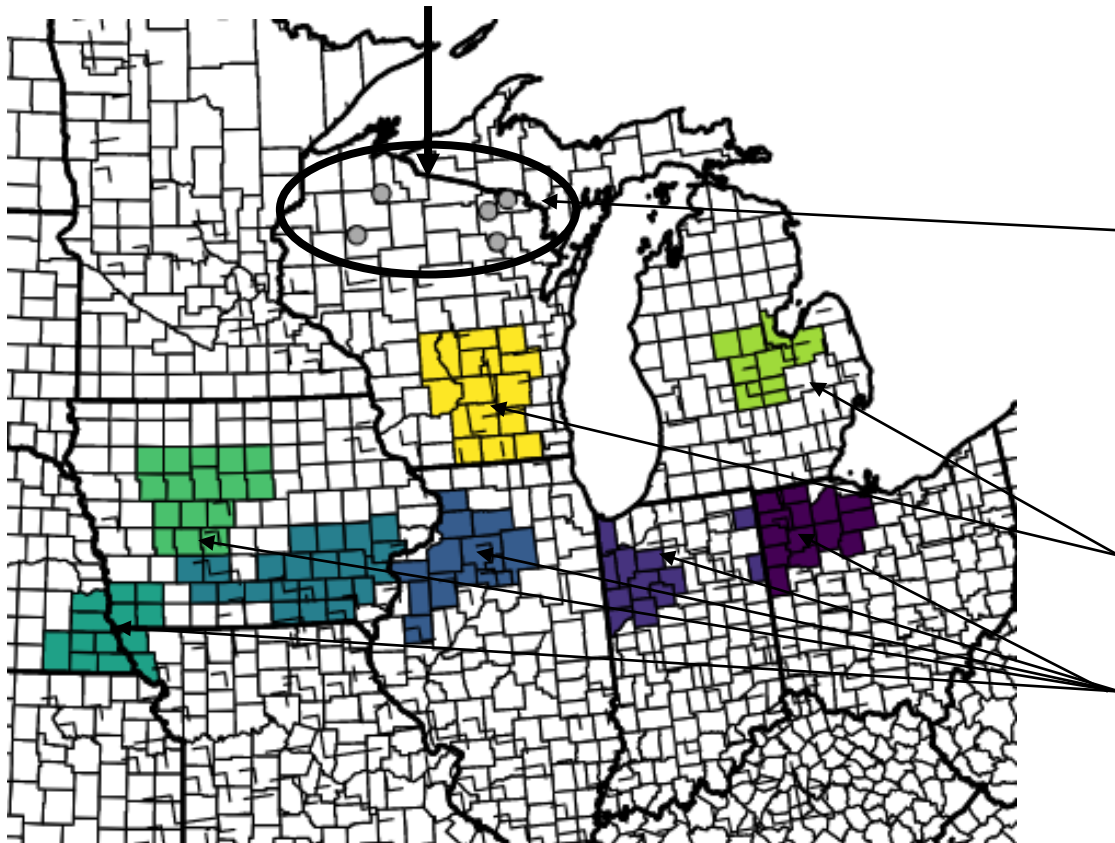
Photo credit: P. Raymond

Step 3: Experiment with Silviculture = Real-World Interactions



Step 3: Experiment with Silviculture = Real-World Interactions

Study sites



Seed Sources by Climate Analog:

- 1.** Current/Local
- 2.** Mid-century
- 3.** End-century

Example Species List

Native to planting site

- 1) Sugar maple
- 2) Basswood
- 3) White spruce
- 4) white cedar
- 5) Eastern white pine

Range Expansion

- 1) White oak
- 2) Shagbark hickory

Species Migration

- 1) Black walnut
- 2) Tulip poplar

Step 3: Experiment with Silviculture, 8 planned sites

6 northern
hardwood

1 oak-maple

1 mixedwood



3 Quebec
5 Wisconsin

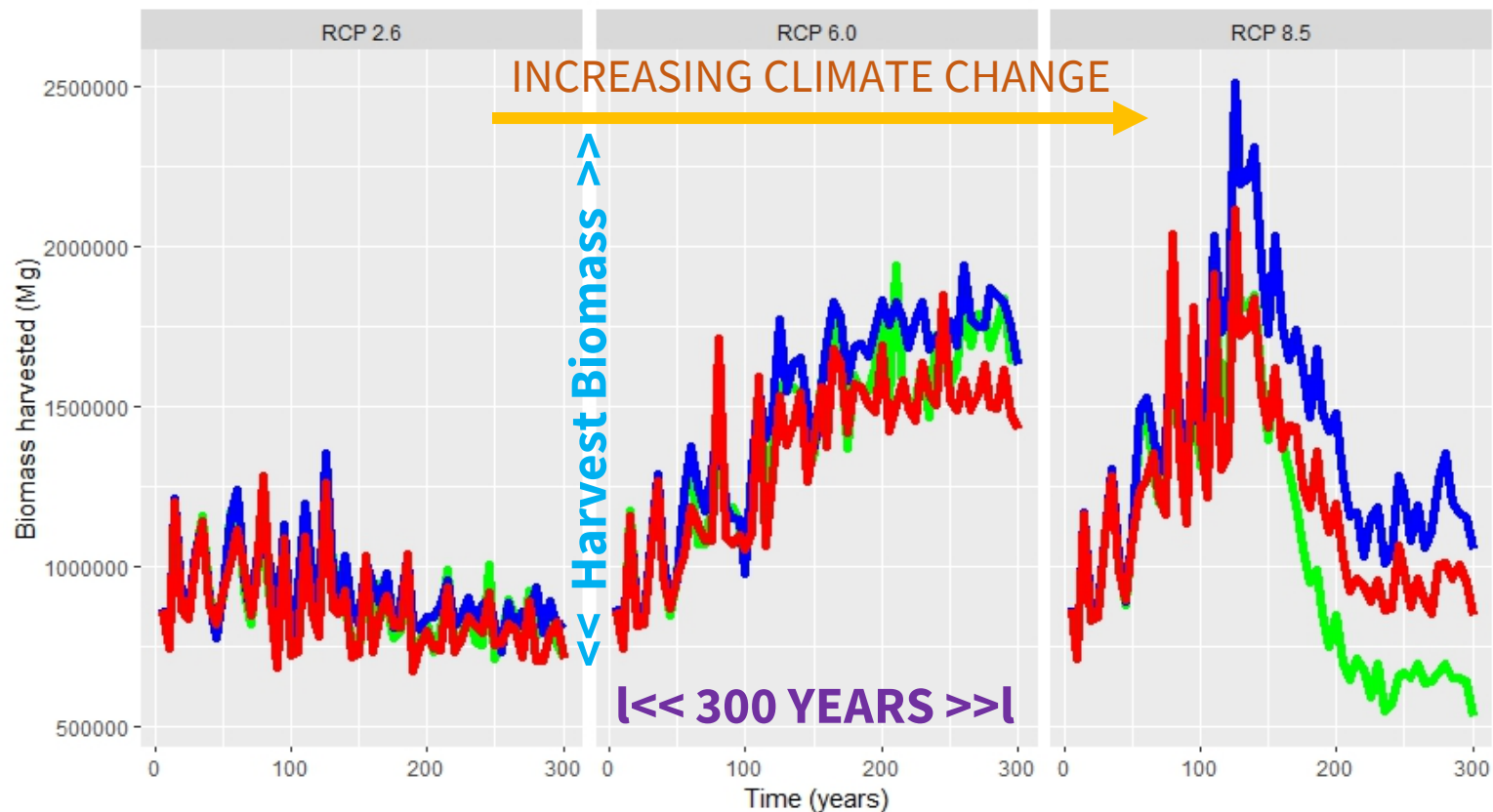
More??
Latitudinal
gradient across
boreal/temperate
ecotone

Step 4: Forecast Management Outcomes

Model Management Scenarios into Future

Data from field and lab

- Seed Sources
- Climate Change
- Silvicultural Systems



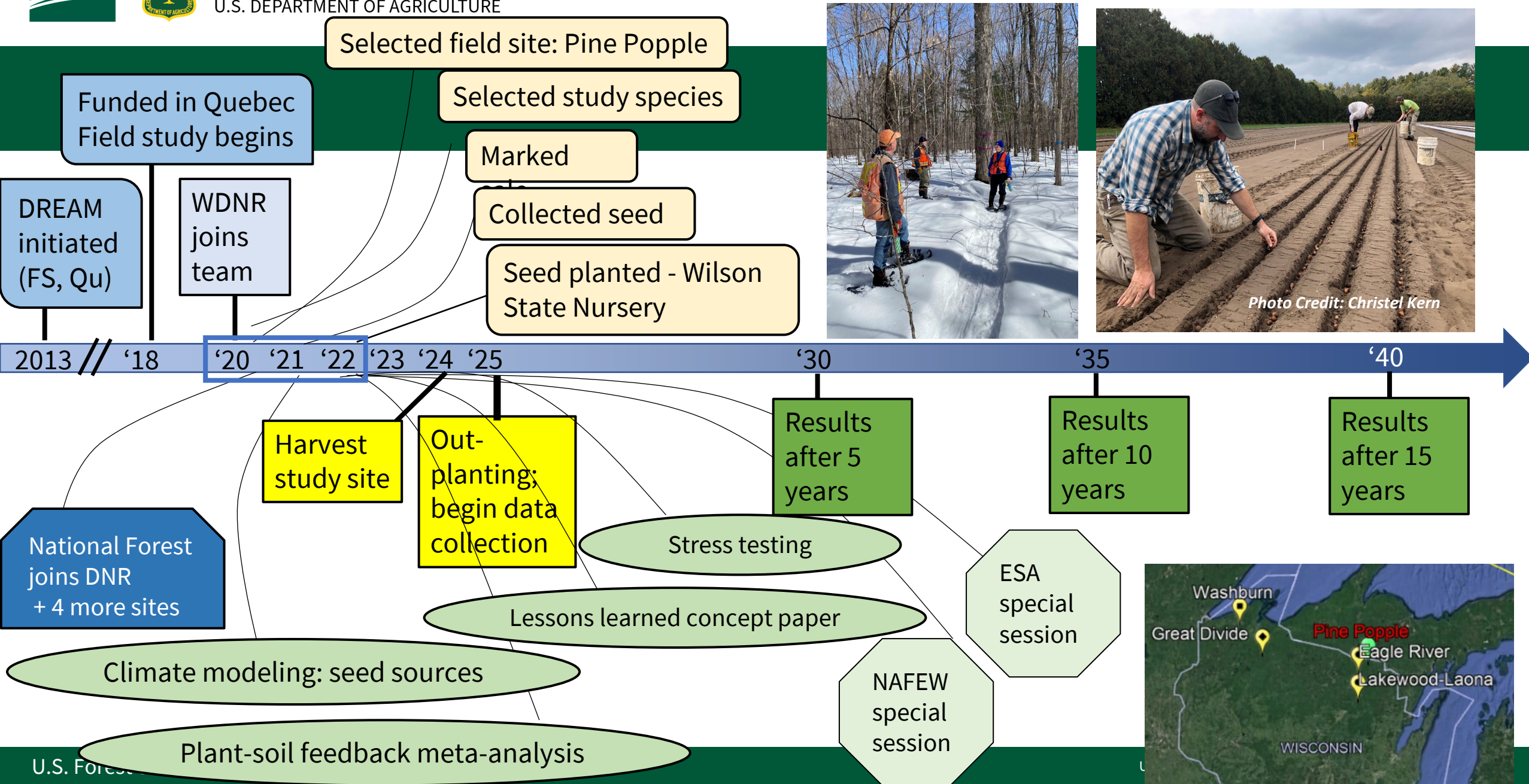
Assisted Migration Strategy ■ Short Range ■ Medium Range ■ Long Range

Gustafson et al. 2023. For Eco & Mgt 529: 120723



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Timeline & Products to Date





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Team Members and Follow-up

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Dr. Dustin Bronson; Research Plant Physiologist, Rhinelander, WI: Dustin.Bronson@usda.gov

Dr. Paula Marquardt; Retired Research Geneticist

USFS – R9

Dr. Nick Labonte, Regional Geneticist

USFS – SPTF

Dr. Carrie Pike, Regeneration Specialist

USFS – Chequamegon-Nicolet NF

Kyle Stover, Forest Silviculturist

Wisconsin Department of Natural Resources

Dr. Amanda McGraw; Research Scientist, Rhinelander, WI

Michigan State University

Dr. Jessica Miesel; Soil Scientist



DREAM

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Québec

Quebec Ministry of Natural Resources and Forests

Dr. Patricia Raymond