USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE



Updates on the American elm breeding program

Cornelia (Leila) Wilson, Kathleen Knight,
Charlie Flower, Gus Goodwin and many others!

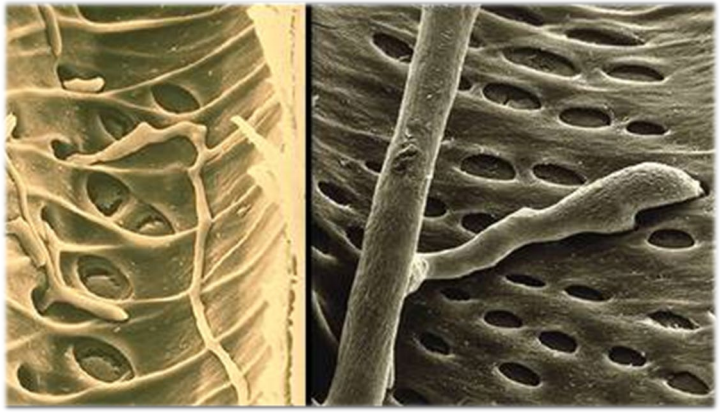
Dutch elm disease, caused by *Ophiostoma ulmi* and *O. novo-ulmi*

ELM THREAT

A dead elm tree is a silent threat to all living elms. It may serve as a breeding place for elm bark beetles which transmit the lethal Dutch elm disease. Cut down and burn all dead trees. If the tree cannot be removed now, at least strip and burn the bark, which might be a shelter for the beetles.

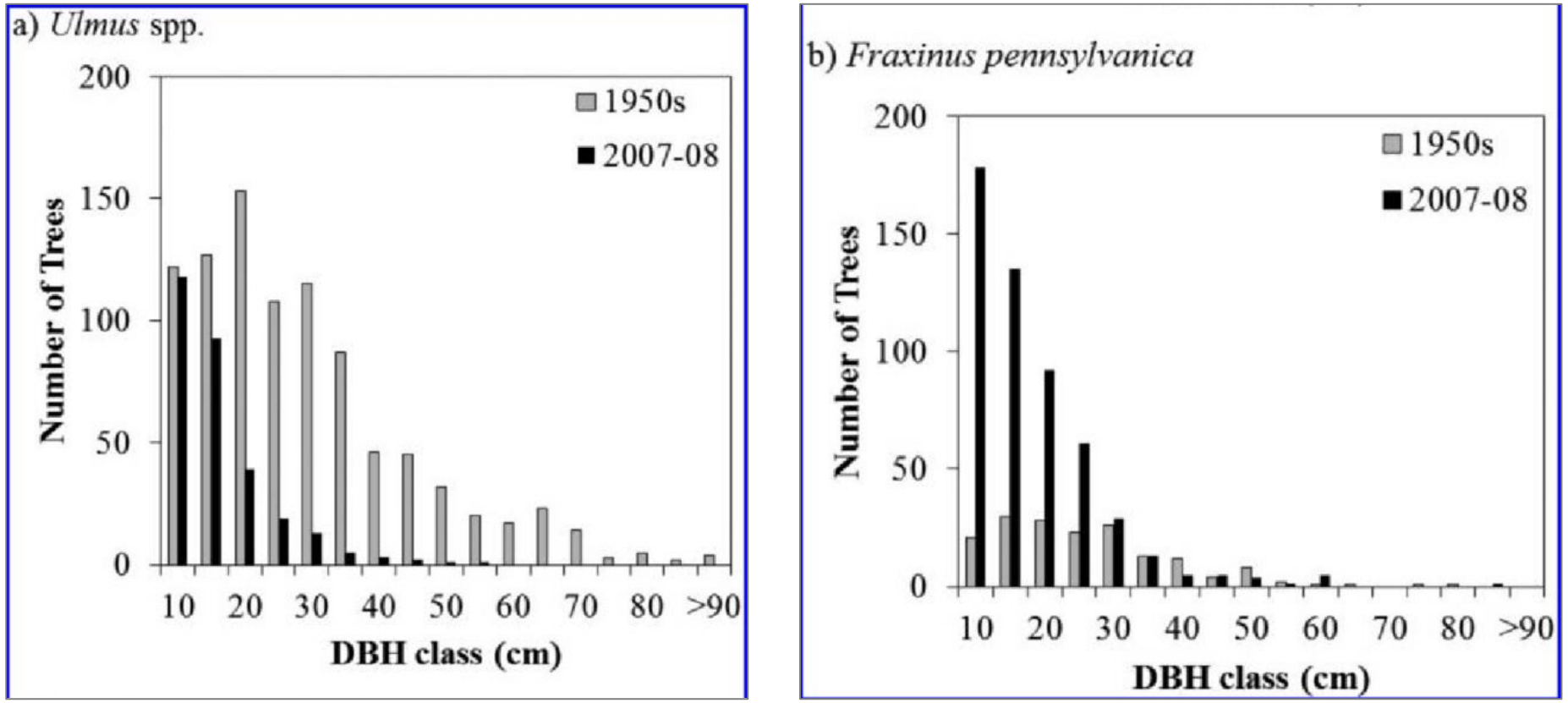
NYT Sept 30, 1956

Smaller European elm bark beetle



Mycelial growth of *O. ulmi* in elm xylem vessels.
www.dutchelmdisease.org

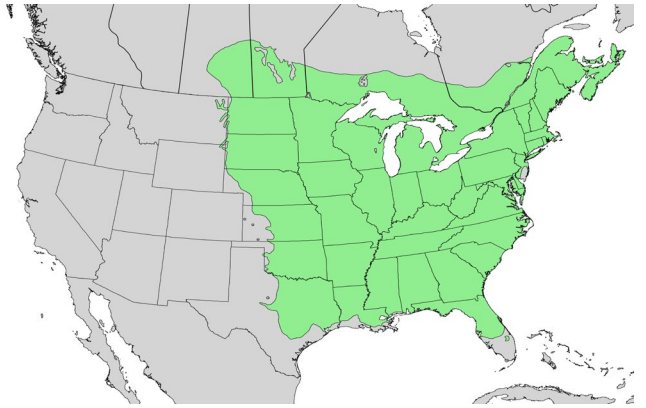
Current status of American elm



Comparison of density–diameter distributions by time period (1950s vs. 2007–2008) for (*a*) *Ulmus* spp. combined and (*b*) *Fraxinus pennsylvanica* among lowland forests in Southern Wisconsin

Johnson and Waller, 2012, Canadian Journal of Forest Research 43: 159-170

American elm (*Ulmus americana*)



Geological Survey. 1999. Digital representation of E.L. Little 1971 "Atlas of United States Trees"

- Intermediate to shade tolerant
- Intermediate in flood tolerance
- Fast growing
- Tolerates a wide range of environmental conditions

American elm (*Ulmus americana*)

Blackburnian Warbler

Yellow-Rumped Warbler

McCormac (2023), jimmccormac.com

Golden-Winged Warbler

- Elms can start flowering at 15 years old
- Bird richness followed elm bud development (r^2=0.4) and was highest during peak of spring migration, also when seeds have developed (R. Koontz, S. Matthews, Ohio State U)

Support of Lepidoptera species

Table 1. Twenty most valuable plant genera ranked (from most to least) in terms of their ability to support Lepidoptera species in the mid-Atlantic (U.S.A.) region.

Rank	*Plant genus*	*Common name*	*Lepidoptera richness*
1	*Quercus*	oak	534
2	*Prunus*	cherry; plum	456
3	*Salix*	willow	455
4	*Betula*	birch	411
5	*Populus*	poplar; cottonwood	367
6	*Malus*	crabapple	308
7	*Vaccinium*	blueberry; cranberry	294
8	*Acer*	maple	297
9	*Alnus*	alder	255
10	*Carya*	hickory	235
11	*Ulmus*	elm	215
12	*Pinus*	pine	201
13	*Crataegus*	hawthorn	168
14	*Rubus*	blackberry; raspberry	163
15	*Picea*	spruce	150
16	*Fraxinus*	ash	149
17	*Tilia*	basswood	149
18	*Pyrus*	pear	138
19	*Rosa*	rose	135
20	*Corylus*	filbert	131

From Tallemy and Shropshire, 2009, Conservation Biology 23(4):941-947.

Elm sphinx moth, *Ceratomia amyntor*

Double-toothed prominent moth, *Nerice bidentata*

Mourning cloak, *Nymphalis antiopa*

Question mark, *Polygonia interrogationis*

“Universal element of the American urban landscape”

-Thomas Campanella

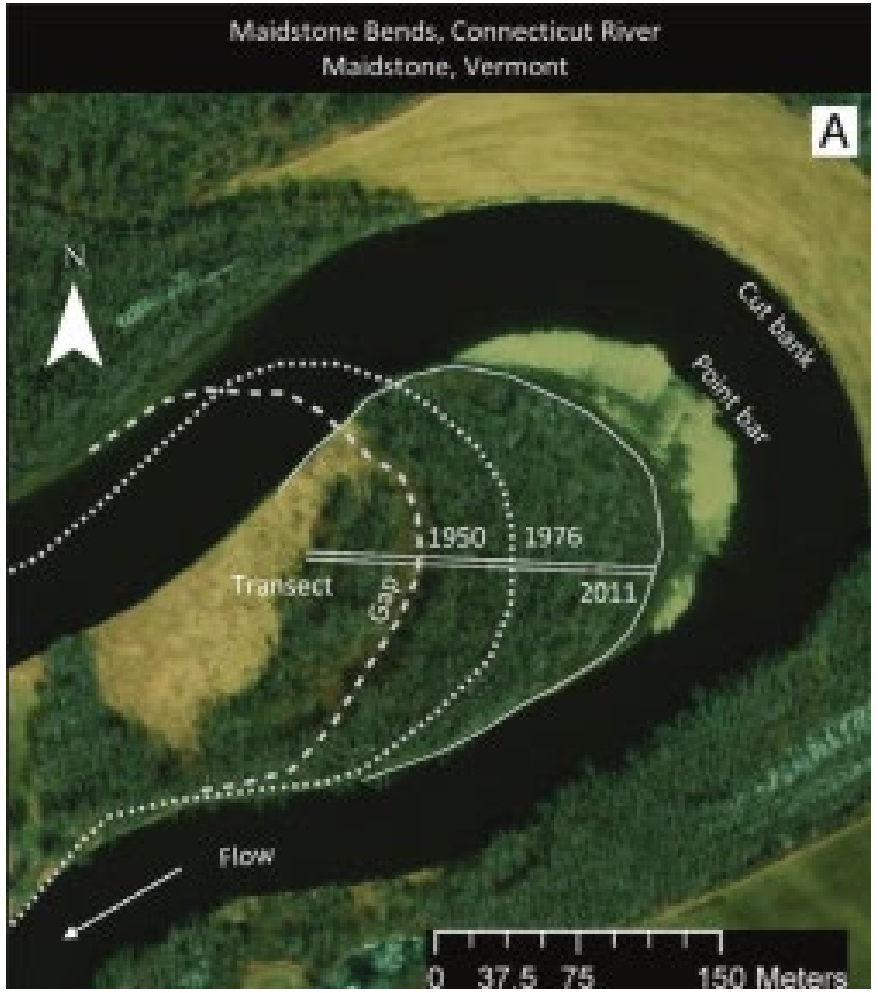
On itree species list for:

- Best temperature cooling
- For reduction of carbon monoxide
- For reduction of ozone
- For reduction of sulfer and nitrogen oxides
- For reduction of particulate matter

Nowak and Heisler. 2010. Air Quality Effects of Urban Trees and Parks. National Recreation and Park Association.

Floodplain forests: ecosystems in peril

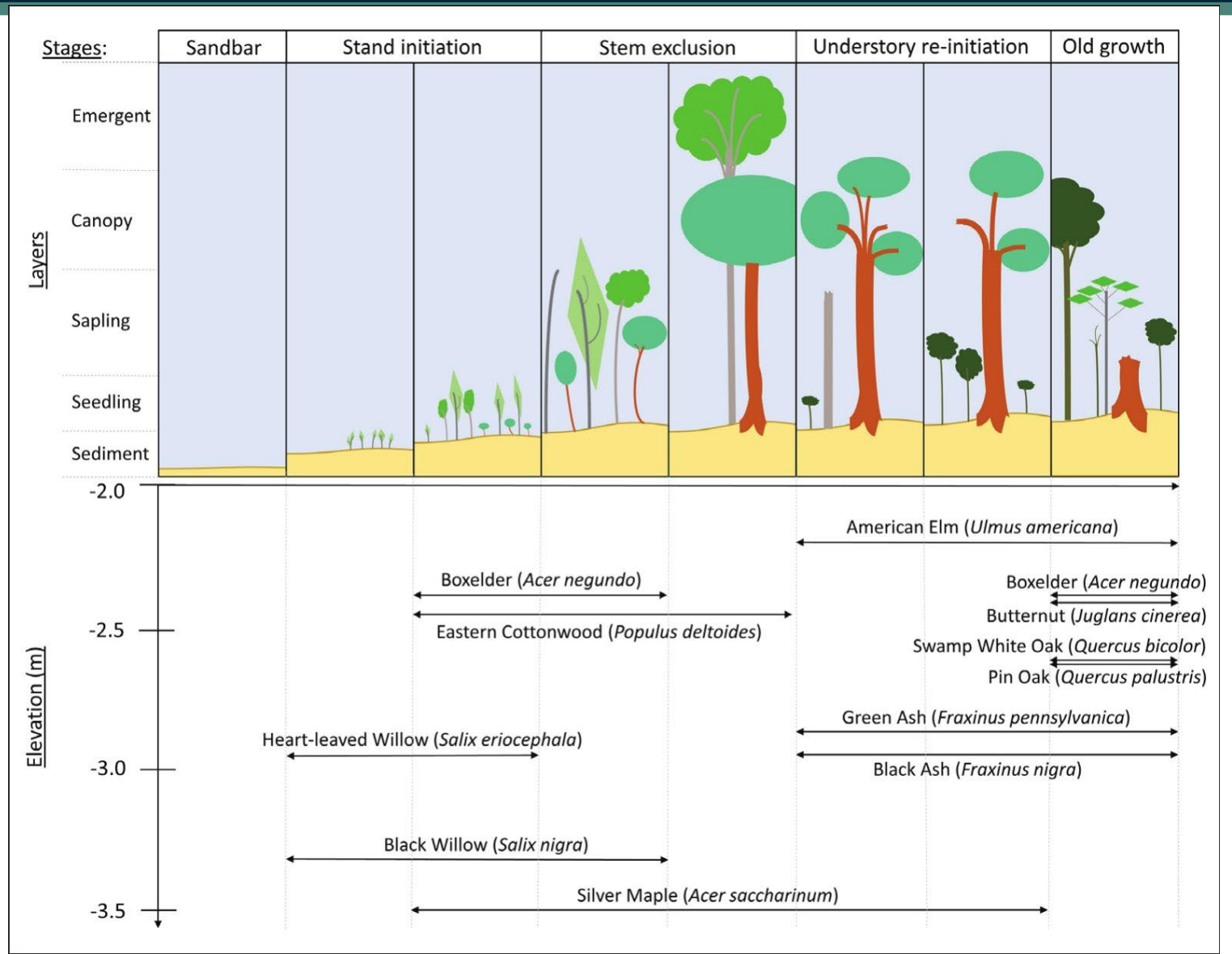
- Dynamic ecosystems due to periodic flooding
- Flooding regime impacts tree species composition
- Values:
  - Flood attenuation
  - Filter sediment and nutrients
  - Maintain/improve water quality
  - Sustain biodiversity
  - Tremendous economic value



Marks, Yellen & Nislow, Northeast Naturalist 2021

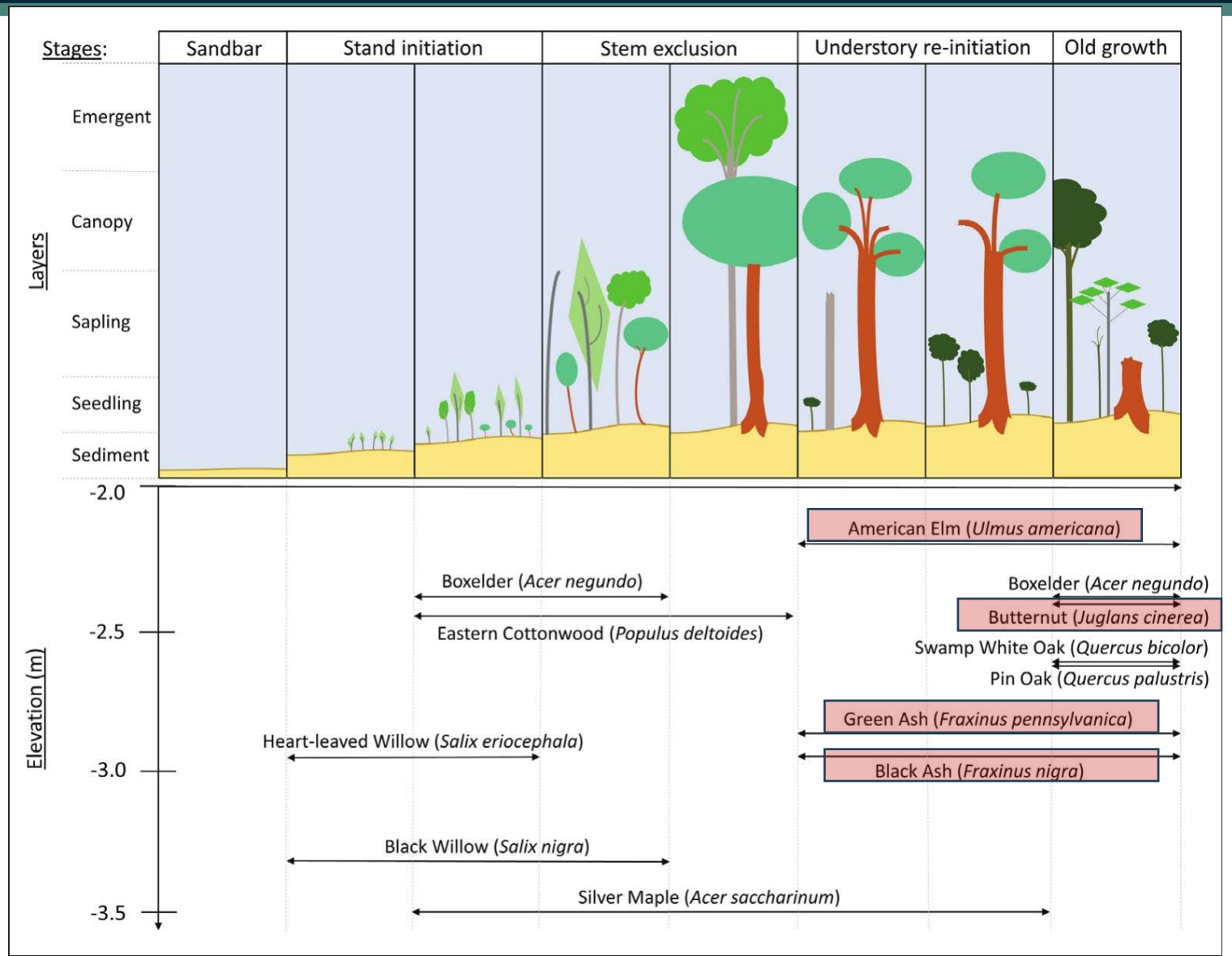
Changes to floodplain forests: > 80% substantially modified

Stand dynamics in floodplain forests



Marks, Yellen and Nislow. 2021. Northeast Naturalist.

Stand dynamics in floodplain forests



Marks, Yellen and Nislow. 2021. Northeast Naturalist.

Vision for tree species restoration

Restoring not just this species, but in doing so, contributing to the restoration of ecosystems that have seen unparalleled deterioration and change.

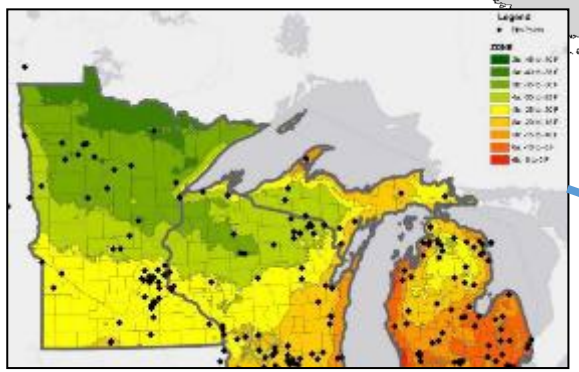
Planting in formerly grazed wetland

Planting after NNIP removal

EAB impacted floodplain

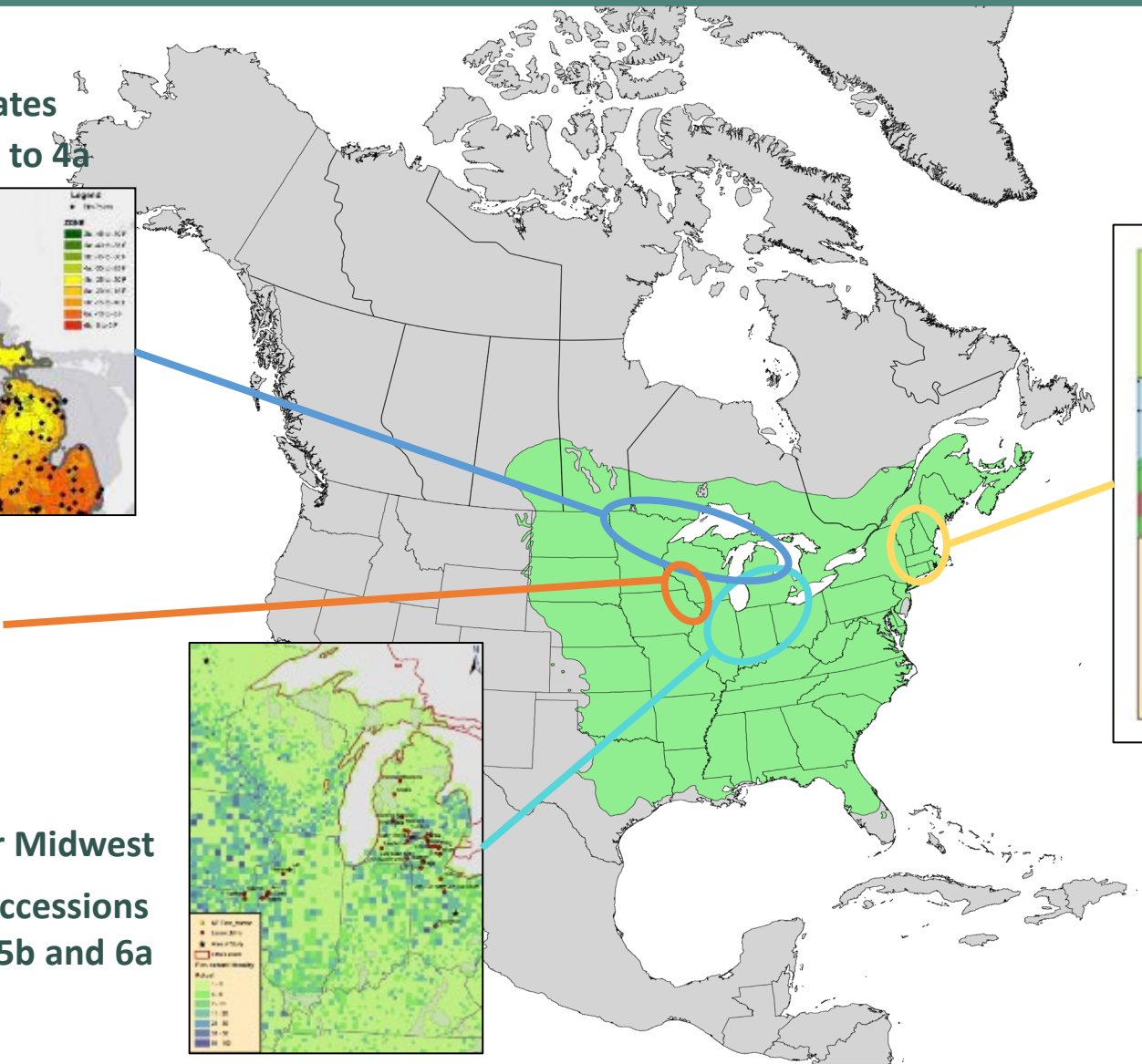
American elm breeding and restoration partnership

Cold-Hardy Lake States
~38 accessions, Zone 2b to 4a

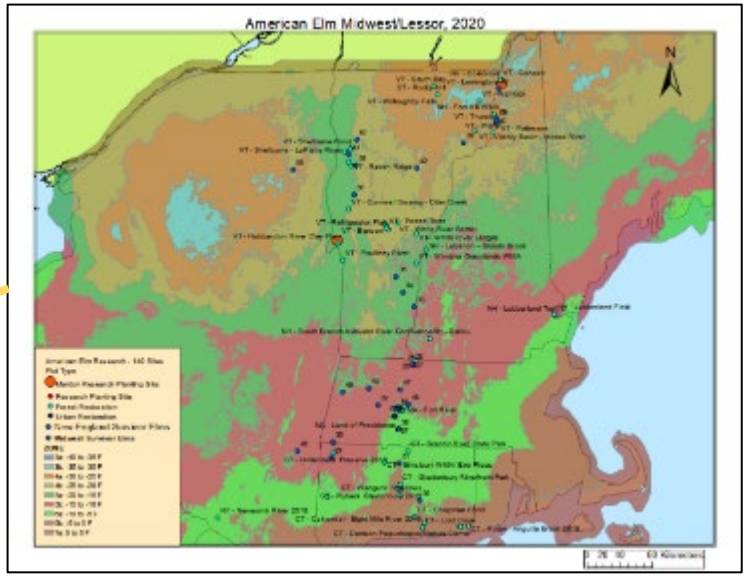


Upper Mississippi
~30 accessions
Zone 4b to 5b

Lower Midwest
~40 accessions
Zone 5b and 6a



New England Connecticut River



26 accessions, Zone 2b to 5b
Inoculations in 2026

The Nature Conservancy

Pipeline for resistant American elms

Survivor elm

≥ 1 year

Propagate elm

1-2 years

Field resistance test

5 years

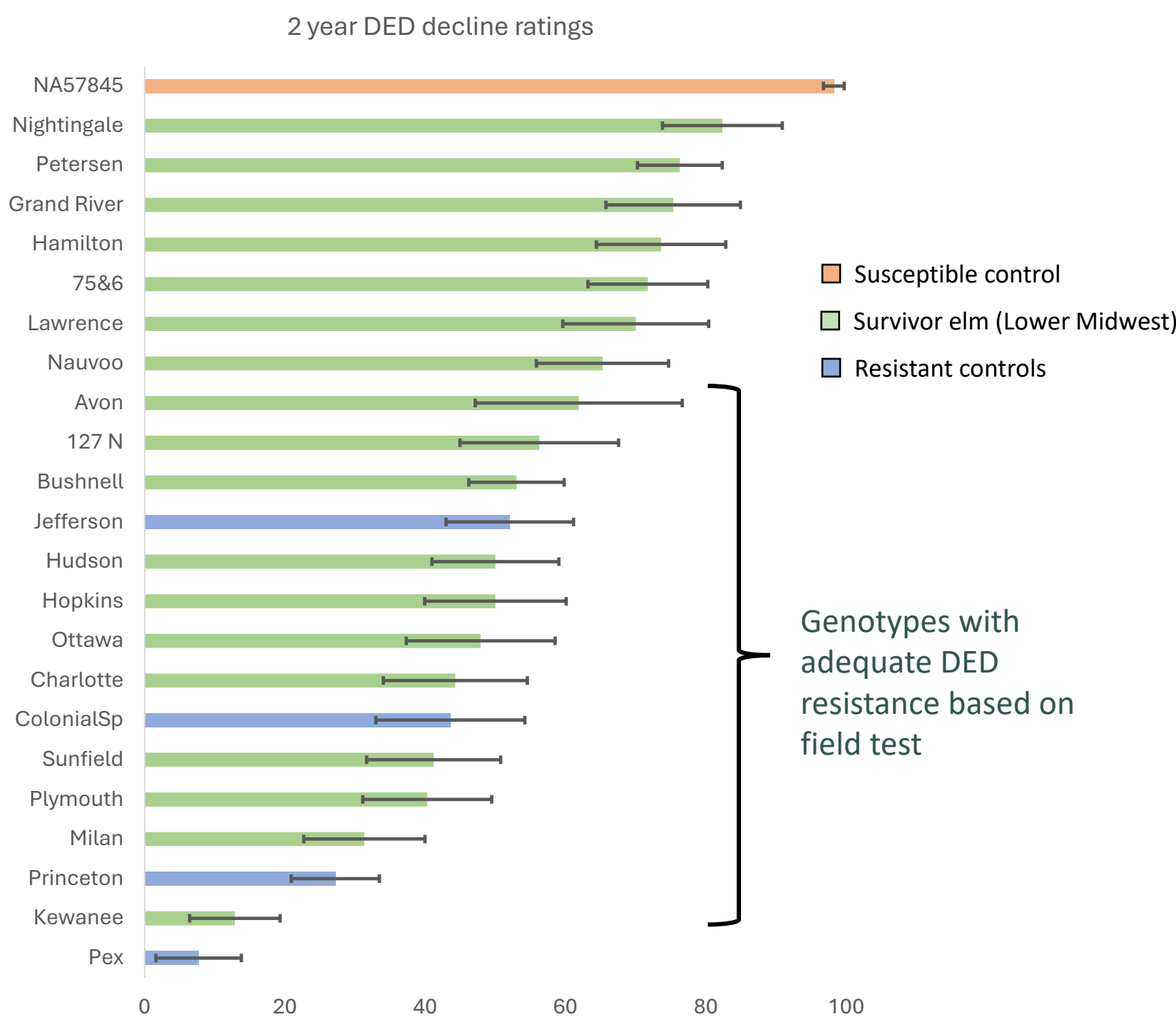
Inoculate and assess

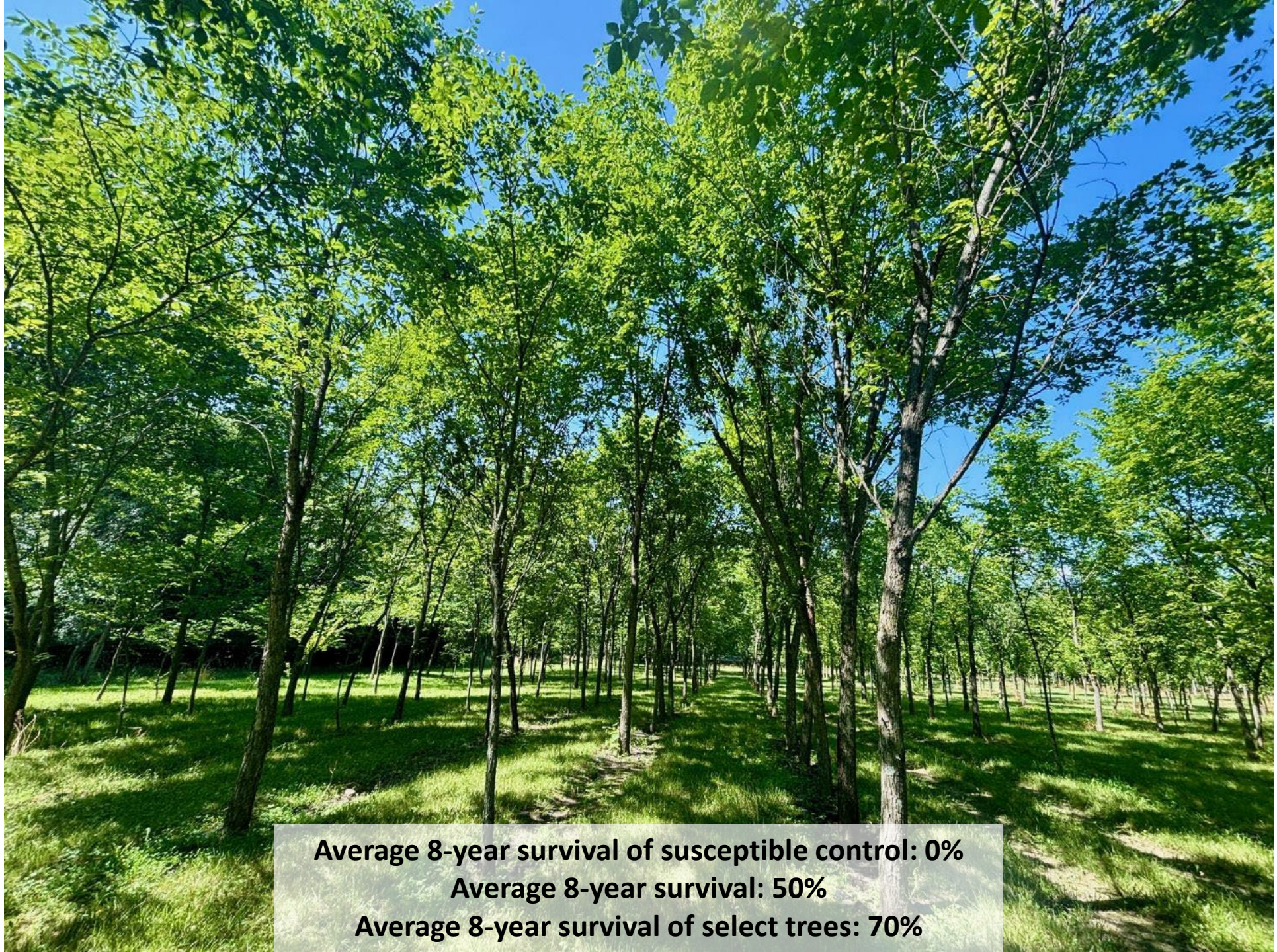
2 years

Plant winners in seed orchards

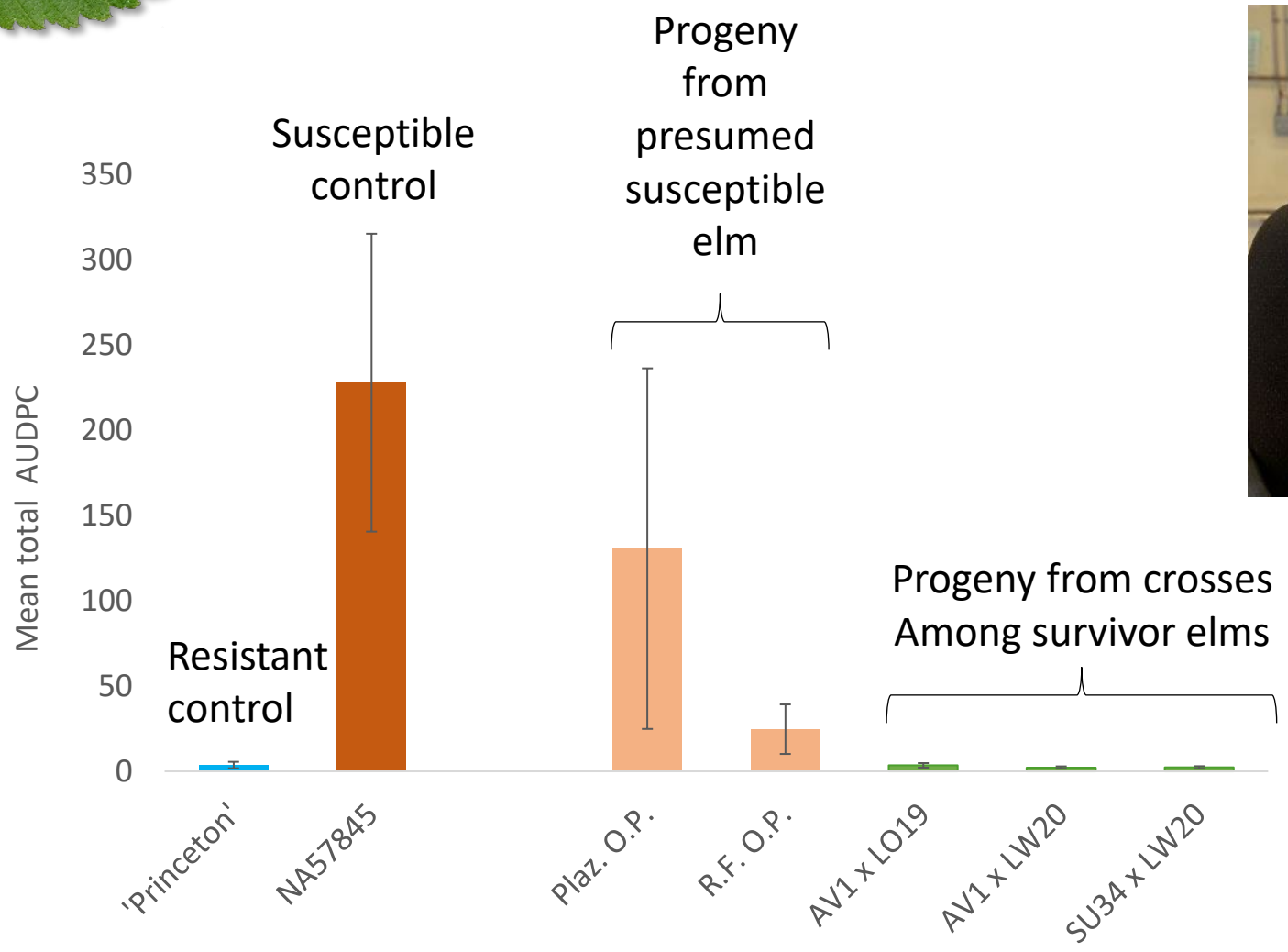
≥ 1 year

10+ years


2 year DED decline ratings
NA57845
Nightingale
Petersen
Grand River
Hamilton
75&6
Lawrence
Nauvoo
Avon
127 N
Bushnell
Jefferson
Hudson
Hopkins
Ottawa
Charlotte
ColonialSp
Sunfield
Plymouth
Milan
Princeton
Kewanee
Pex
0
20
40
60
80
100
Susceptible control
Survivor elm (Lower Midwest)
Resistant controls
Genotypes with adequate DED resistance based on field test

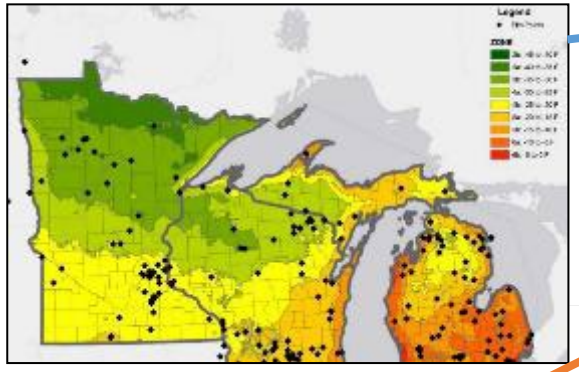

Average 8-year survival of susceptible control: 0%
Average 8-year survival: 50%
Average 8-year survival of select trees: 70%

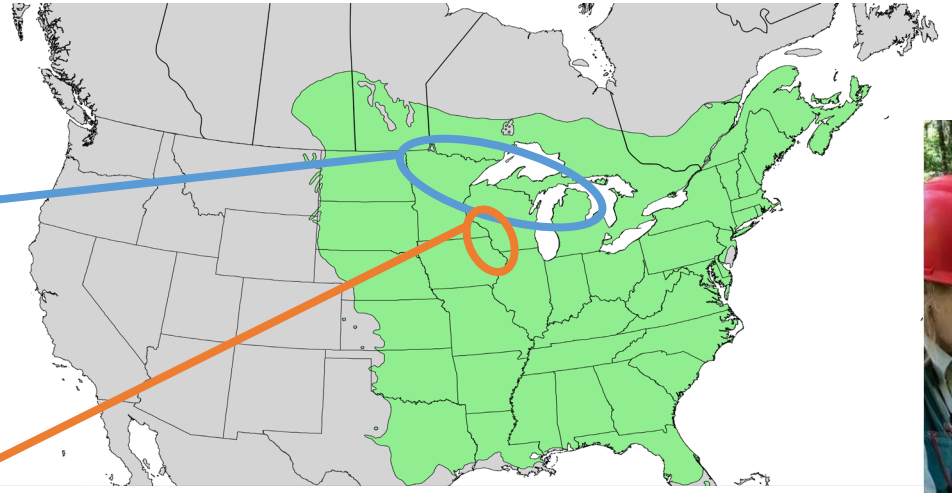
Testing survivor elm progeny in potted assay



American elm restoration in the upper Midwest

Cold-Hardy Lake States
~38 accessions, Zone 2b to 4a





Upper Mississippi
~30 accessions
Zone 4b to 5b

Partners:
Nick Labonte, USFS
Scott Rogers, USFS
Keith Konan, USFS
Andy Meier, Army Corps
Scott O'Donnell, WI DNR
Melanie Moore, USFS NRS
Kathleen Knight, USFS NRS
Carrie Pike, USFS FHP

Disease resistant elm as a restoration tool

Riparian restoration on the Finger Lakes NF

Disease resistant elm as a restoration tool

Planted tree and shrub seedlings spring 2015

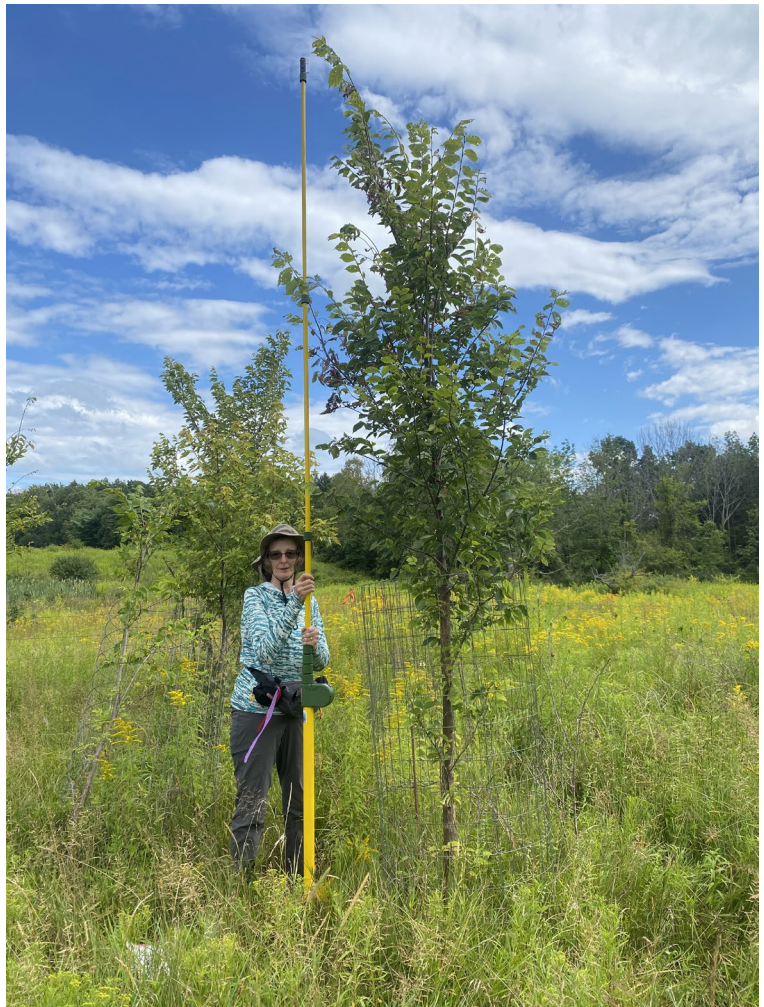







Disease resistant elm as a restoration tool

August 2023: 80% survival



Lessons learned from planting trials

Deer protection is necessary

- Underplanting: use mesh shelters or wire caging
- Planting in full sunlight: plastic, mesh or wire shelters

Lessons learned from planting trials

- Planting larger trees (1/2” diameter) generally leads to better survival, particularly when grown in full light
- Smaller stock (<3’ tall) may require competition control

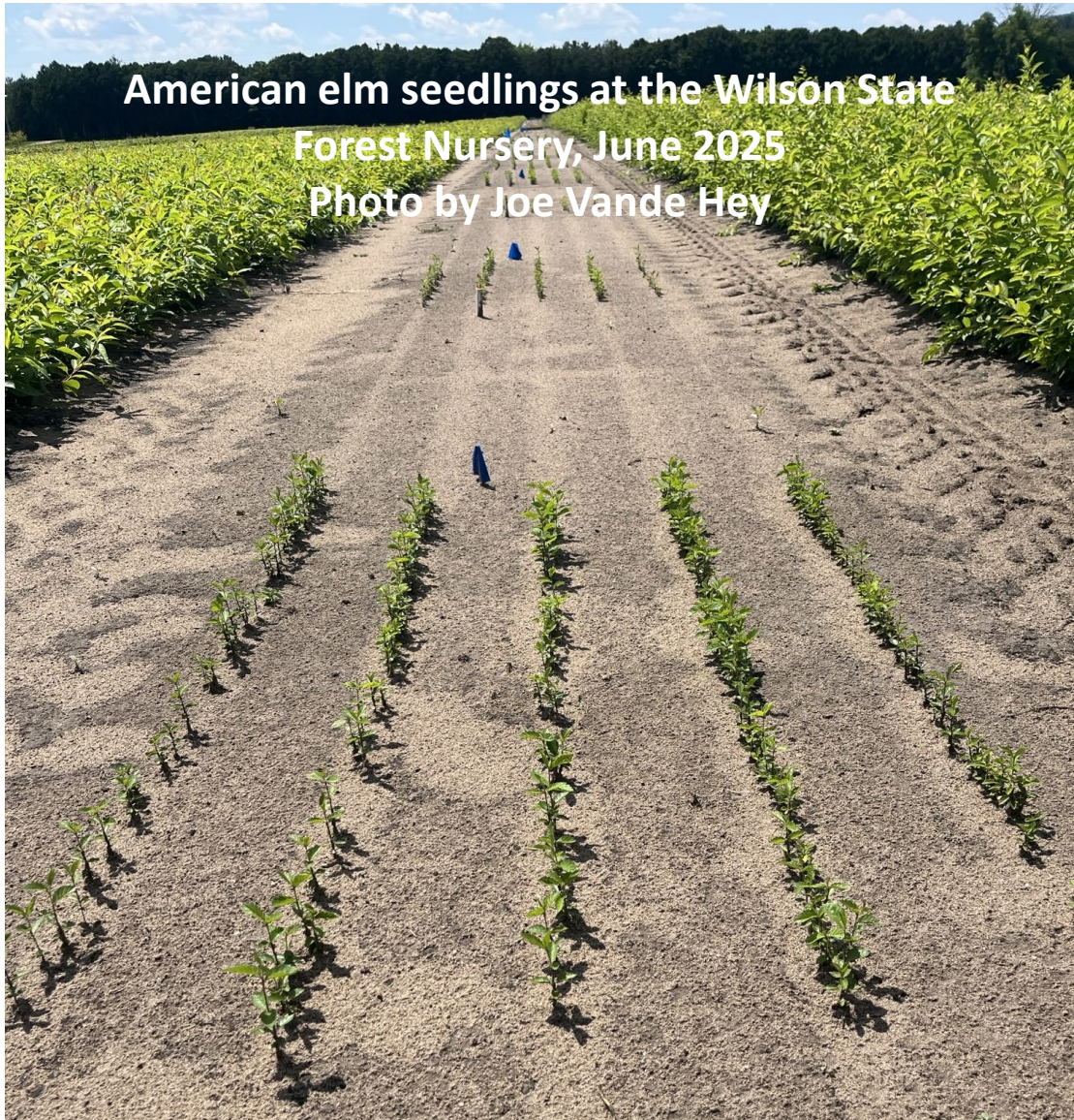
Thank you!

- NRS elm team: Nancy Hayes-Plazolles, Kirsten Lehtoma, Tim Fox, Josh Wigal, Melanie Moore, Mikayla Bailey, Allison Patrick, Jim Warren

- Many partners who have helped collect the cold-hardy elm population: Wisconsin Board of Commissioners of Public Land (John Schwarzmann), Michigan DNR, Minnesota DNR, Chippewa NF, Superior NF, Chequamegon-Nicolet NF, Ottawa NF, etc.

- USFS Oconto River Seed Orchard and Army Corps of Engineers for ongoing help with elm collection and testing

The Nature Conservancy



American elm seedlings at the Wilson State Forest Nursery, June 2025
Photo by Joe Vande Hey

Contact me!

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