Restoring Old-Growth Characteristics
Eastern Old-growth Forest Conference

Photo: Tony D'Amato

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The UNIVERSITY of VERMONT

Why now?

2007
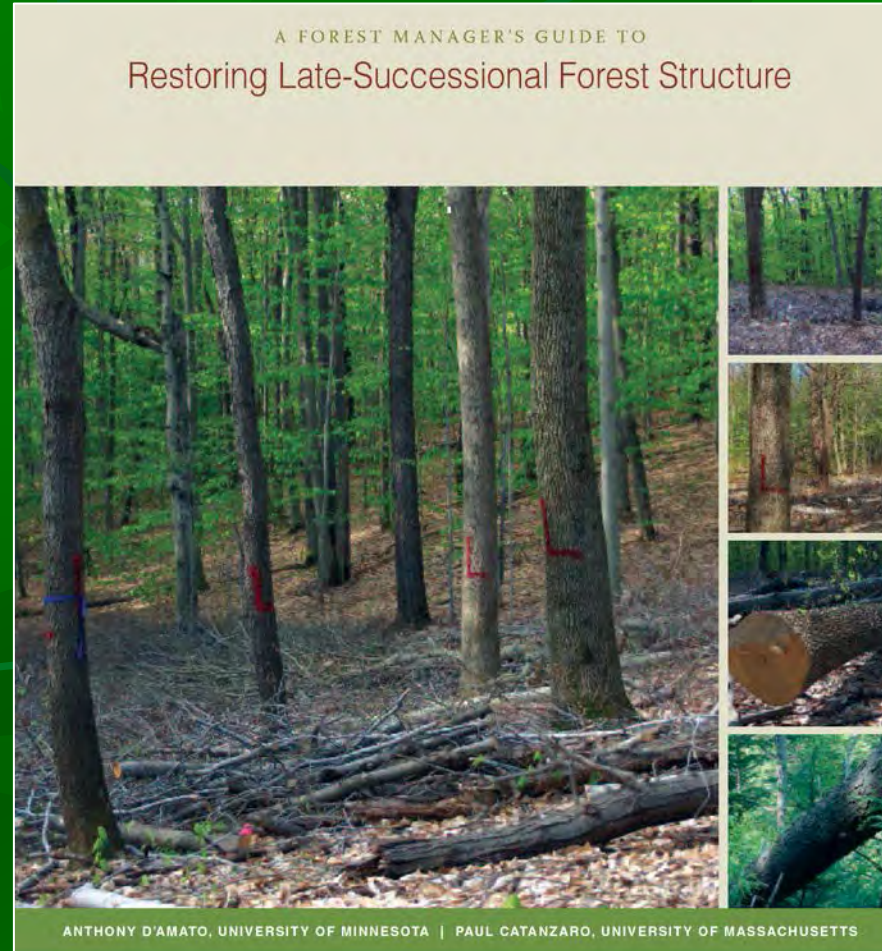
2009

- Climate change mitigation
- Biodiversity
- Resilience

Pre-Colonial Land Use History

https://native-land.ca/
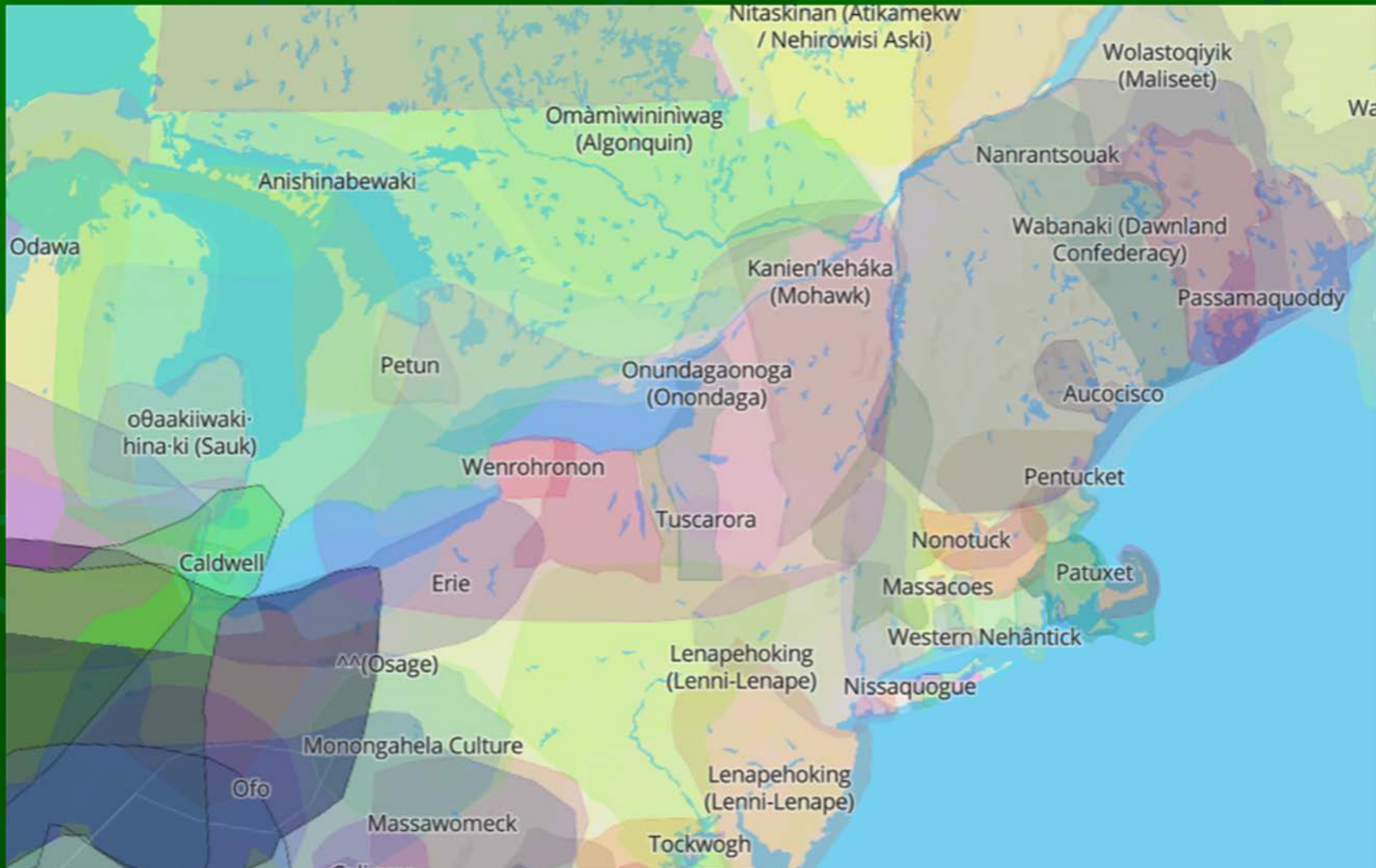
Colonial Land Use History

1700

1740

1830

1910

Harvard Forest Fisher Museum - Petersham, MA

Current Forest Age

Ducey et al. (2013)
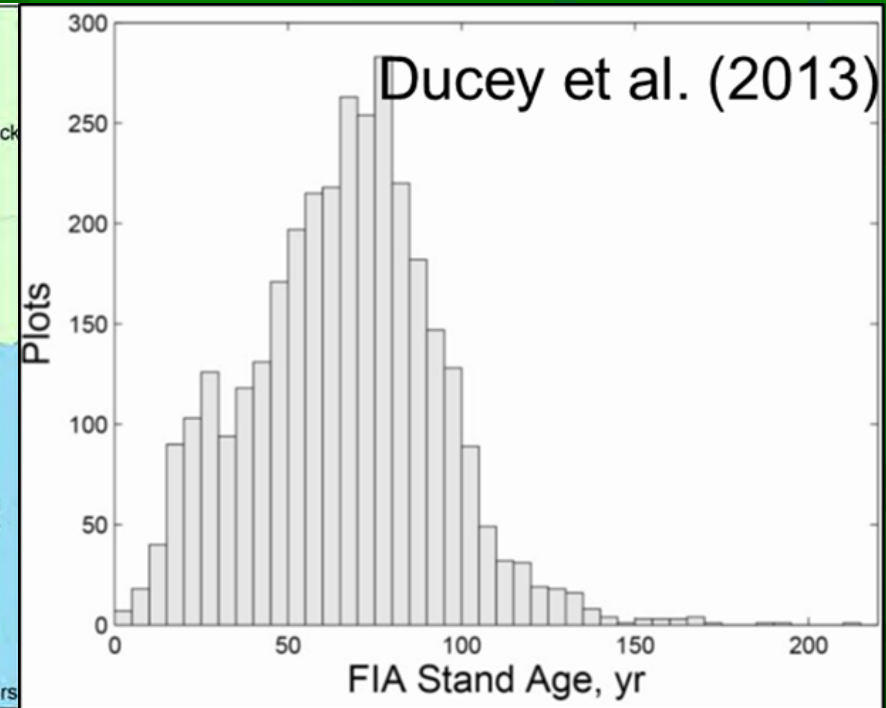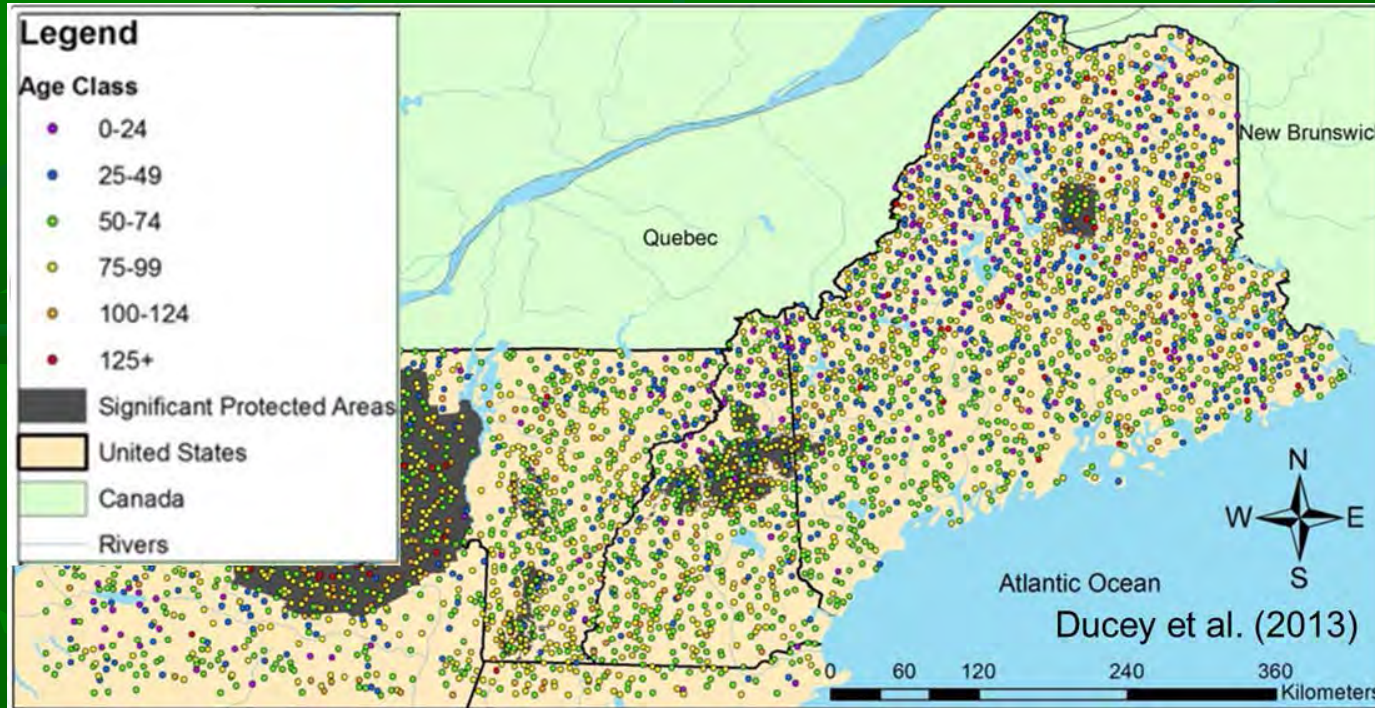
Most of our forests are **ecologically-young**, second growth

Forest Succession

Biological Legacies Provide <u>Continuity</u> Through Time and Forest Stages

No End Point
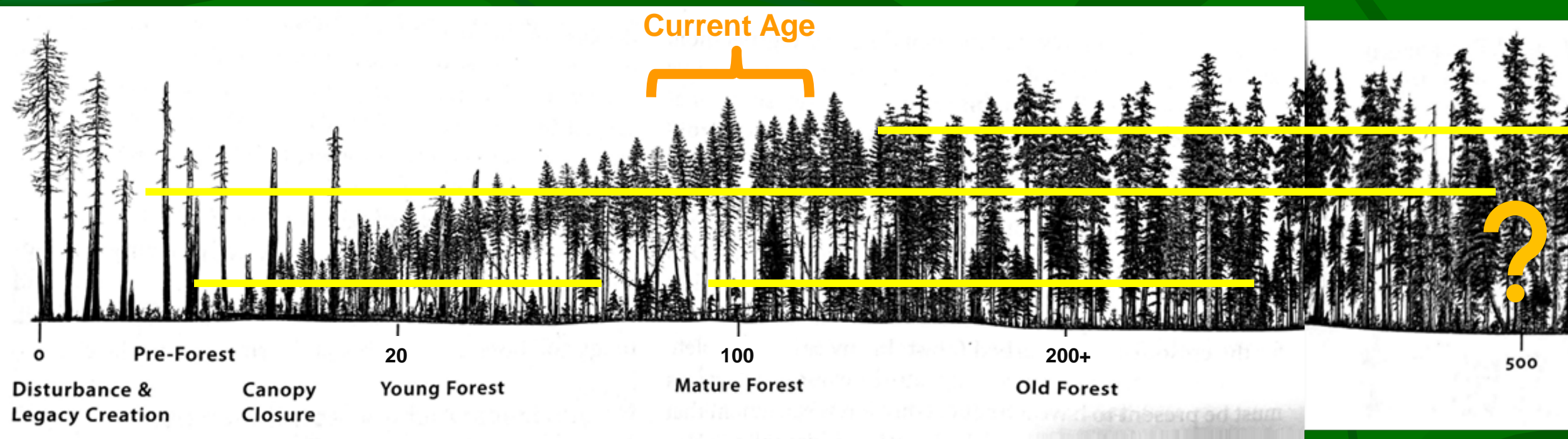
Current Age

| o | Pre-Forest | 20 | 100 | 200+ | 500 |

Disturbance & Legacy Creation

Canopy Closure

Young Forest

Mature Forest

Old Forest

Terminology

- **Old growth:** forests that were never directly impacted by intensive human land uses, such as those brought on by European settlement.

- **Second growth:** forests that established and grew following intensive human land use, such as agriculture or logging.

- **Old forests**: forests that contains a critical mass of characteristics associated with old growth.

  - Age at which these characteristics develop varies by forest type, disturbance history, and site quality. Focus on restoring tractable characteristics **versus relying on stand age**.

Photo: Tony D'Amato

Past Extent of Old-Growth

- **Old-growth forests covered ~ 90% of the landscape prior to European settlement**

Harvard Forest

Harvard Forest, Fisher Museum
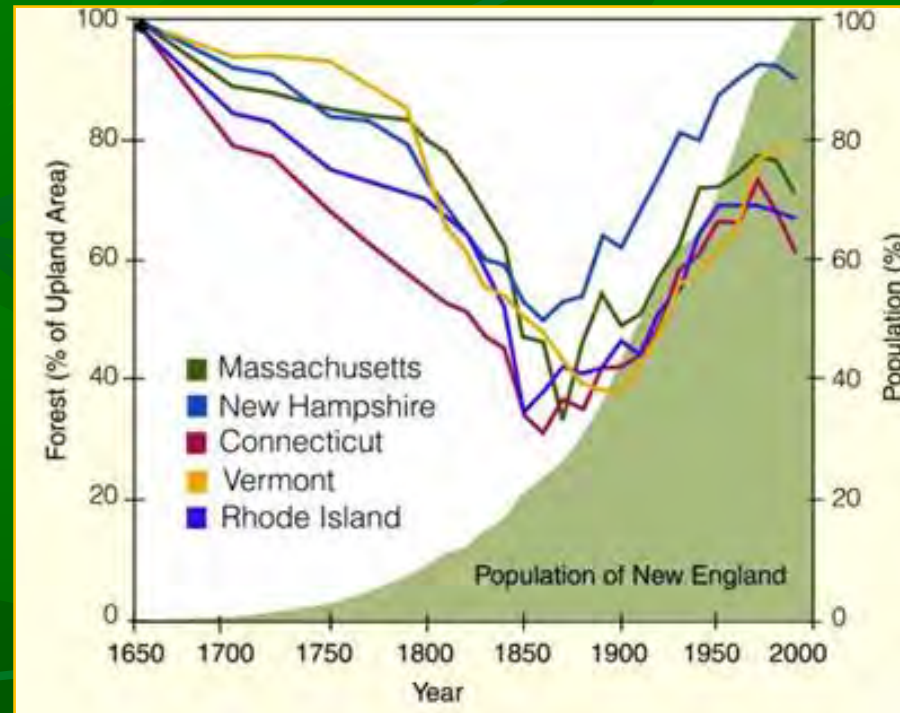
Current Extent of Old-Growth

State	Estimated Acres of Old Growth	Total Forested Acres*	% of Forest in Old Growth
Connecticut	0[1]	1,763,459	0%
Massachusetts	1,119[2]	2,984,347	.04%
Maine	50,000[3] (old forest)	17,521,753	.29%
New Hampshire	~3,500[4]	4,691,524	.07%
Rhode Island	0[5]	361,127	0%
Vermont	~1,000[6]	4,523,088	.02%
New England	55,619	31,845,298	.17%

*2019 USDA Forest Service Forest Inventory and Analysis Unit

[1] Personal communication Chris Martin, State Forester, CT DEEP

[2] D'Amato, Anthony W., David A. Orwig, and David R. Foster. 2006. New Estimates of Massachusetts Old-growth Forests: Useful Data for Regional Conservation and Forest Reserve Planning. Northeastern Naturalist. 13(4):495–506.

[3] Personal communication, Justin Schlawin, Maine Natural Areas Program

[4] Personal communication, Chris Kane, NH Natural Heritage ecologist

[5] Davis, Mary Byrd, (Ed.). *Eastern Old-Growth Forests: Prospects for Rediscovery and Recovery.* Island Press, 1996.

[6] Personal communication, Anthony D'Amato, UVM

What do we do with the other ~ 99.83% of the forest?

General Old Growth Characteristics
It's more than big trees!

- Diversity of tree sizes and ages
  (including large trees 20+ and <u>old</u> 400+)

- Spatial variability
  (crowded small trees, well-spaced big trees, & in-between)

- Dead standing trees (snag)

- Downed logs

- Late seral plan communities
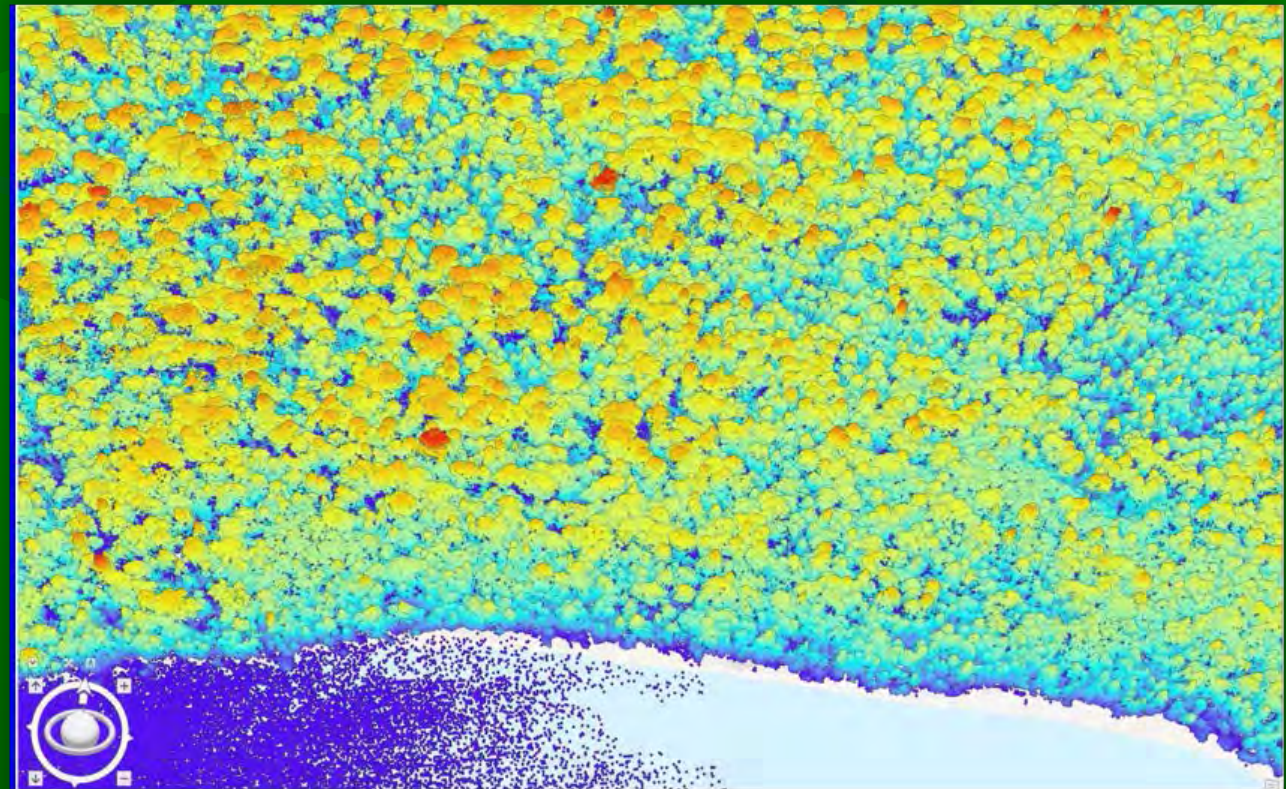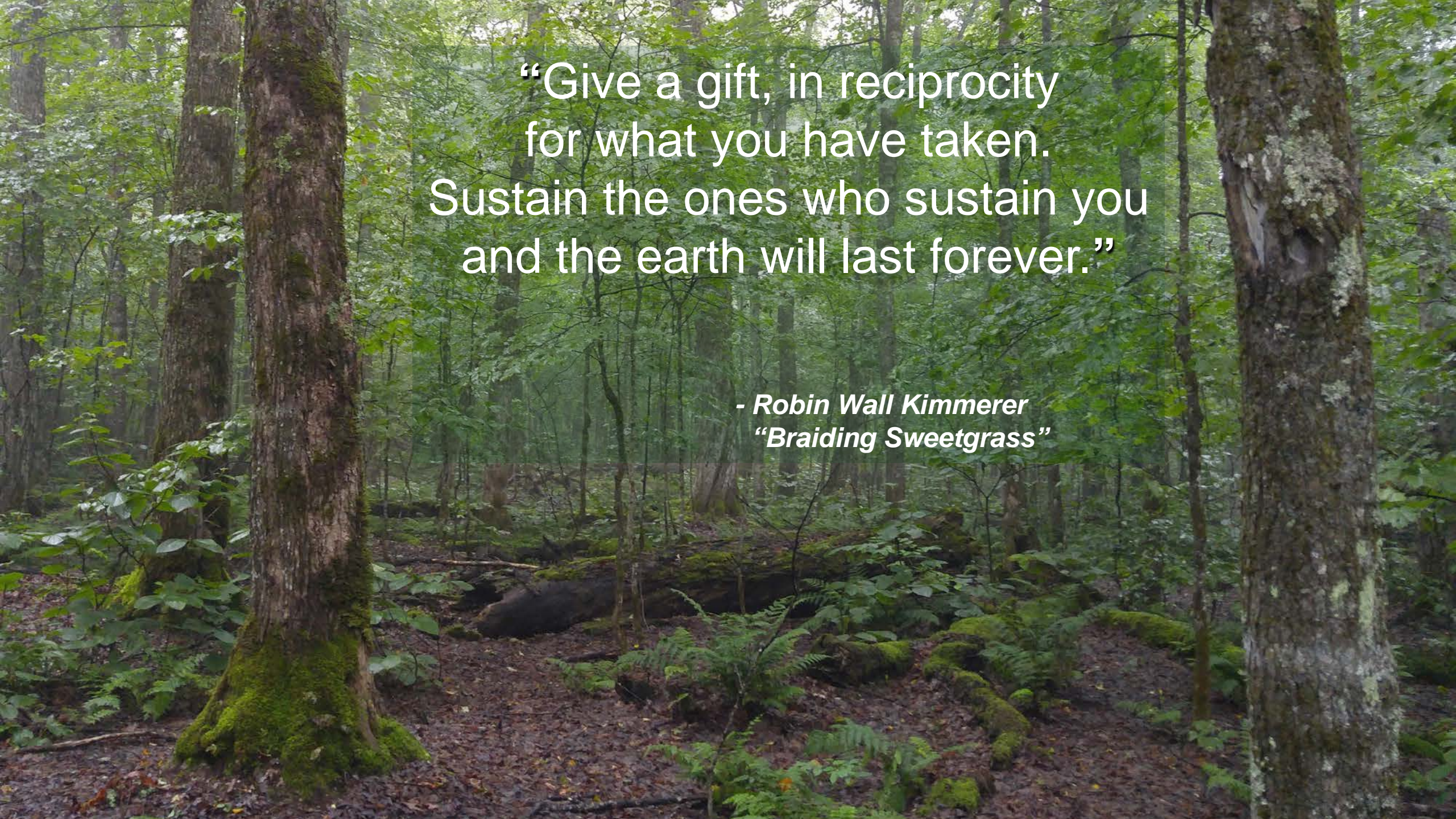
Courtesy of John Hagan: jhagan@ourclimatecommon.org

These characteristics are the result of continuous disturbance over centuries…and also demonstrate continuity!

"To Keep Every Cog and Wheel is the First Precaution of Intelligent Tinkering"

- Aldo Leopold

"Give a gift, in reciprocity
for what you have taken.
Sustain the ones who sustain you
and the earth will last forever."

- Robin Wall Kimmerer
"Braiding Sweetgrass"

Strategies for Restoring Old-Growth Characteristics

- We can't re-create old-growth forests, so how do we close the gap from ~90% to ~ .17%?

  - Passive Management
  - Active Management

Passive Management

- Let nature take its course

- Characteristics developed through forest growth and natural disturbances (*e.g.,* windstorms, ice storms, insects, and disease)

Photo: Tony D'Amato

Should I Salvage?

- Developing OG structure means leaving dead and dying trees in the woods. While looking "messy", it is what creates the structure we are missing

- If you do salvage, keep some patches un-salvaged and limit the removal of live trees.

Photos: John Burke

Passive Pathway to Old Forests
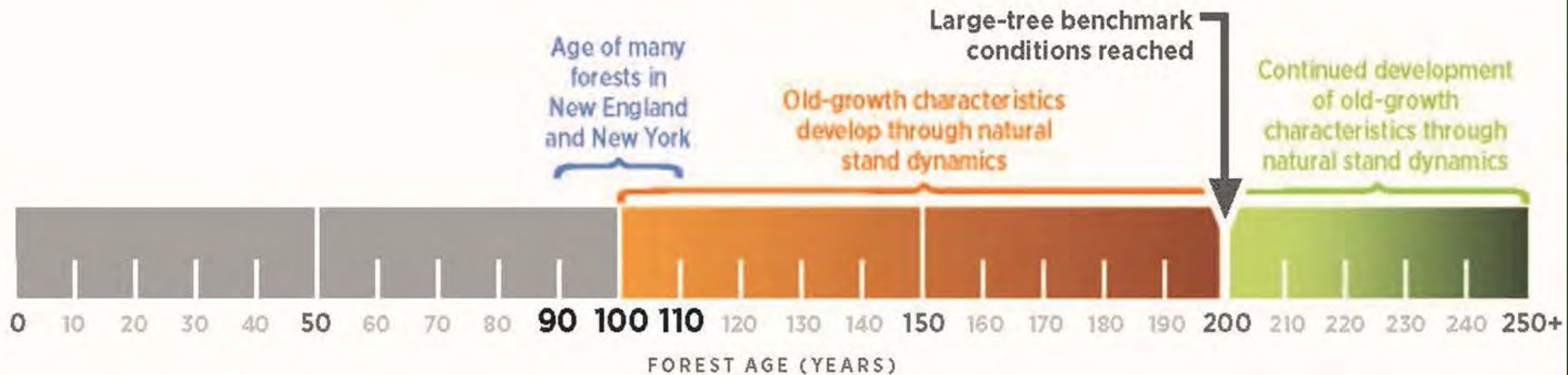
Siting Passive Management
One of the things that keeps me up at night

- Not all forests will develop old-growth characteristics over the next decades/century.

- Will they develop old-growth characteristics over centuries?

Mt. Laurel & Hay-scented Fern

Japanese Barbery

UGA5270039

Deer Herbivory

Active Restoration

Step 1: Identify old-growth characteristics already present, minimize impact, and establish <u>patch reserve</u> around these features

Variation in Tree Sizes, Ages, & Spatial Arrangement

- Most stands are starting from even-aged or two-aged condition

- Introduce (and build from) spatial heterogeneity using regeneration methods that **combine removals of individual trees and groups of canopy trees**, while also retaining a high proportion of mature trees (single-tree and group selection; irregular shelterwoods; variable density thinning)

- Emulate range of natural canopy disturbances (0.1-0.5 ac), including mesoscale events (1-3 ac with heavy retention)

1-3 acre regeneration opening (40-60 ft^2/ac retained)

Thinning between to 80-90 ft^2/ac with legacy designation

Patch retention to protect unique ecological features
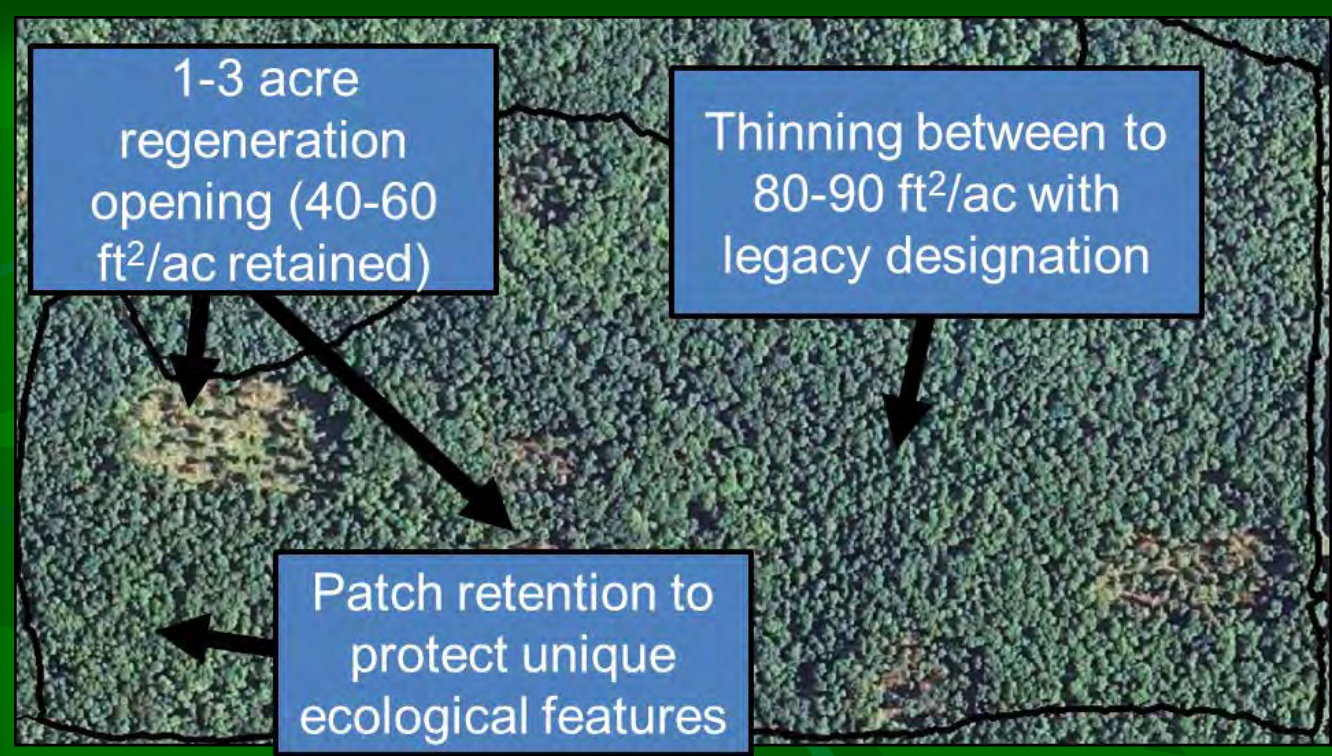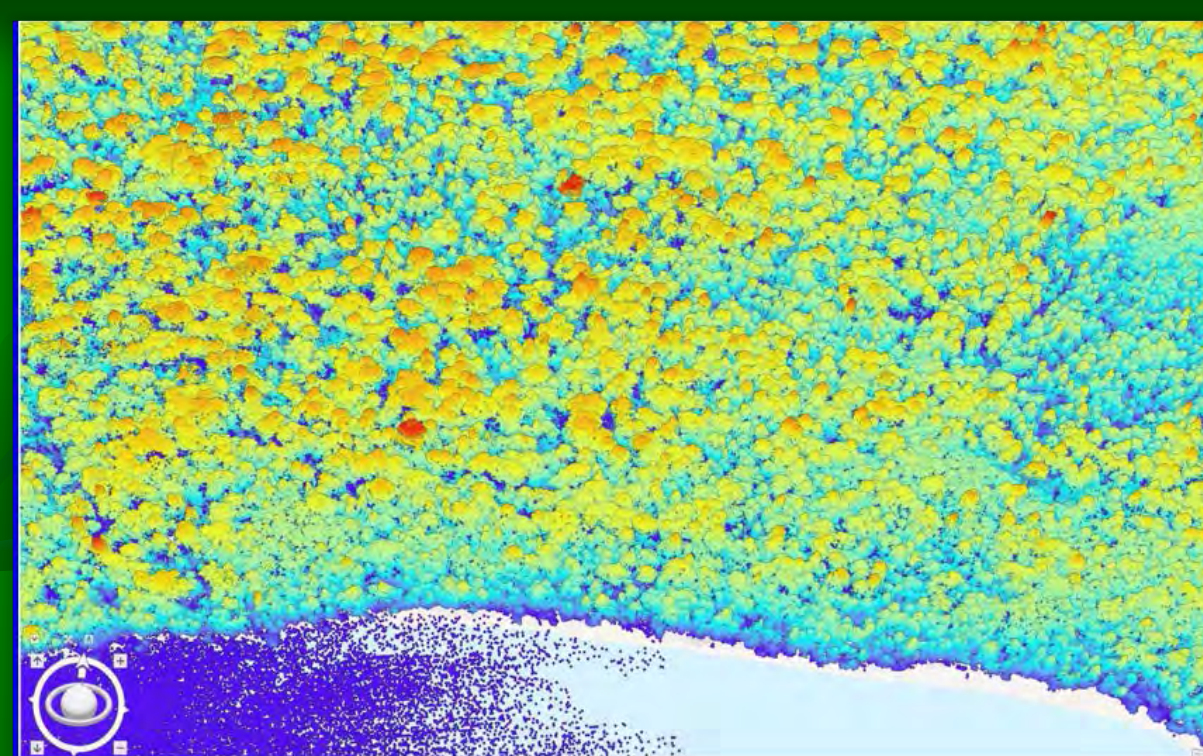
Large, Old Trees

- Legacy tree designation

- Priorities: large diameter (cull is fine), existing cavities, complex crown forms, underrepresented seed/food source, built to last (species and form)

Large, Old Trees

- Thin crown on 3-sides to accelerate tree growth

- Target: 40-60 dominant/co-dominant trees/acre

- Density accounts for natural mortality and future commercial removals and downed woody material

Standing Dead Trees in Various States of Decay

- Cavity-tree recruitment is most effective from natural **death of legacy trees**

- Girdling of large diameter trees can quickly increase snag abundance
  - Safety considerations for property (locations near trails, future harvests)
  - Lower ecological function and residence time relative to naturally-created snags

Downed Logs in Various Stages of Decay

- Fell and leave 8-10 large diameter trees per acre

- Future inputs from natural mortality of legacy trees and forester-induced

- Cut and leave most operationally efficient,
  but pulling over individuals an option where economics/operations allow
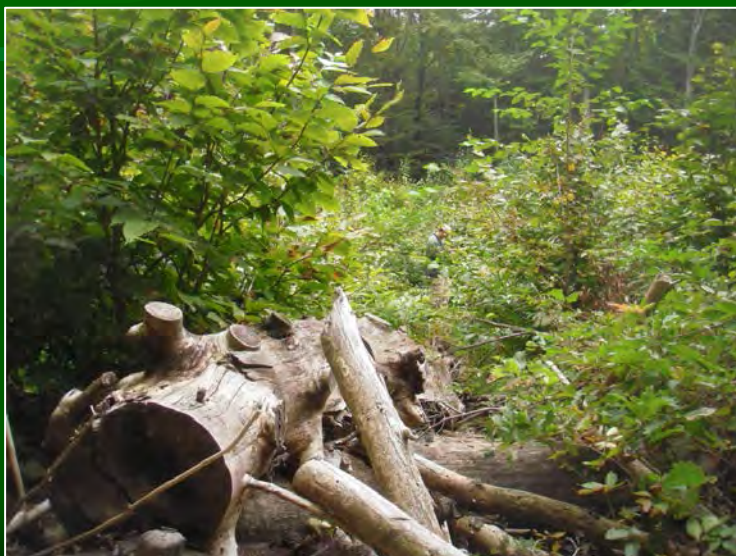
Morticulture

- Like silviculture, morticulture is for the long-term

- Integrate deliberate deadwood retention at each harvest entry
  (> 2-4 canopy trees per acre after initial entry)

- Approximates "pulses" of deadwood naturally delivered from disturbance encouraging a decay continuum

Presence of Late Seral Flora
(Understory plants, mosses, and lichens)

- Designation of "patch reserves" within stands where no harvesting occurs

- Legacy trees to support an abundance of mosses and lichens

Second Growth Forest
(100 years old)
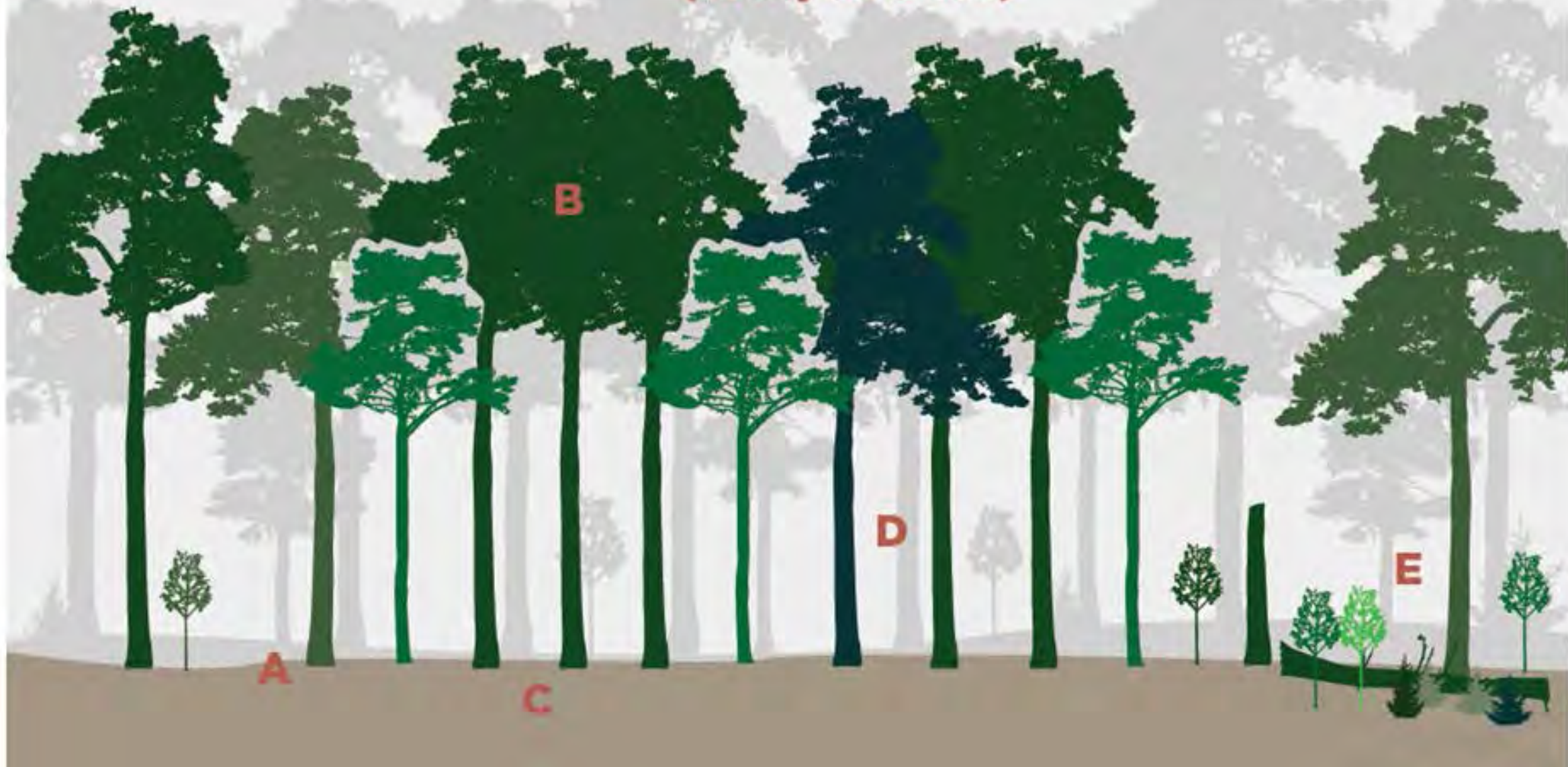
2 Second Growth Forest with Active Management for Old-Growth Characteristics

3

15 Years after Active Management for
Old-Growth Characteristics

30 Years after Active Management for Old-Growth Characteristics

Active Pathway to Old Forests

Age of many forests in New England and New York

Old-growth characteristics develop primarily through active management

Large-tree benchmark conditions reached

Continued development of old-growth characteristics through a combination of active management and natural stand dynamics

0 10 20 30 40 50 60 70 80 **90 100 110** 120 130 140 **150** 160 170 180 190 **200** 210 220 230 240 **250+**

FOREST AGE (YEARS)

Gradient of old-growth restoration strategies

NO FOREST MANAGEMENT

- Leave 25%–50% as legacy trees
- Cut and/or girdle other trees to create gaps, diverse tree sizes, snags, and downed logs
- Thin to create larger trees
- Leave all trees in woods
- Cost to landowner

- Leave 25%–50% as legacy trees
- Harvest using group selection to create gaps and diverse tree sizes
- Cut and leave cull trees in the woods to create downed logs
- Thin to create larger trees
- Sell harvested logs

- Leave 10%–25% as legacy trees
- Harvest using forester's recommended method
- Cut and leave cull trees in the woods to create downed logs
- Sell harvested logs

- Leave a few legacy trees
- Harvest using forester's recommended method
- Sell harvested logs

PASSIVE	MORE	ACTIVE OLD-GROWTH RESTORATION	LESS

PRIMARY OBJECTIVE	COMPLEMENTARY OBJECTIVE	RELATED OBJECTIVE

Our New England Landscape

Public Lands
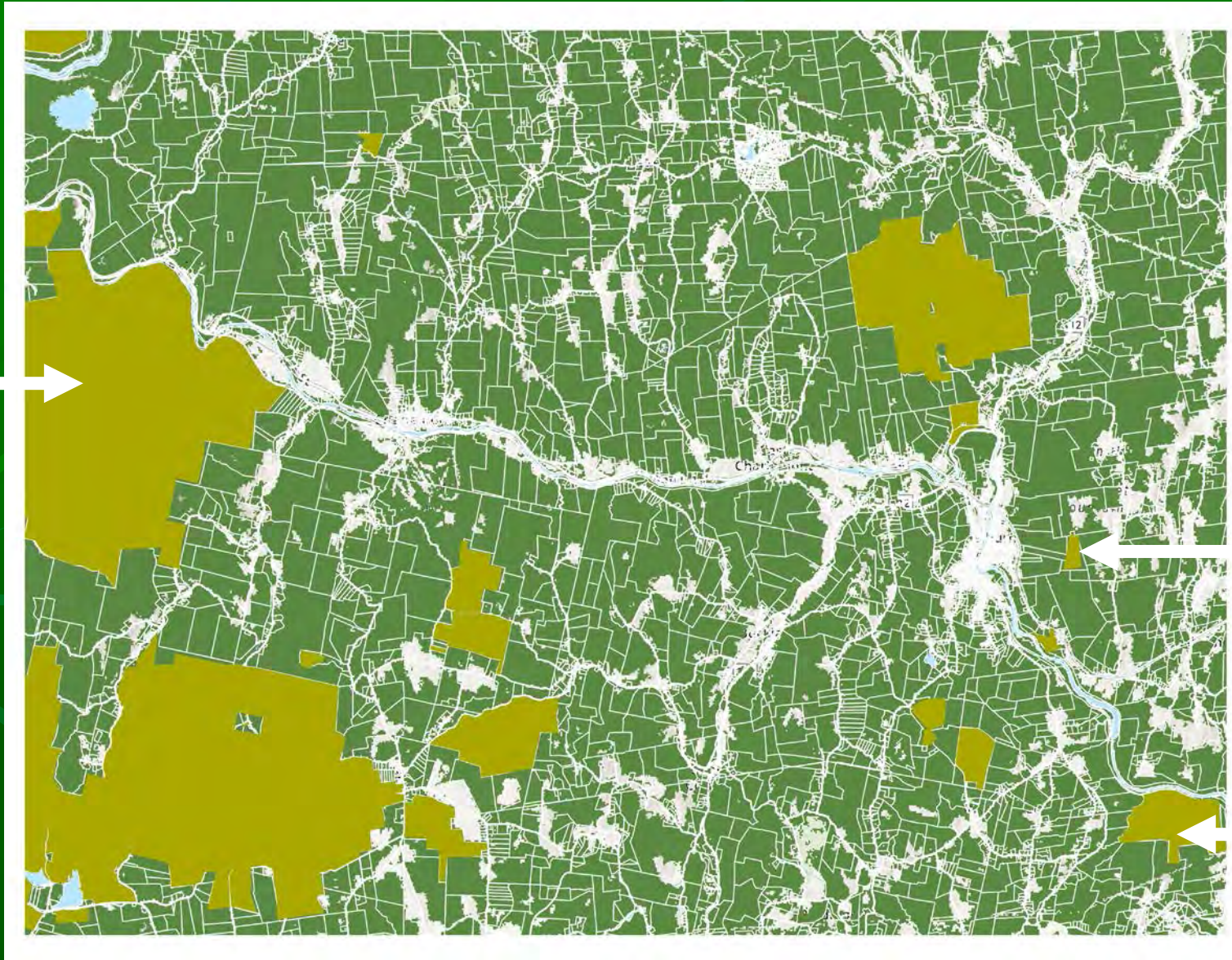
NGO/CE Land

Municipal Land

Credit: Lina Clifford

Passive and Active Across the Landscape

'Stepping Stones' Biological Legacies

Active – Tolerant/ Mid-tolerant

Passive
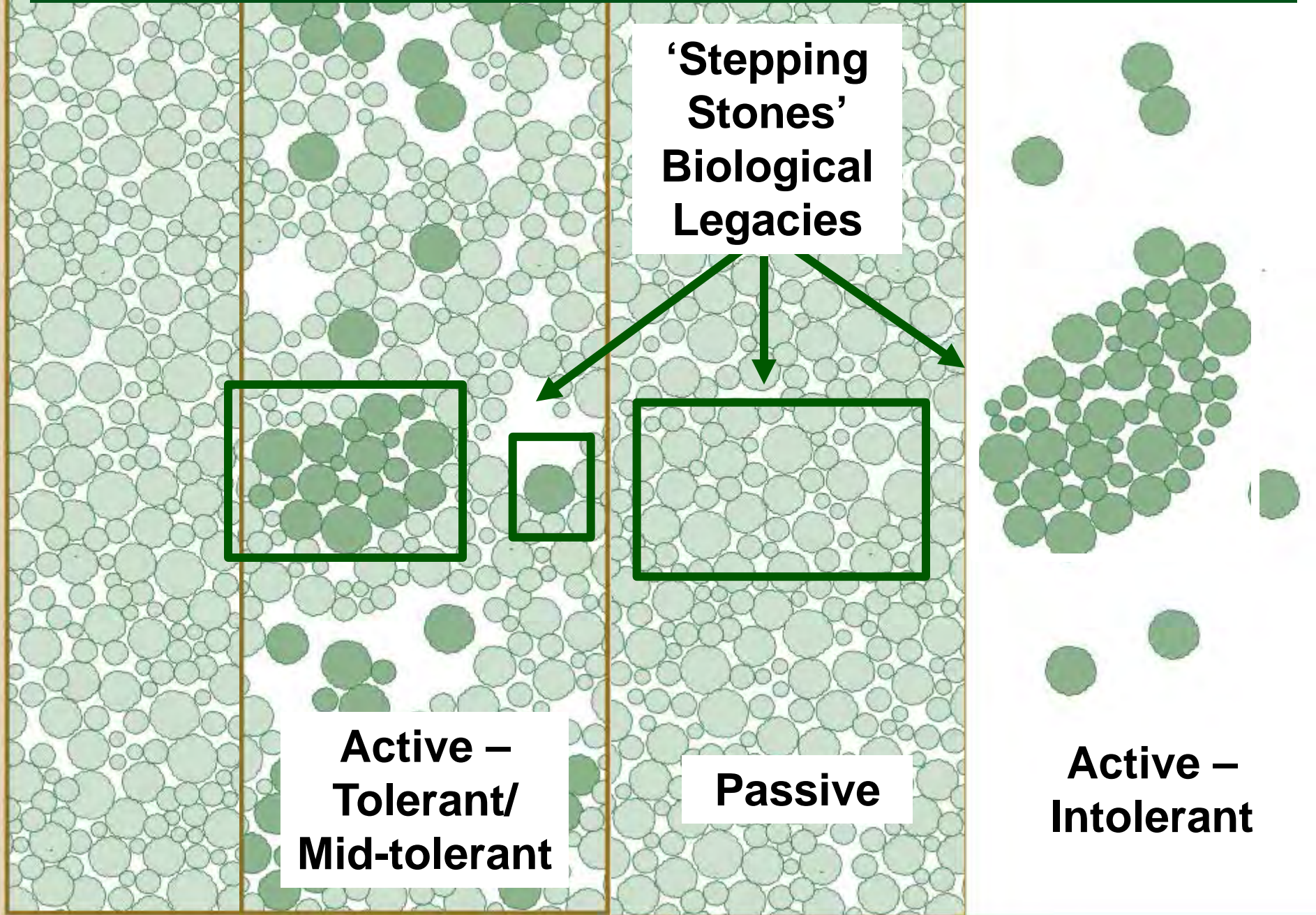
Active – Intolerant

A diversity of benefits and landowner goals requires a diversity of approaches

- Passive and active strategies are complimentary and achieve a wide range of goals (e.g., tolerant & intolerant) and benefits

- Critical mass of characteristics across the landscape

- Restore the continuity back to the landscape

Passive and Active Documentation

- On the ground
- Management plans
- GIS
- Database
- Organizational/landowner succession planning

Land Protection is Essential
The other thing that keeps me up at night!

- It will take decades/centuries to restore characteristics.

- Average age of family forest owners is ~ 65 years old

- Largest inter-generational transfer we have ever experienced.

Take-homes

- Old-growth forests are a rare, but historically important forest type.

- Passive and active management strategies exists for restoring old-growth characteristics and the many benefits we depend on. We need both!

- Old-growth restoration can be implemented in a gradient of intensities to meet landowner goals. Different benefits necessitate different strategies!

- A landscape scale perspective is essential in our region

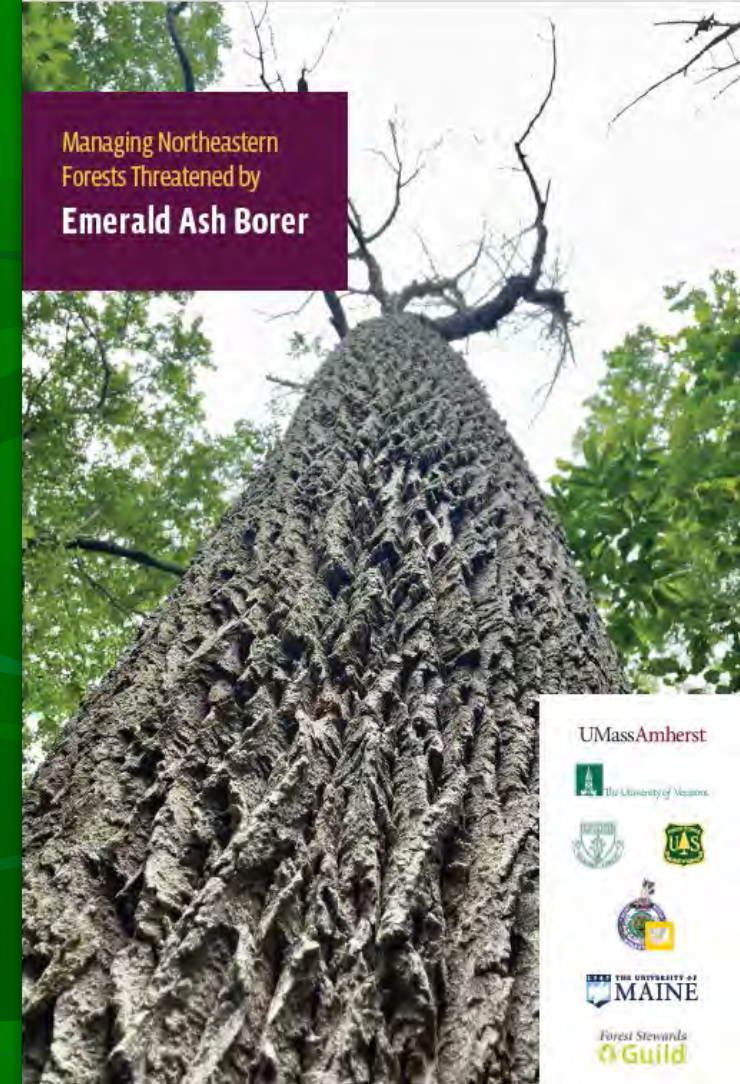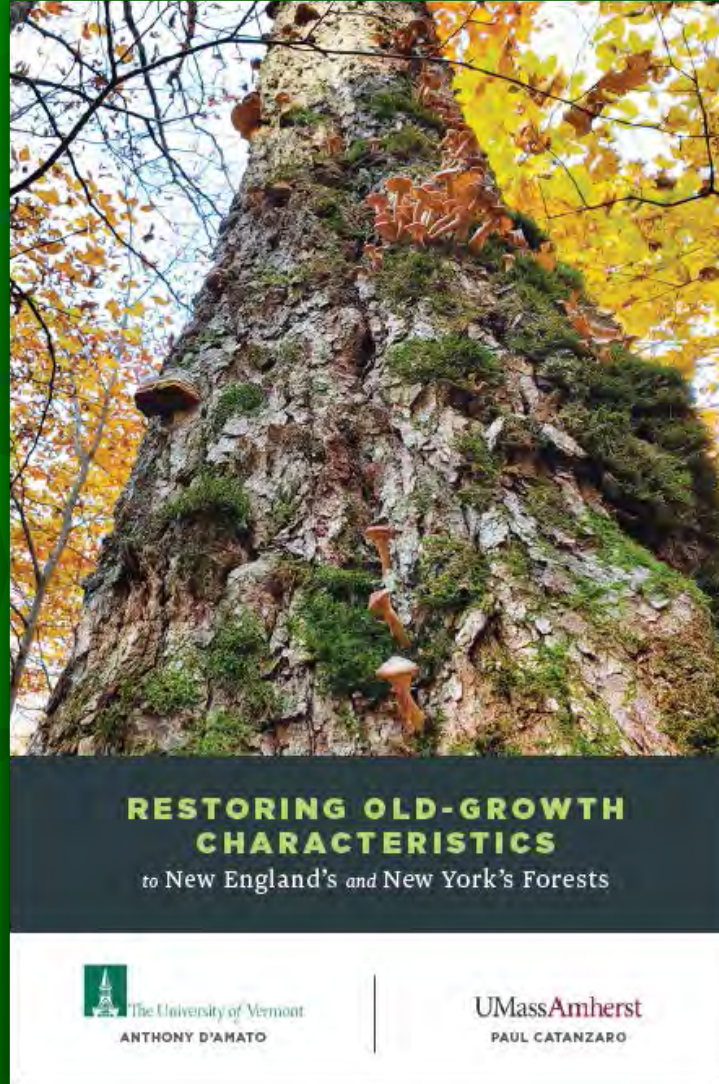- We must permanently protect enough forests to ensure essential public benefits.

Thank you!

Paul Catanzaro

**Professor &
State Extension Forester**

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RESTORING OLD-GROWTH
CHARACTERISTICS
to New England's *and* New York's Forests

The University of Vermont

UMassAmherst

ANTHONY D'AMATO

PAUL CATANZARO

Managing Northeastern
Forests Threatened by
Emerald Ash Borer

UMassAmherst

The University of Vermont

THE UNIVERSITY OF
MAINE

Forest Stewards
Guild

New Publication!!!

Mike Barry & Paul C. at Elm Hill, October 2019

Cooley Hill

Elm Hill Wildlife Sanctuary
- ~1,100 acres, acquired by Mass Audubon in 1995
- Subject to APR, including forest products
- Demonstration site for *Foresters for the Birds* Program & Climate-smart forestry
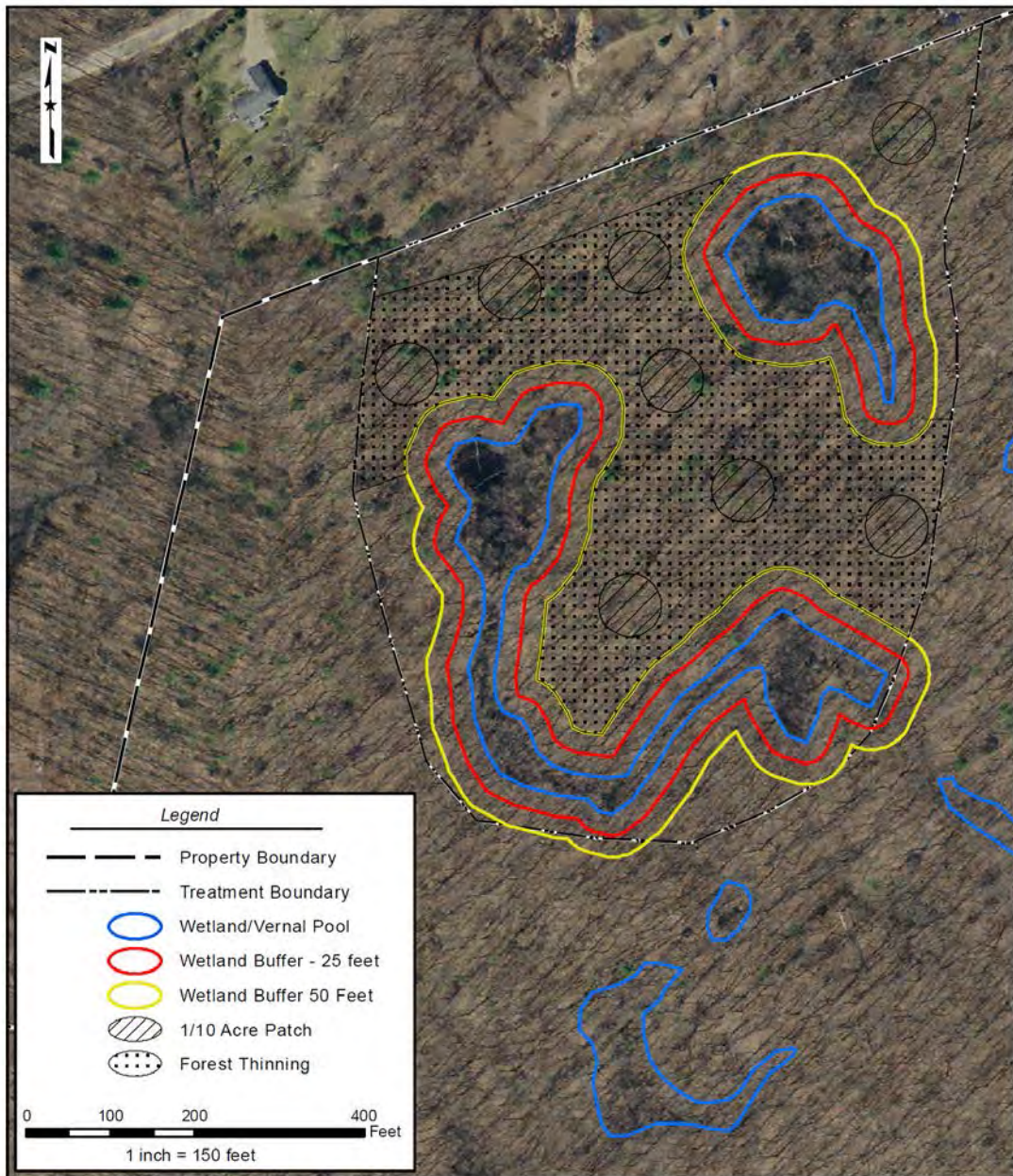- Project support from DCR, NRCS, NFWF, NIACS, others

2019

Treatment Map - Vertical Structure Enhancement Area
1/10 Acre Patches and Thinning
Elm Hill Sanctuary, Massachusetts Audubon Society, Inc.
North Brookfield, Massachusetts

Legend
- — — Property Boundary
- — · — Treatment Boundary
- Wetland/Vernal Pool
- Wetland Buffer - 25 feet
- Wetland Buffer 50 Feet
- 1/10 Acre Patch
- Forest Thinning

0   100   200   400 Feet
1 inch = 150 feet

Treatment Plan

- Approximately 10 acres, extending from complex of vernal pools
- Light canopy thinning outside of 50' wetland buffer
- Eight 1/10-acre patch cuts with a reserved tree or two within area