DWSP Forest Management Update

WSCAC- June 2025

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DWSP Invasive Plant Management

Sudbury Reservoir- April 2024

2011 Terrestrial Invasive Plant Management Strategy

- **Outlines the pervasive issue of terrestrial invasive plants** across its water supply watersheds.
  - Historical land use has directly influenced invasive species on DWSP lands.
    - deliberate homestead plantings
    - landscaping that predated DCR/MWRA acquisition
    - High deer populations; deer avoid invasives,

- **Defines invasive species,** details **federal and state mandates** for their control**,** and **analyzes the environmental problems** they cause, such as inhibiting native plant regeneration and impacting biodiversity.

- Explores various **management principles,** including mechanical, chemical, and biological control methods**,** and discusses their **relative costs and efficacy** through past pilot programs.

- Establishes **priorities for invasive plant management** on DWSP lands,
  - **Early Detection, Rapid Response** (EDRR)
  - Protection of **critical natural communities and habitats** and rare species
  - **Detailed descriptions** and **control options** for common invasive species found in the region

2025 DWSP Invasive Plant Management Update

Updated strategy for managing terrestrial invasive and interfering plants emphasizing **watershed resiliency** and **drinking water quality**.

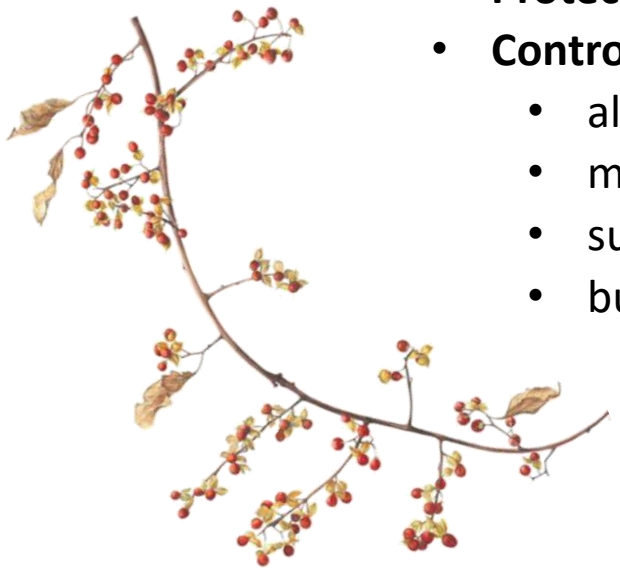
- challenges of climate change and the critical long-term need to maintain the forest filter

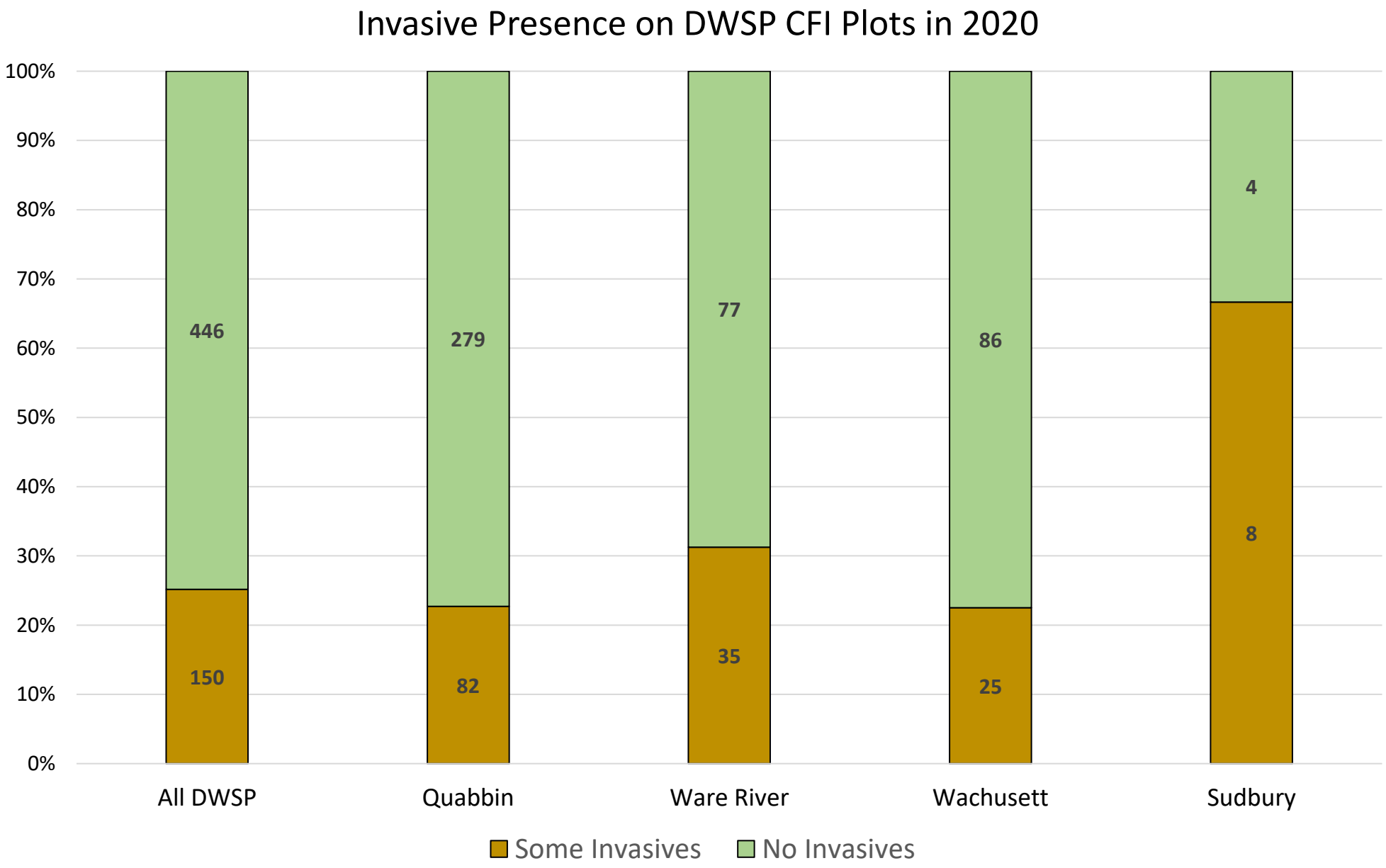
It builds upon the 2011 Strategy: focusing on **integrated vegetation management**:

- combine **mechanical, chemical, and cultural control methods**,
- including the strategic use of **herbicides and prescribed fire**.

Risks posed by invasive plants and establishes **priorities for future actions**:
Data-driven management

- **Protect:** promptly identifying and eliminating newly detected invasive species.
- **Control:** established invasive and interfering plants effectively enough to
  - allow for species-diverse forest regeneration
  - maintain important wetland biodiversity and function
  - sustain native, natural communities
  - build ecosystem resilience




Invasive Presence on DWSP CFI Plots in 2020
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
446
150
279
82
77
35
86
25
4
8
All DWSP
Quabbin
Ware River
Wachusett
Sudbury
Some Invasives
No Invasives

DWSP Forest Management

Ware River Watershed - June 2024

Hubbard Brook Experimental Forest (HBEF)

Key Implications for Forest-Filtered Water Supplies:

healthy, diverse, and structurally complex forests are essential for safeguarding drinking water—and that proactive, adaptive forest management will be increasingly necessary to protect water supplies in a changing climate.

Experimentally cleared forest (100+ acres) in 1965-66

- Saw dramatic increases in **nutrient export**, particularly calcium and nitrate, into streams.
- Nitrate levels spiked to concentrations **over 50 times higher** than in undisturbed watersheds.
- **Without regen, recovery can take decades-** Forest-filtered water supplies must plan for long-term impacts of extreme events (e.g., hurricanes, ice storms, insect infestations) that become more likely with climate change.

- Emphasized how forest vegetation is crucial for **maintaining water quality**, preventing **soil erosion**, and regulating **stream hydrology**.

- Forests regulate water quality and quantity—carry major implications for forest-filtered water supplies under future climate change scenarios. Forest management should prioritize **resilience-based silviculture** to maintain both ecological function and water supply protection under future conditions.

DWSP Land Management Plan (LMP) Overview

The DWSP uses a multifaceted approach to the management of forested areas to ensure long-term resilience, the primary goal of this management being the protection of the forest-filter in perpetuity.

While DWSP watershed forests are generally healthy, they are routinely threatened from physical disturbances, like ice, strong winds and fire, as well as biological disturbances, such as insects, diseases, invasive plants, and herbivore browsing.

To combat these threats, DWSP has developed watershed forest management goals within the LMP that focus on creating and maintaining a watershed protection forest that is resistant to and resilient from disturbance.

Goal: The desired condition for the watershed protection forest is **a mosaic of managed and unmanaged areas incorporating both planned and inherent diversity**. Together, this enhances long-term forest stability, ensures the continued production of high-quality drinking water, and promotes and maintains regional biodiversity.

- Monitor, maintain, and enhance **overall forest health.**
- Encourage and maintain **diversity of native species** and create a **diversity of forest structure.**
- Maintain the ability of the forest to **establish abundant, diverse regeneration**
- **Balance the co-benefits** of forests for wildlife, local economy, and carbon storage.

Rationale: Building Resiliency with two pillars of diversity

*1. A forest with **many age and height classes** is less likely to be impacted by a catastrophic weather-related disturbance.*

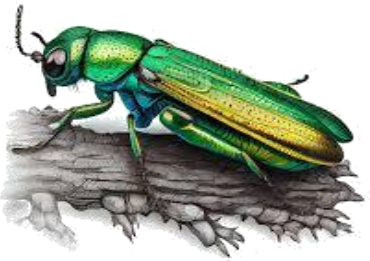
Example:

Windthrow from a major hurricane:

- a forest with mostly tall, old, even-aged trees vs. forest managed for age/structural diversity.

*2. A forest with a **variety of species** is less susceptible to disease and insect outbreaks.*

- If a forest is dominated by a single species, a disease or insect outbreak that targets that species can have a devastating impact.



Emerald Ash Borer

Overall, the DWSP employs an **adaptive management approach** to its Land Management Plan, which integrates both scientific information and public input to inform and revise its strategies to manage forested areas for resilience against disturbances. By focusing on creating and maintaining a healthy and diverse forest, DWSP is helping to ensure the long-term protection of water quality in its watersheds.

HURRICANE OF 1938
AND ITS EFFECT ON MASSACHUSETTS FORESTS

Known as the Great New England Hurricane, it struck on September 21, 1938.

WIDESPREAD BLOWDOWN
Entire stands of trees were uprooted or snapped by the strong winds

INCREASED SALVAGE LOGGING
Massive volumes of downed timber led to extensive logging

SHIFT IN FOREST COMPOSITION
Early successional species regenerated in windthrown areas

LONG-TERM LEGACY
The hurricane left a lasting ecological footprint on the forests

Remembering the Hurricane of 1938, and Forecasting in the Future

What is the risk?

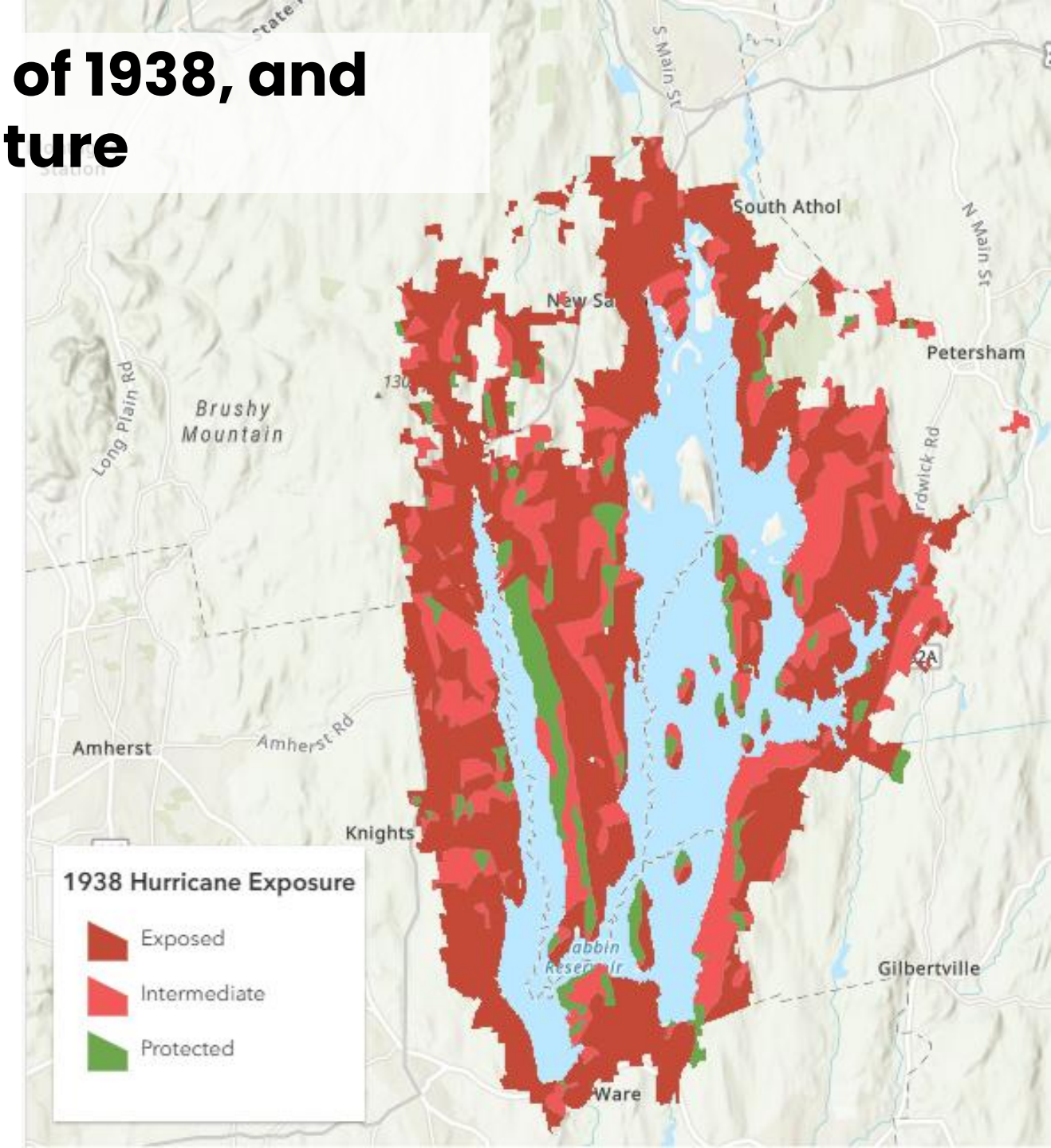
MAP: Quabbin's physical exposure to a wind event similar to that of the hurricane of 1938.

Predicting damage:

- 1992: greater than 95% of the current Quabbin forest exceeds the height projected to be damaged to some extent.

Based on: Daniel Ottenheimer's (SUNY) thesis where he applied the Harvard Forest hurricane exposure model to DWSP lands at Quabbin.

- *Foster, D.R. and E.R. Boose 1992 Patterns of forest damage resulting from catastrophic wind in central New England, USA Journal of Ecology 80:79-80*



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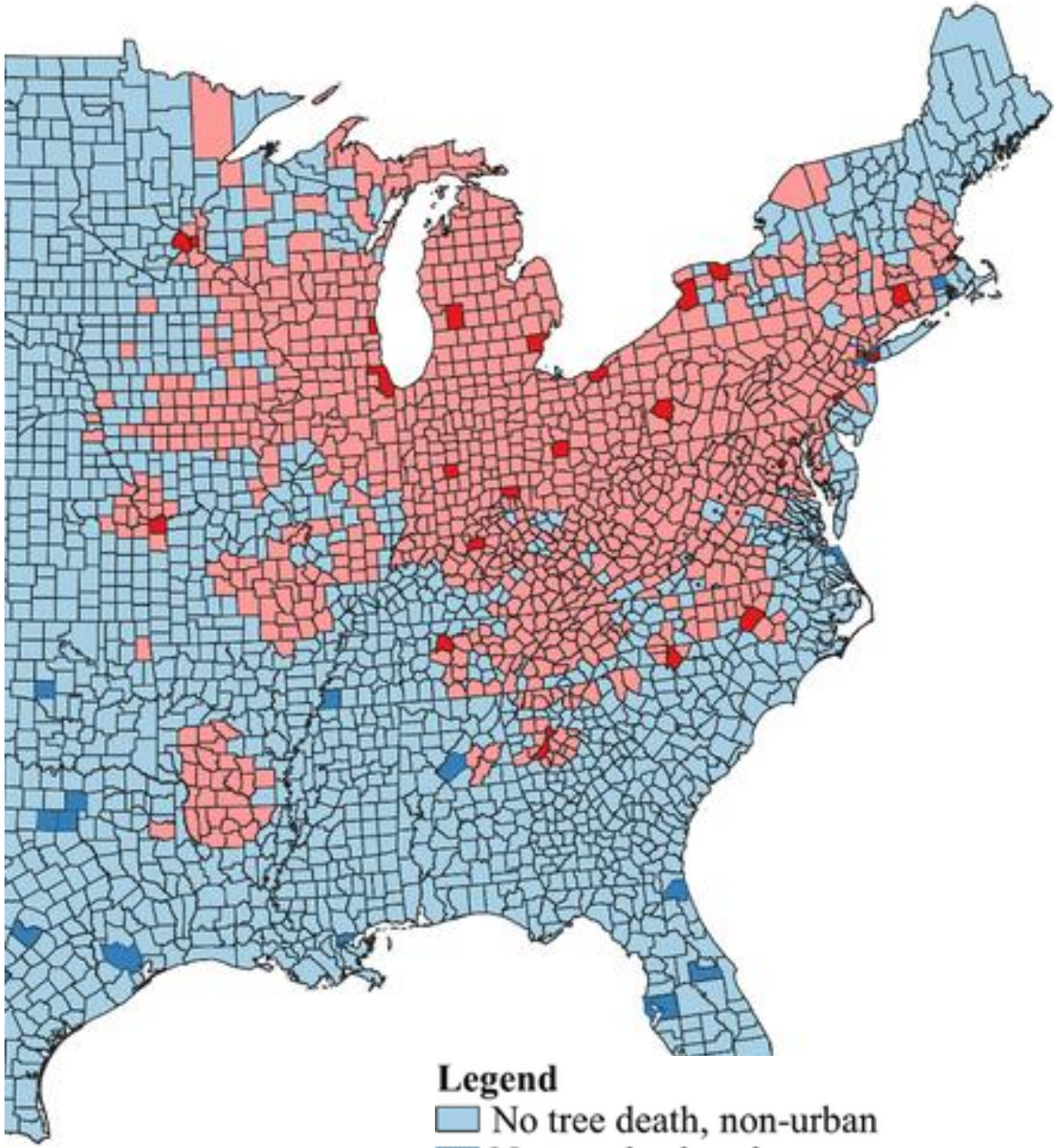
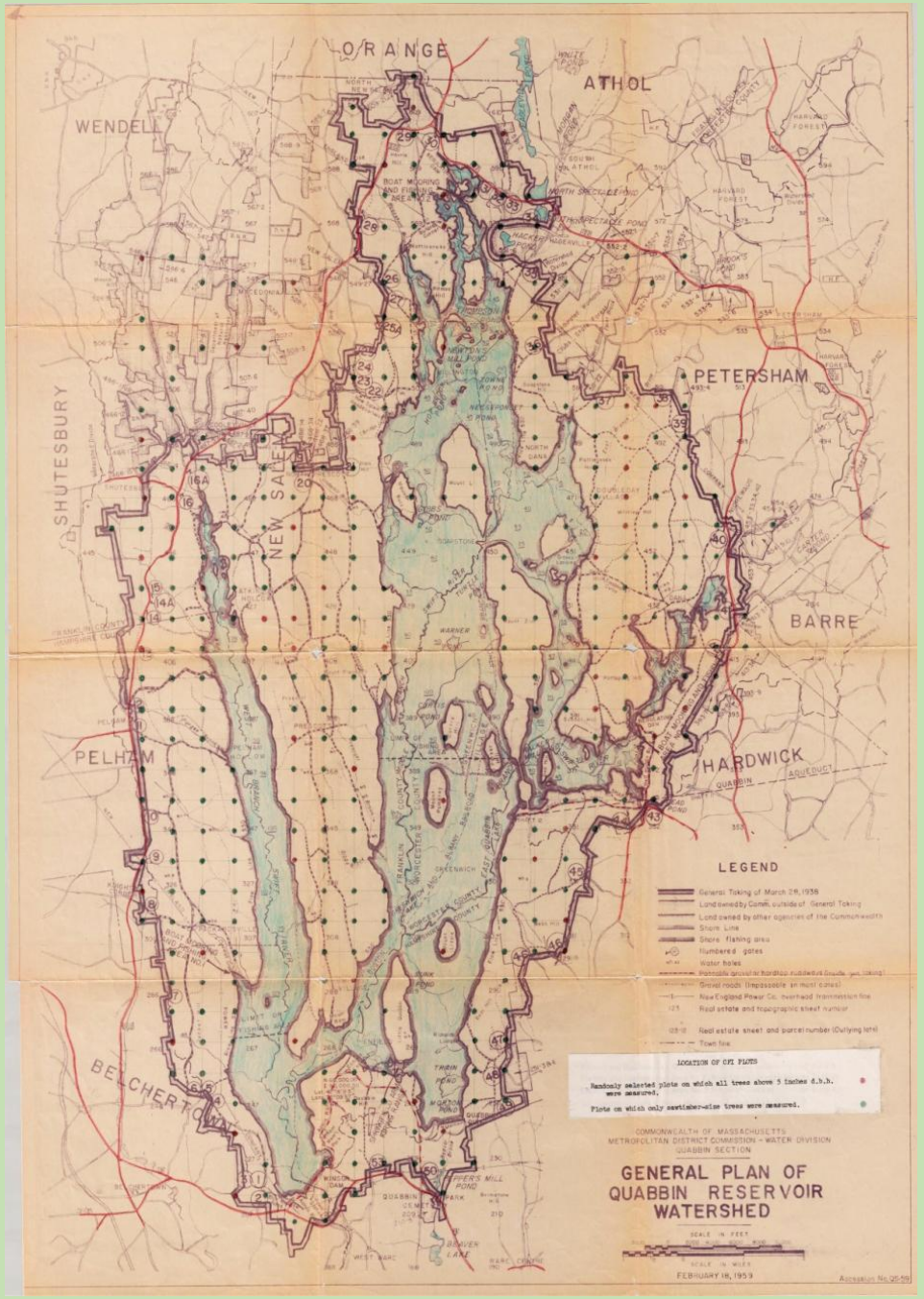


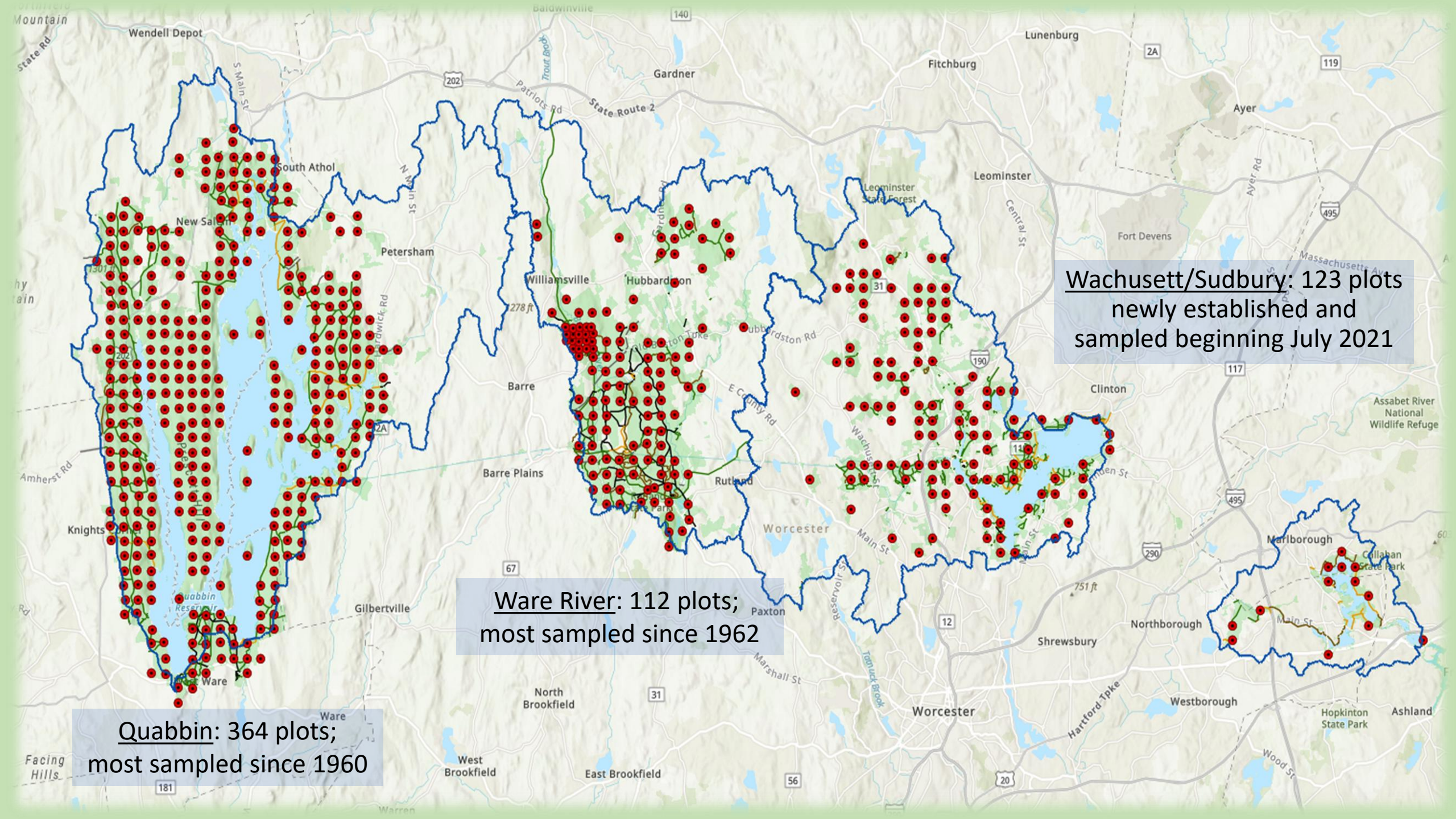
DWSP Continuous Forest Inventory

Wachusett Watershed - May 2025

“Forest Resources on Metropolitan District Commission Lands Surrounding Quabbin Reservoir”

- Masters Thesis, UMass 1961, Fred Hunt
- Established CFI based on State/USFS model; ½ mile grid spacing
- Each 1/5-acre plot ‘represents’ 160 acres (giving a sampling rate of 1/800 or 0.00125)
- Re-measurement interval = 10 years



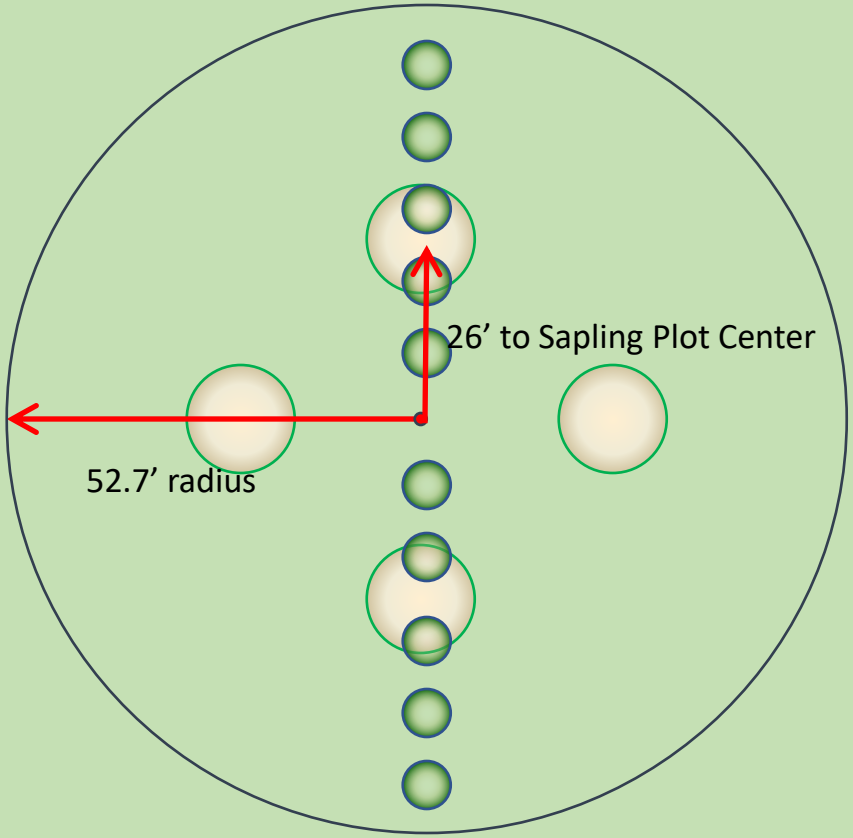

Wachusett/Sudbury: 123 plots newly established and sampled beginning July 2021
Ware River: 112 plots; most sampled since 1962
Quabbin: 364 plots; most sampled since 1960
Wendell Depot
South Athol
New Salem
Petersham
Gardner
Williamsville
Hubbardston
Barre
Barre Plains
Rutland
Leominster
Fitchburg
Lunenburg
Ayer
Fort Devens
Clinton
Worcester
Paxton
Gilbertville
Ware
North Brookfield
West Brookfield
East Brookfield
Shrewsbury
Northborough
Marlborough
Westborough
Hopkinton State Park
Ashland
Assabet River National Wildlife Refuge

Continuous Forest Inventory (CFI) Plot Design Details

- Circular fixed 0.2-acre plot (52.7' radius)
- Located on ~½ mile grid
- Permanently staked center point
- <u>TREES</u>: Number (with paint) and collect data for all trees ≥5.6” DBH within plot

- <u>SAPLINGS</u> (since 2000): Four 6-foot radius plots, centered 26 feet from plot center in each cardinal direction (not monumented)
  - Record # of stems 1” DBH to 5.5” DBH, by species

- <u>REGENERATION</u> (since 1990): Ten 1/1000th acre plots, 10 feet apart, N-S
  - Record species of two tallest stems >1' tall up to 1" Diameter
  - Likely to be modified/abandoned in favor of full counts in the sapling plots to better align with DSPR methods



CFI Plot Level Data

- Static Information:
  - Plot Number
  - Location (Lat + Long)
  - Slope and Aspect
  - Terrain Position
- Dynamic Information:
  - Cover Type
  - Land Use
  - Disturbances
  - Interfering plants
  - Invasive plants
  - Browse
  - Non-forest area
- Future updates:
  - Woody debris, leaf litter, herbaceous vegetation

CFI Tree Level Data

- Static Information:
  - Tree Number
  - Location (Azimuth and Distance from center)
  - Species
- Dynamic Information:
  - Live/Dead/Cut status
  - Diameter
  - Tree Class
  - Height
  - Sawlogs
  - Crown position
  - Live Crown Ratio
  - Cavities

Trees are assigned permanent numbers which are marked with ‘tube paint’…

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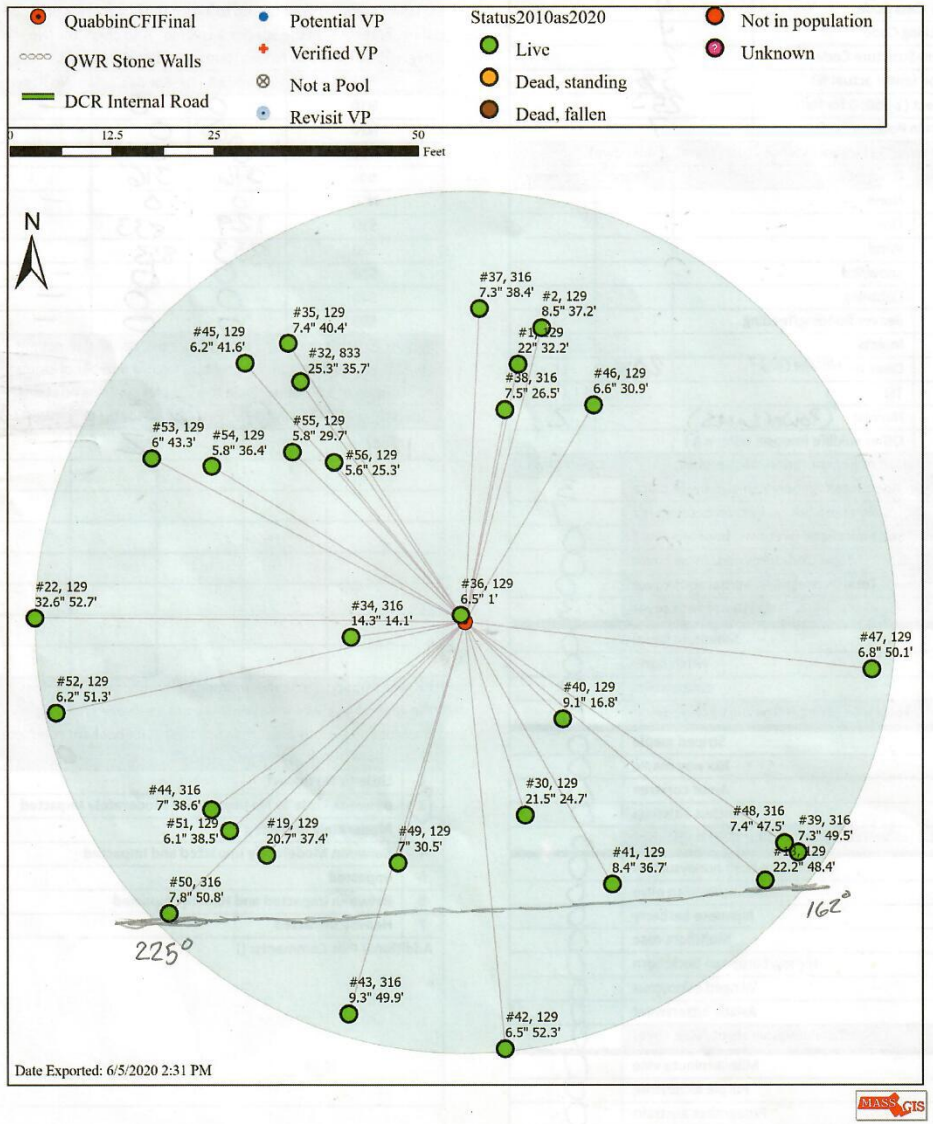
… as are diameter measure points

QUABBIN CONTINUOUS FOREST INVENTORY – PLOT LEVEL DATA -- 2020

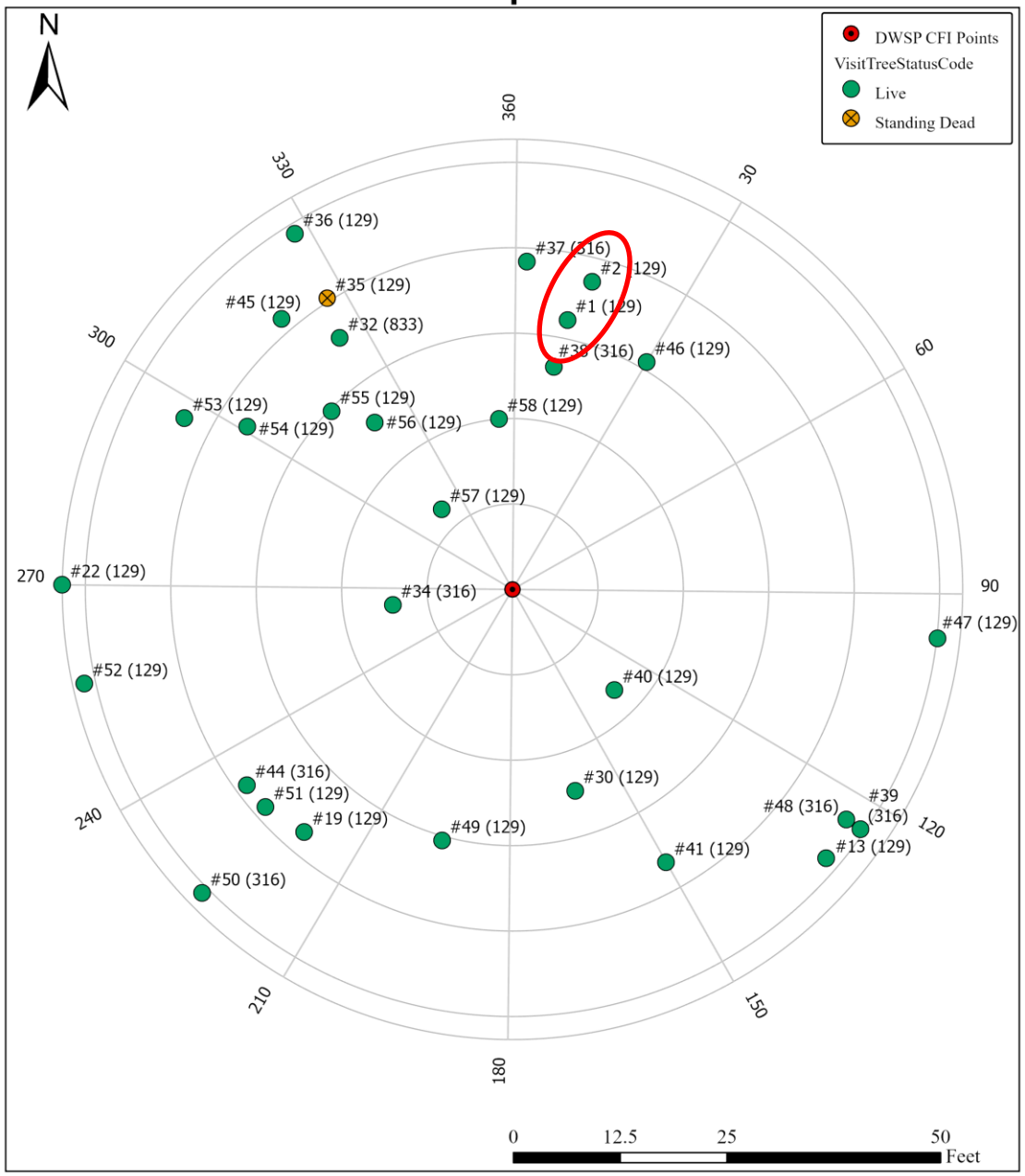
2010 Quabbin CFI Tree Map -- Plot 100

DCR - Division of Water Supply Protection
Office of Watershed Management



Massachusetts Department of Conservation & Recreation
Division of Water Supply Protection
Office of Watershed Management

2020 CFI Tree Map: Plot 10100



These two trees tell a long story of *competition* and growth response to *silviculture*

	DBH Tree 1	DBH Tree 2
1960	5.3	5.6
1965	6.5	6.5
1970	7.3	6.8
1980	11.4	7
1990	15.2	7.4
2000	18.5	7.5
2010	22.0	8.5
2020	24.4	8.8

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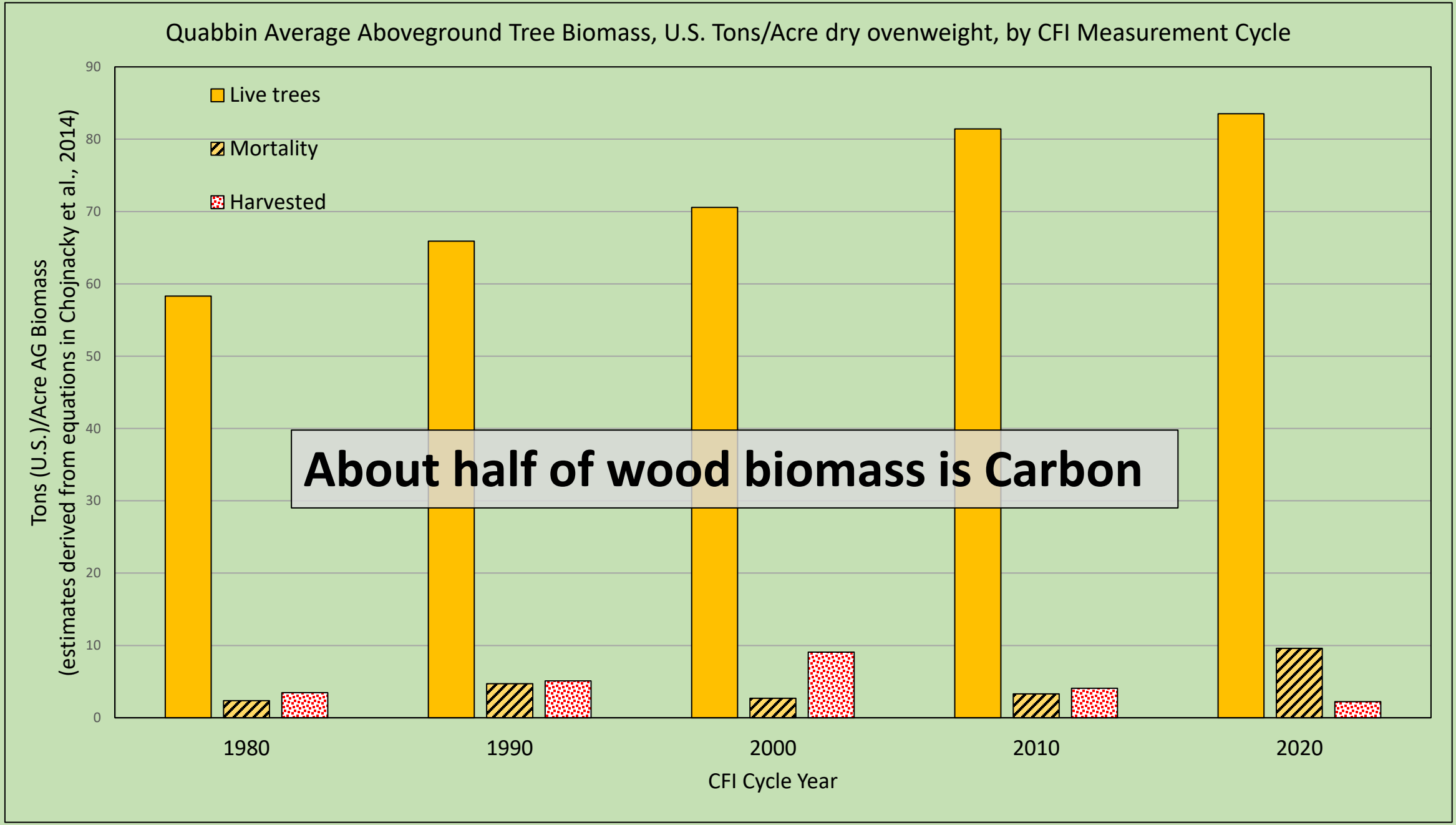
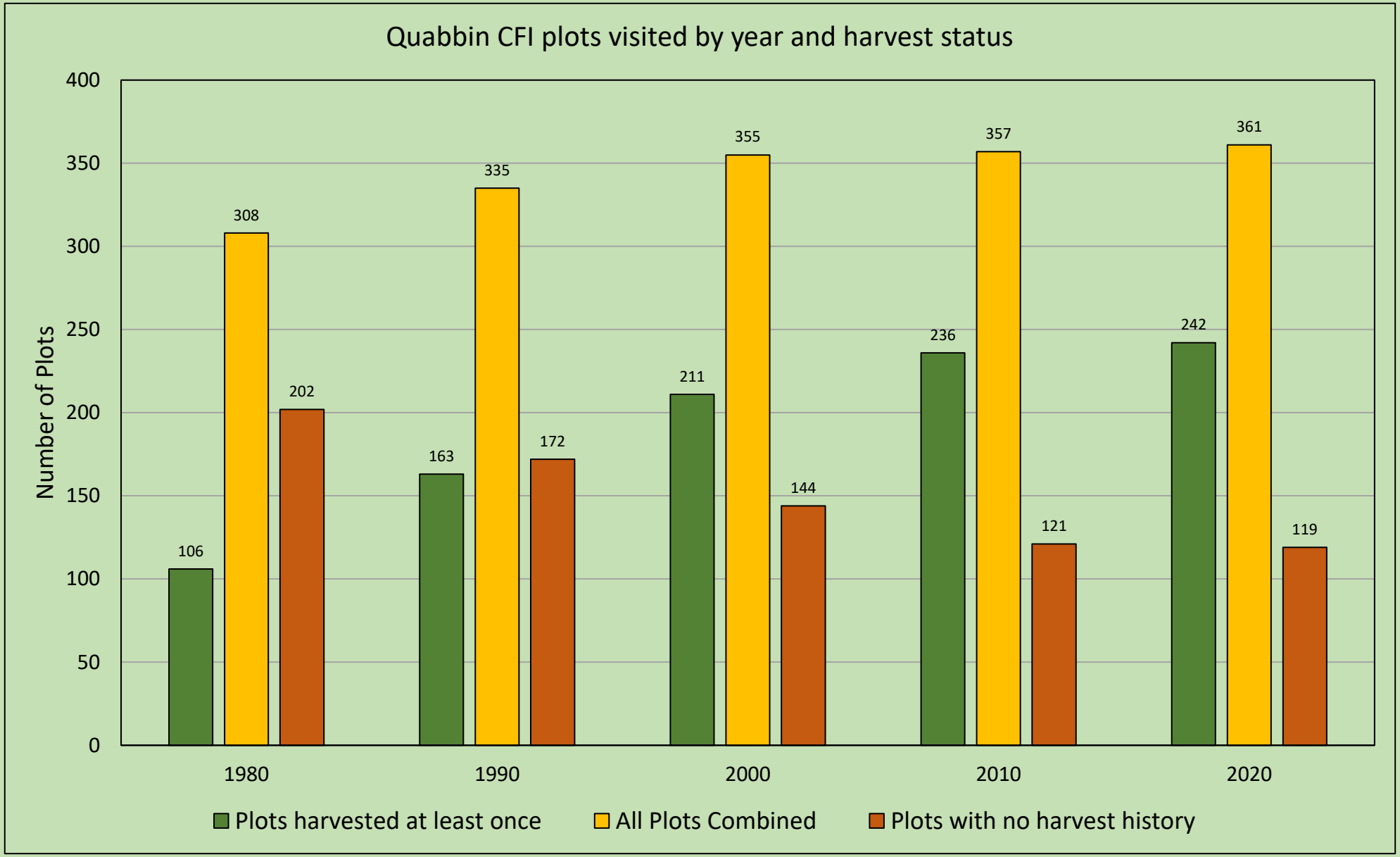
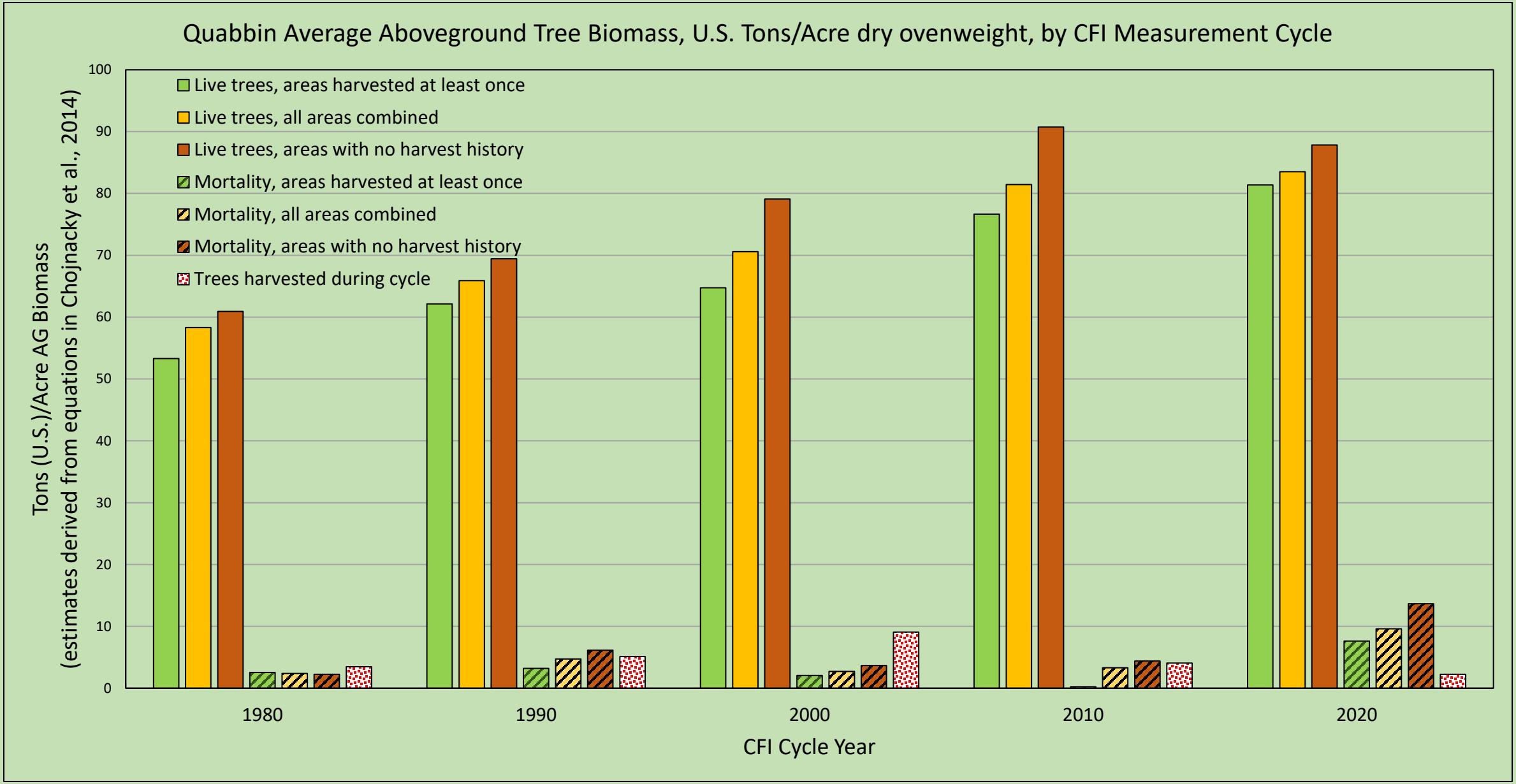
Records show harvesting between 1965 and 1970, again in 1970's, and again in 1994


Quabbin Average Aboveground Tree Biomass, U.S. Tons/Acre dry ovenweight, by CFI Measurement Cycle
Live trees
Mortality
Harvested
Tons (U.S.)/Acre AG Biomass
(estimates derived from equations in Chojnacky et al., 2014)
90
80
70
60
50
40
30
20
10
0
1980
1990
2000
2010
2020
CFI Cycle Year
About half of wood biomass is Carbon


Quabbin CFI plots visited by year and harvest status
Number of Plots
400
350
300
250
200
150
100
50
0
106
308
202
163
335
172
211
355
144
236
357
121
242
361
119
1980
1990
2000
2010
2020
Plots harvested at least once
All Plots Combined
Plots with no harvest history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Tons (U.S.)/Acre AG Biomass
(estimates derived from equations in Chojnacky et al., 2014)
Live trees, areas harvested at least once
Live trees, all areas combined
Live trees, areas with no harvest history
Mortality, areas harvested at least once
Mortality, all areas combined
Mortality, areas with no harvest history
Trees harvested during cycle
100
90
80
70
60
50
40
30
20
10
0
1980
1990
2000
2010
2020
CFI Cycle Year


QUESTIONS?