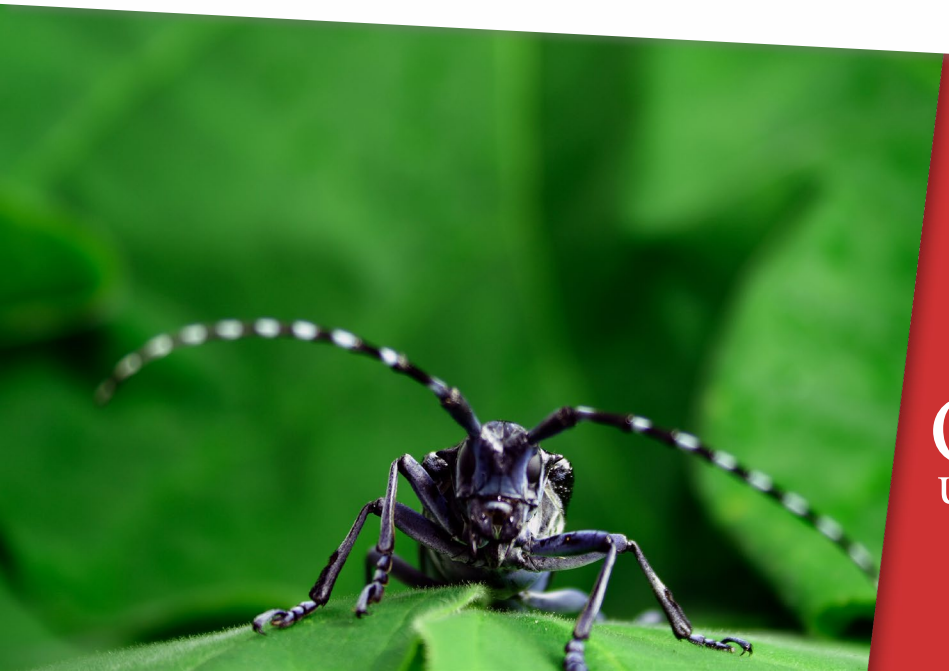
Stakeholder Summit 2014

Human Environment Regional Observatory



HERO

NSF

CLARK UNIVERSITY 1887

Human-Environment Regional Observatory (HERO), 2014

Beetle Impact Assessment

Gaia Khairina
Clark University

Anona Miller
Appalachian State University

Hannah Rush
Clark University

Amber Todoroff
University of Florida

Andrew Varuzzo
College of the Holy Cross

Place Making Assessment

Elizabeth Anderson
Rensselaer Polytechnic Institute

Albert Bautista
Humboldt State University

Benjamin Ewald
Clark University

Alison Jackman
Whittier College

Marina Khananayev
Clark University

Amy Phillips
Clark University

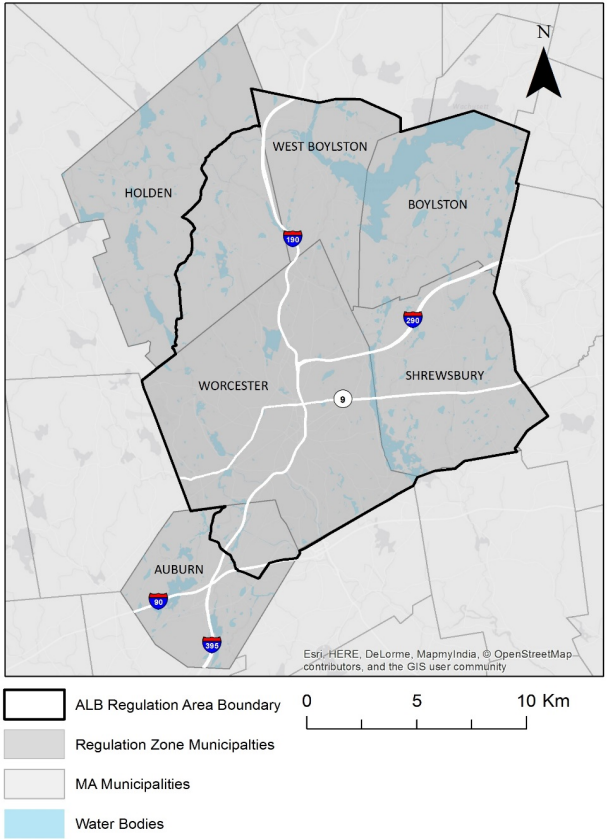
Introduction: The Beetle

Asian Longhorned Beetle (ALB)

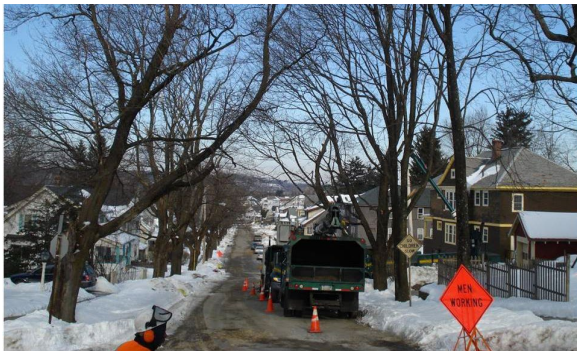
- Wood-boring beetle
- Native to Eastern Asia
- Targets maples, poplars, elms, willows and other hardwoods

Worcester Infestation

- Discovered in Worcester in 2008
- 337km^2 regulation area in six towns
- Economic impacts on timber, sugaring, tourism



- Host tree removal
- Ongoing removal of 31,965 trees
- Greendale and Burncoat neighborhoods
- Recently Green Hill Park



Overarching Research Objectives

2012-2014

Examine the impacts of the ALB infestation on the physical environment, politics, and society of the Worcester area.

Beetle Impact Assessment (BIA) 2014

To measure the current conditions and mortality rates of DCR tree replantings (2010-2012) and what factors influence these.

Placemaking Assessment (PMA) 2014

To conduct a survey testing the findings of previous years, in order to make generalizations about the larger population within the Quarantine Zone.

Overarching 2014 PMA Research Objectives

2012-2014

Examine the impacts of the ALB infestation on the physical environment, politics, and society of the Worcester area.

Beetle Impact Assessment (BIA)

To measure the current conditions and mortality rates of DCR tree replantings (2010-2012) and what factors influence these.

Placemaking Assessment (PMA)

To conduct a survey testing the findings of previous years, in order to make generalizations about the larger population within the Quarantine Zone.

Three Year Study

2012

Background information about the ALB issue, stakeholder perceptions from interviews and media analysis in Worcester

2013
Interviewed policy makers in other towns

2013
Gathered residents' perceptions with focus groups

2014

Can past findings be applied to a broader Quarantine Zone population?

Relational Placemaking

House

Community Groups

Traditions

Walking the dog

Neighbors

People

Yard

Trees

Transport systems

Family

Feeling

Town

Government

Economic processes

Special Places

Landmarks

Mixed Methods

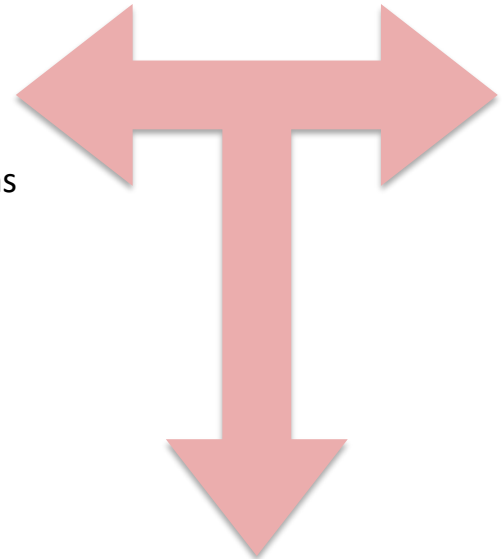
Quantitative Methods

Multiple choice questions

Graphs

Charts

Maps



Qualitative Methods

Open ended questions

Interviews

Focus groups

Mixed Methods Study

2014 Methods

Survey

Creation, writing questions based on past findings

Sampling

Strata

Distribution of five surveys

Unique URLs allow for respondent distinction

Statistical Analysis

Preliminary findings

Creation of Survey

Past Findings

Importance of Trees

Damage from ALB

Community Strength

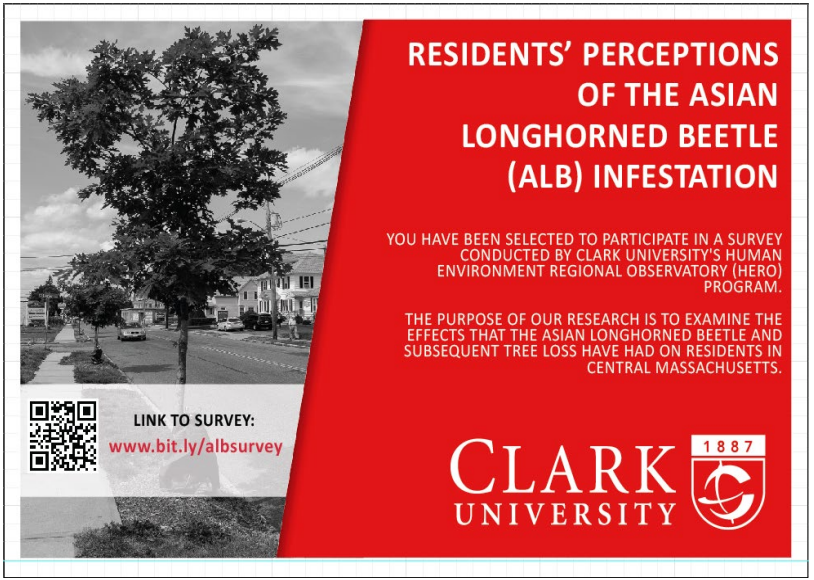
Resilience

New Networks

Personal  **Communal/ Regional**

Sampling Strategy

1. Sample included residents from all six towns, of all income brackets, and those who were both affected or not by tree removal due to ALB.
2. 2000 points were generated and distributed equally by strata.
3. The points were assigned to the nearest residential address.
4. Each point was manually validated.



Front of postcard mailed to residents in Quarantine Zone

Survey Distribution

- Sent out 891 postcards
- Hand delivered over 200 postcards
- Press release sent to *Telegram & Gazette*, *InCityTimes*, and *Worcester Magazine*
- 30 flyers posted
- Link to survey included in Worcester Tree Initiative listserve newsletter

Survey Responses

Survey Type	Responses
Random Sample	25
Handouts and Flyers	21
WTI List Serve	12
Press Release	22
Previous Interaction with HERO	15
Total:	**95**

Analysis of Survey Responses

→Using IBM SPSS and Qualtrics, various statistical analysis techniques were used to determine connections and trends within the survey data.

→We ran:

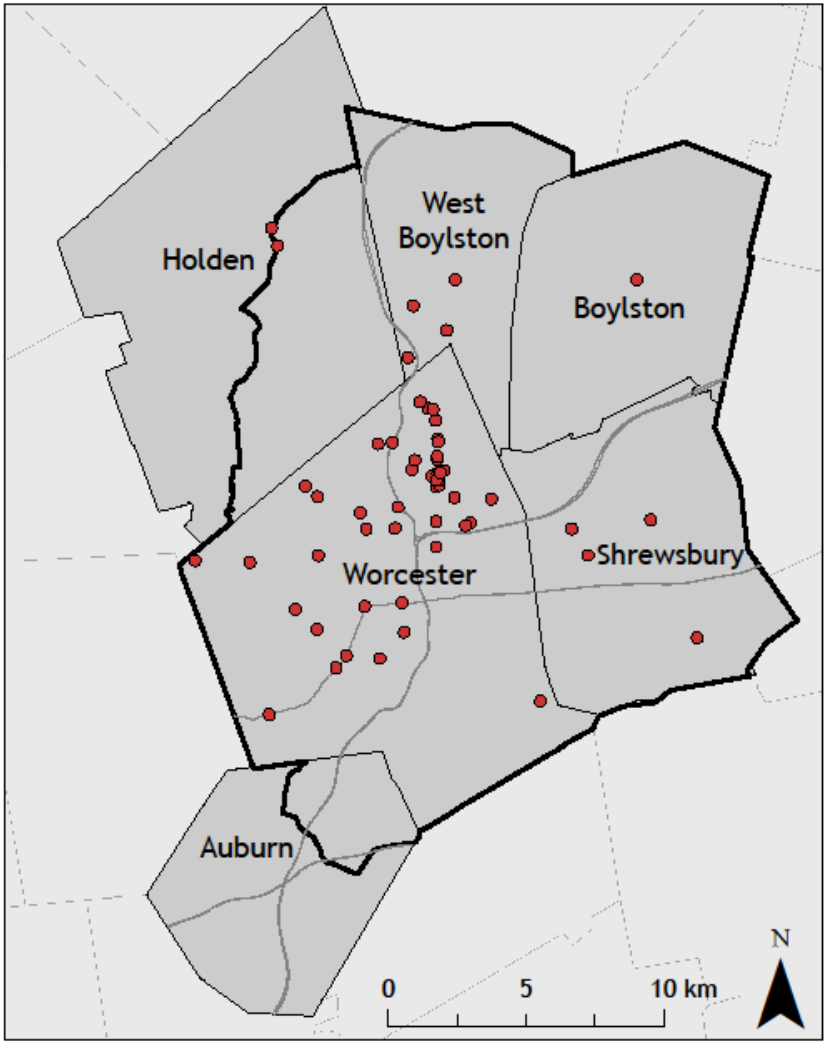
- Basic Descriptive Statistics
- Correlation Matrix
- Chi Squared Analysis

Demographics

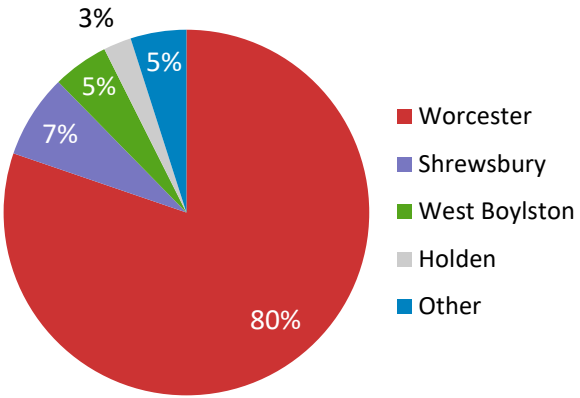
- **Female:** 38 (55%)
- **Male:** 31 (45%)
- **Mean age:** 45-54
- **Mean household income:** $120,000 - $130,000
- **Race:** Predominantly Caucasian

Location of Survey Respondents

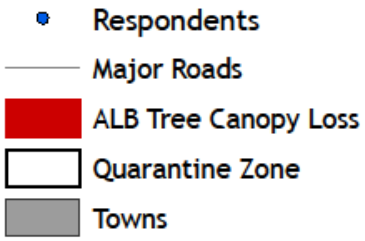
- Respondents
- Major Roads
- Quarantine Zone
- Towns

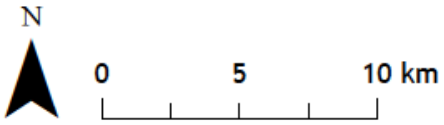


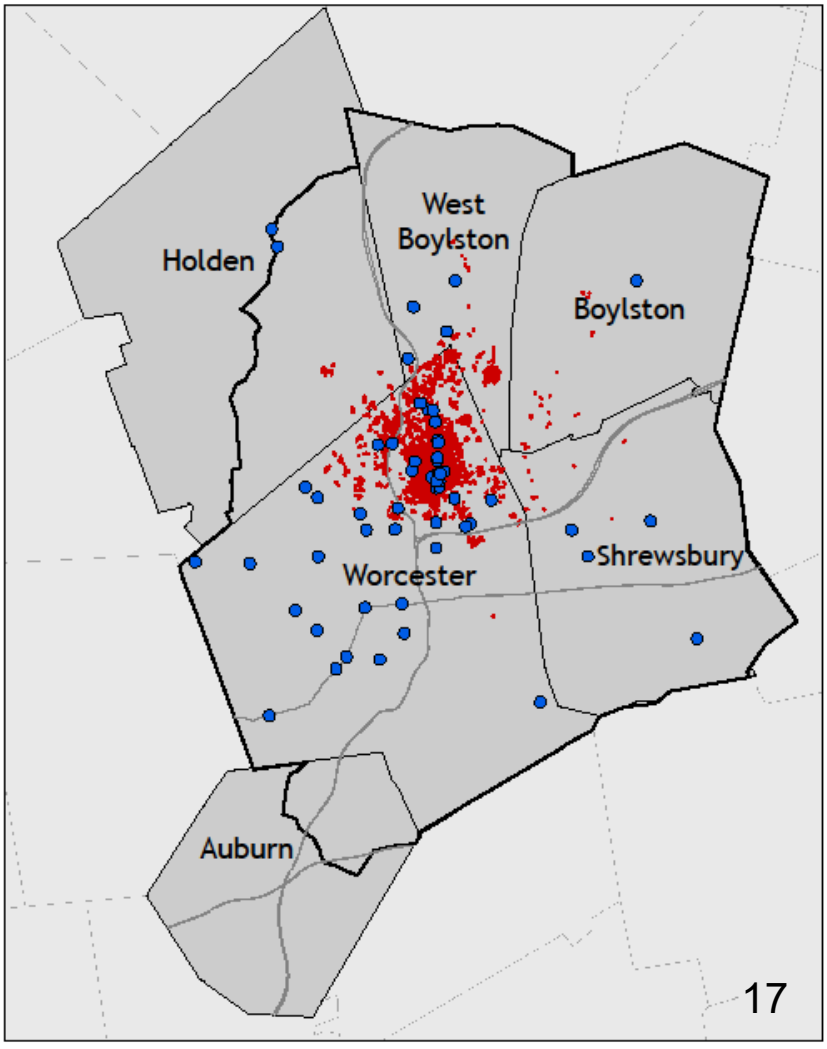
Respondents' City/Town



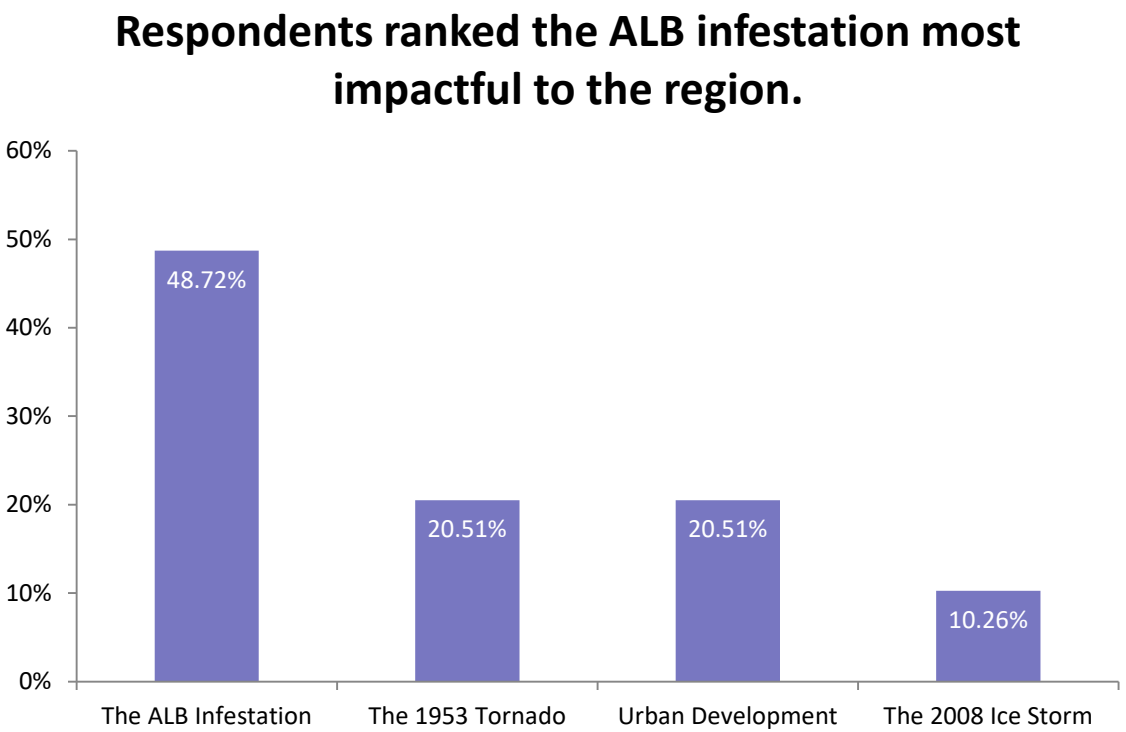
Respondents and Tree Canopy Loss Due to ALB







Descriptive Statistics



Themes

Community Character

Mutual Communication

2014 Narrative

Residents have experienced change in **community character**

Residents are more **receptive to information** regarding environmental issues

What is Community Character?

Importance of Trees

"When they took at the trees out, it really did look **like a warzone**. It looks like, it looked **like a tornado came through** and just ripped everything out but the houses, and just **stripped it.**"

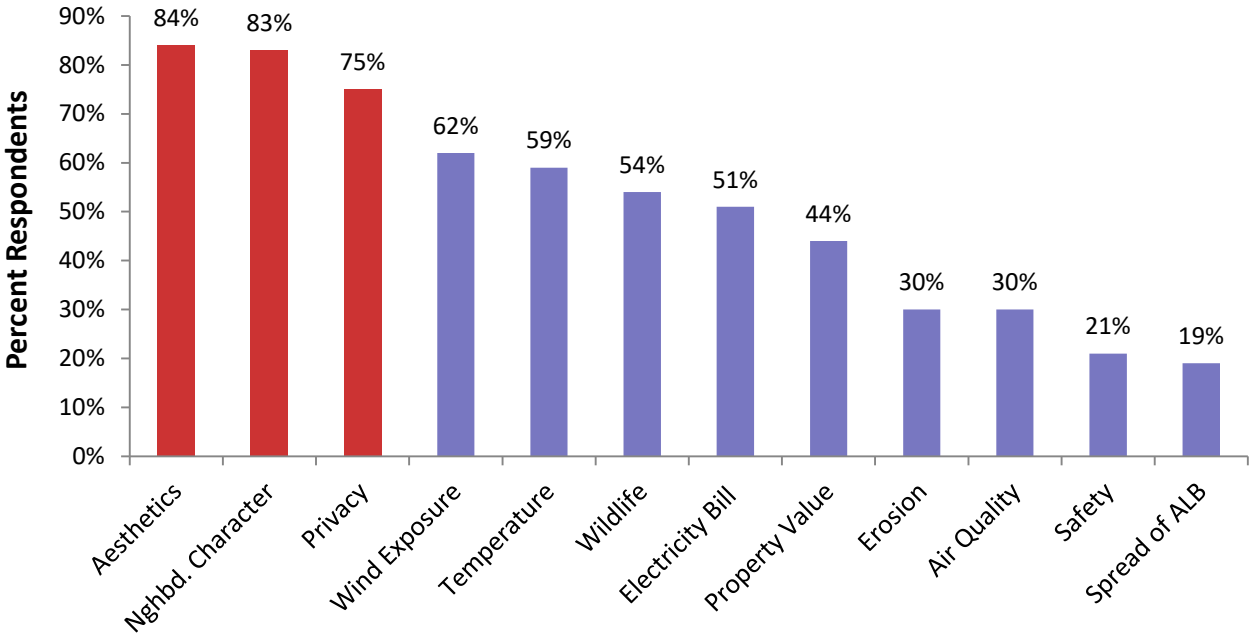
-Worcester Resident, 2013 Interview

"You could stand out on the street with your **neighbors** and talk right under that canopy. It was really comfortable, really pleasant. No one stands in the streets now. It's **not someplace anyone gathers**."

-Worcester Resident, 2013 Interview

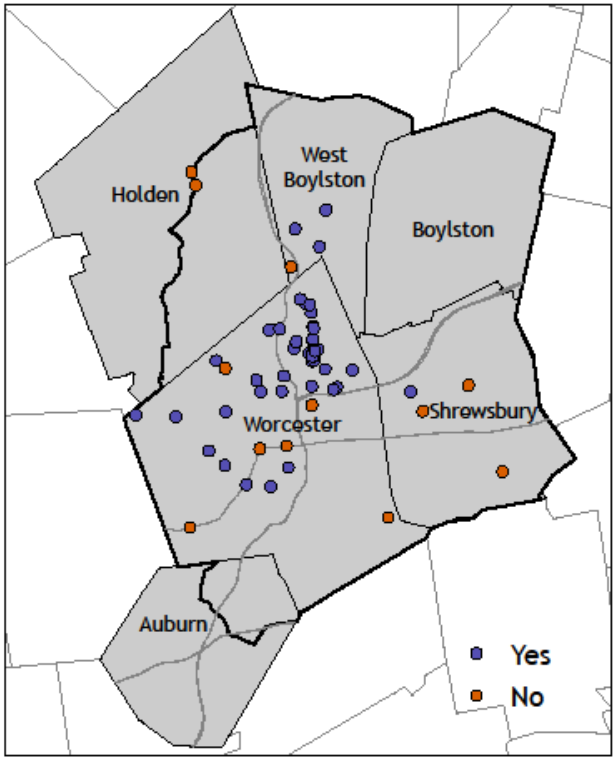
Community Character

When asked about changes in residences/neighborhoods due to tree loss, 83% of respondents stated they experienced change in neighborhood character.

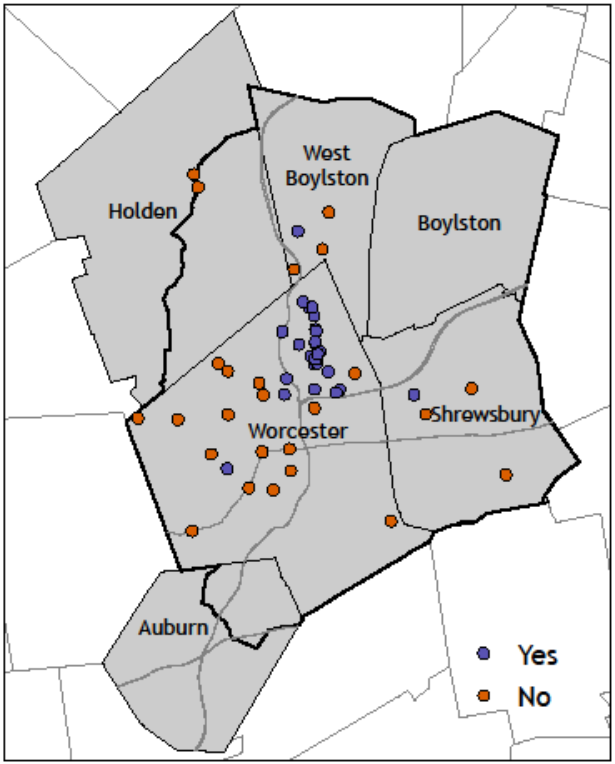


Impact and Change in Neighborhood Character

Would you consider yourself to have been impacted by the ALB infestation?



Has the character of your neighborhood changed since the beginning of the ALB infestation?



N

0 5 10 km

Major Roads Quarantine Zone Towns

Community Character Quotes

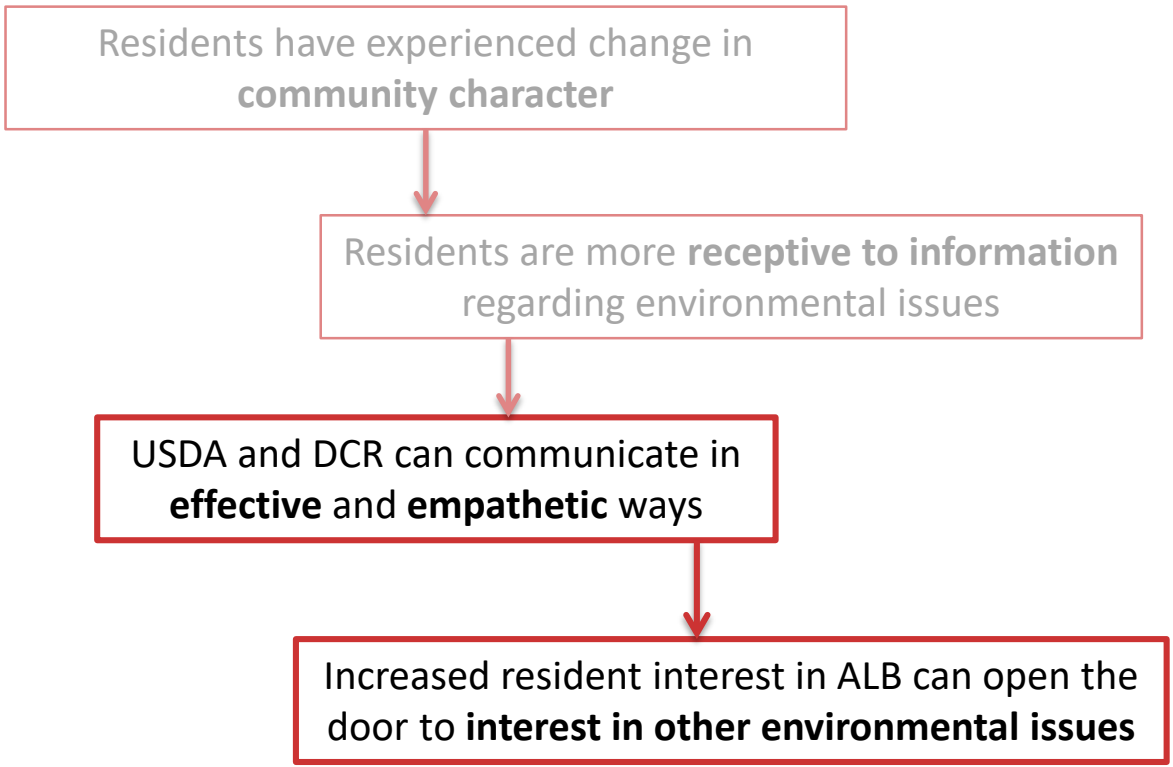
"After the trees were taken **I felt the street had been defaced**. It had a barren feel to it **as if our homes were picked up and moved** to another location."

-Worcester Resident, Survey 2014

"Prior to the infestation our neighborhood was an area of **beautiful tree lined streets**. Shade was abundant and the neighborhood looked lovely. Now our area is **barren and depressing**."

-Worcester Resident, Survey 2014

2014 Narrative



Mutual Communication

HERO 2013 Finding: Importance of Involvement

+

HERO 2013 Finding: Successful Response—Communication

2014

Increased mutual communication can be linked to a **greater understanding of ALB policy**

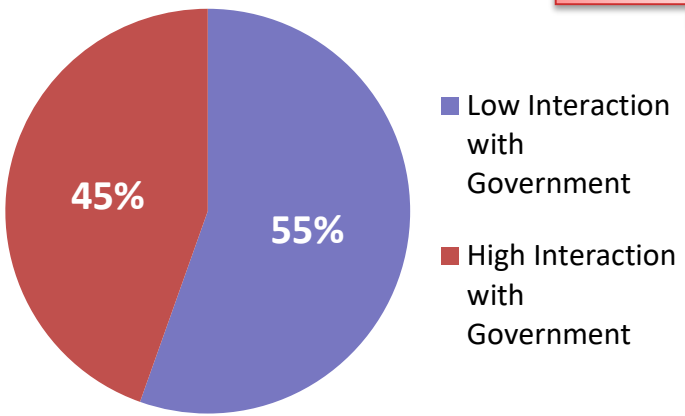
Residents identified preferred **future channels of communication**

Bettering communication between government and residents can have **positive long-term effects**

Interaction and Familiarity: Government

Interaction/Familiarity

- Communication via:
  - Email
  - Phone
  - Face to face
  - News Letter
  - General knowledge of



High Interaction/Familiarity

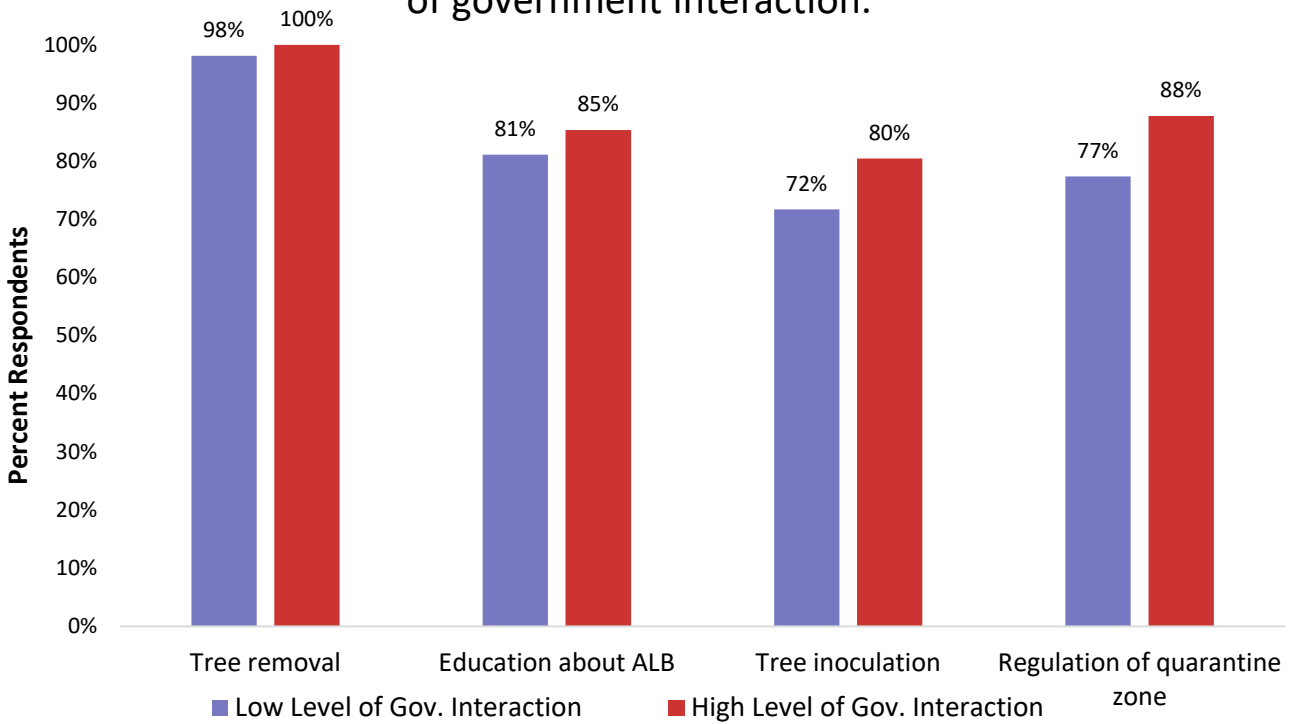
- Self reported frequent or occasional interaction

Low Interaction/Familiarity

- Self reported no interaction or minimal interaction
- No knowledge of this group

Mutual Communication

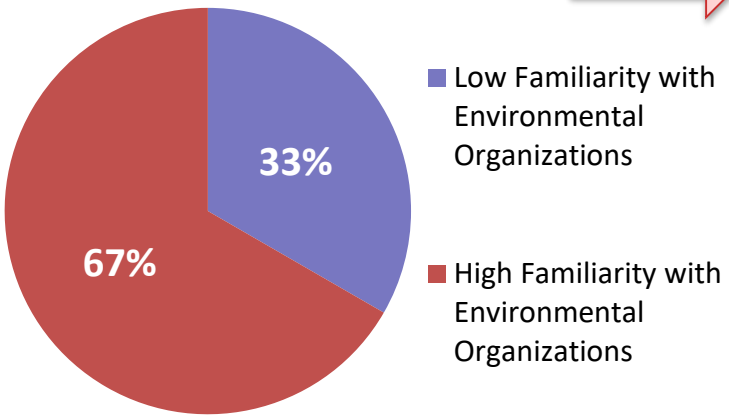
A greater knowledge of ALB policy was related to self-reported higher levels of government interaction.



Interaction and Familiarity: Environmental Organizations

Interaction/Familiarity

- Communication via
  - Email
  - Phone
  - Face to face
  - News Letter
  - General knowledge of



High Interaction/Familiarity

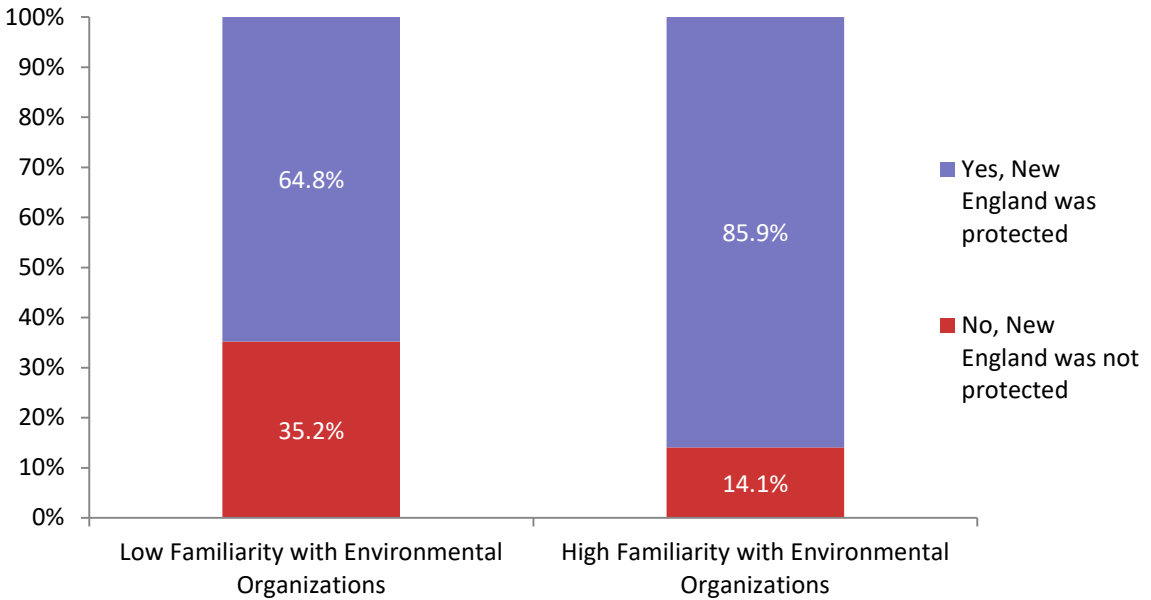
- Member of organization
- Attended Meeting/ event
- On mailing list

Low Interaction/Familiarity

- Hadn't heard of organization
- Knowledge of organization but no interaction with

Mutual Communication

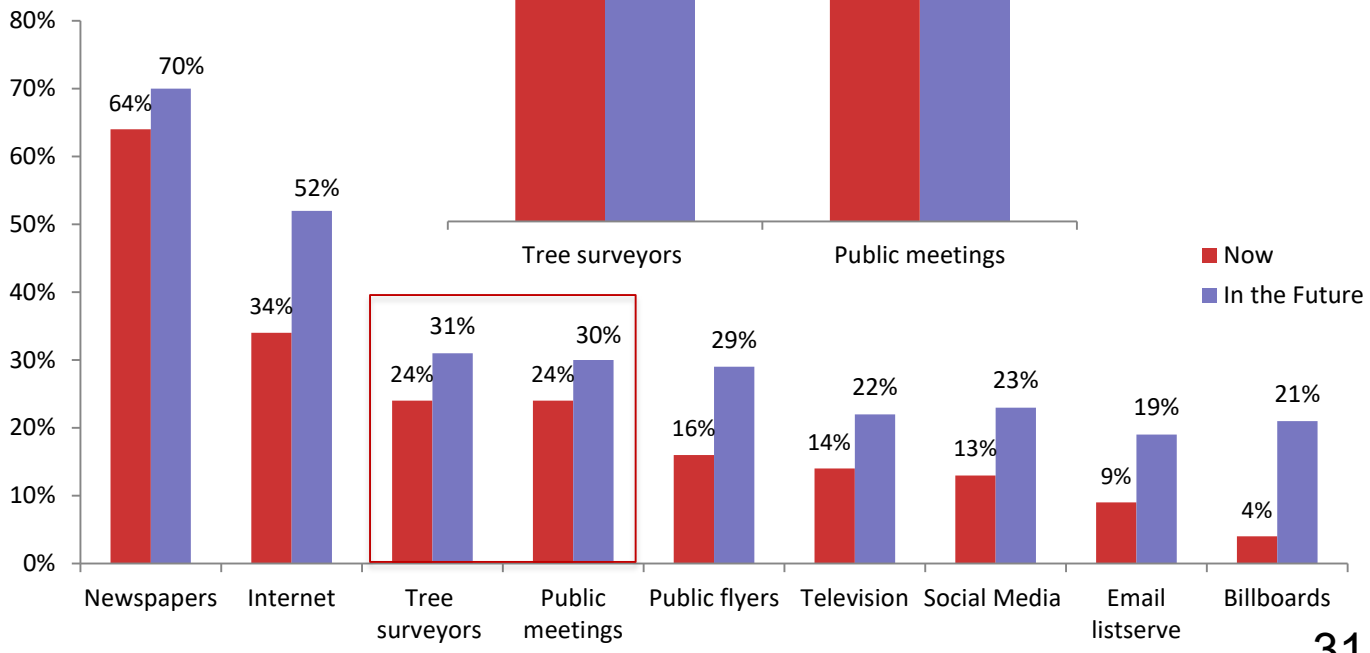
Respondents who were more involved with environmental organizations felt that **New England** had been protected by ALB policy.



(All values $p < .05$)

Mutual Communication

Residents want more information available through specific channels.



Importance of Communication

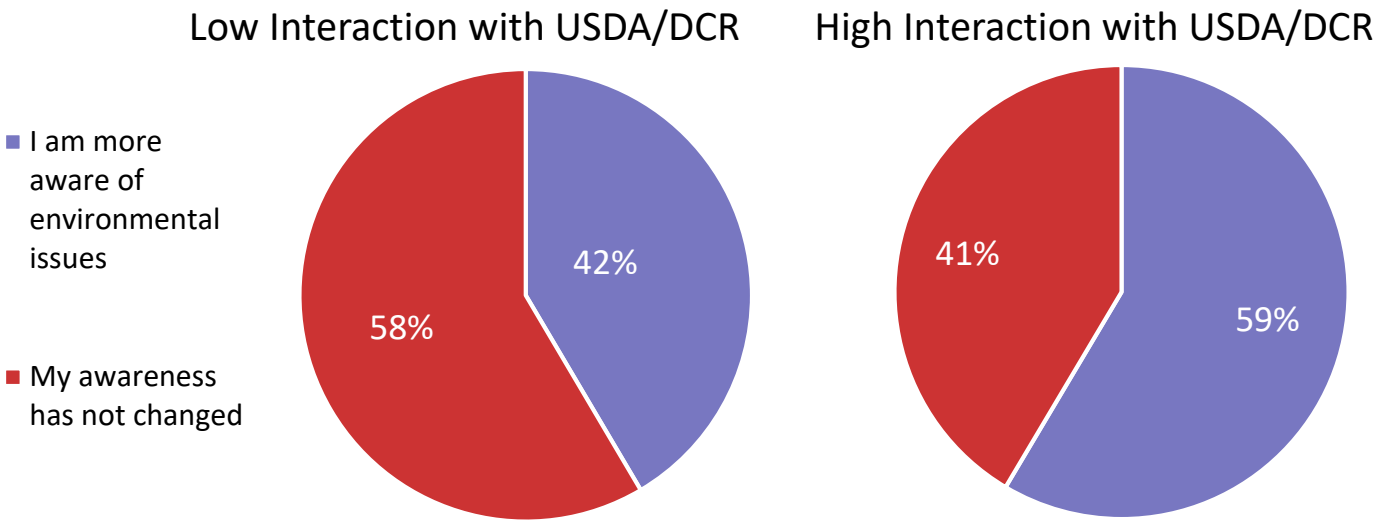
"Keep **talking** to the residents - they know their neighborhood and can be a wealth of information. They need to be **kept informed**, and to be **full participants in decision-making**."

"Dive right in. **Educate** the public **continually.**"

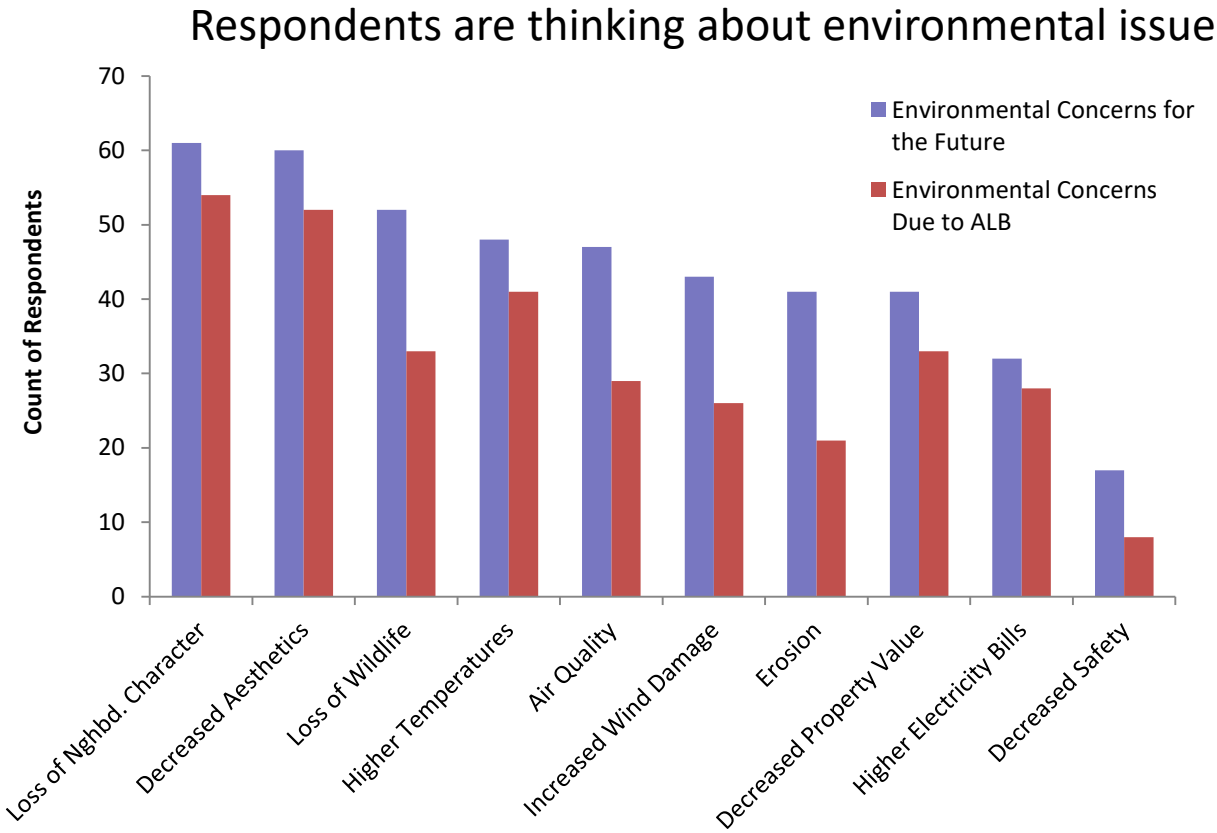
"[The] first response to any **future ALB** infestations…should be conducted by already **trained ALB staff** to **minimize mis-information** given to the public."

Increased Awareness

Respondents who reported higher interaction with the USDA/DCR also reported greater awareness of environmental issues.



Increased Awareness



Conclusions

Residents have experienced change in **community character**

Potential for a citizen body that is more **informed**, **responsive**, and **aware** of environmental stewardship

USDA and DCR can communicate in **effective** and **empathetic** ways

Increased resident interest in ALB can open the door to **interest in other environmental issues**

Overarching Research Objectives

Examine the impacts of the ALB infestation on the physical environment, politics, and society of the Worcester area.

Beetle Impact Assessment (BIA)

To measure the current conditions and mortality rates of the DCR's replantings (2010-2012) and what factors influence these.

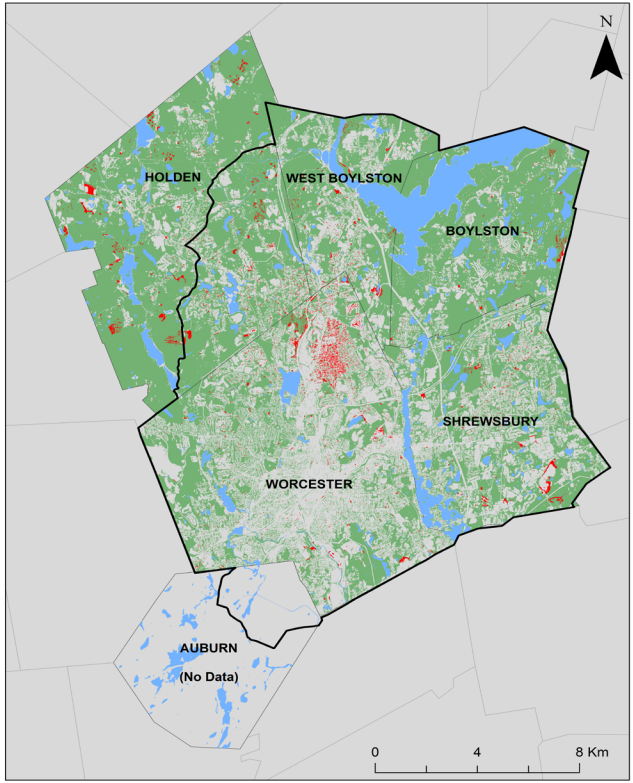
Placemaking Assessment (PMA)

To conduct a survey testing the findings of previous years, in order to make generalizations about the larger population within the Quarantine Zone.

Causes of Tree Loss

Canopy cover decreased by 2% (2.46 km^2) in the regulation zone from 2008 to 2010

- 47% urban development
- **25% ALB tree removal**
- 15% timber harvest
- 6% ice-storm damage
- 7% other



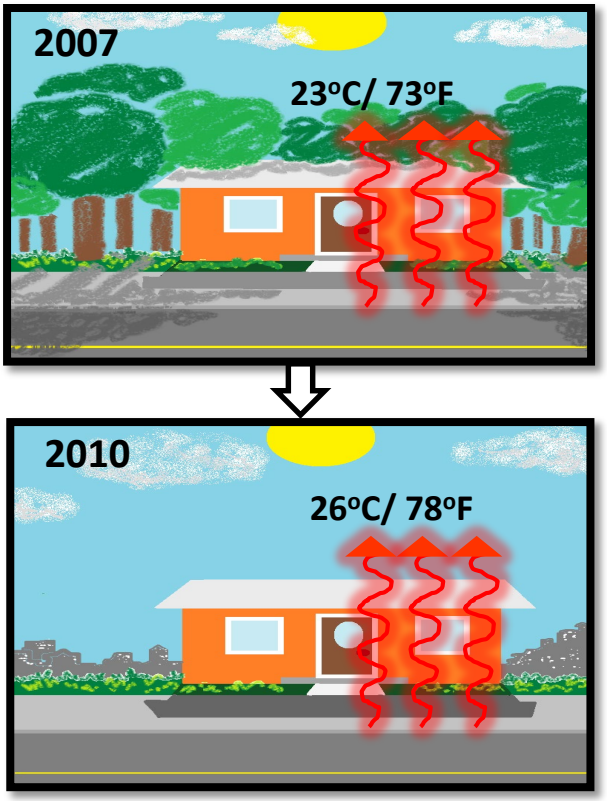
Legend

- Regulation Zone
- Water Bodies
- No Canopy Change
- Canopy Loss
- MA Towns

Impact of Tree Loss

Tree removal resulted in a **temperature increase** in the regulation zone

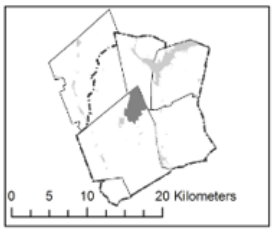
Burncoat and Greendale neighborhoods showed a **1-9˚C** (1.8-16˚F) increase from 2007 to 2010

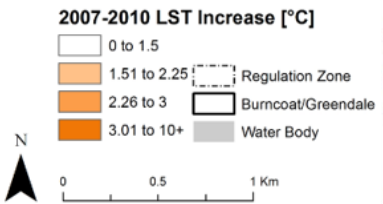


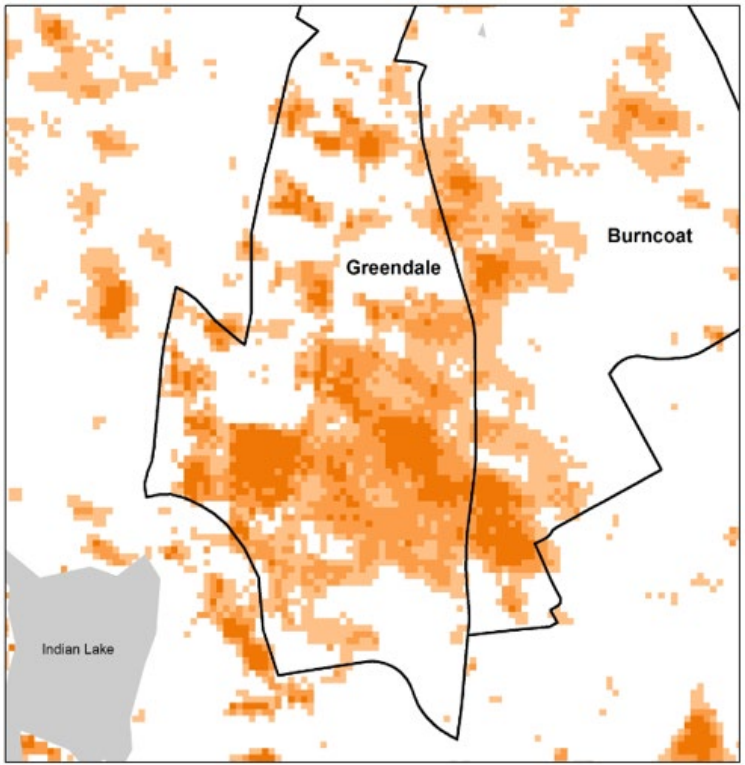
Impact of Tree Loss

Tree removal resulted in a **temperature increase** in the regulation zone

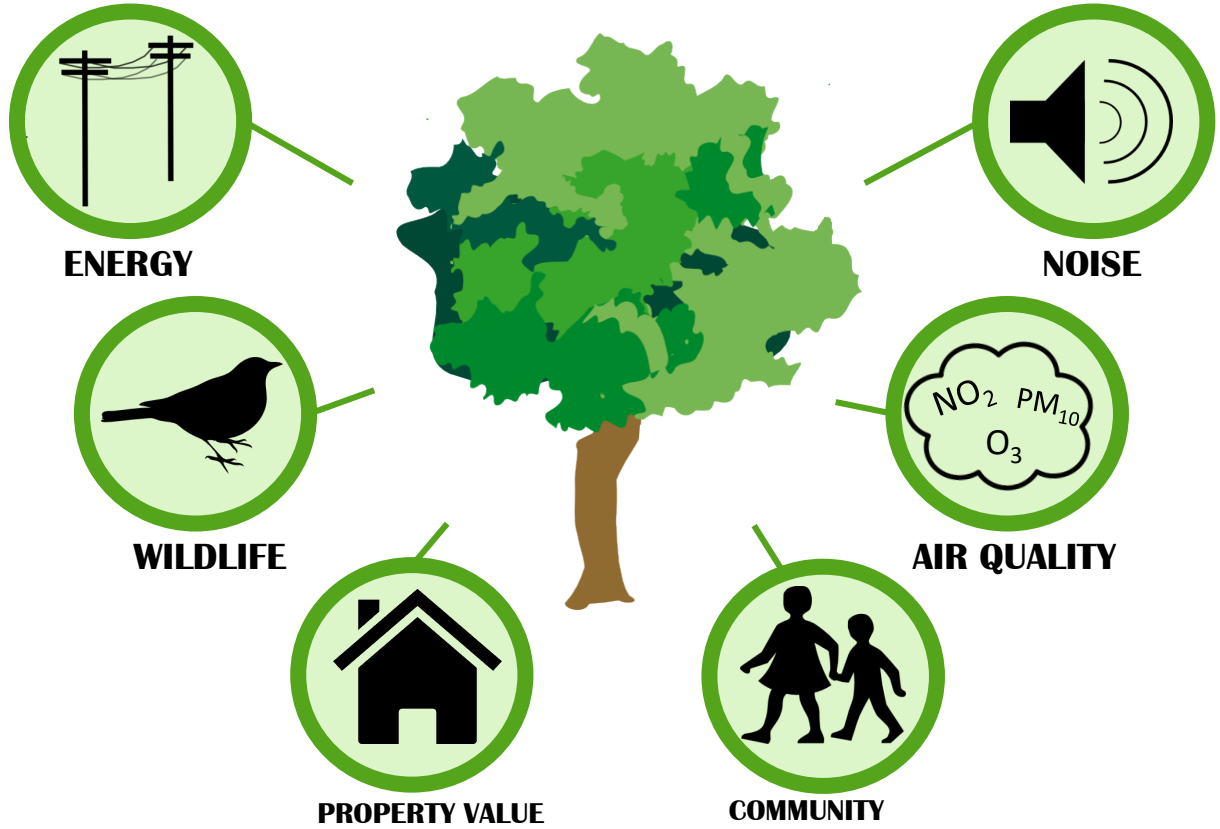
Burncoat and Greendale neighborhoods showed a **1-9°C** (1.8-16°F) increase from 2007 to 2010



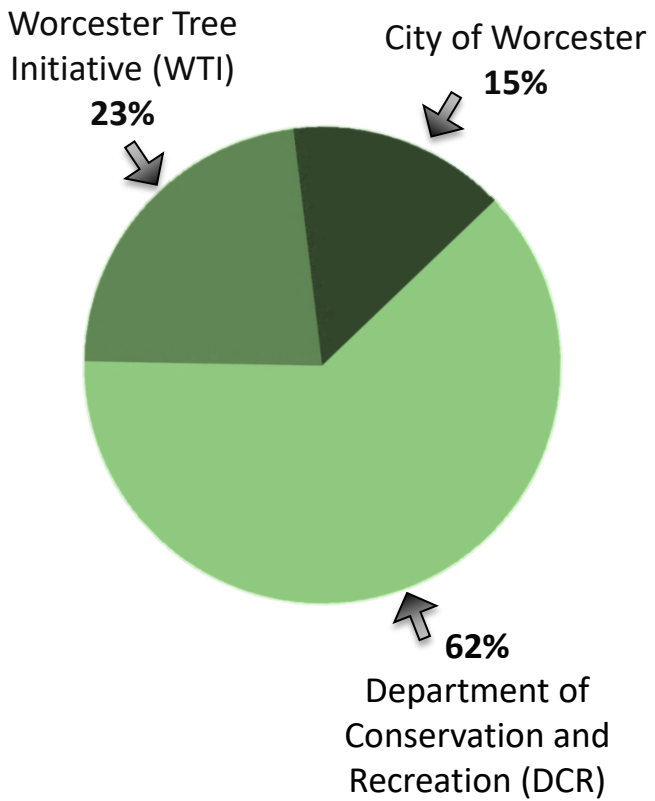




Benefits of Trees

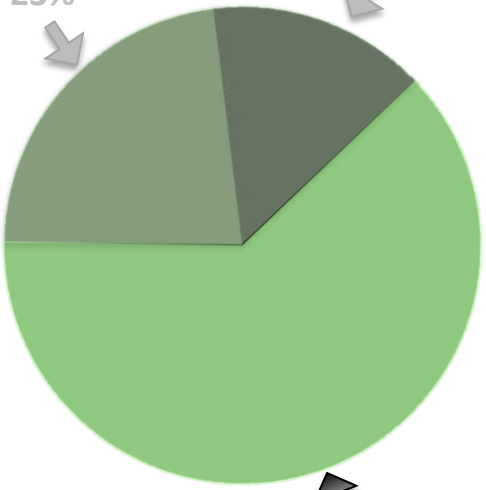


Replanting



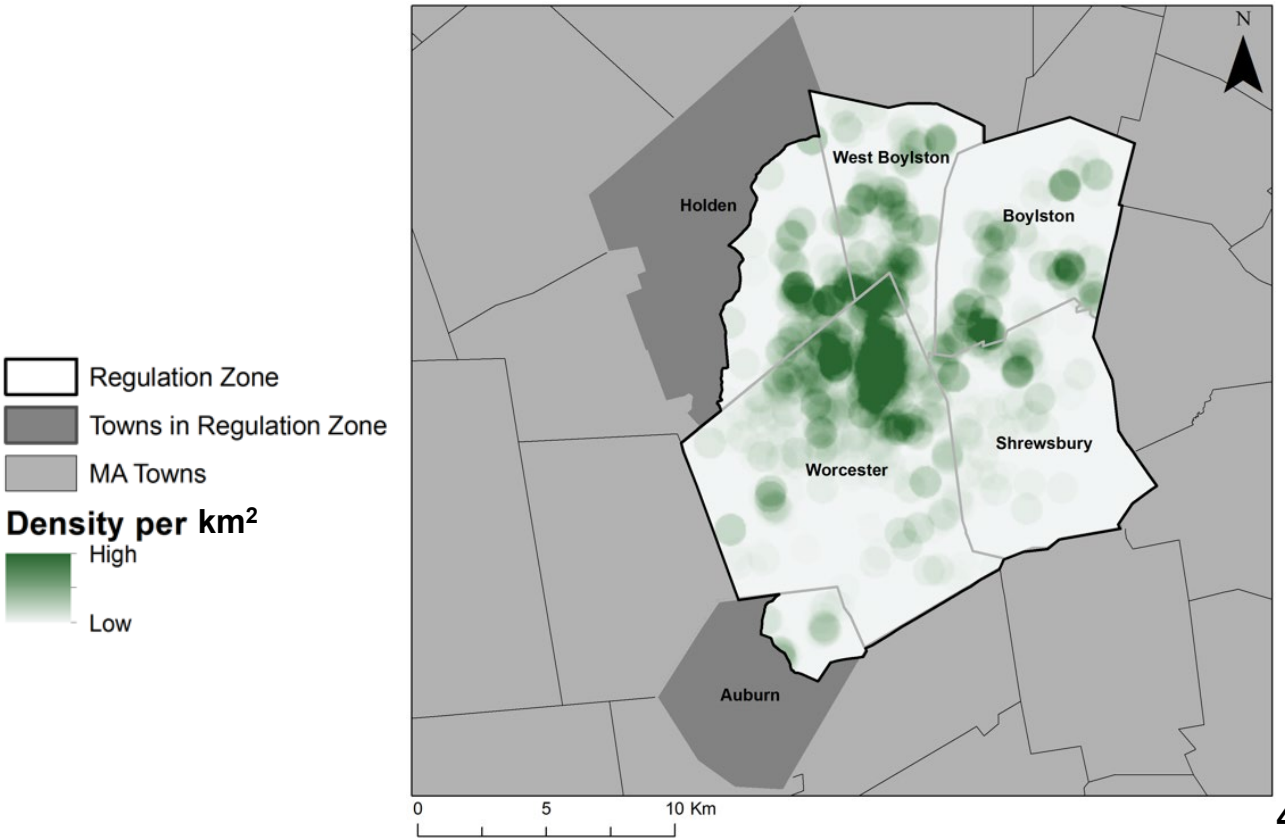
Granville Ave. before (top) and after (bottom) replanting.

Replanting



Granville Ave. before (top) and after (bottom) replanting.

DCR Replanted Trees

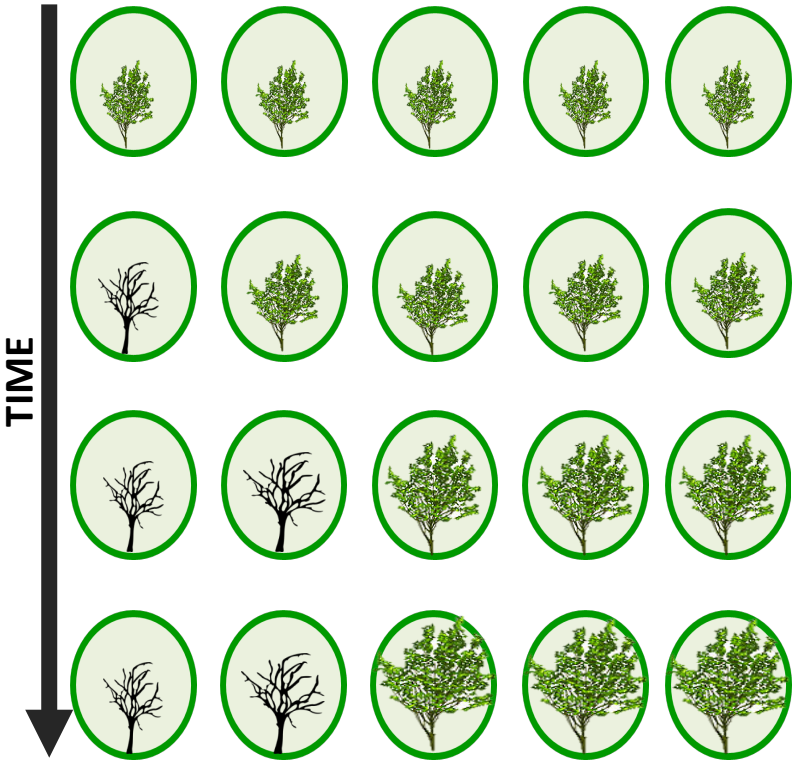


Replanting Survivorship

The benefits of tree planting programs accrue over the years as trees mature.

Planting benefits dependent upon tree mortality and growth rate.

Benefits are maximized when more trees reach maturity.



Research Questions

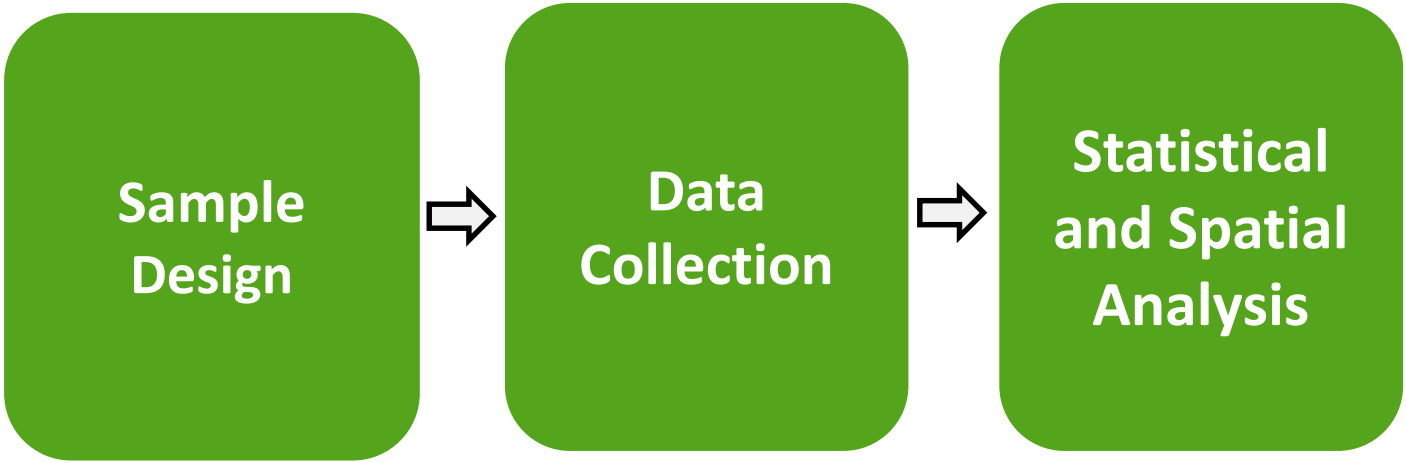
DCR Replanted Trees
2010 - 2012

What is the current overall **condition** and **composition** of the cohort?

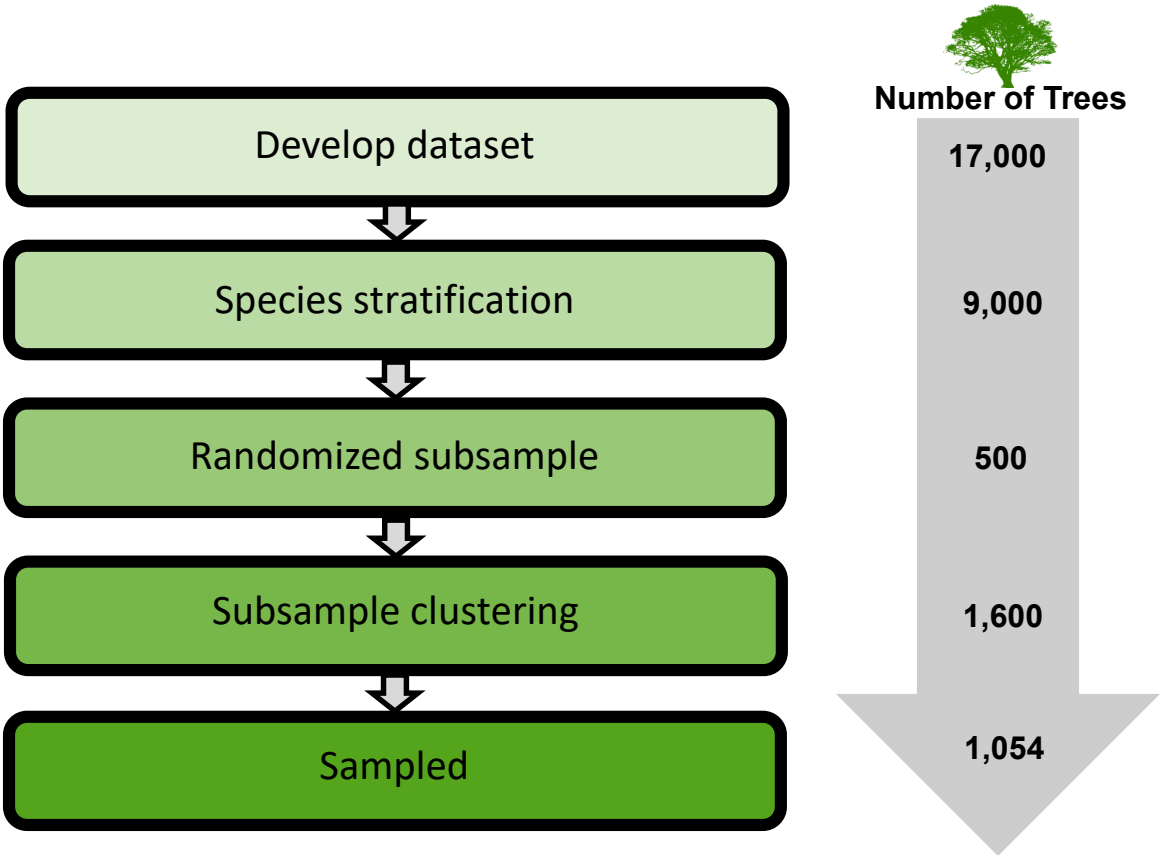
What is the current and projected **mortality rate** of the cohort?

Do **socioeconomic factors** influence tree mortality?

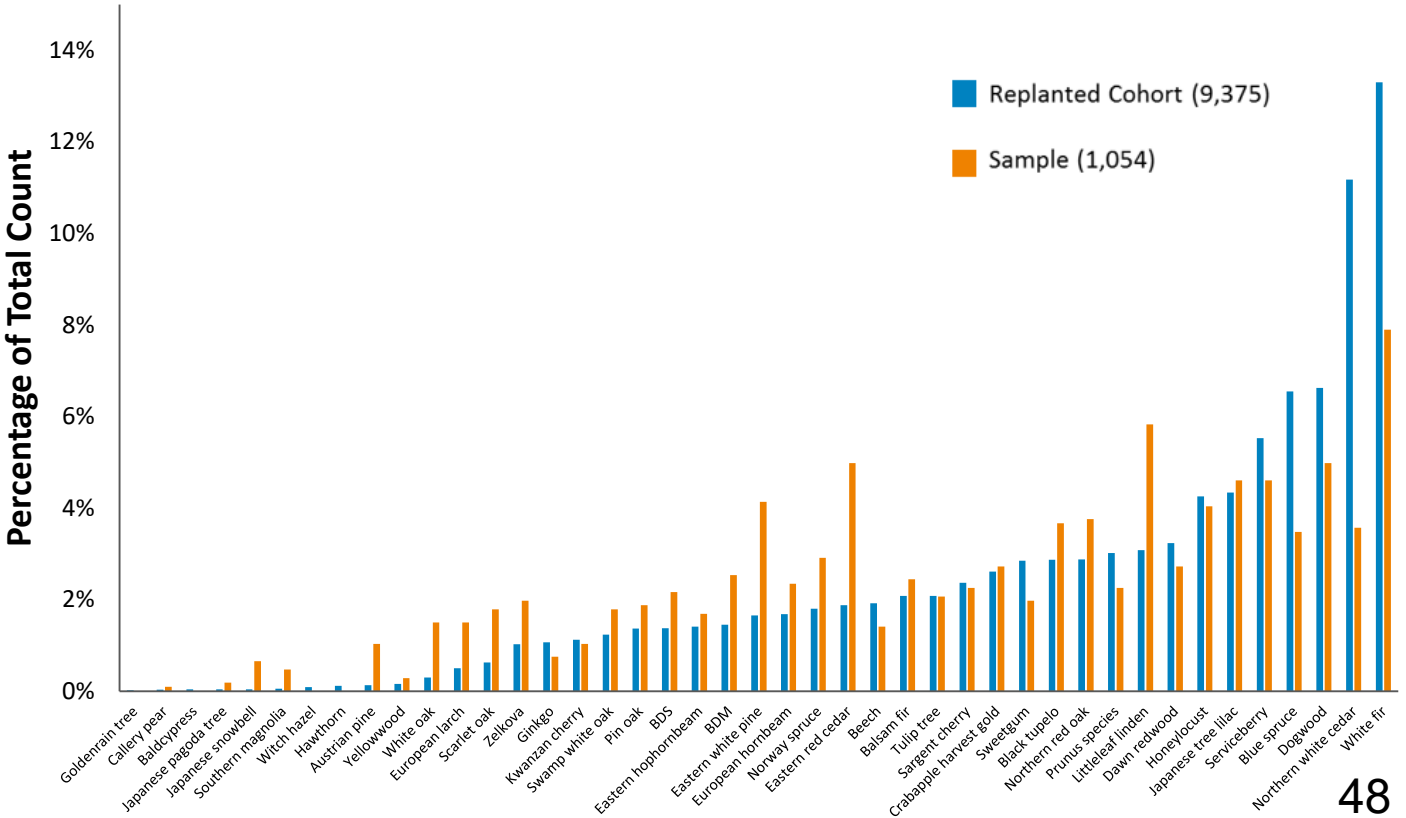
Overview of Methods



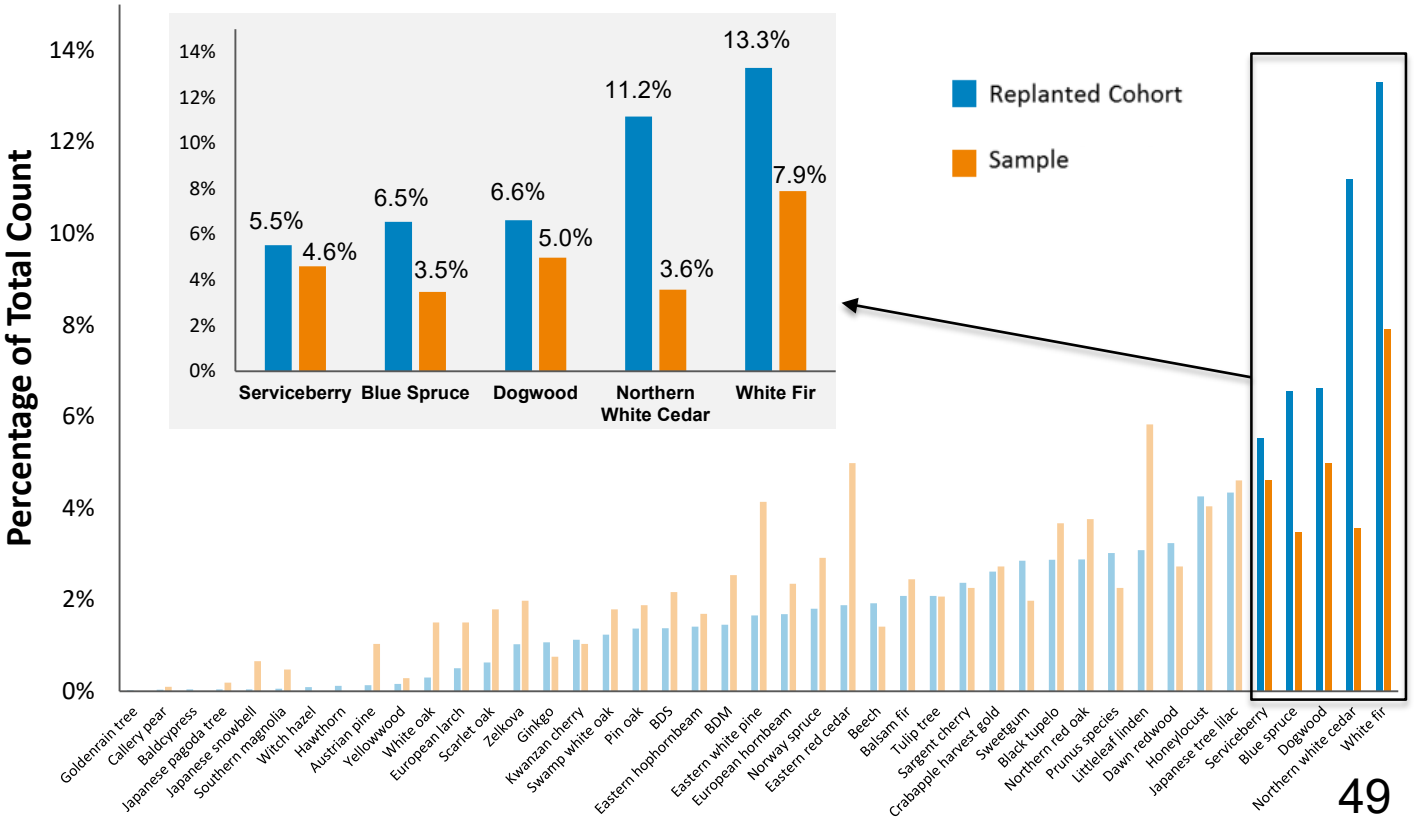
Sample Design



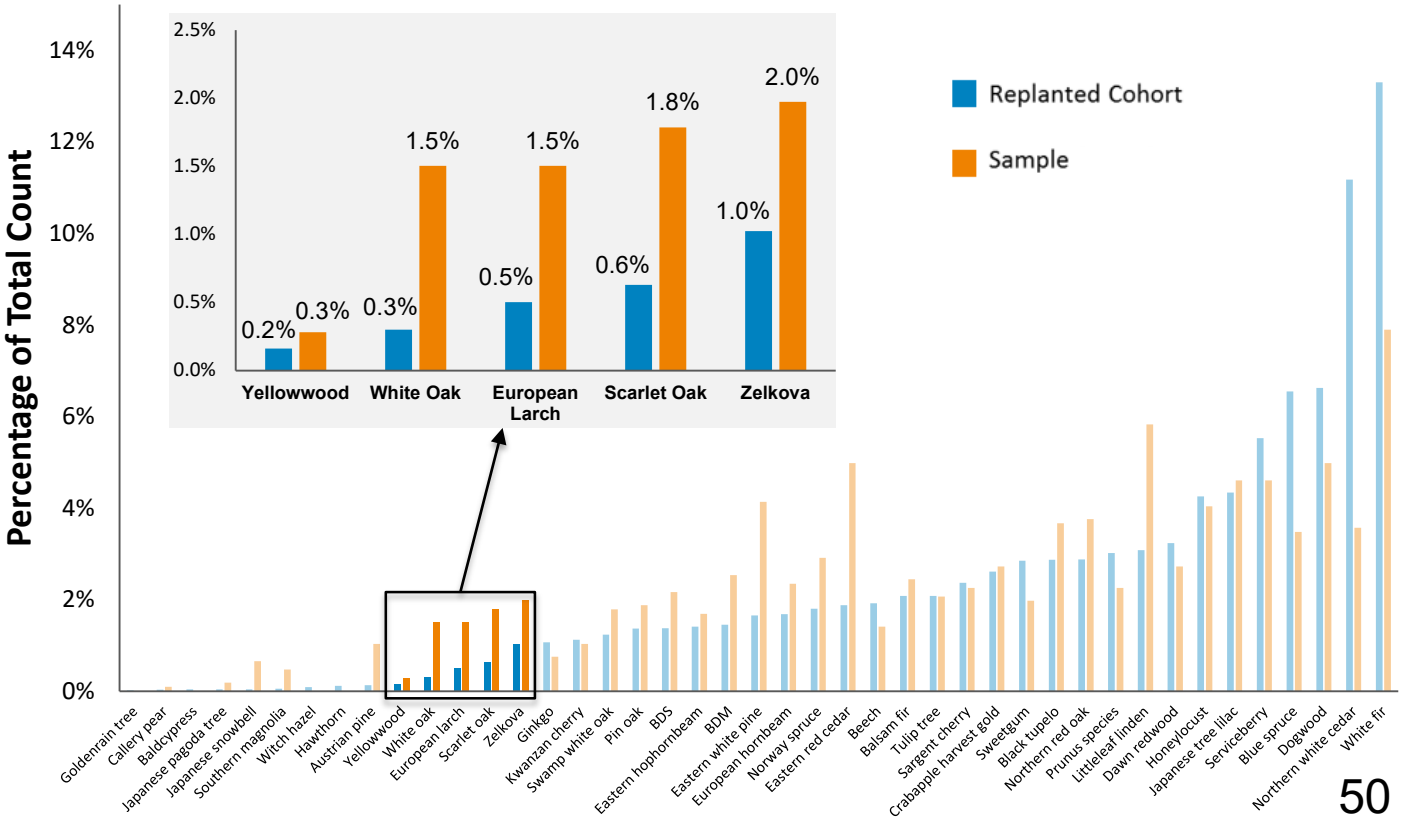
Species Distribution of Replanted Cohort and Sampled Trees



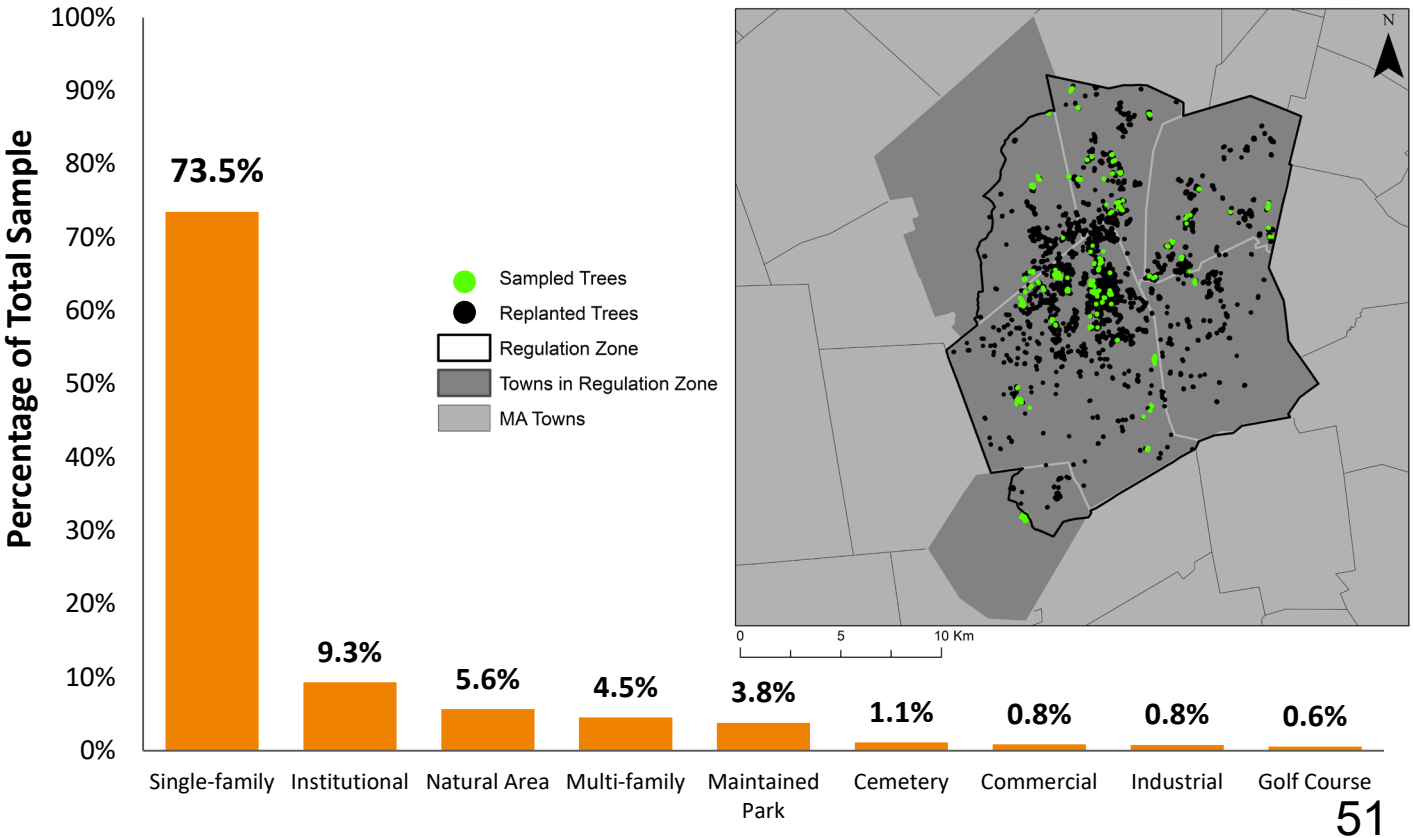
Species Distribution of Replanted Cohort and Sampled Trees



Species Distribution of Replanted Cohort and Sampled Trees



Geographic and Land-Use Distribution of Sampled Trees



Summary of Assessment Characteristics

Health Characteristics

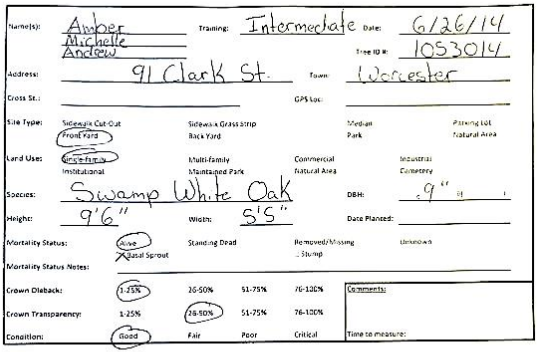
- Crown Dieback
- Crown Transparency
- Basal Sprouting
- Trunk Damage
- Pest Damage
- Overall Rating

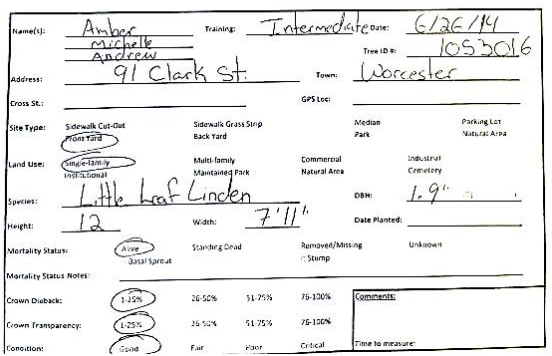
Mortality Status

- Standing Dead
- Stump
- Removed/Missing

Size Metrics

- Height
- Diameter at Breast Height (DBH)
- Canopy Width





Crown Dieback

1-25%

26-50%

51-75%

76-100%

Crown Transparency

1-25%

26-50%

51-75%

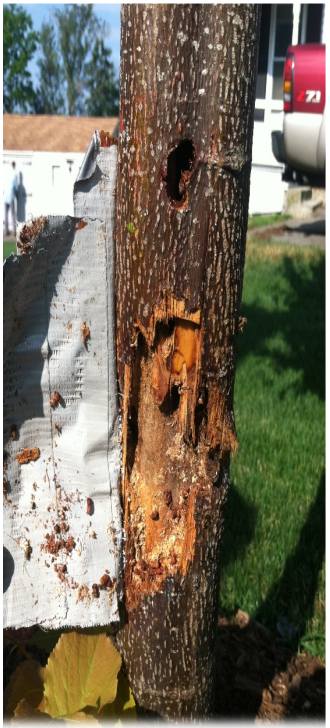
76-100%

Other Health Characteristics

Standing Dead

Basal Sprouting

Trunk Damage



Pest Damage

Overall Rating

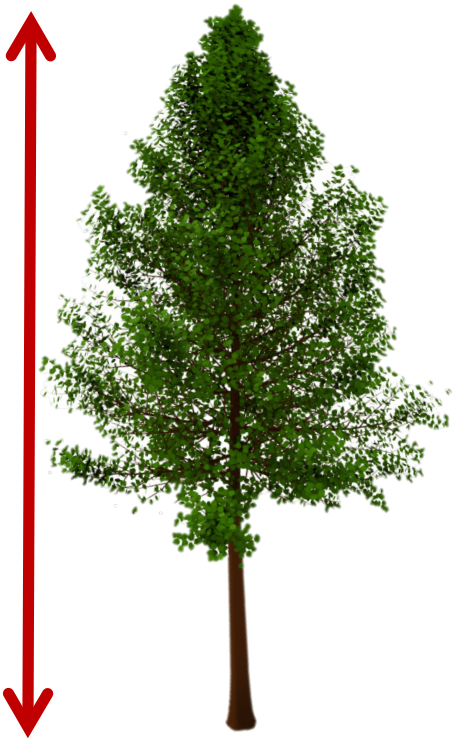
Good

Fair

Poor

Critical

Size Metrics



Height

DBH

Width

Research Questions

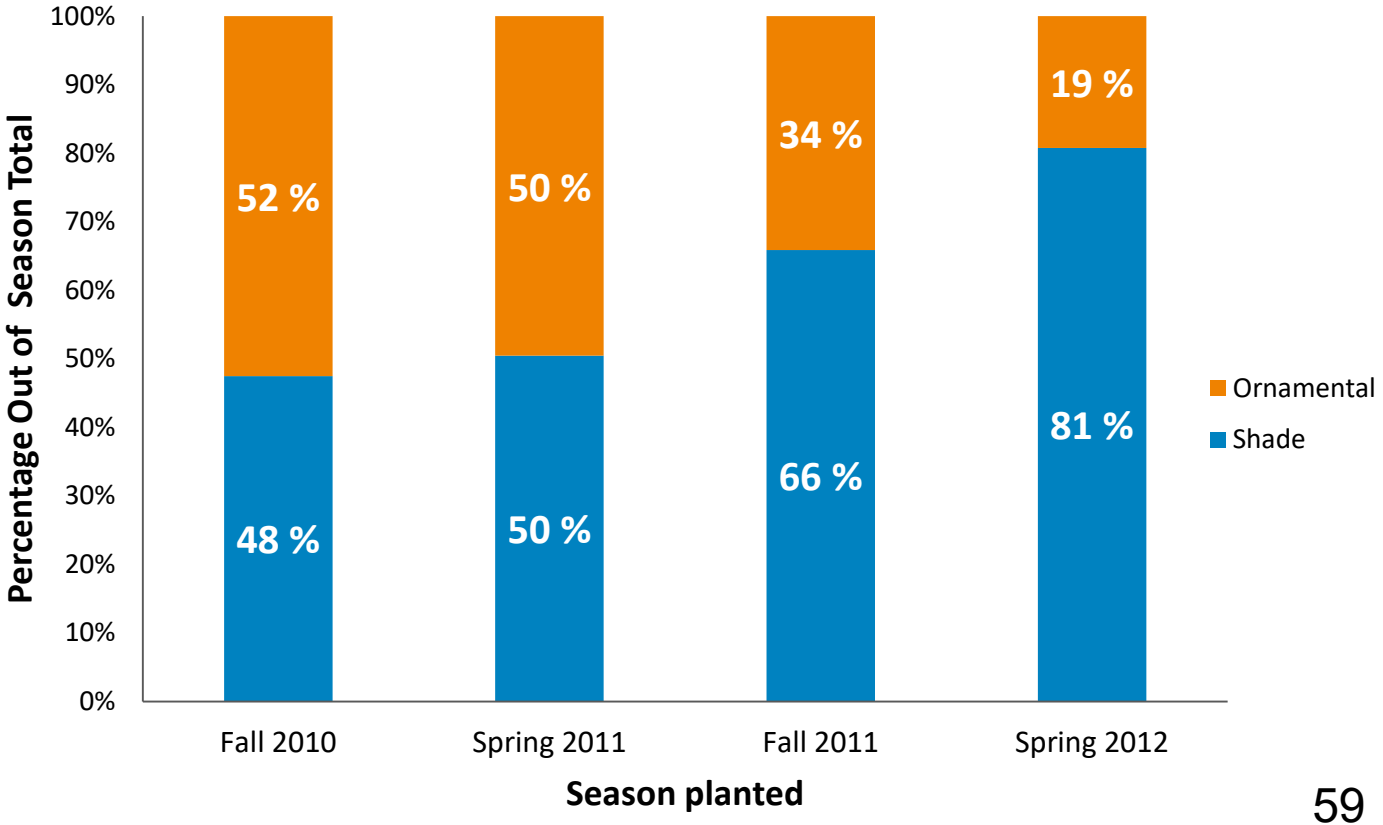
DCR Replanted Cohort
2010 - 2012

What is the current overall **condition** and **composition** of the cohort?

What is the current and projected **mortality rate** of the cohort?

Do **socioeconomic factors** influence tree mortality?

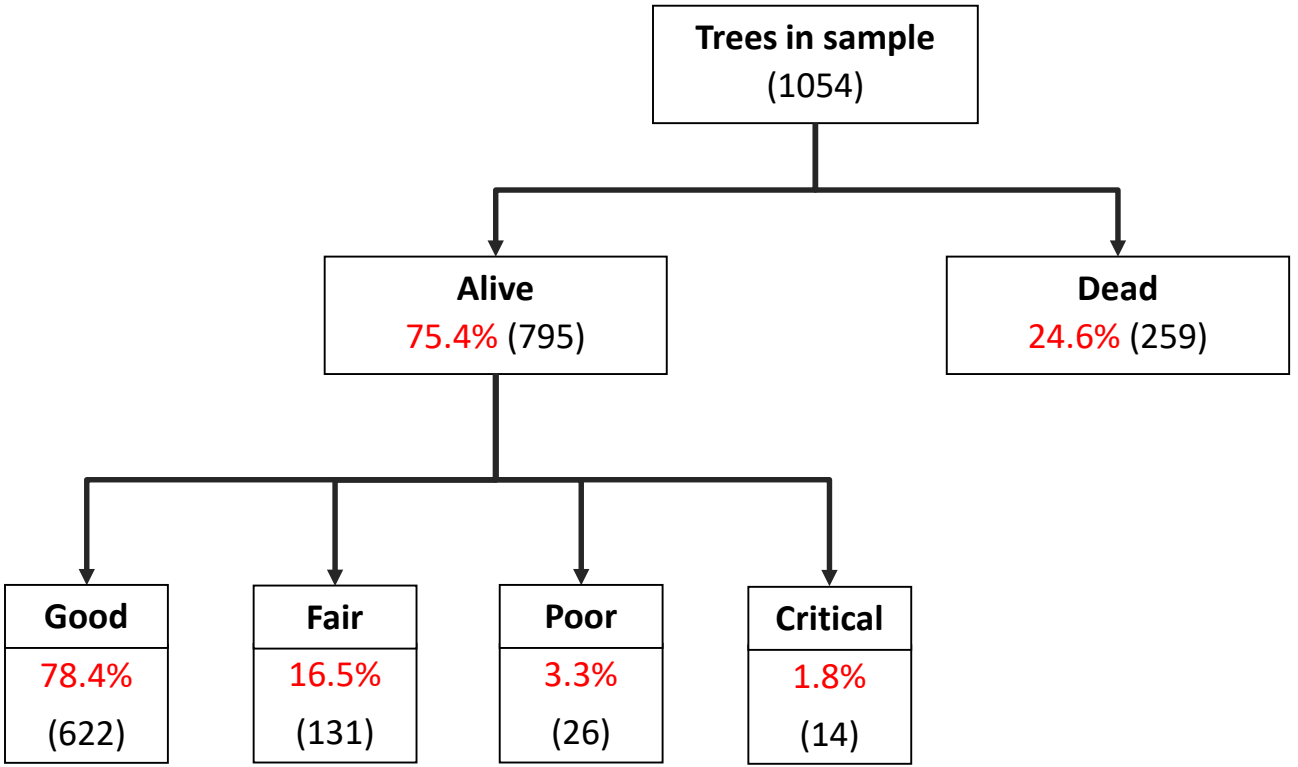
Shade vs. Ornamental Trees by Planting Season



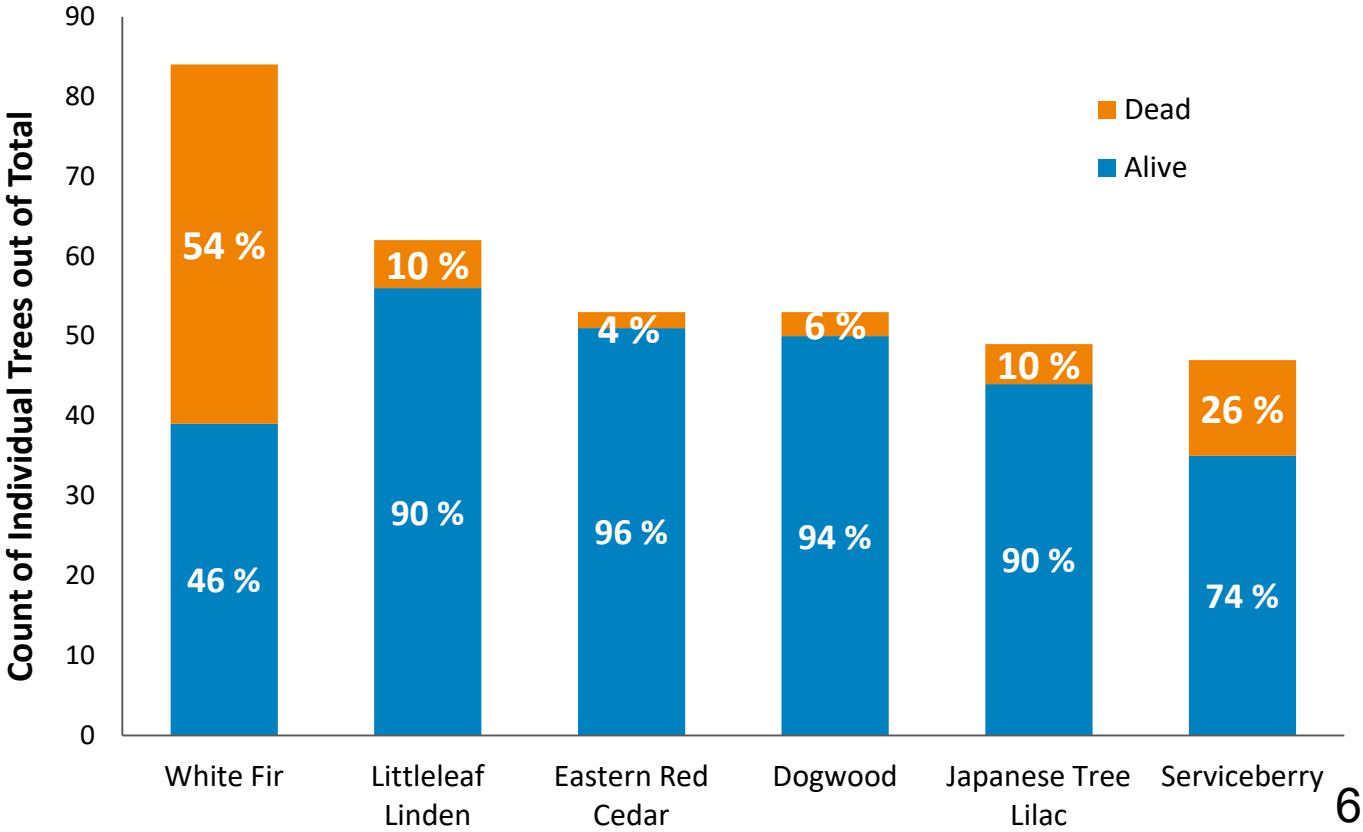
Top 3 Species
Front Yard vs. Back Yard

Front Yard	 Dogwood	 Japanese Tree Lilac	 Black Tupelo
Back Yard	 White Fir	 Eastern Red Cedar	 Northern White Cedar

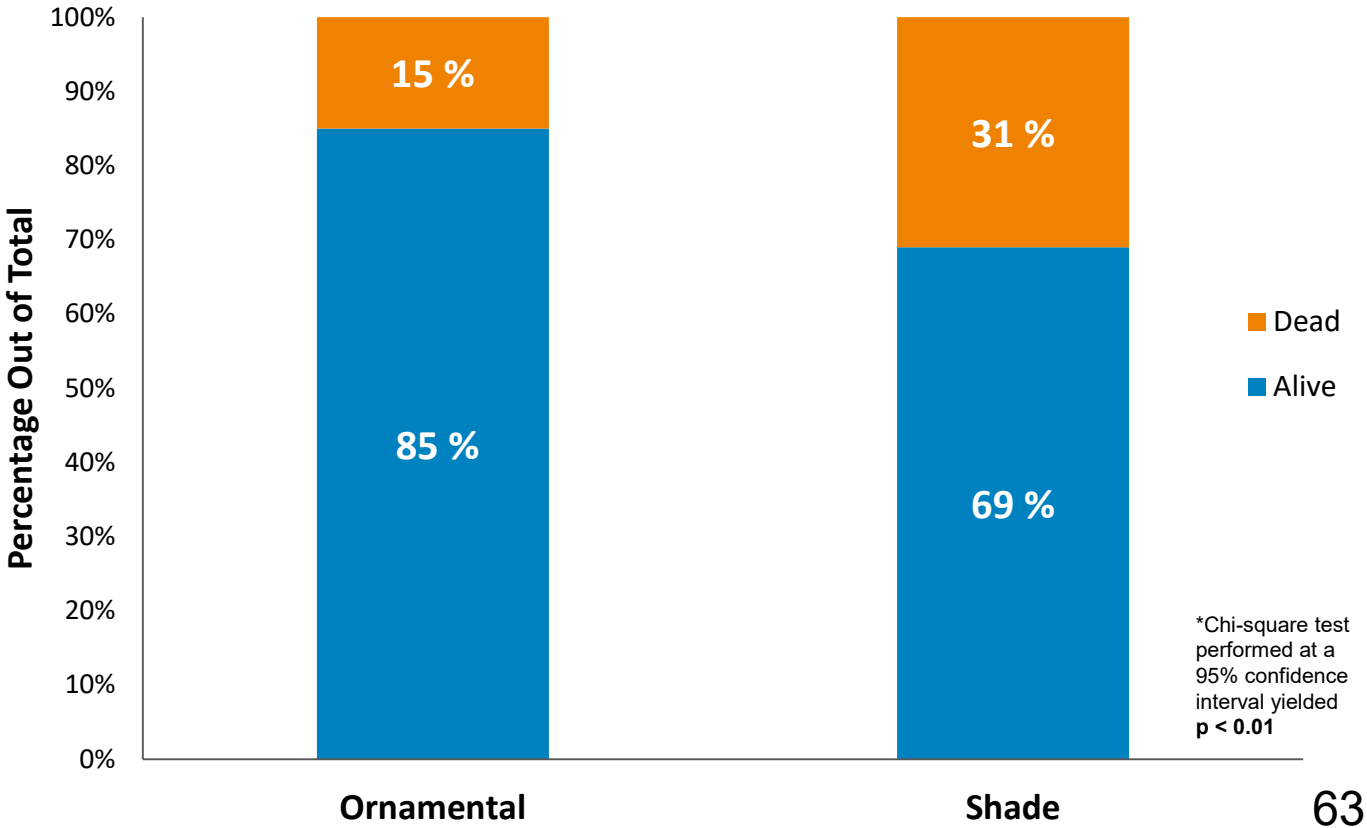
Tree Mortality and Condition Within Sample



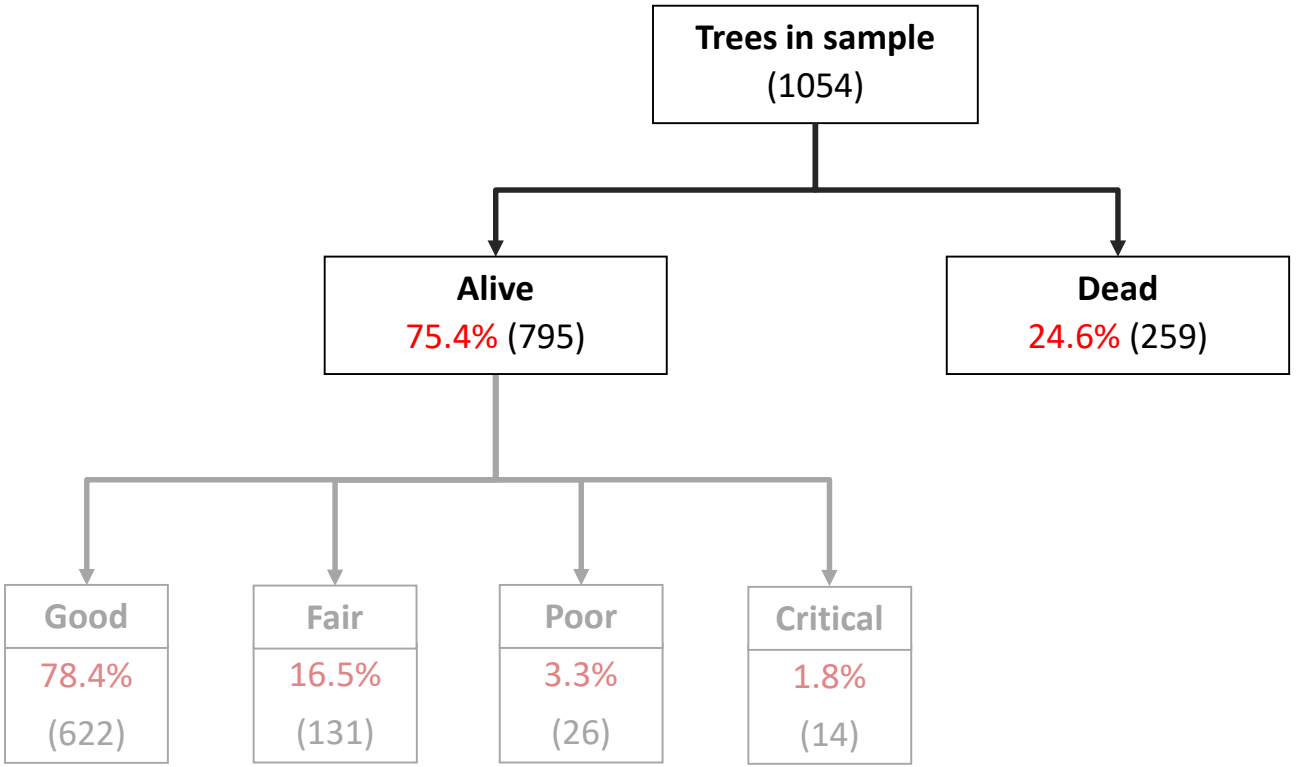
Mortality Among Six Most Frequently Sampled Species



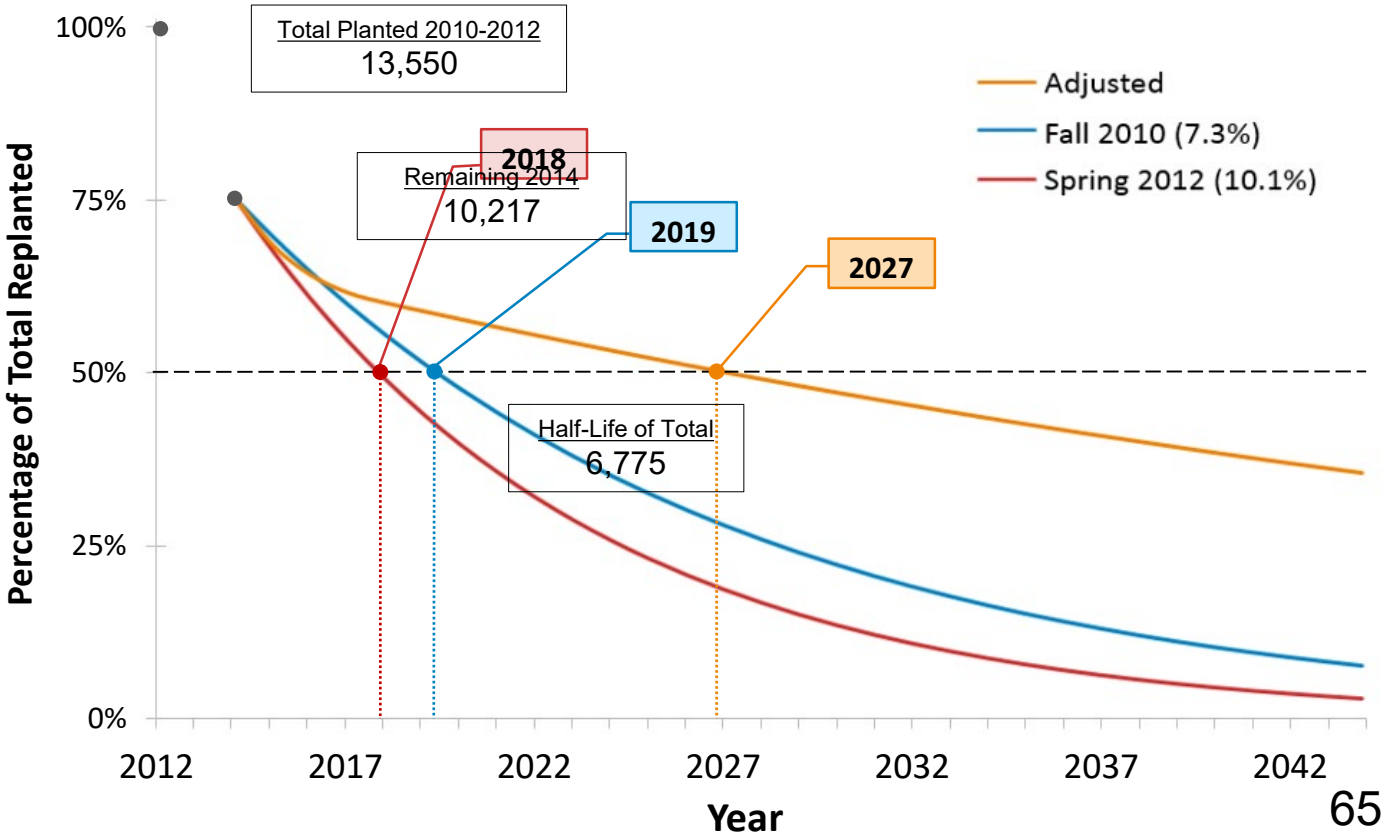
Mortality Among Shade vs. Ornamental Trees



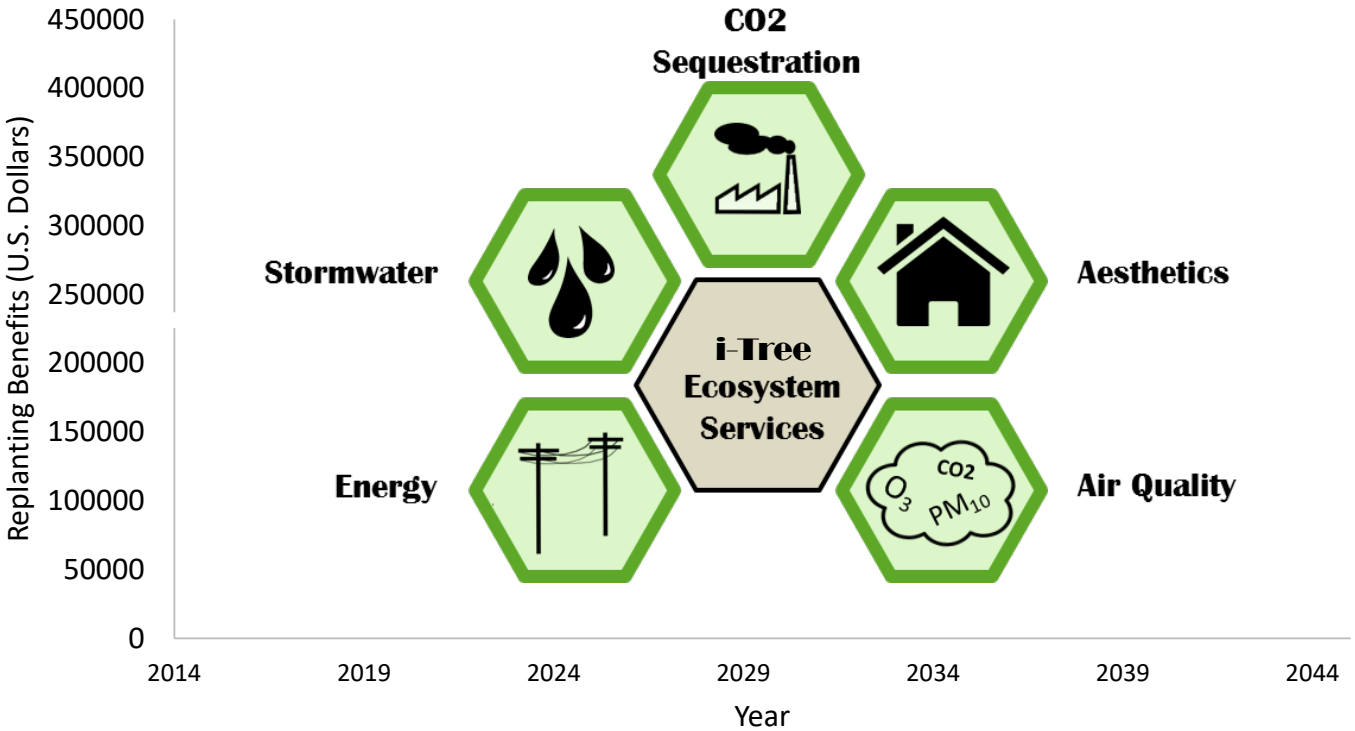
Tree Mortality and Condition Within Sample



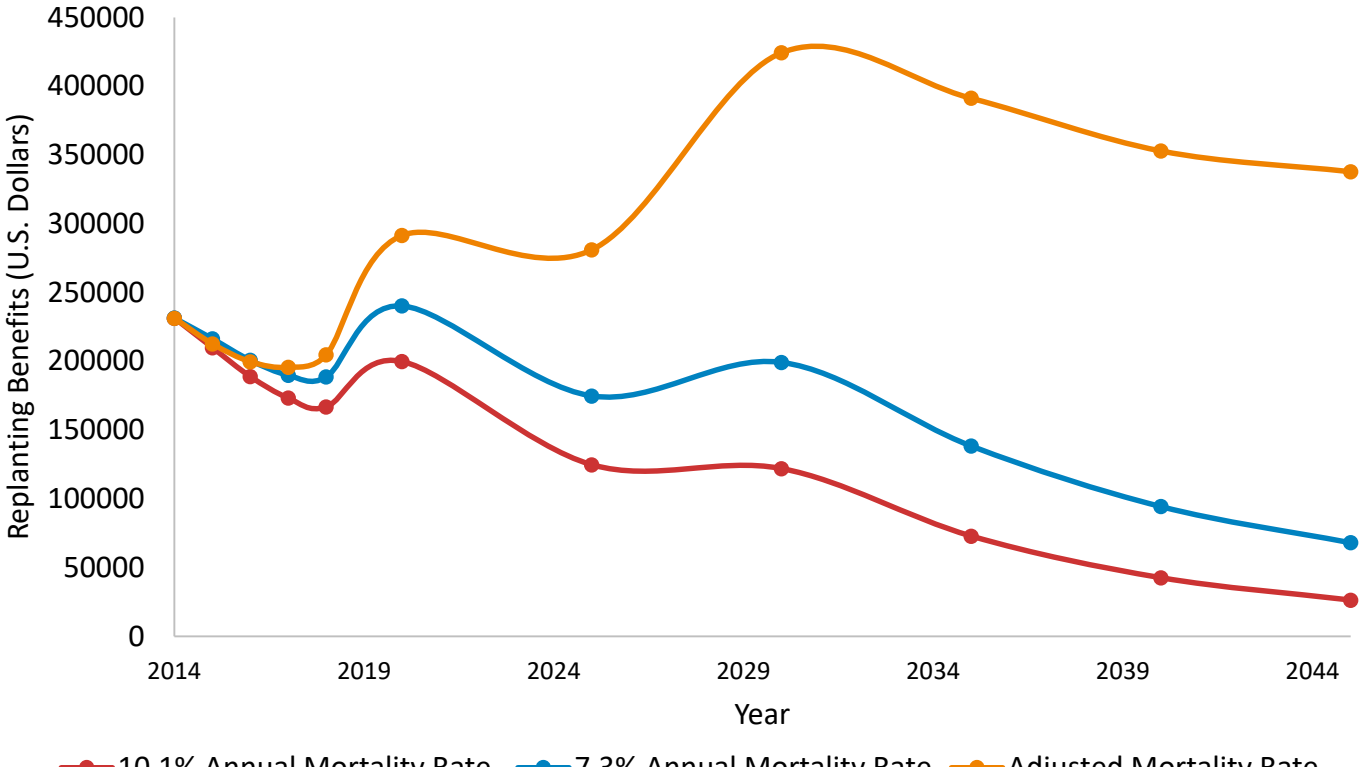
Projected Mortality Scenarios for DCR Trees Replanted 2010-2012



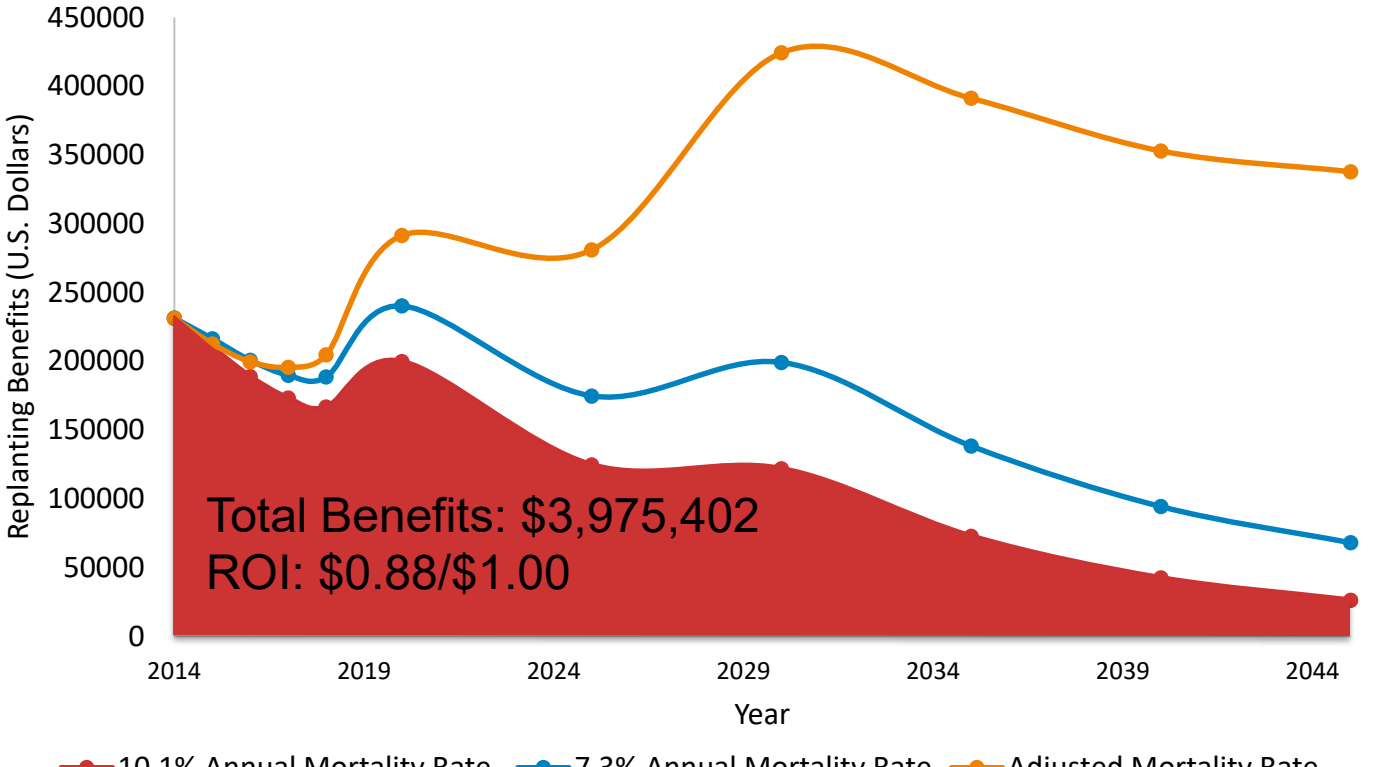
Replanting Benefits Modeled By i-Tree



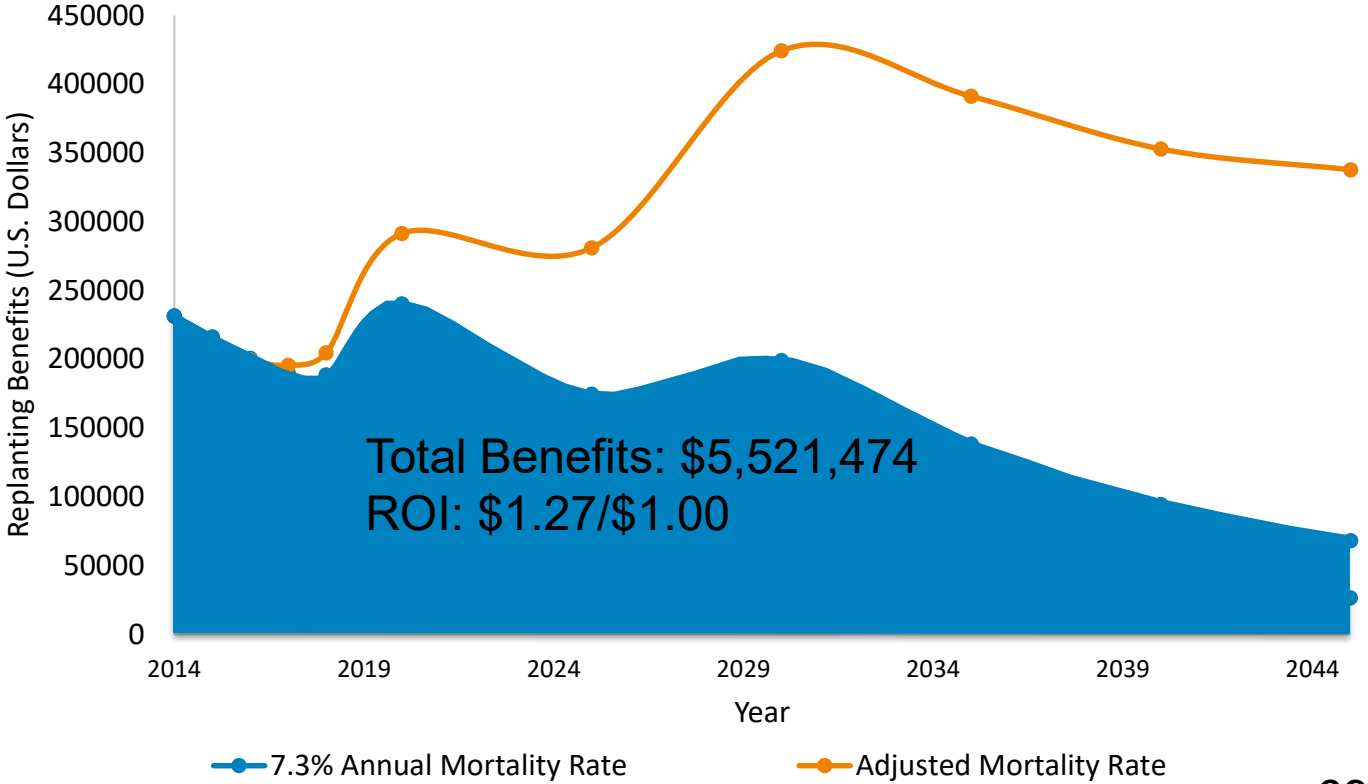
Annual Replanting Benefits Using Three Sample Mortality Rates



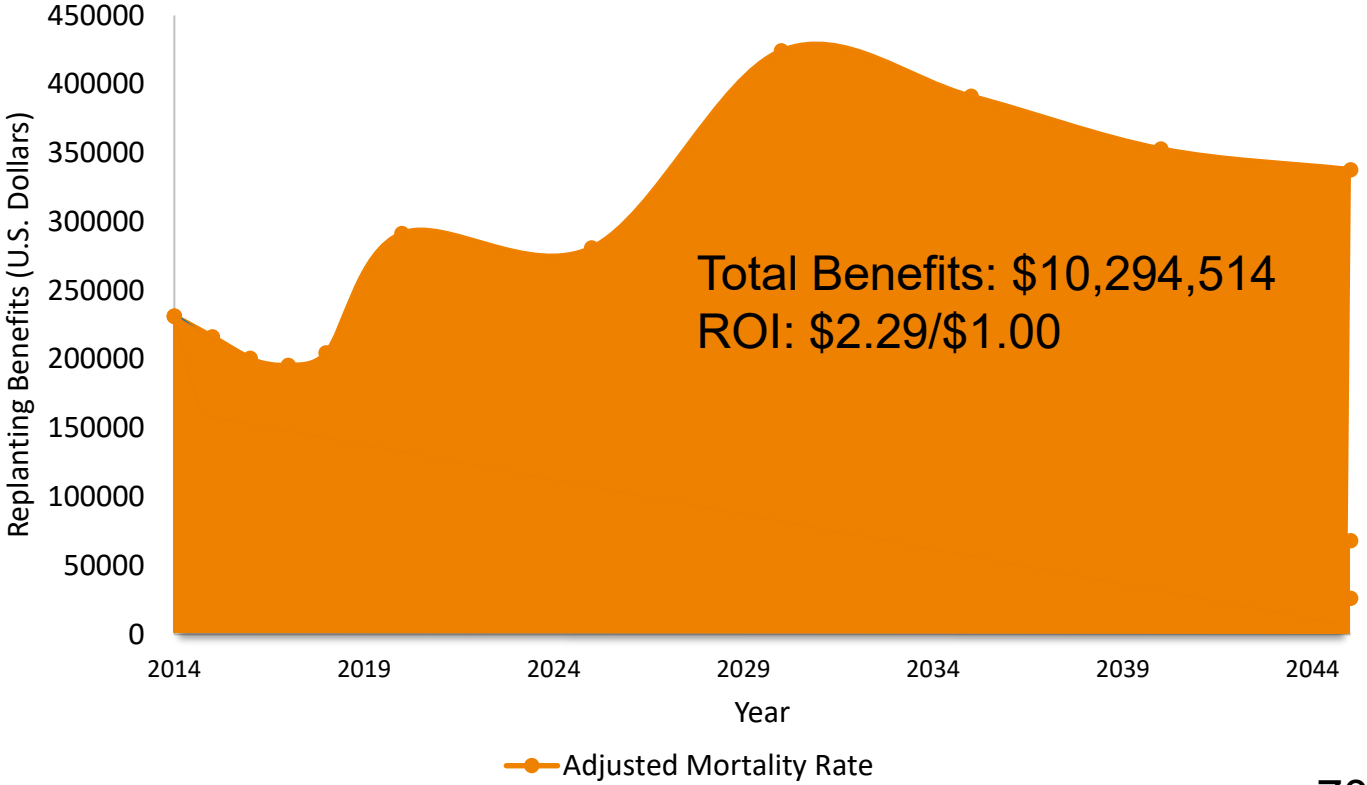
Annual Replanting Benefits Using Three Sample Mortality Rates



Annual Replanting Benefits Using Three Sample Mortality Rates



Annual Replanting Benefits Using Three Sample Mortality Rates

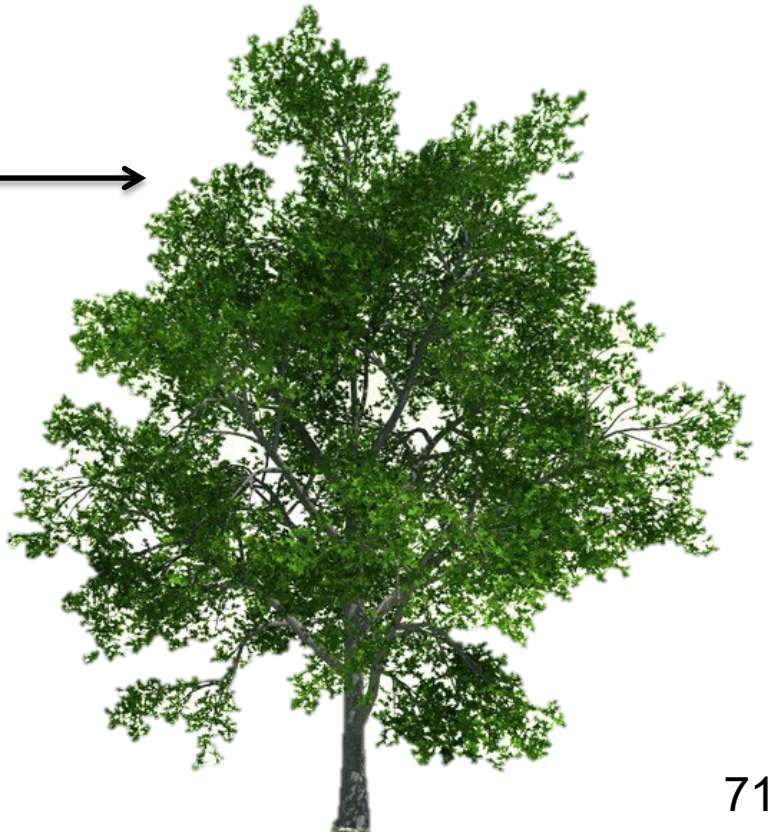


Shade Versus Ornamental Tree Benefits

Average New Tree Cost:
$310

Mature 24” DBH Pin Oak
$250 in Annual Benefits

Mature 15” DBH Dogwood
$70 in Annual Benefits



Research Questions

DCR Replanted Cohort
2010 - 2012

What is the current overall **condition** and **composition** of the cohort?

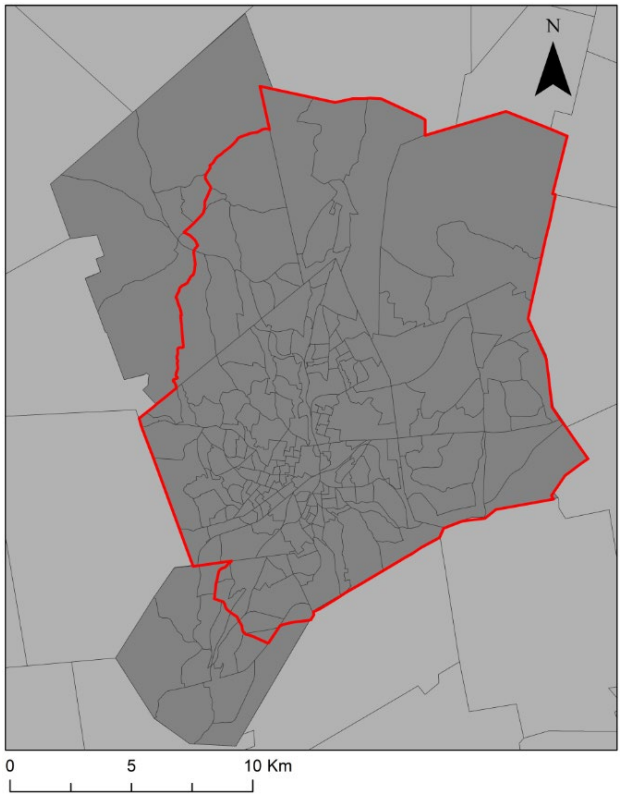
What is the current and projected **mortality rate** of the cohort?

Do **socioeconomic factors** influence tree mortality?

Tree Mortality, Condition and Socioeconomic Variables

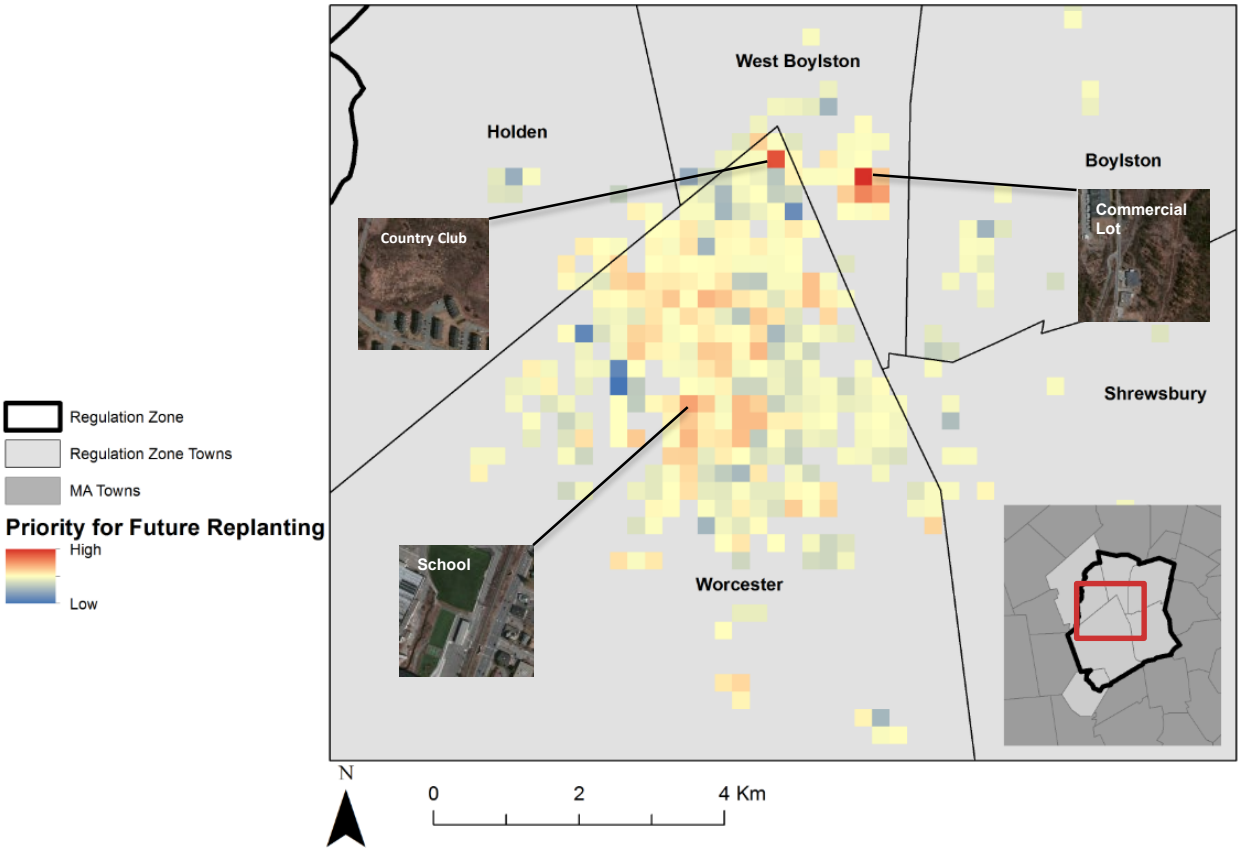
- **Tree mortality and trees in good condition** compared with socioeconomic variables at the Census Block Group (CBG) level:
  - Income
  - Education
  - Homeownership stability
  - Home value

- **No significant relationships found**



Regulation Zone
Census Block Groups
MA Towns

Targeted Areas for Future Replanting Efforts



Conclusions

- Half of the DCR replanted trees are estimated to still be alive in **2027**.
- **Long-term replanting** should replace trees that experience mortality.
- Replanting benefits are maximized by planting **shade trees** and **limiting mortality.**
- **Focus replanting** in areas with increased land surface temperatures, canopy loss and where no replanting has occurred.

Conclusions

- PMA found that residents' experience with change in community character increases their receptiveness to information regarding environmental issues.

- BIA found that maintaining a continuous replanting program is necessary to offset the high mortality rate of young trees and ensure that residents will benefit from Worcester's urban forest in the future.

THANK YOU!

Any Questions?

CLARK UNIVERSITY 1887

Significant Correlations with Tree Mortality Rate

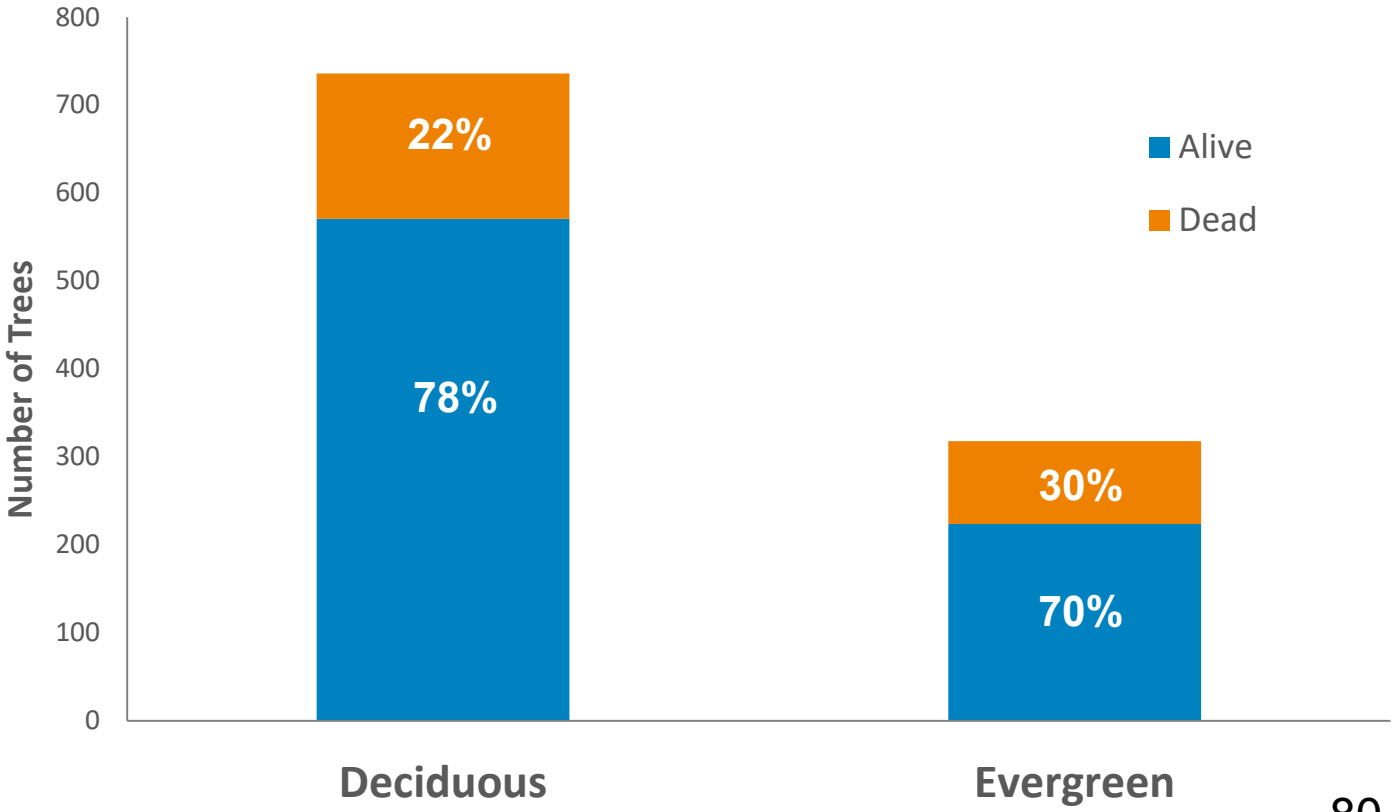
American Community Survey (2006-2010)

- Income
  - Household Income $75,000-$99,999 and Householder Age 45-64*
  - Household Income $45,000-$49,999 and Householder Age 25-44*
- Homeownership Stability
  - Owner Households by Year Householder Moved In:
    - 1970 to 1979*
    - 1980 to 1989*
    - 2005 or Later*
- Property Value
  - Home Value $125,000-$149,000*

*$p \leq 0.01$

Deciduous vs. Evergreen Tree Mortality

DCR Tree Planting Fall 2010-Spring 2012



White Fir Sub-Analysis

- Land-Use
  - 90% Single Family
  - 10% Natural Area
- Site-Type
  - 60% Back Yard
  - 30% Natural Area
  - 10% Front Yard
- Season Planted
  - 50% Spring 2011
  - 30% Fall 2010
  - 20% Fall 2011
- Season Mortality
  - 70% Fall 2011
  - 60% Fall 2010
  - 40% Spring 2011