

Stakeholder Summit 2014

Human Environment Regional Observatory



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

Elizabeth Anderson

Rensselaer Polytechnic Institute

Albert Bautista

Humboldt State University

Benjamin Ewald

Clark University

Place Making Assessment

Alison Jackman

Whittier College

Marina Khananayev

Clark University

Amy Phillips

Clark University

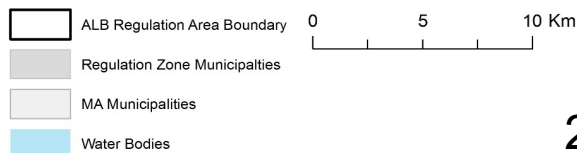
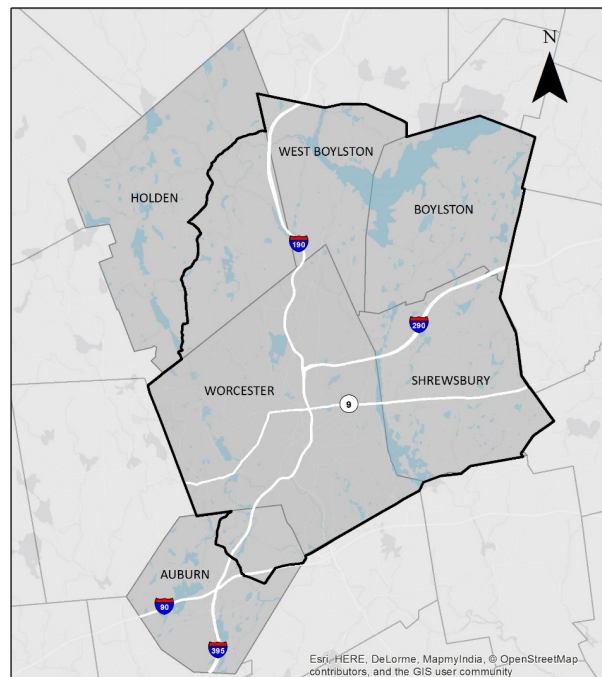
Introduction: The Beetle

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
- 337km² 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

2013

Interviewed policy makers in other towns

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***

Trees *Transport systems* **Yard**

Town *Feeling* *Family*

Government *Economic processes*

Special Places **Landmarks**

Mixed Methods

Quantitative Methods

Multiple choice questions

Graphs

Charts

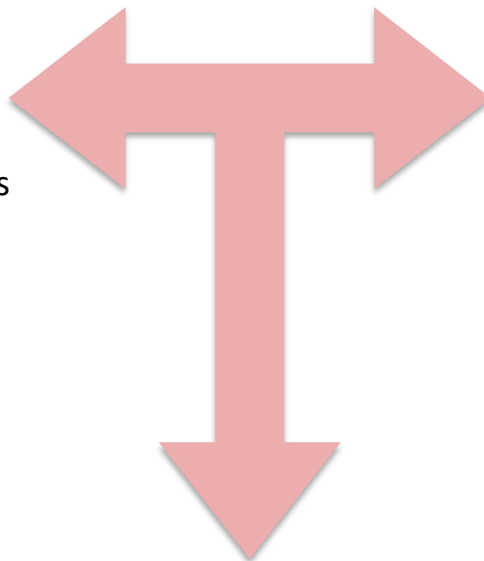
Maps

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

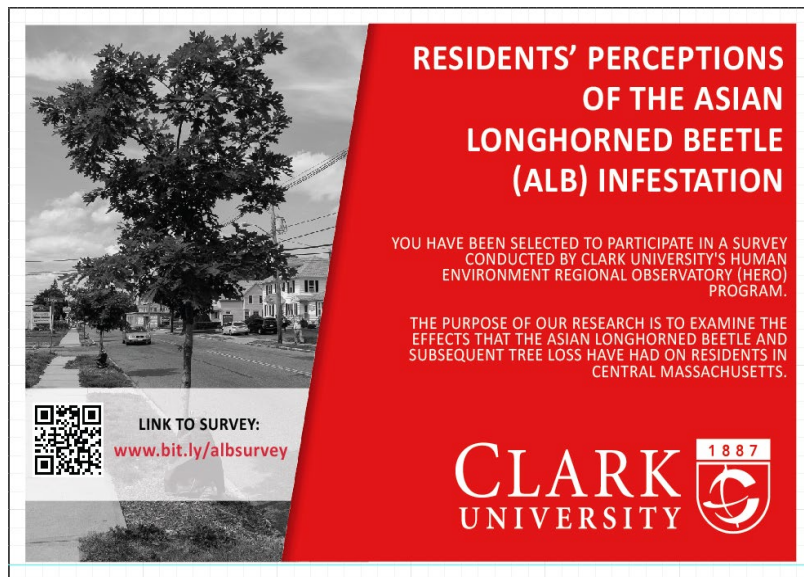
Personal



**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

www.bit.ly/clarkalbsurvey

- 12

Survey Responses



Survey Type	Responses
Random Sample	
Handouts and Flyers	
WTI List Serve	
Press Release	
Previous Interaction with HERO	
Total:	



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

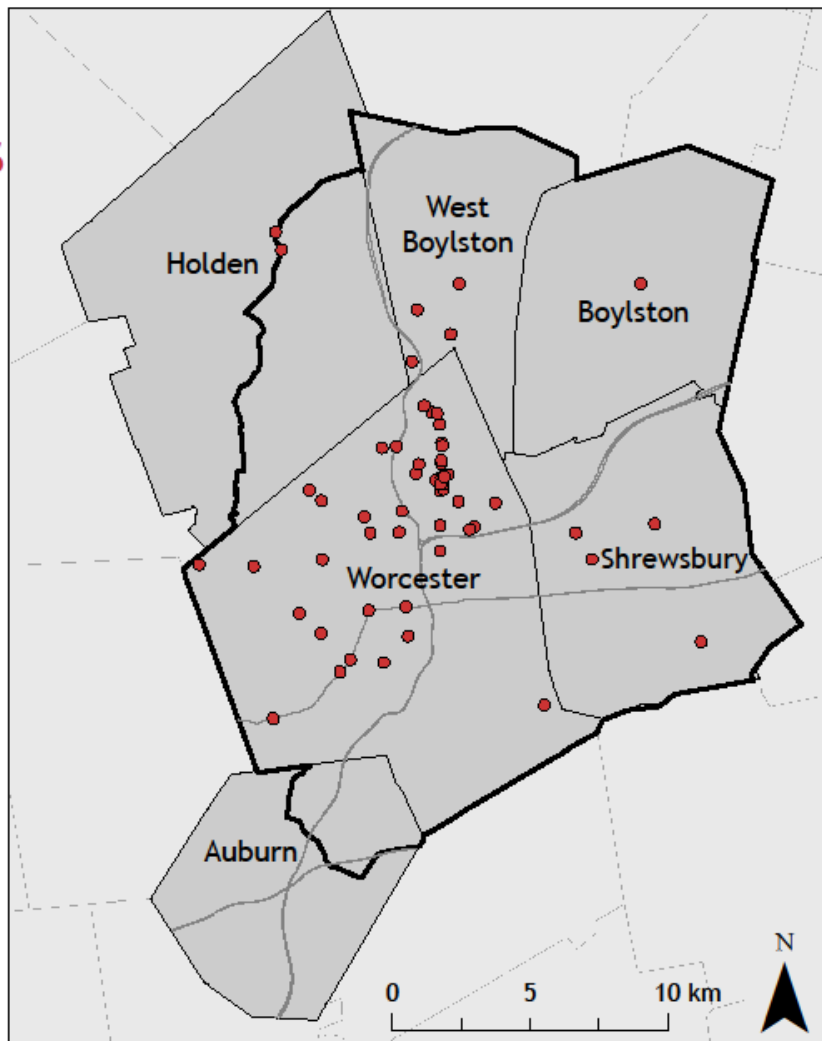
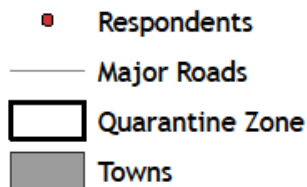
Demographics



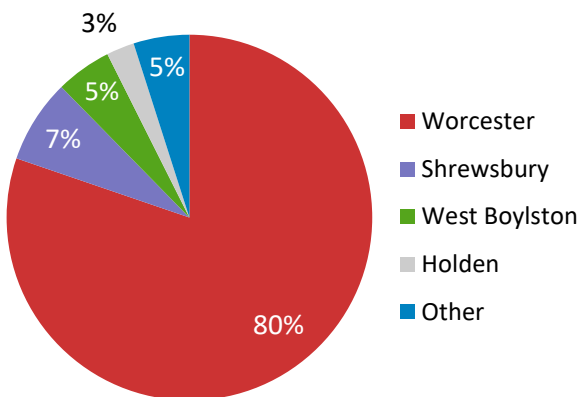
- **Female:** 38 (55%)
- **Male:** 31 (45%)
- **Mean age:** 45-54
- **Mean household income:** \$120,000 - \$130,000
- **Race:** Predominantly Caucasian



Location of Survey Respondents

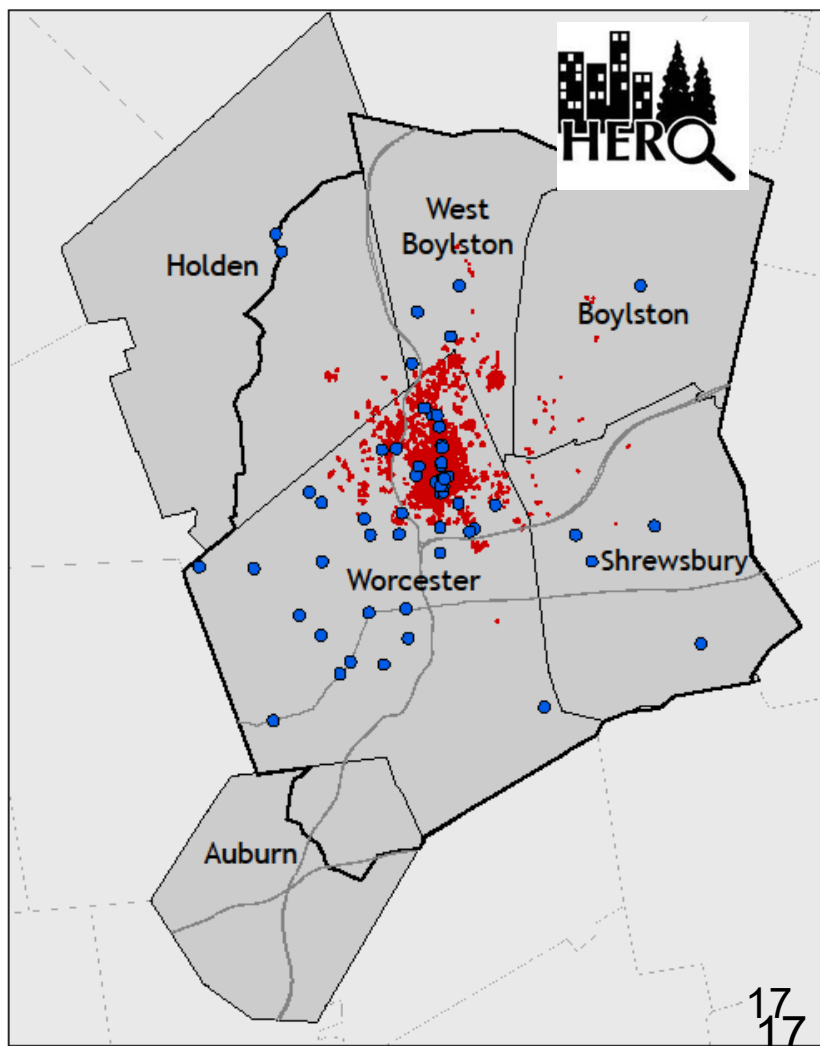
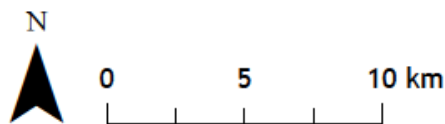


Respondents' City/Town



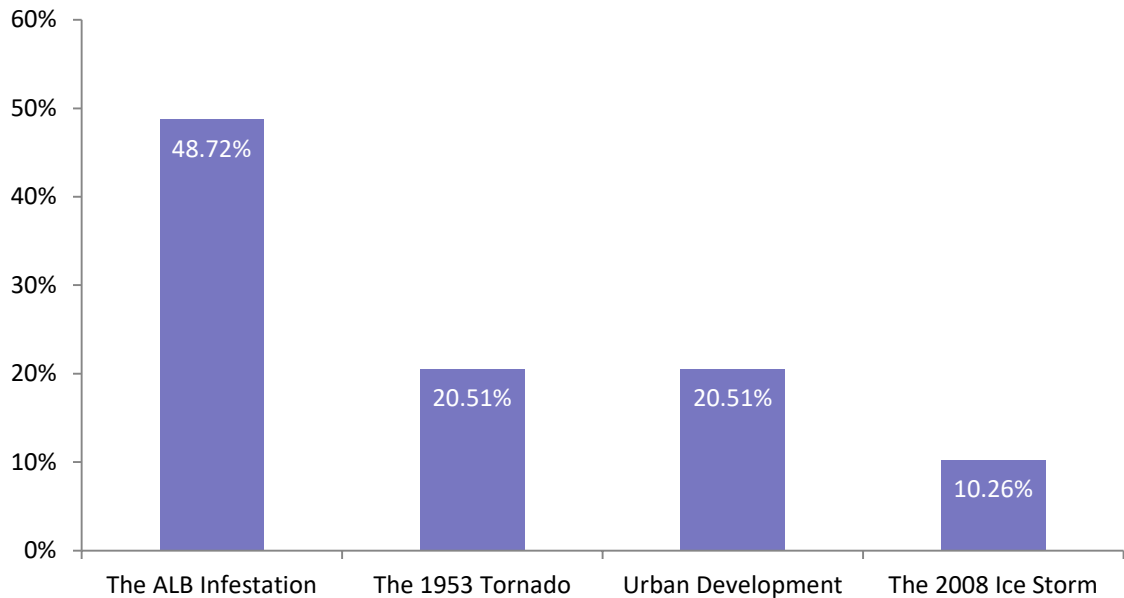
Respondents and Tree Canopy Loss Due to ALB

- Respondents
- Major Roads
- ALB Tree Canopy Loss
- Quarantine Zone
- Towns





Respondents ranked the ALB infestation most impactful to the region.



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 all 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*

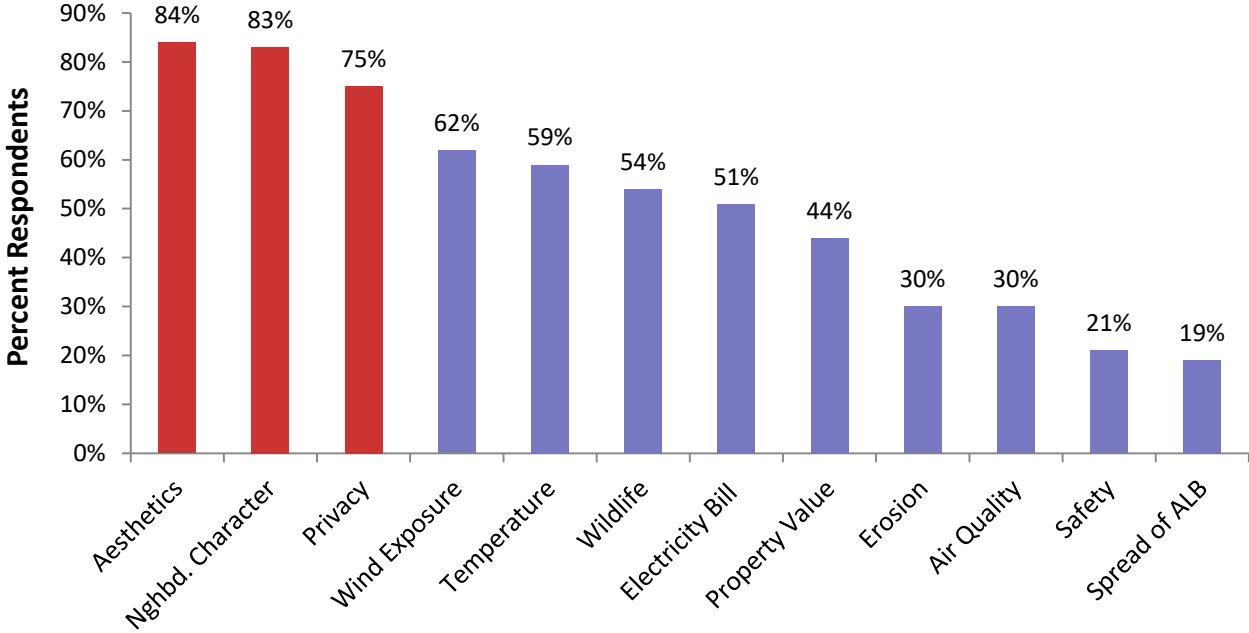
“You could stand out on the street with your **neighbors** and talk right under that canopy. It was really comfortable, really pleasant. No one stands in the streets now. It's **not someplace anyone gathers**.”

*-Worcester Resident,
2013 Interview* 21

Community Character



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



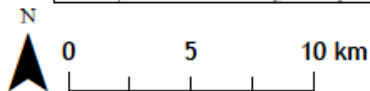
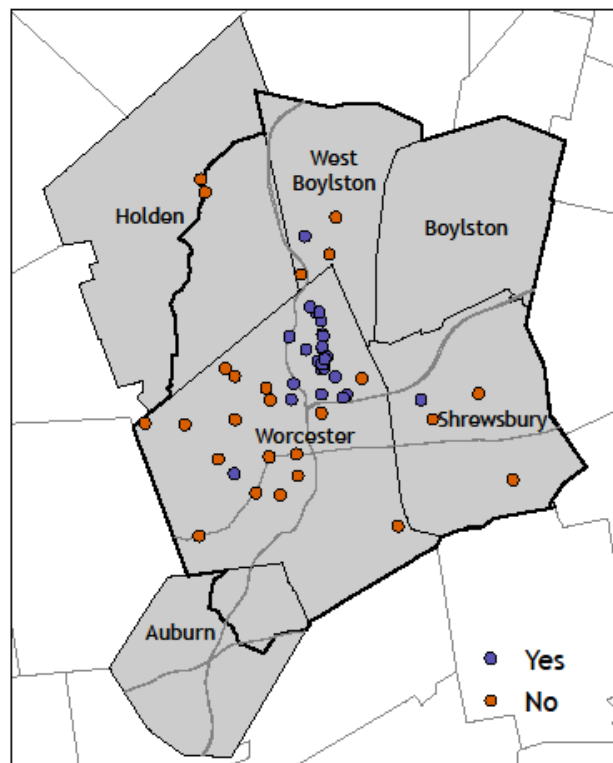
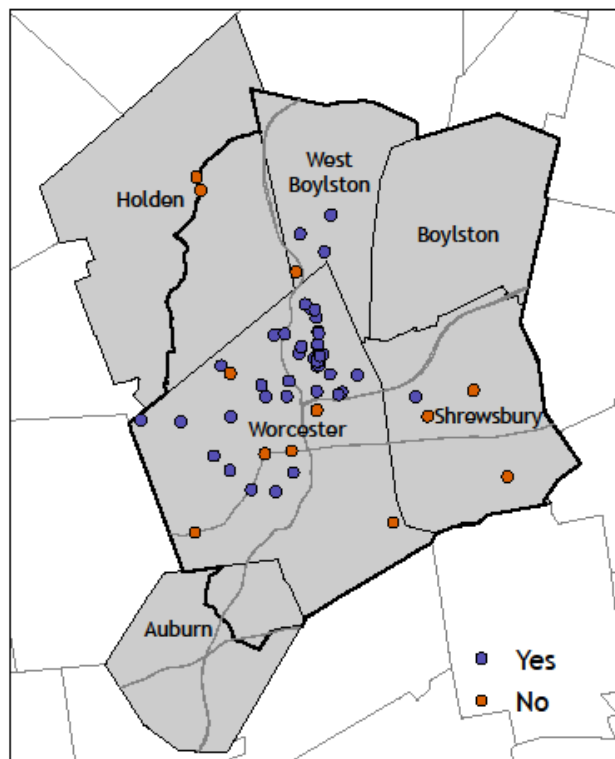
Impact and Change in Neighborhood Character

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...



ter
ood
e



— 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

Residents have experienced change in
community character



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



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**

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



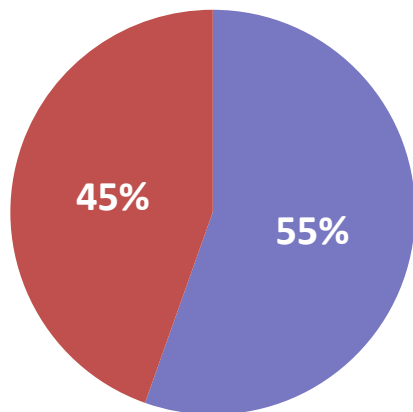
High Interaction/Familiarity

- Self reported frequent or occasional interaction



Low Interaction/Familiarity

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



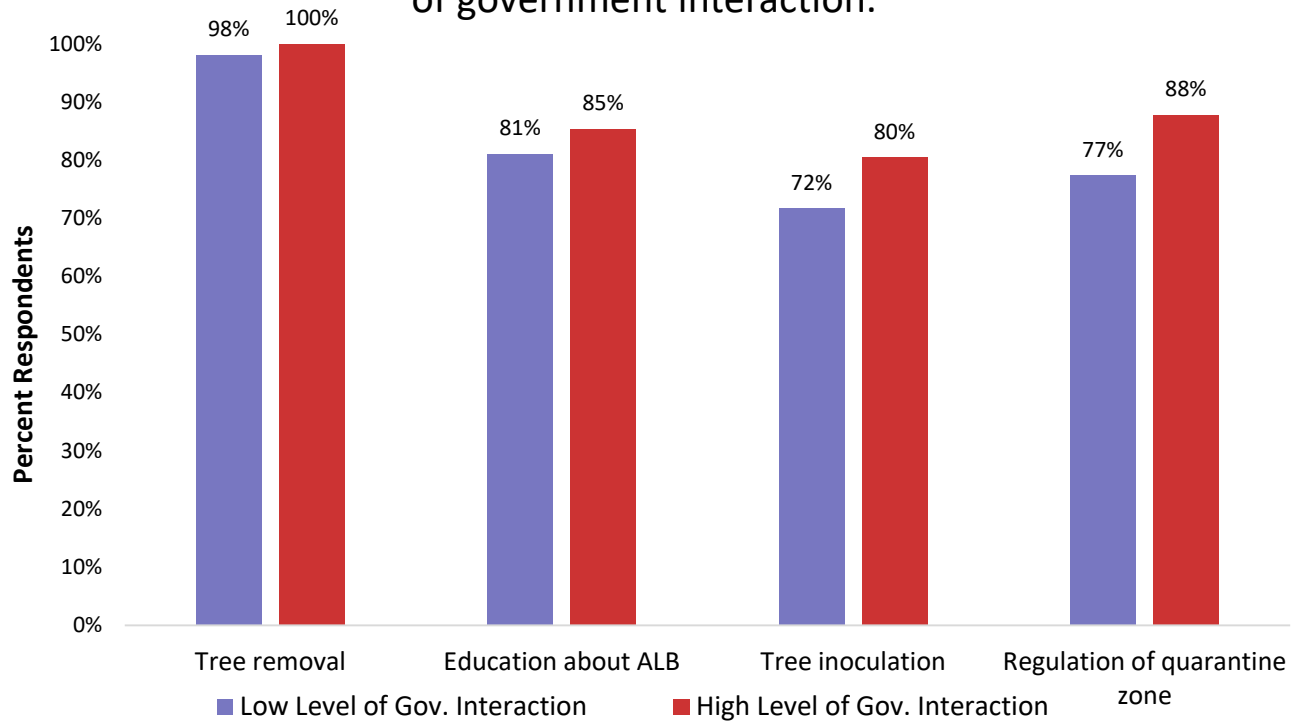
■ Low Interaction
with
Government

■ High Interaction
with
Government

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



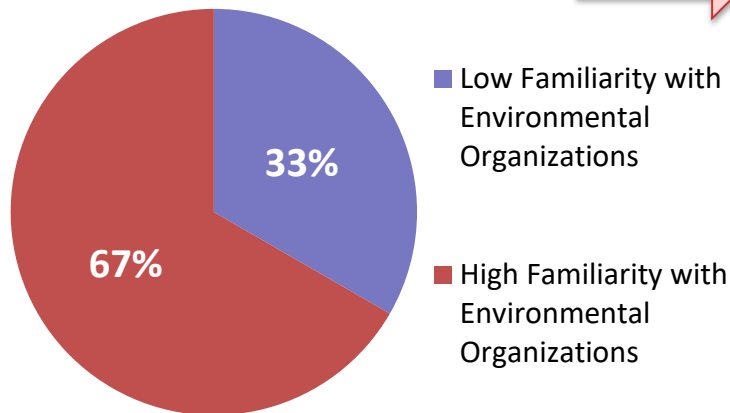
High Interaction/Familiarity

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



Low Interaction/Familiarity

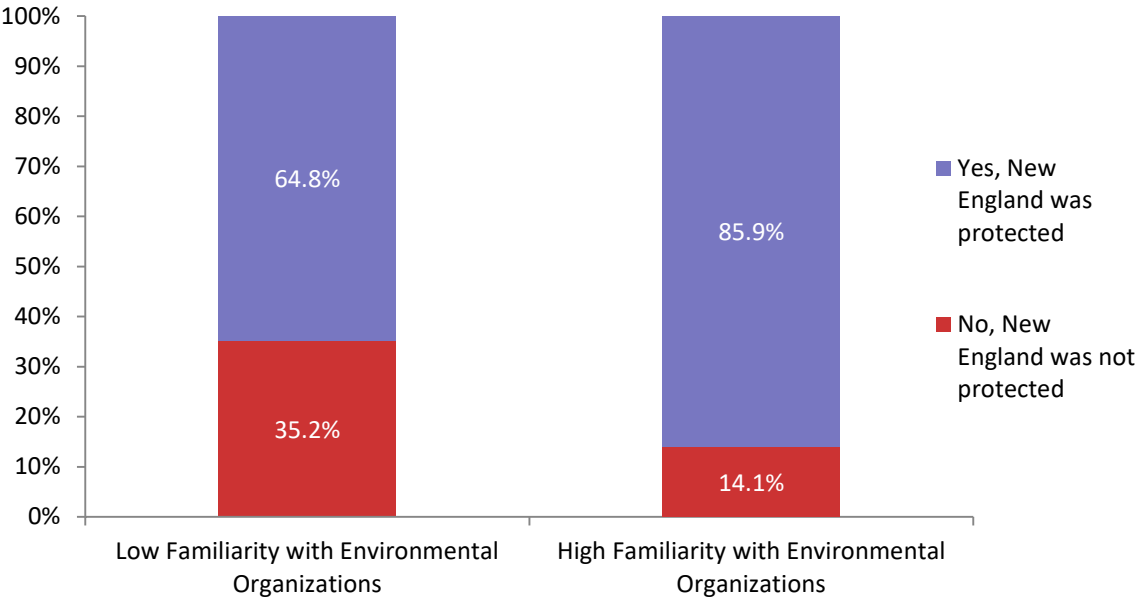
- Hadn't heard of organization
- Knowledge of organization but no interaction with



Mutual Communication



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

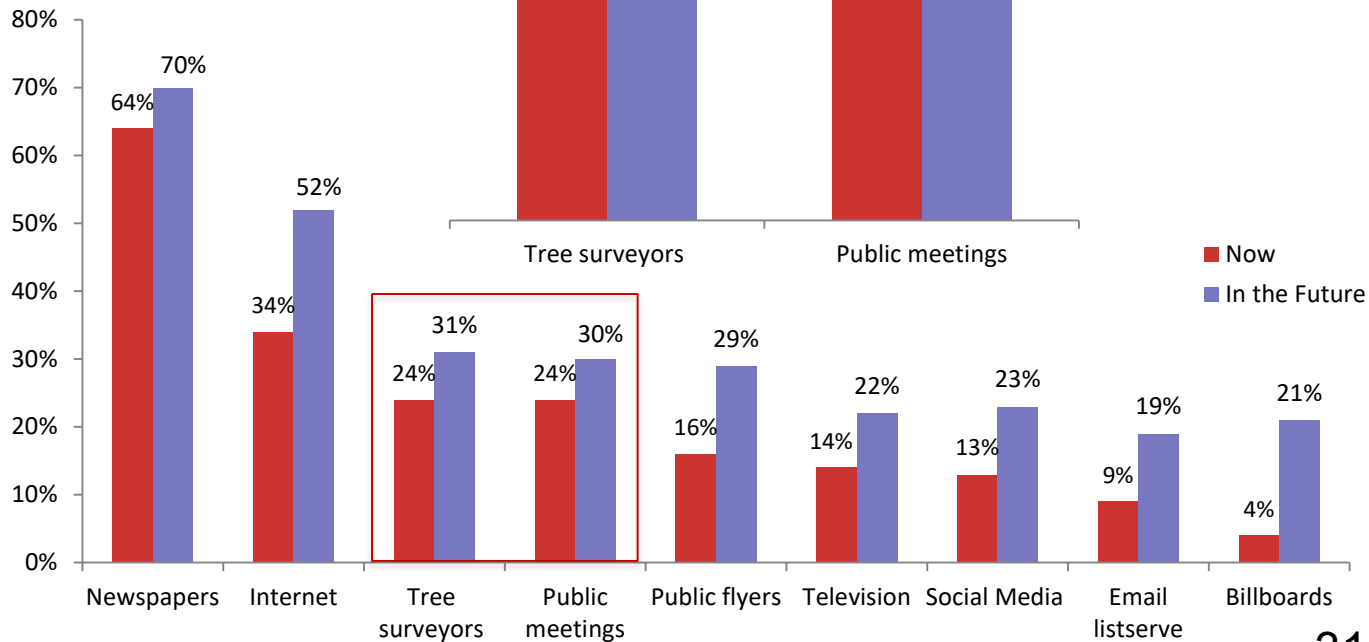


(All values $p < .05$)

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.**”

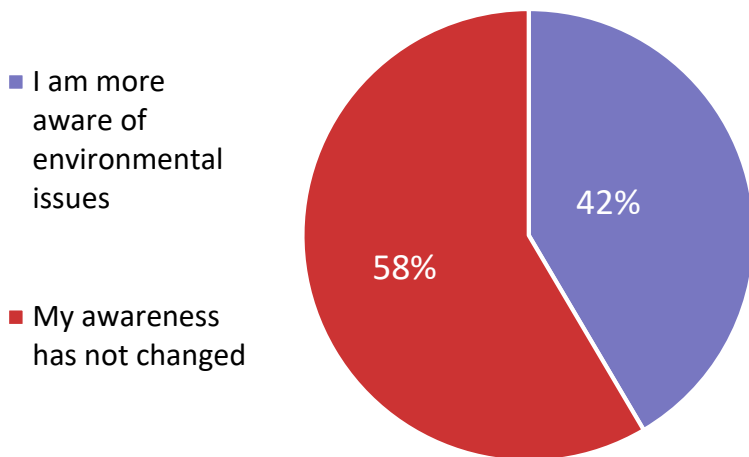
“[The] first response to any **future ALB** infestations...should be conducted by already **trained ALB staff** to **minimize mis-information** given to the public.”



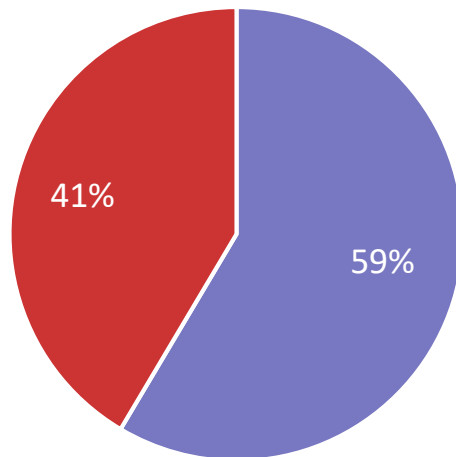
Increased Awareness

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

Low Interaction with USDA/DCR

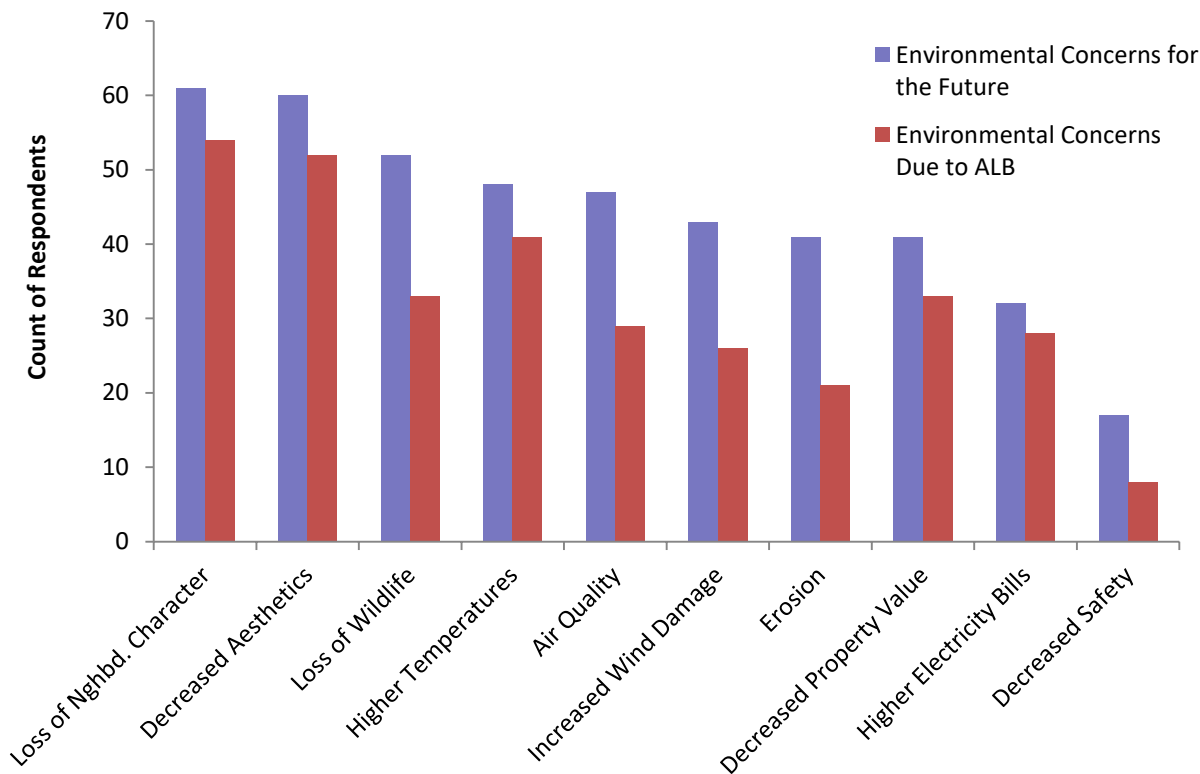


High Interaction with USDA/DCR



Increased Awareness

Respondents are thinking about environmental issues.



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)

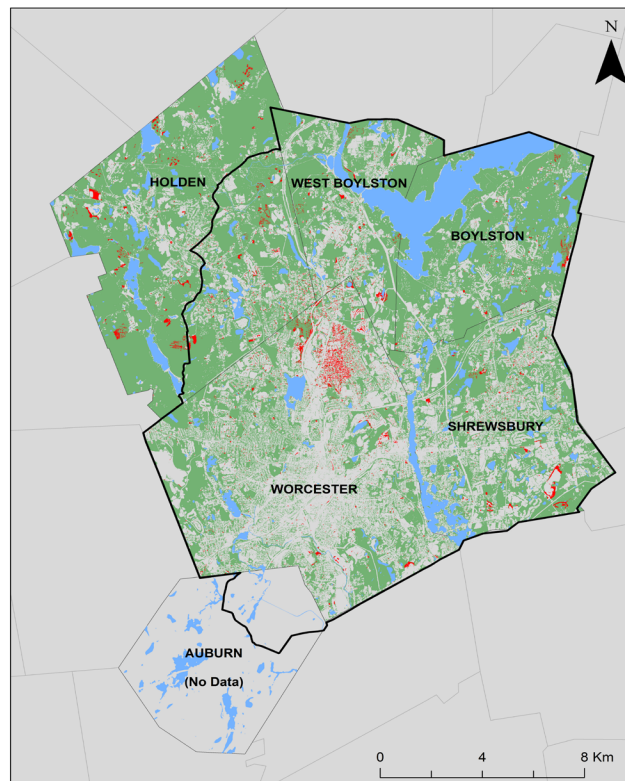
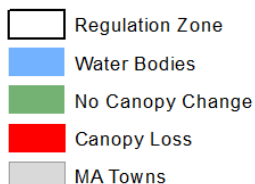
To conduct a survey testing the findings of previous years, in order to make generalizations about the larger population within the Quarantine Zone.

Causes of Tree Loss

Canopy cover decreased by 2% (2.46 km²) in the regulation zone from 2008 to 2010

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

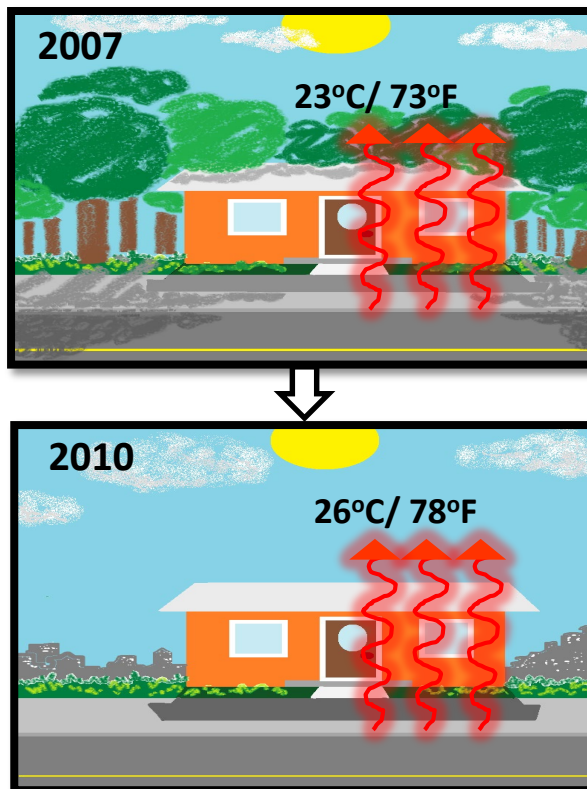
Legend



Impact of Tree Loss

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

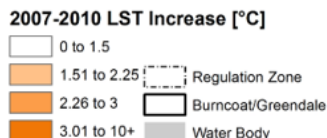
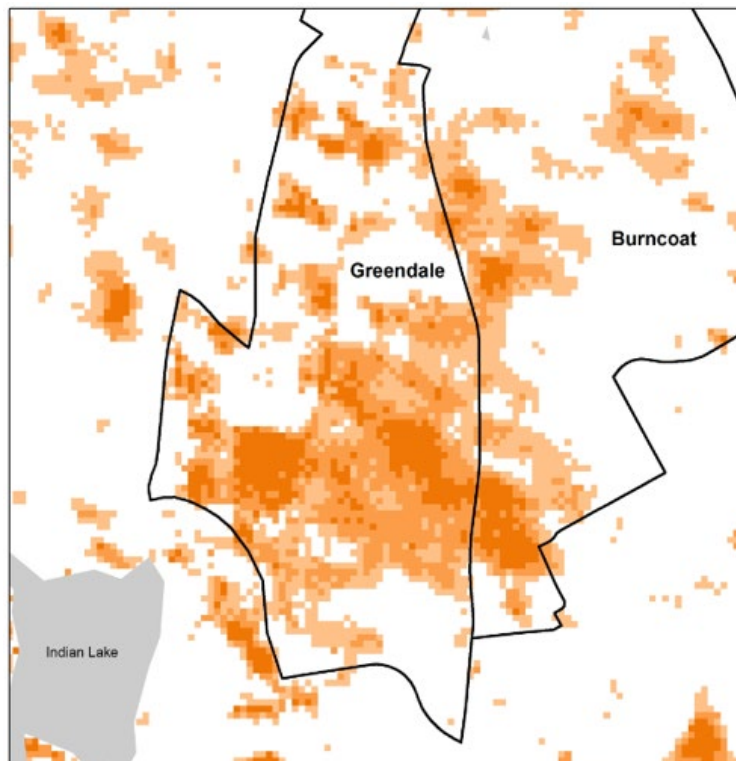
Burncoat and Greendale neighborhoods showed a **1-9°C** (1.8-16°F) increase from 2007 to 2010



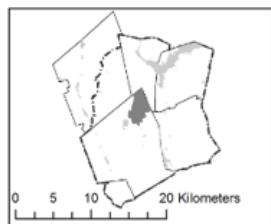
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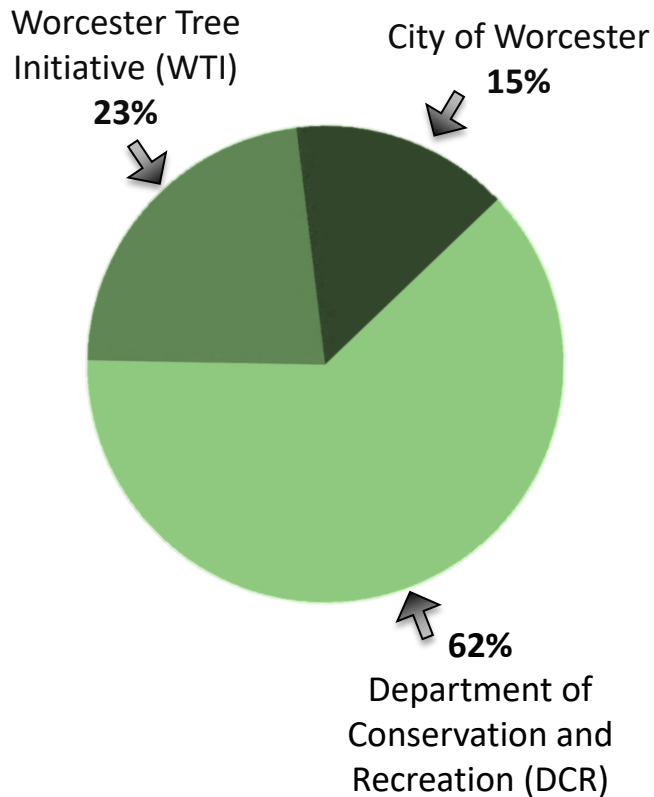
0 0.5 1 Km



Benefits of Trees

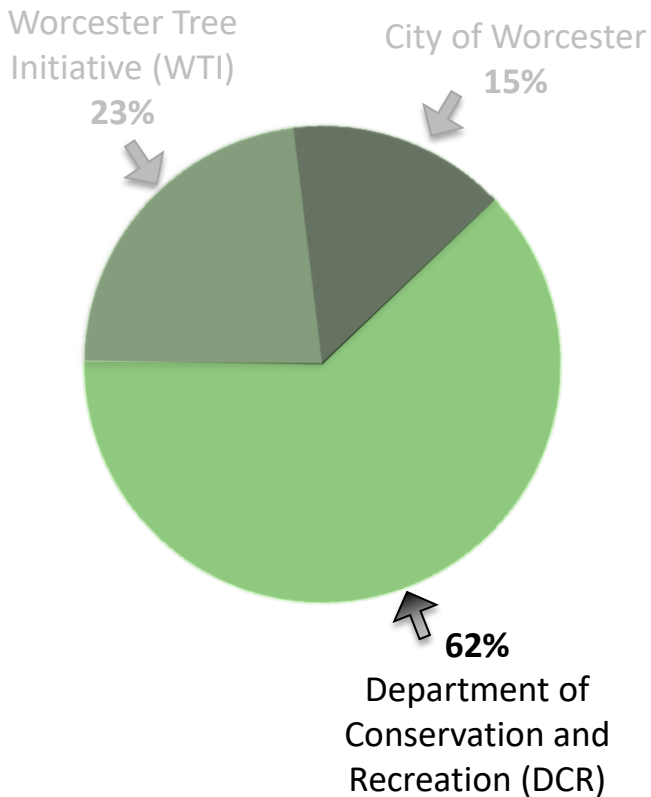


Replanting



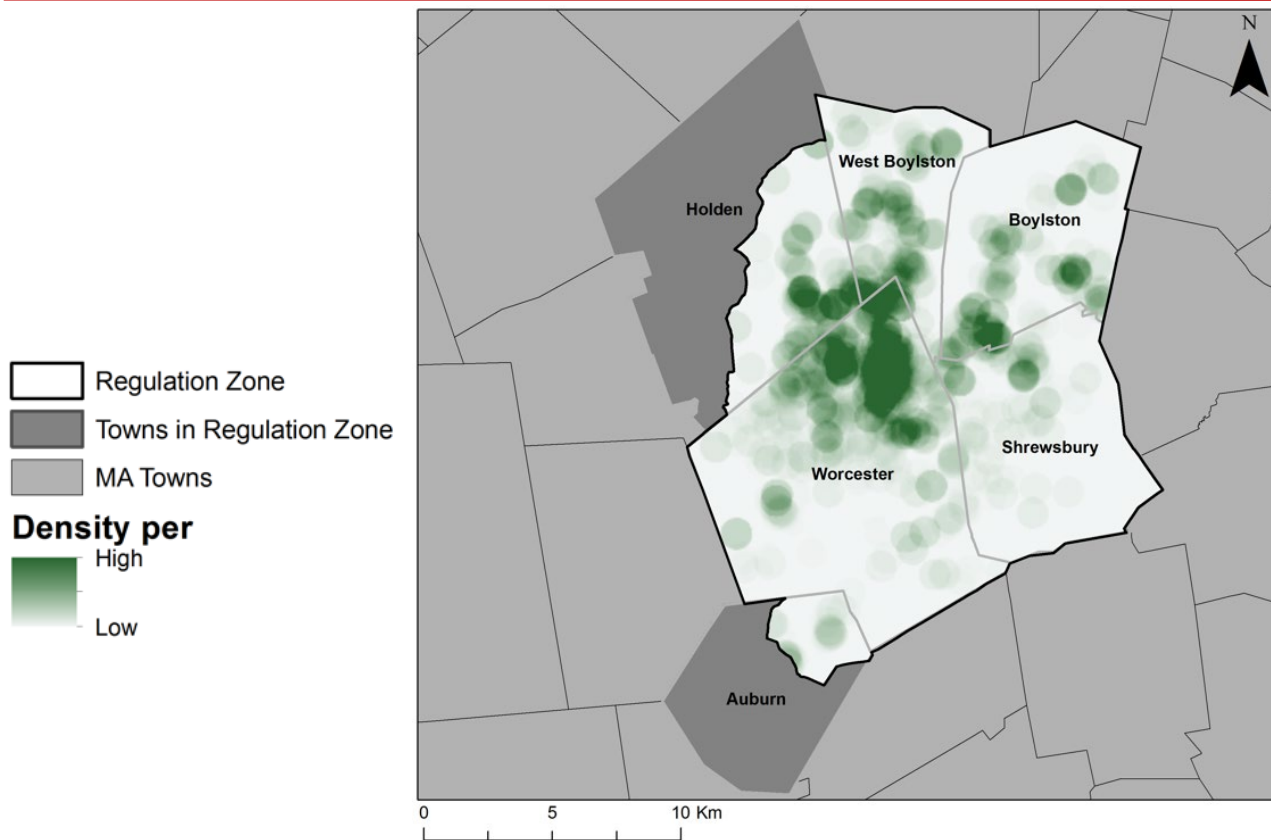
Granville Ave. before (top) and after (bottom) replanting.

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.

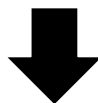
Benefits are maximized when more trees reach maturity.

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**



**Data
Collection**



**Statistical
and Spatial
Analysis**

Sample Design



Number of Trees

17,000

9,000

500

1,600

1,054

Develop dataset



Species stratification



Randomized subsample

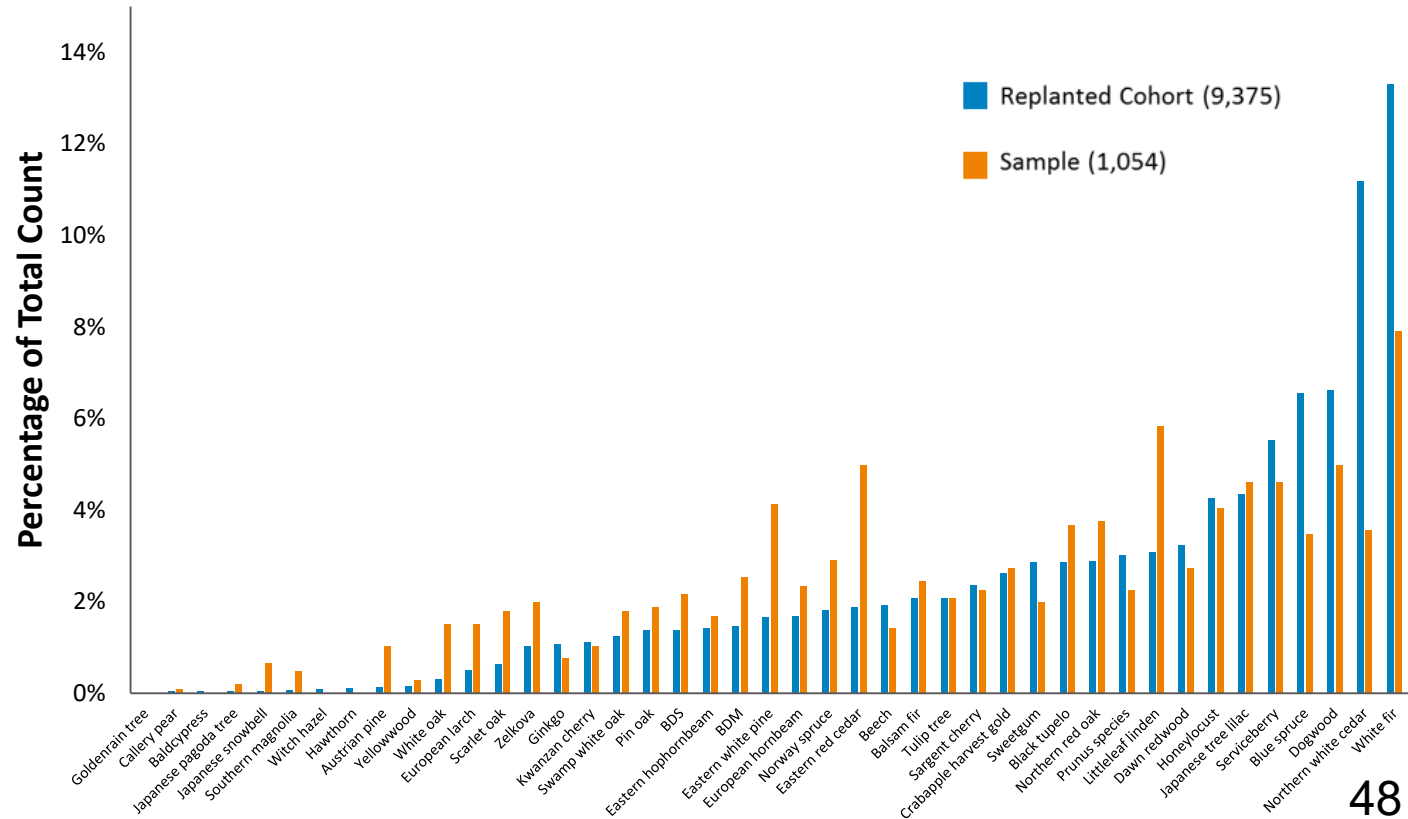


Subsample clustering

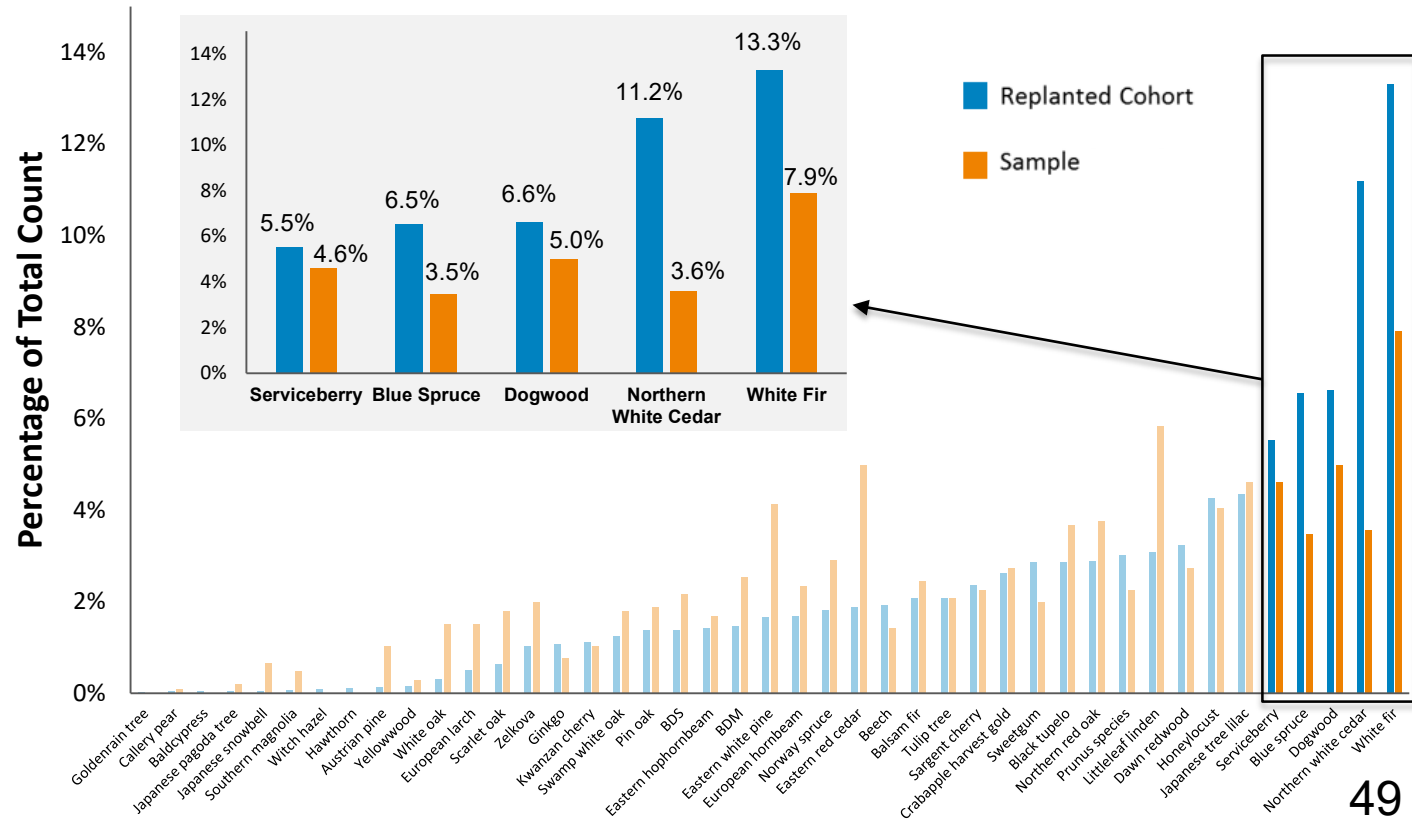


Sampled

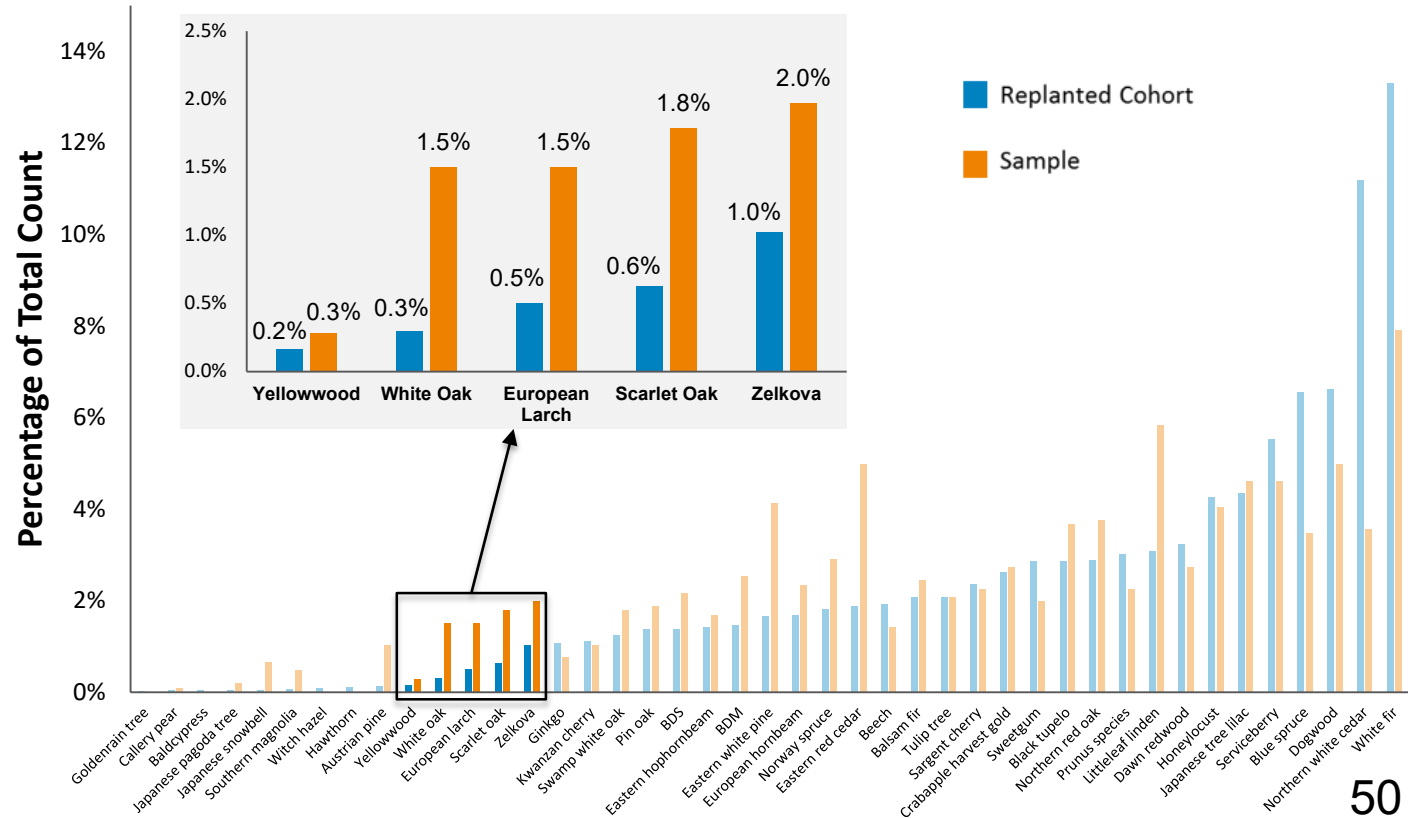
Species Distribution of Replanted Cohort and Sampled Trees



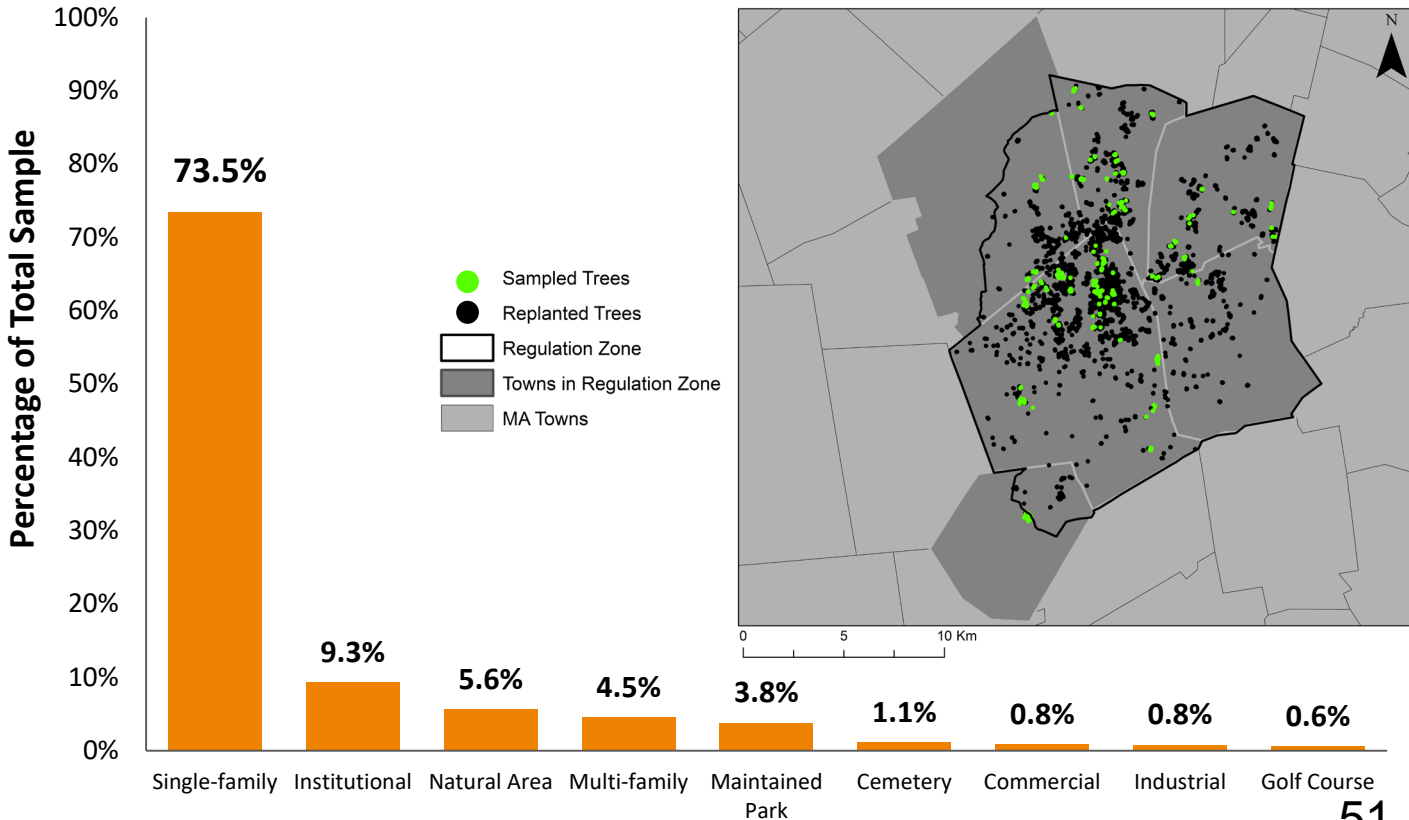
Species Distribution of Replanted Cohort and Sampled Trees



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

Name(s): <u>Amber Michelle Andrew</u>	Training: <u>Intermediate</u>	Date: <u>6/26/14</u>
Address: <u>91 Clark St.</u>		Tree ID #: <u>1053014</u>
Cross St.: _____	GPS Loc: _____	
Site Type: <u>Sidewalk Cut-Out</u> <u>Front Yard</u>	Sidewalk Grass Strip Back Yard	Median Park
Land Use: <u>Residential</u> <u>Industrial</u>	Multi-family Maintained Park	Commercial Natural Area
Species: <u>Swamp White Oak</u>	DBH: <u>9"</u>	Parking Lot Natural Area
Height: <u>9'6"</u>	Width: <u>5'5"</u>	Date Planted: _____
Mortality Status: <u>Alive</u> <u>Partial Sprout</u>	Standing Dead	Removed/Missing Stump
Mortality Status Notes: _____		
Crown Dieback: <u>1-25%</u>	26-50%	51-75%
Crown Transparency: <u>1-25%</u>	26-50%	51-75%
Condition: <u>Good</u>	Fair	Poor
Time to measure: _____		

Name(s): <u>Amber Michelle Andrew</u>	Training: <u>Intermediate</u>	Date: <u>6/26/14</u>
Address: <u>91 Clark St.</u>		Tree ID #: <u>1053016</u>
Cross St.: _____	GPS Loc: _____	
Site Type: <u>Sidewalk Cut-Out</u> <u>Front Yard</u>	Sidewalk Grass Strip Back Yard	Median Park
Land Use: <u>Residential</u> <u>Industrial</u>	Multi-family Maintained Park	Commercial Natural Area
Species: <u>Little Leaf Linden</u>	DBH: <u>1.9"</u>	Parking Lot Natural Area
Height: <u>12'</u>	Width: <u>7'11"</u>	Date Planted: _____
Mortality Status: <u>Alive</u> <u>Partial Sprout</u>	Standing Dead	Removed/Missing Stump
Mortality Status Notes: _____		
Crown Dieback: <u>1-25%</u>	26-50%	51-75%
Crown Transparency: <u>1-25%</u>	26-50%	51-75%
Condition: <u>Good</u>	Fair	Poor
Time to measure: _____		

Crown Dieback



1-25%



26-50%



51-75%



76-100%

Crown Transparency



1-25%



26-50%



51-75%



76-100%

Other Health Characteristics



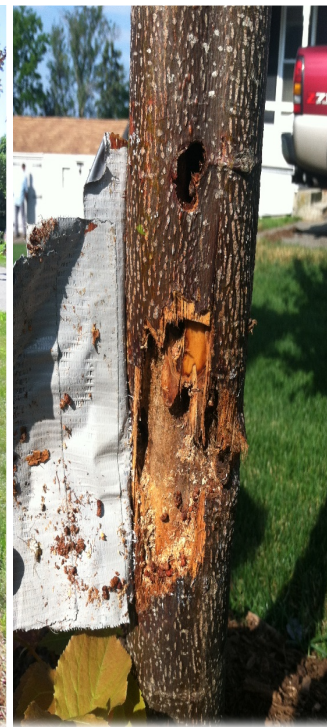
Standing Dead



Basal Sprouting



Trunk Damage



Pest Damage

Overall Rating



Good



Fair



Poor



Critical

Size Metrics



Height



DBH

4.5 feet



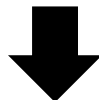
Width

Research Questions

DCR Replanted Cohort
2010 - 2012



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

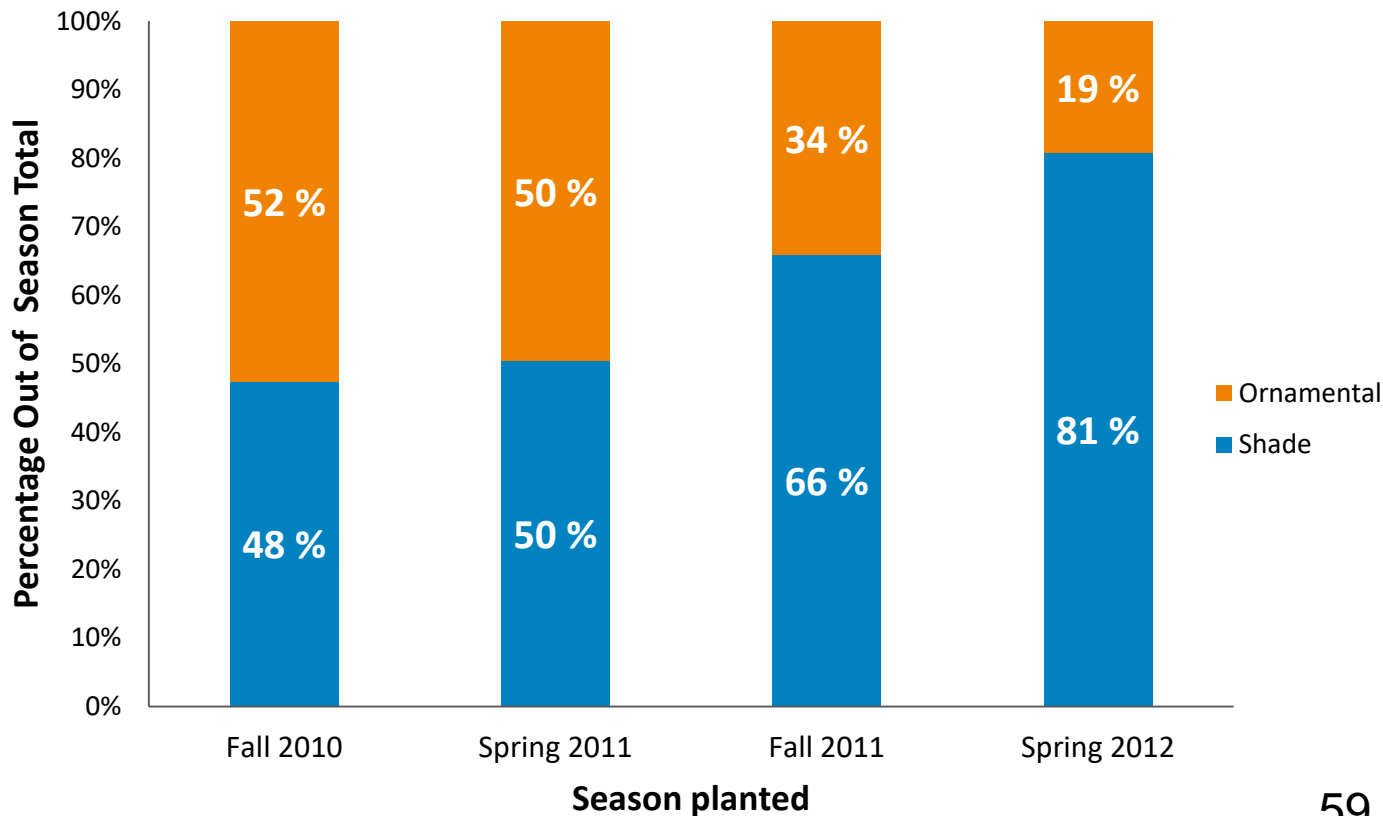


What is the current and projected **mortality rate** of the cohort?



Do **socioeconomic factors** influence tree mortality?

Shade vs. Ornamental Trees by Planting Season



Top 3 Species

Front Yard vs. Back Yard



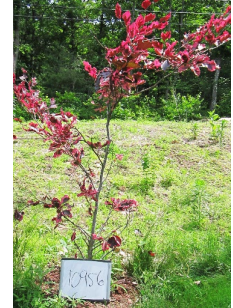
Front
Yard



Dogwood



Japanese Tree
Lilac



Black Tupelo

Back
Yard



White Fir

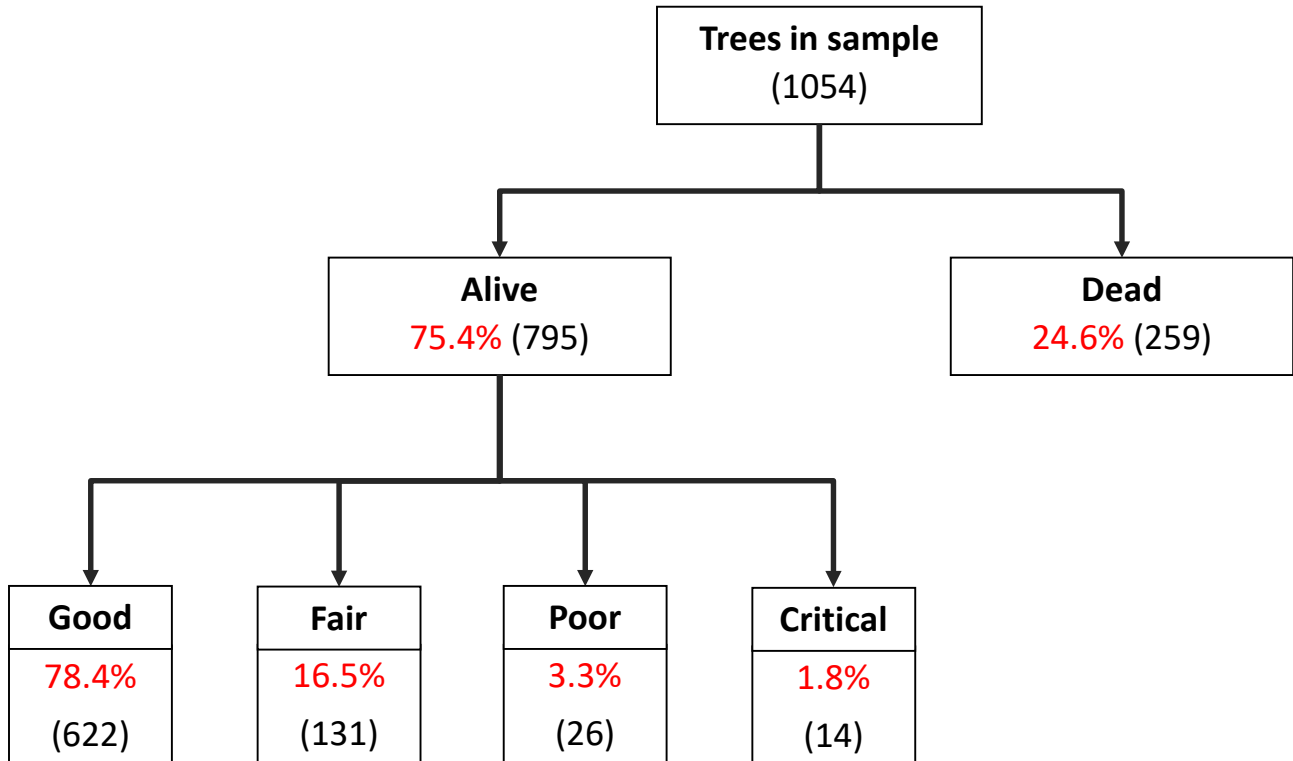


Eastern Red
Cedar

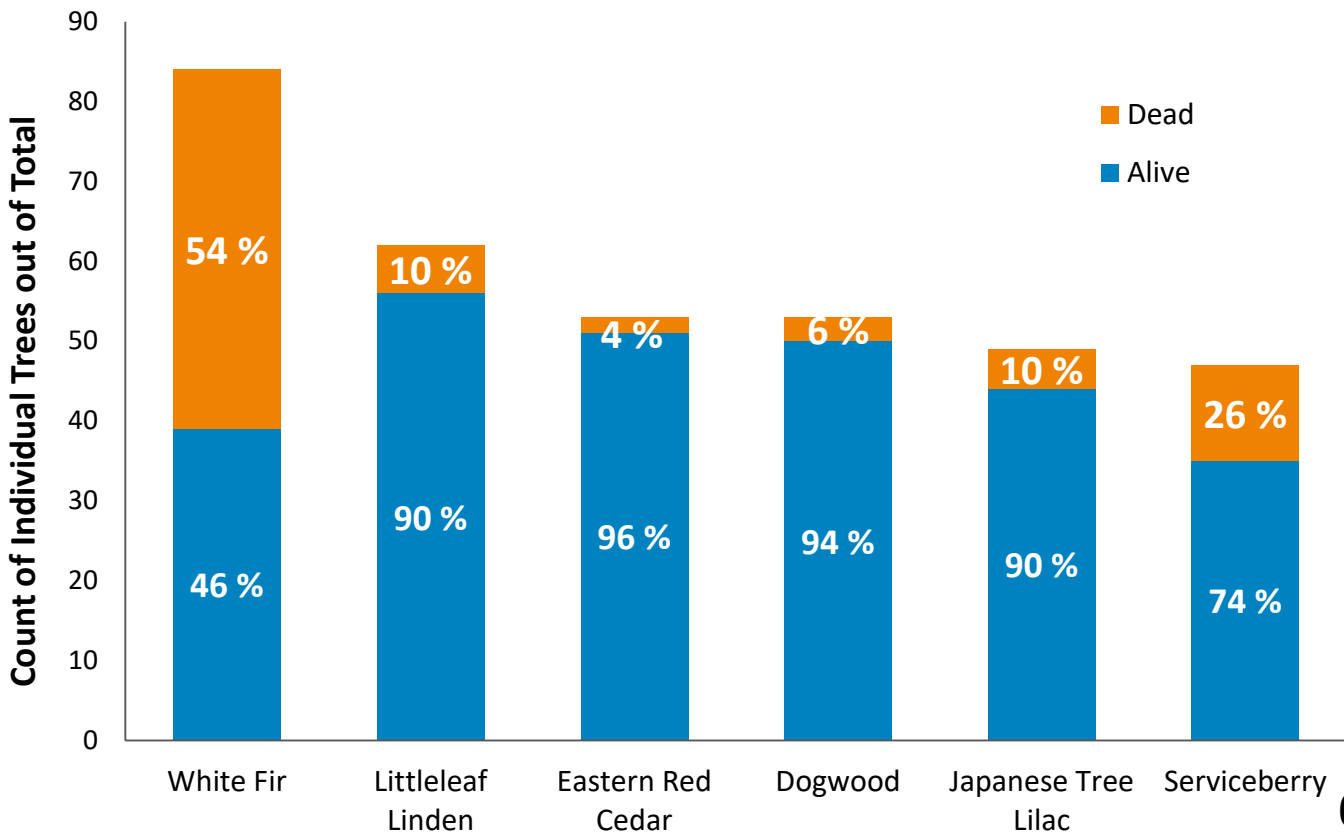


Northern White
Cedar

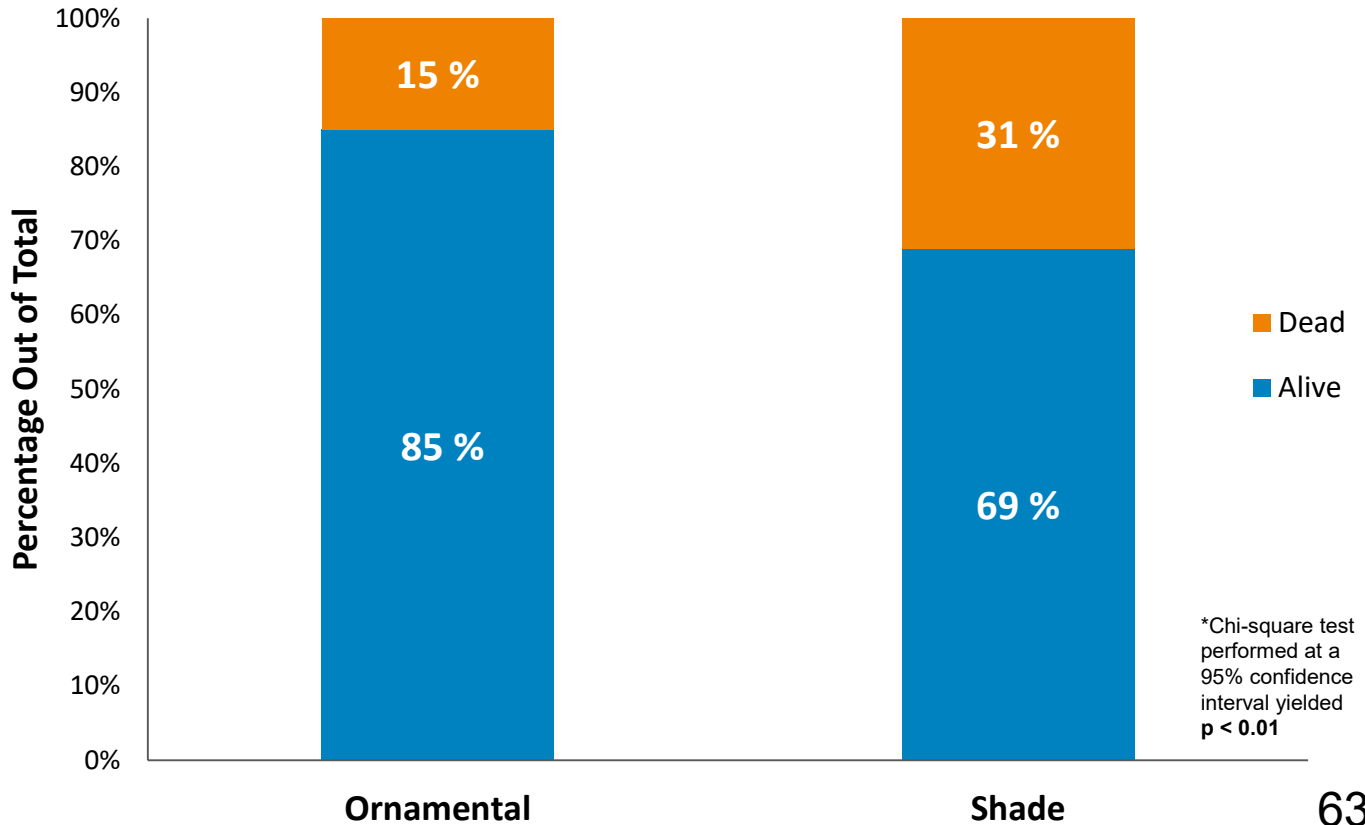
Tree Mortality and Condition Within Sample



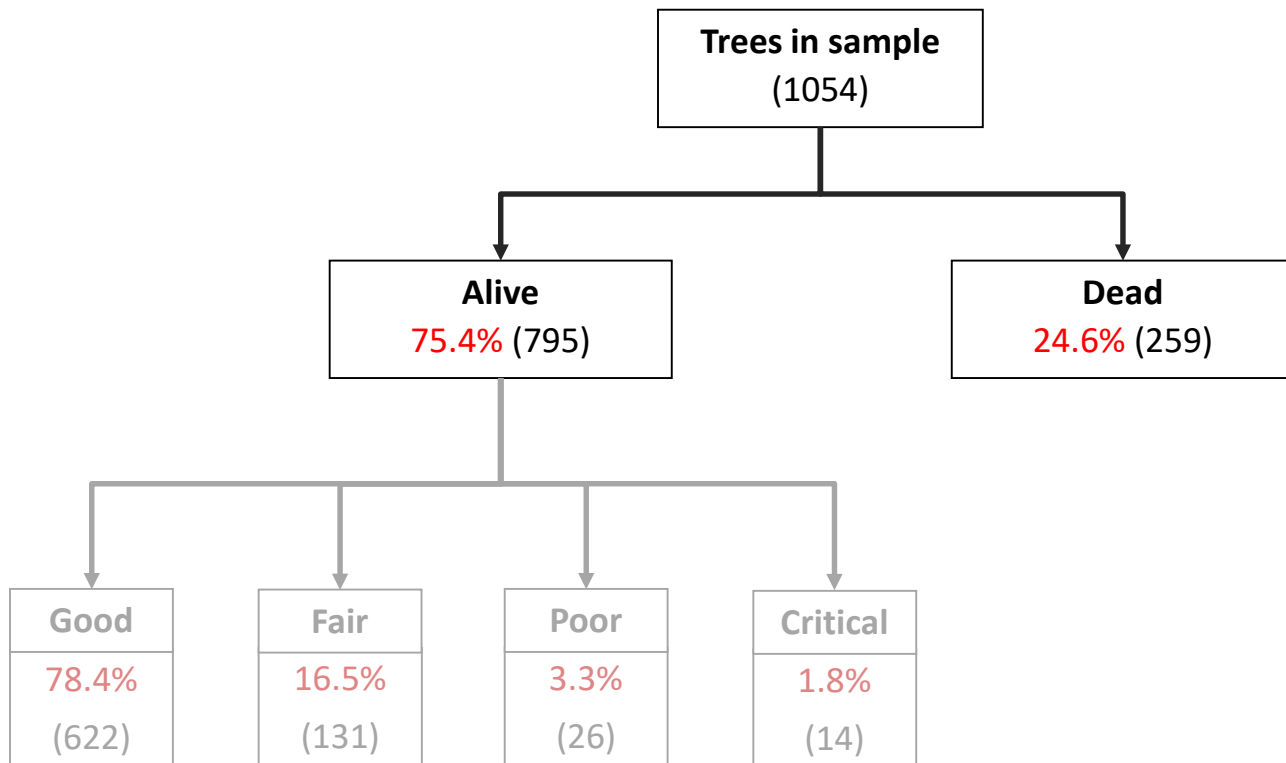
Mortality Among Six Most Frequently Sampled Species



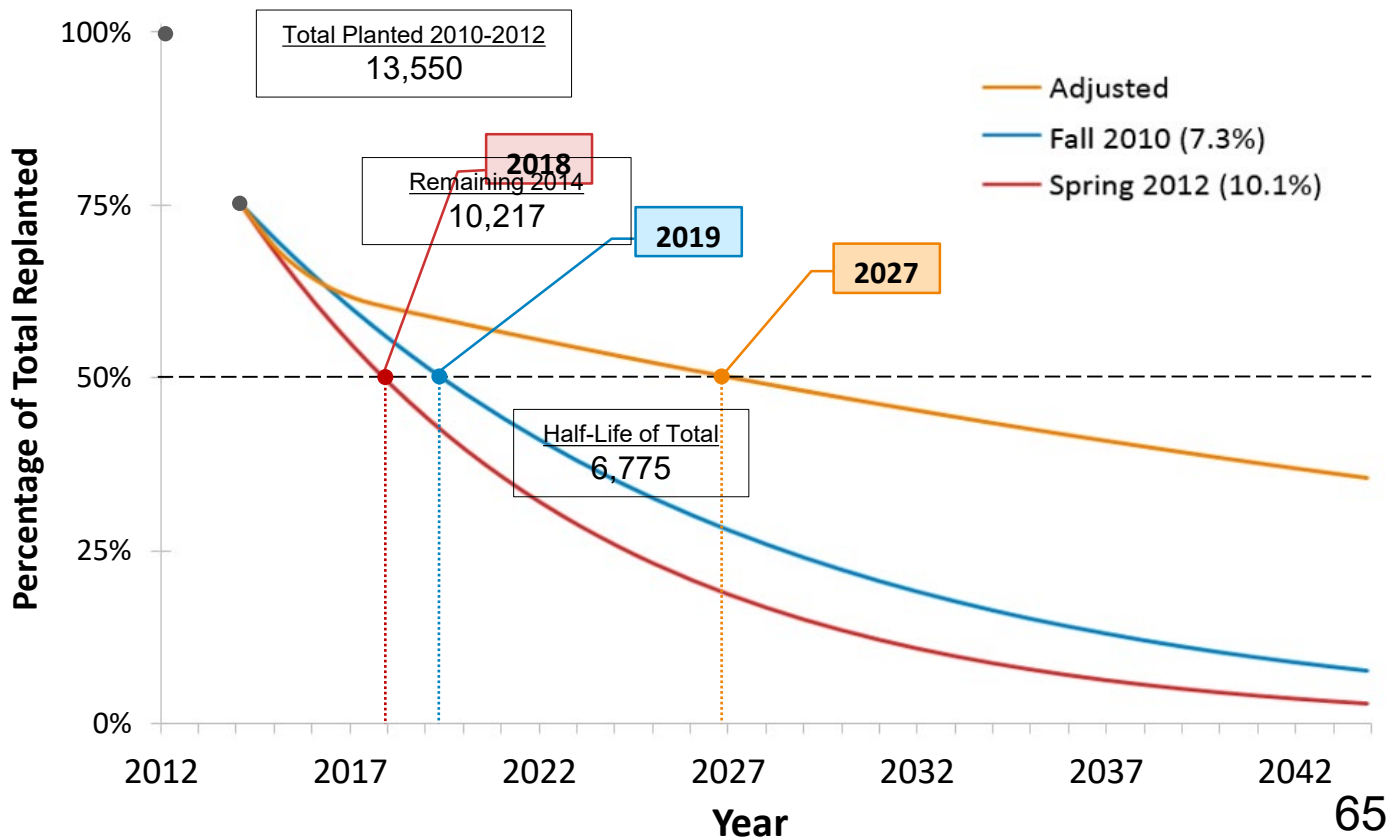
Mortality Among Shade vs. Ornamental Trees



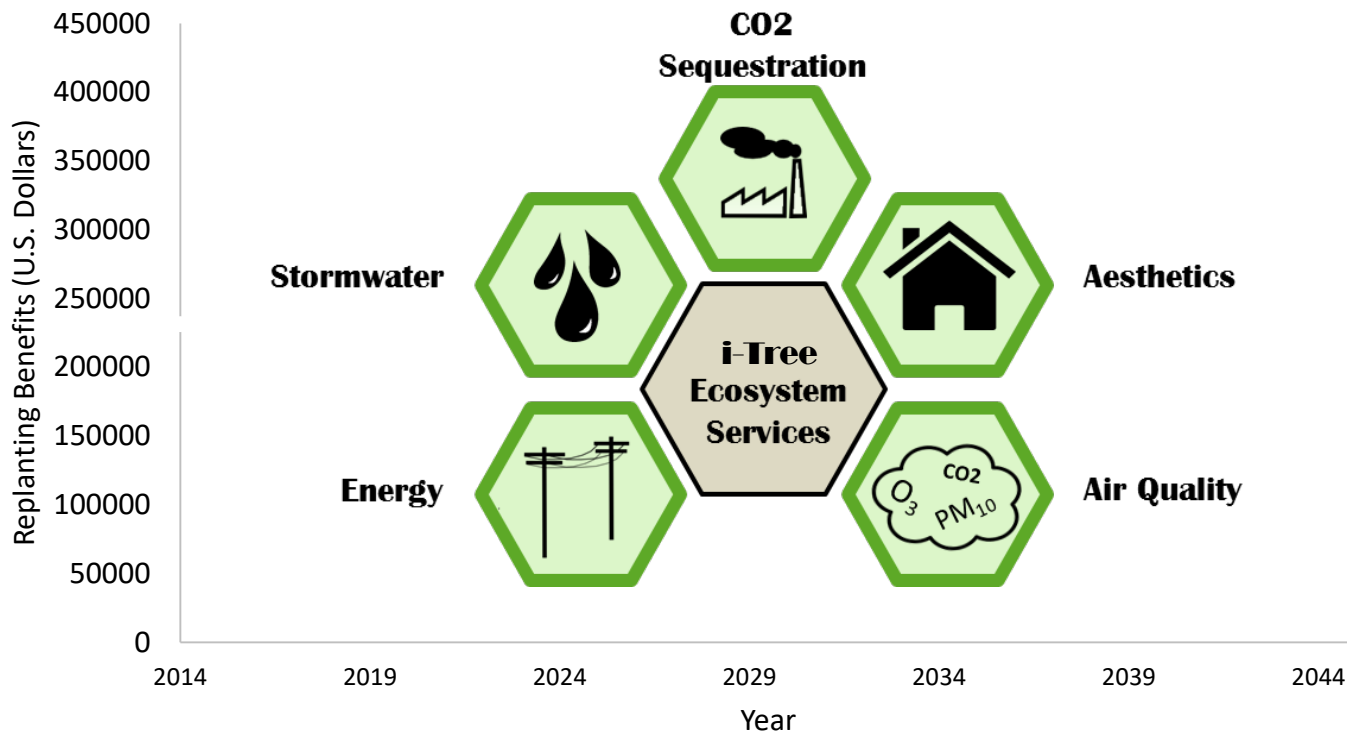
Tree Mortality and Condition Within Sample



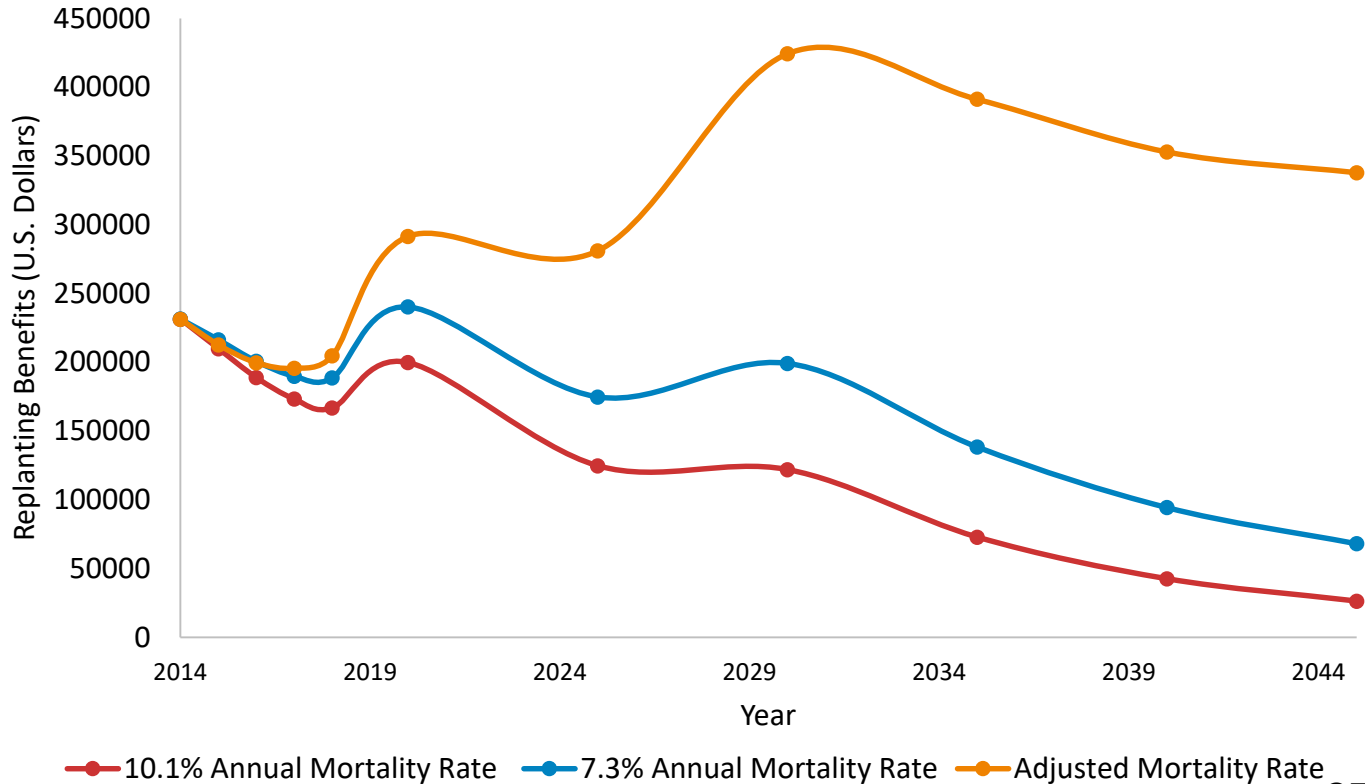
Projected Mortality Scenarios for DCR Trees Replanted 2010-2012



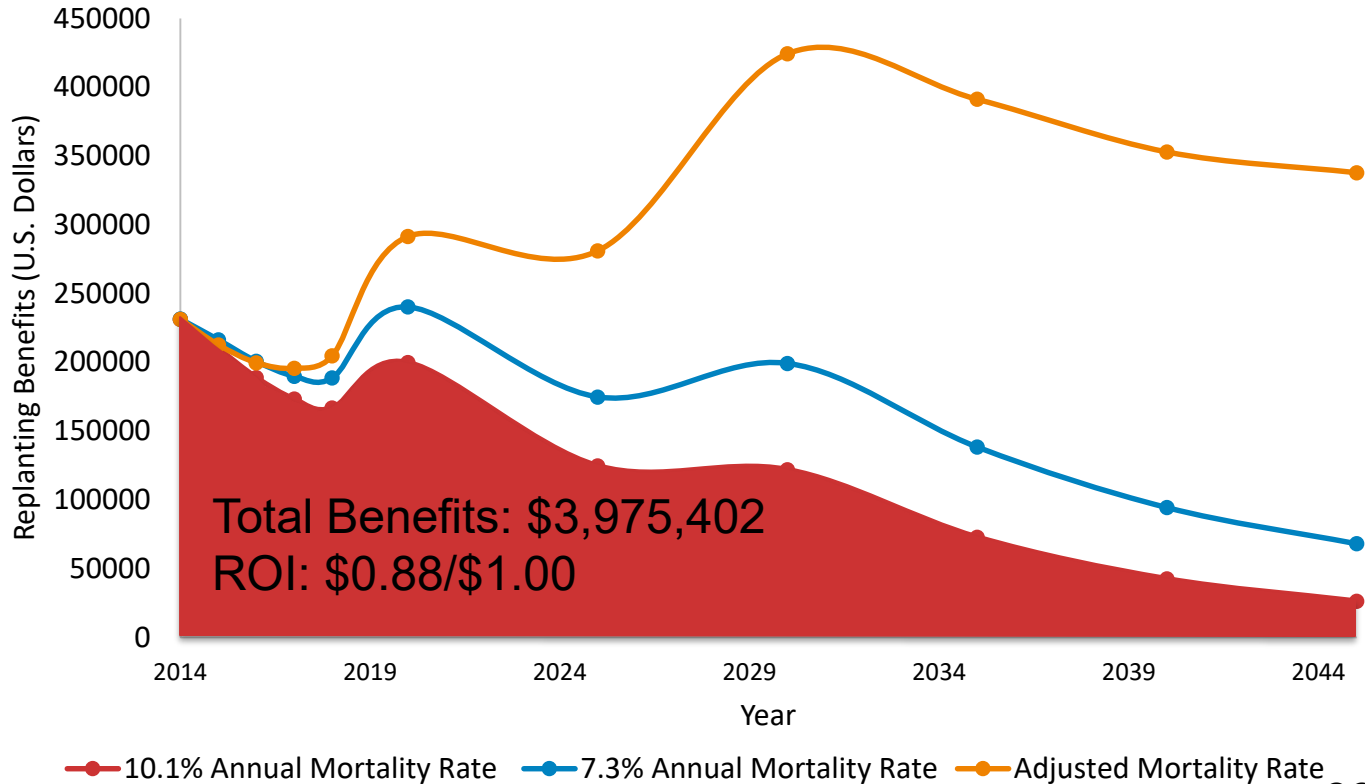
Replanting Benefits Modeled By i-Tree



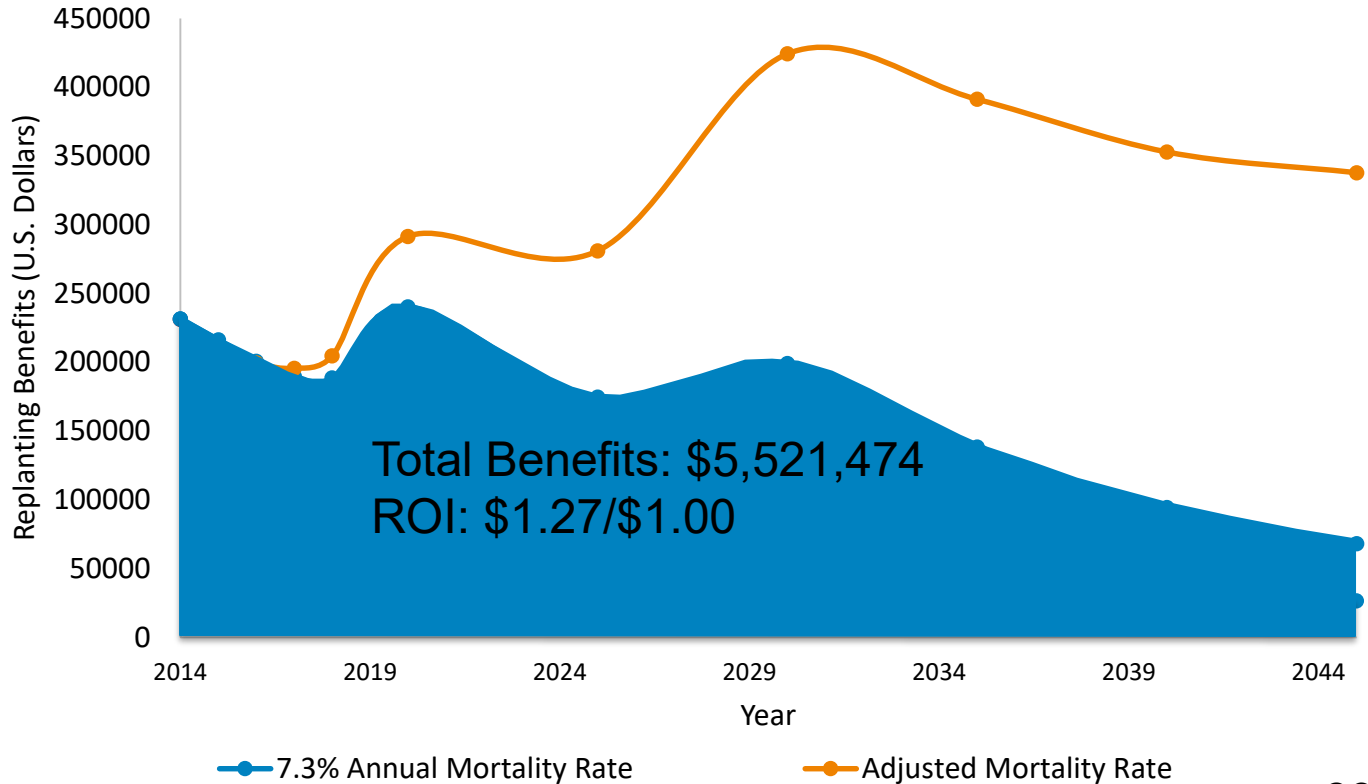
Annual Replanting Benefits Using Three Sample Mortality Rates



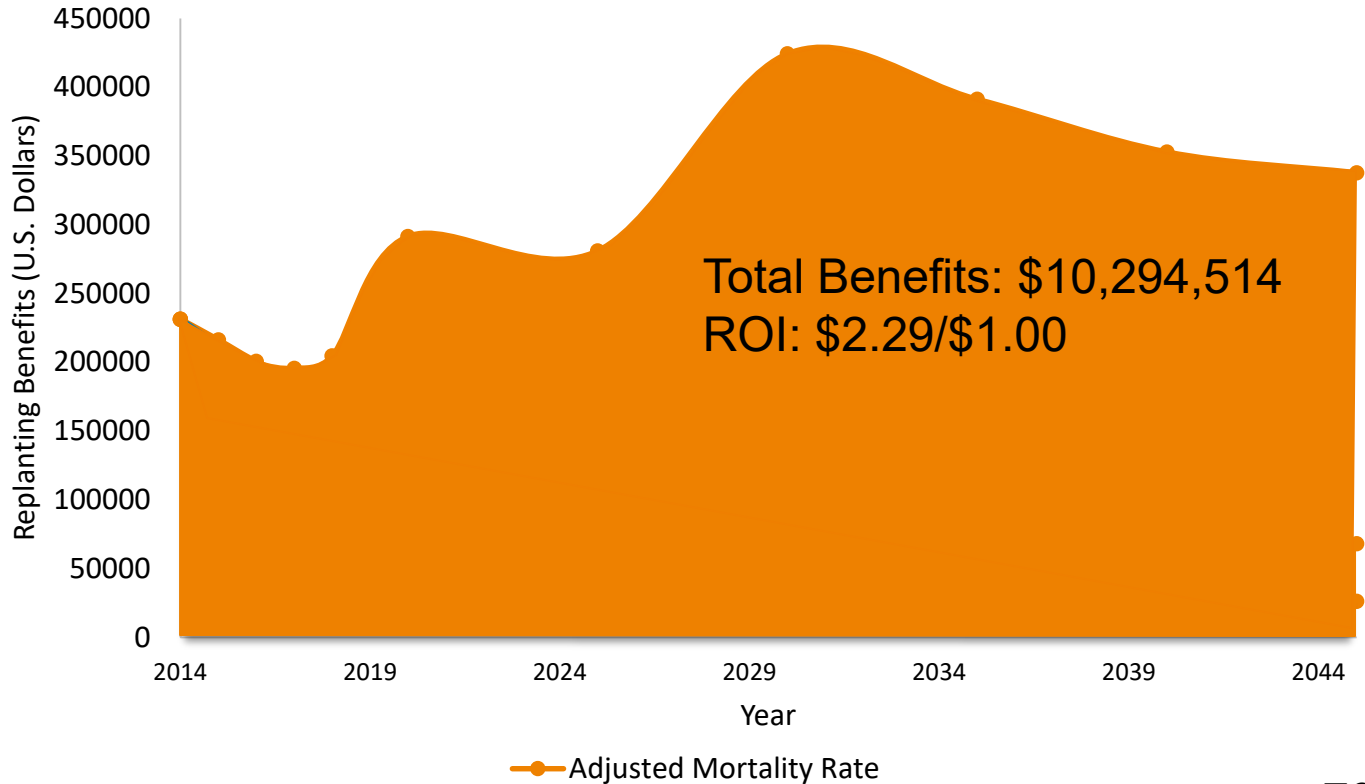
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Shade Versus Ornamental Tree Benefits



Average New Tree Cost:

\$310

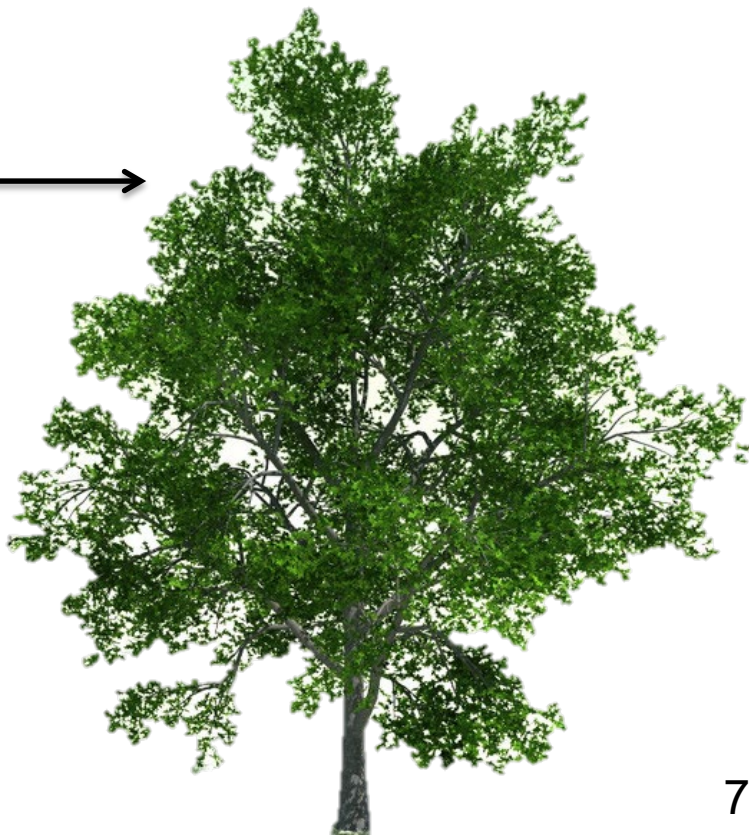
Mature 24" DBH Pin Oak

\$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?

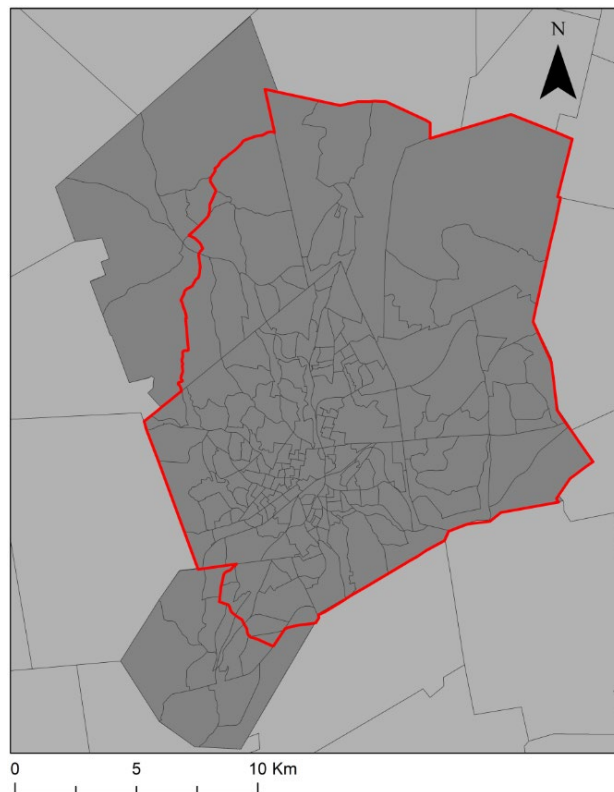
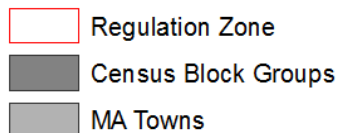
What is the current and projected **mortality rate** of the cohort?

Do **socioeconomic factors** influence tree mortality?

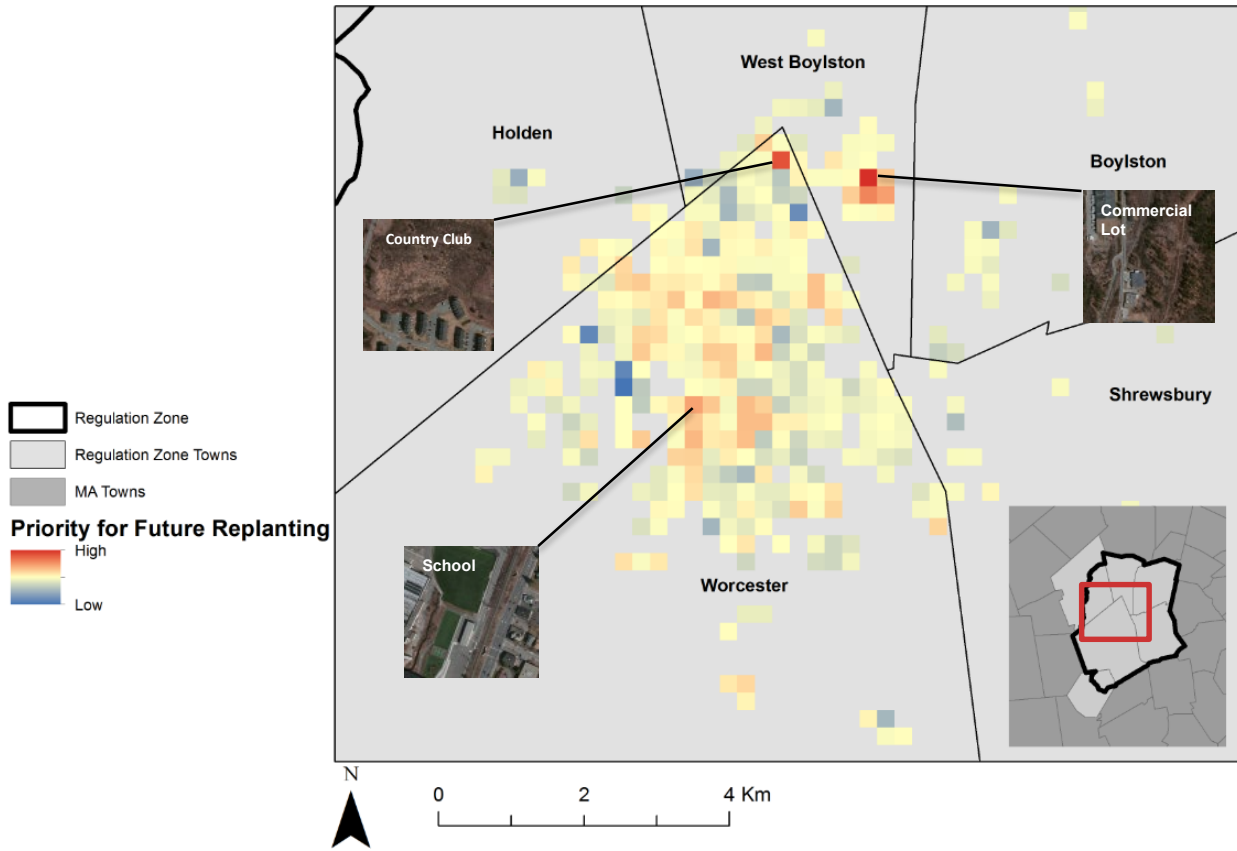
Tree Mortality, Condition and Socioeconomic Variables



- **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**



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?



Significant Correlations with Tree Mortality Rate



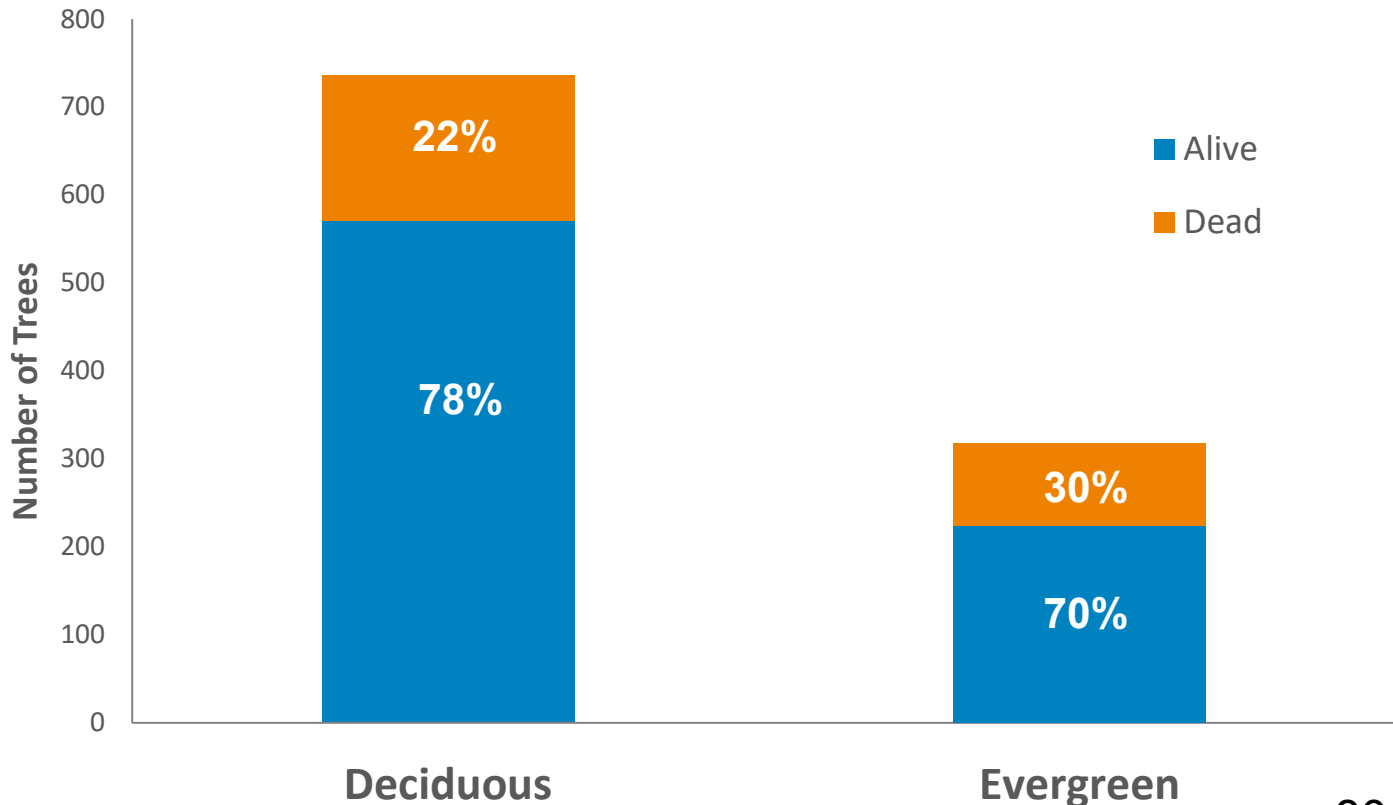
American Community Survey (2006-2010)

- 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