# Human Environment Regional Observatory (HERO) 2024 Stakeholder Presentation

## Assessment of Tree Health and Resident Perspectives in Holyoke and Chelsea

Quinn Chang Martin, Aria Cranford, Espi Garschina-Bobrow, Juju Kaiser, Jack Keane, Mara Litten, Kalon Shepard

GREENING THE GATEWAY CITIES
MA Urban Canopy Project

dcr Massachusetts

# Meet the 2024 HERO Team!

From Left to right: Kalon Shepard, Quinn Chang Martin, Espi Garschina-Bobrow, Jack Keane, Mara Litten, Aria Cranford, Juju Kaiser, Aidan Caron, Adlai Nelson, Tanner Honnef, Nicholas Geron

**Undergraduate Fellows**
Quinn Chang Martin, Aria Cranford, Espi Garschina-Bobrow, Juju Kaiser, Jack Keane, Mara Litten,
Kalon Shepard

**Team Managers and Graduate Mentors**
Jason Andrews, Aidan Caron, Nicholas Geron, Tanner Honnef, Adlai Nelson

**Directors**
Dr. John Rogan and Dr. Deborah Martin

https://www.clarku.edu/departments/hero-program/

GREENING
THE GATEWAY CITIES
MA Urban Canopy Project

Goals include increasing canopy cover by 5% in high priority neighborhoods in Gateway Cities throughout Massachusetts. Tree canopy has numerous energy and environmental benefits such as lowering high temperatures and wind speeds.

“Gateway City” = population ranging from 30,000-250,000, with median household income and educational attainment lower than the Massachusetts average. Plantings are happening in 23 out of 26 Gateway Cities!


*An American Linden (Tilia americana), surveyed in 2017 (left) and re surveyed in 2024 by Kalon (right)*

*Natalie, an urban forester in Holyoke planting a European Hornbeam (Carpinus betulus)*

GGCP planting starts in 2014 in three pilot cities; Chelsea, Fall River, and Holyoke.

From 2017-2019 HEROs also surveyed trees in Chicopee, Leominster, and Pittsfield.

40,000th tree planted in Chicopee in April of 2024

2024 HEROs return to Holyoke and Chelsea

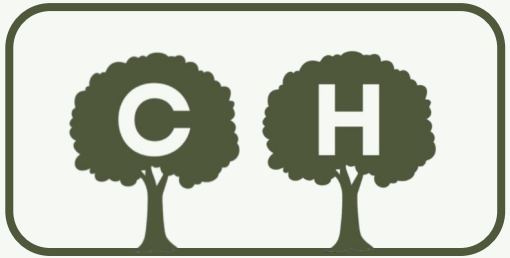
HERO partners with GGCP for the first time in 2017, comparing tree health and the contributions of residents and stakeholders across three cities; Holyoke, Chelsea and Revere.

$1.3 million federal funds to the GGCP Spring 2023

# Presentation Outline

- HERO 2024 Research Objectives and Study Areas
- Biophysical Field Methods and Data Collection
- Tree Assessments and Statistics
- Species and Growth Analysis
- Interview Analysis and Takeaways
- Conclusions

*HERO team having lunch in O'Malley State Park in Chelsea*




*These "H" and "C" icons represent which city is being referred to and which data set is being used in figures and slides*

# HERO 2024 Study Objectives

## Biophysical

Measure the growth and survivorship of trees planted by the DCR's Greening the Gateway Cities Program in Holyoke, MA and Chelsea, MA.

What is the current status of tree health and structure and what factors have the greatest impact on tree growth and survivorship?

How does the tree health and structure compare to the 2017 HERO tree survey?

## Social

Interview community members in Chelsea and Holyoke about their perceptions around tree planting and stewardship.

How do residents perceive the role of trees on their property and in their neighborhood?

How does the DCR collaborate with community partners during tree planting initiatives?

1,500 Trees Surveyed

# Holyoke

**Population:** 37,628 - 1,806 per sq. mile

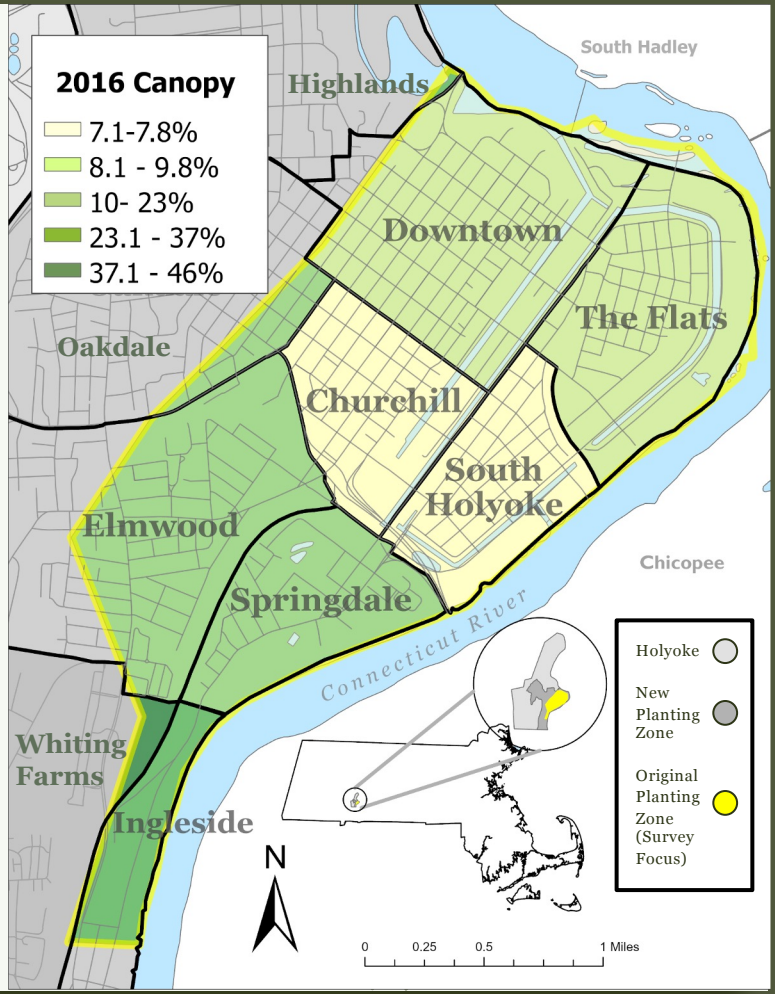
**Median Household Income:** $49,007, *MA: $95,505*

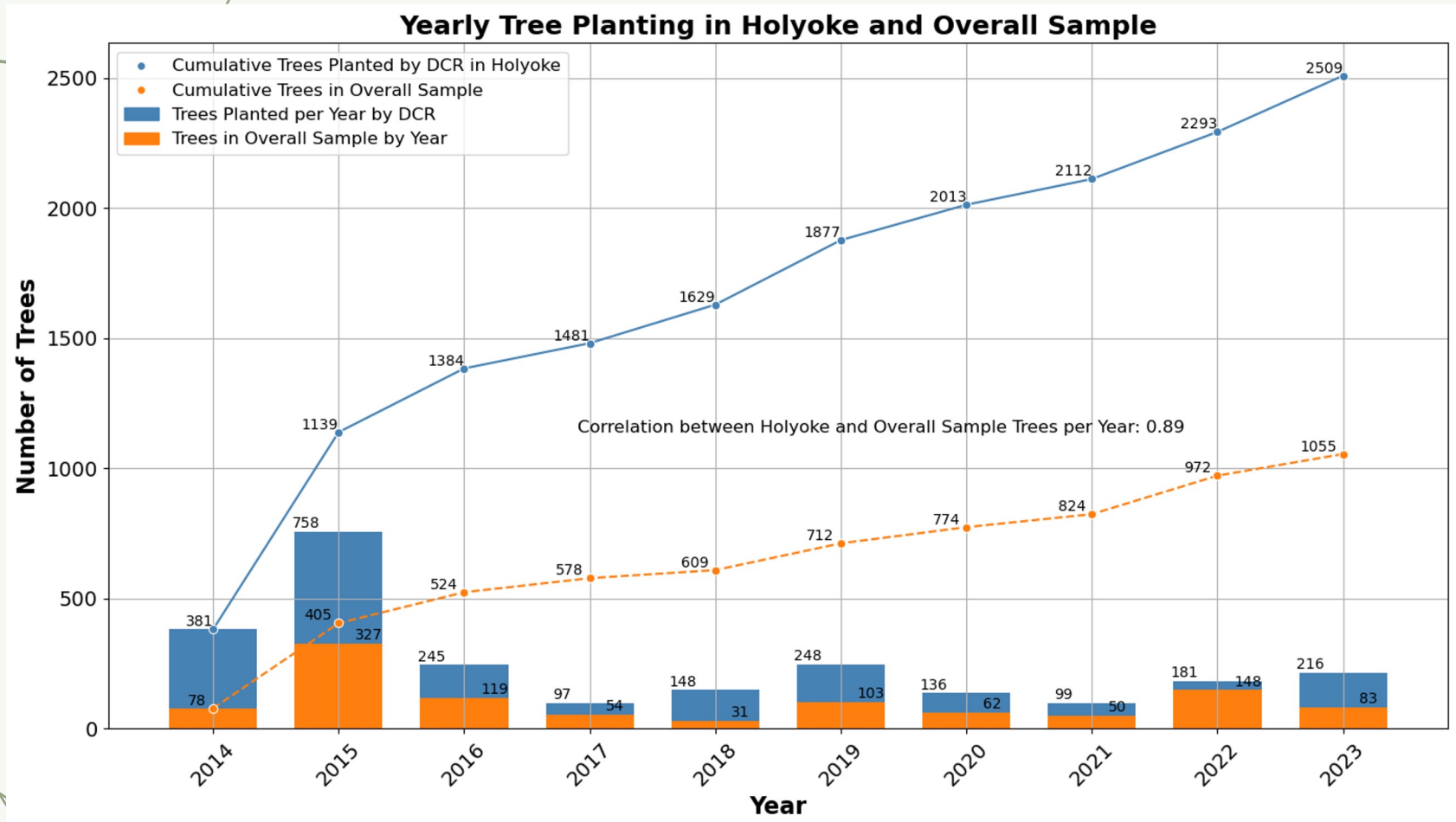
**Education:** 22.2% of persons aged 25+ have obtained a Bachelor's degree or higher , *MA: 45.9% Bachelor's degree or higher*

| Racial Demographics | Holyoke | *Massachusetts* |
|---|---|---|
| White | 67.5% | *79%* |
| Hispanic or Latino | 51.7% | *13.5%* |
| Black or African American | 4.6% | *9.6%* |
| Asian | 0.8% | *7.9%* |

53.7% canopy cover for all of Holyoke, 14.2% for our Study Area

42.6% Spanish speaking




Yearly Tree Planting in Holyoke and Overall Sample
Cumulative Trees Planted by DCR in Holyoke
Cumulative Trees in Overall Sample
Trees Planted per Year by DCR
Trees in Overall Sample by Year
Number of Trees
Year
Correlation between Holyoke and Overall Sample Trees per Year: 0.89
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
381
1139
1384
1481
1629
1877
2013
2112
2293
2509
78
405
524
578
609
712
774
824
972
1055
758
327
245
119
97
54
148
31
248
103
136
62
99
50
181
148
216
83

1,509 Trees Surveyed

# Chelsea

**Population:** 38,319 - 17,974 per sq. mile

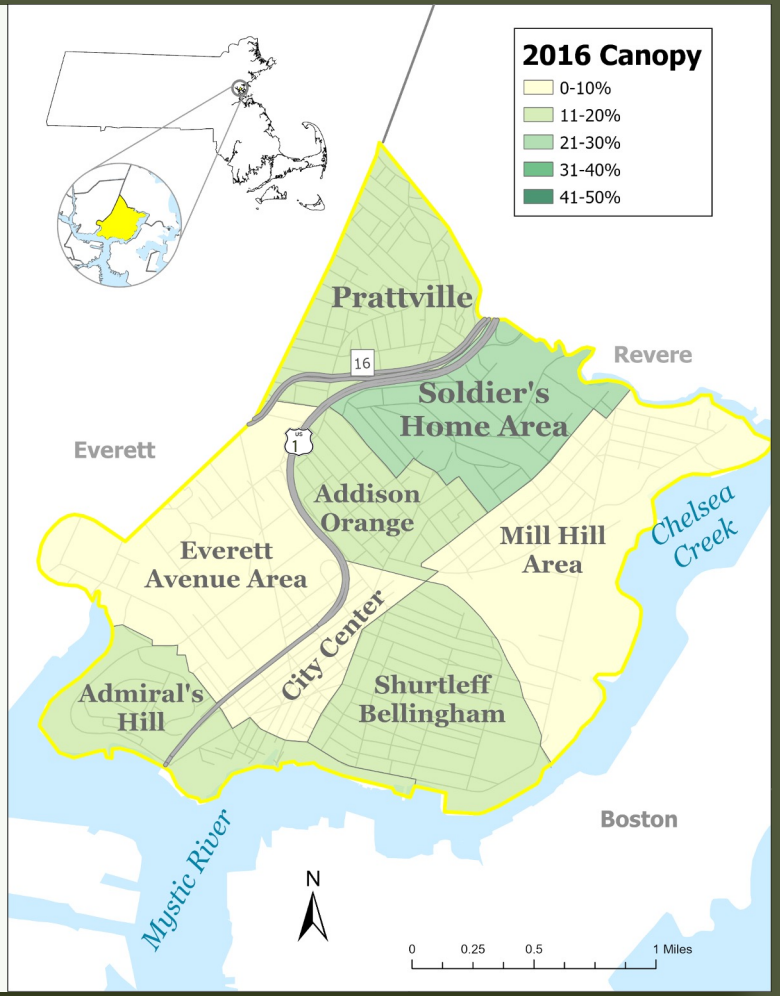
**Median Household Income:** $71,051, *MA: $95,505*

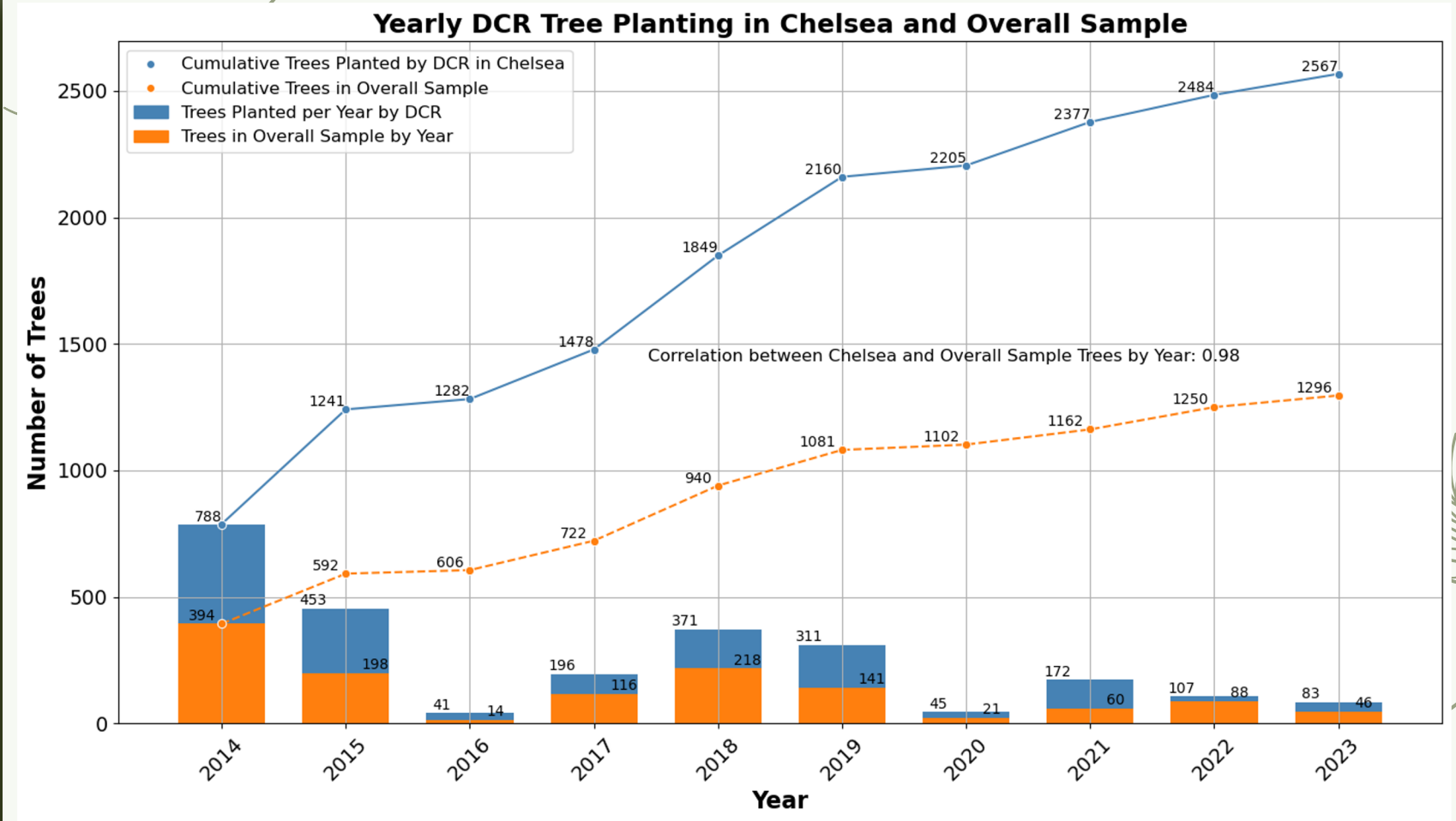
**Education:** 21.6% of persons aged 25+ have obtained a Bachelor's degree or higher , *MA: 45.9% Bachelor's degree or higher*

| Racial Demographics | Chelsea | *Massachusetts* |
|---|---|---|
| White | 33.9% | *79%* |
| Hispanic or Latino | 67.4% | *13.5%* |
| Black or African American | 6.2% | *9.6%* |
| Asian | 2.9% | *7.9%* |

10.9% canopy cover in 2016

60.3% Spanish speaking




Yearly DCR Tree Planting in Chelsea and Overall Sample
Cumulative Trees Planted by DCR in Chelsea
Cumulative Trees in Overall Sample
Trees Planted per Year by DCR
Trees in Overall Sample by Year
Correlation between Chelsea and Overall Sample Trees by Year: 0.98
Number of Trees
Year
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
788
1241
1282
1478
1849
2160
2205
2377
2484
2567
394
592
606
722
940
1081
1102
1162
1250
1296
453
198
41
14
196
116
371
218
311
141
45
21
172
60
107
88
83
46

HERO 2024 Research Objectives and Study Areas

Biophysical Field Methods and Data Collection

Tree Assessments and Statistics

Species and Growth Analysis

Interview Analysis and Takeaways

Conclusions

# Biophysical Field Measurements

**Tree photos:**
Capturing images of measured trees with its associated ID number


*Jack (left) and Adlai (right) measuring the crown width of a Red Oak (Quercus rubra). Methods from (Roman et al., 2020)*


**Diameter at Breast Height (DBH):**
Measured in inches, at 54 inches, or the closest unobstructed point with a diameter tape

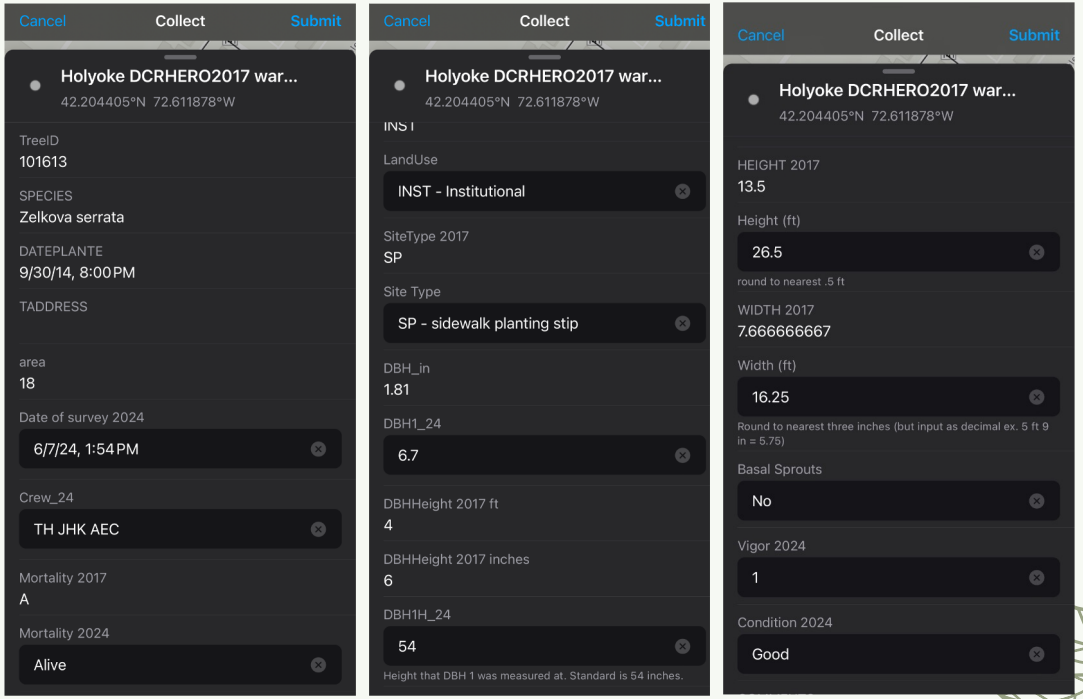

**Crown Width:**
Measured in feet using a standard measuring tape


**Tree Height:**
Measured in feet using the Nikon Forestry Pro II rangefinder/ hypsometer

*Juju skillfully getting the height of a tree in an Industrial "Other Maintained" site .*

# Data Collection and Input


*ArcGIS Field Maps mobile app locating tree ID #101613, a Japanese Zelkova (Zelkova Serrata) in Holyoke, MA*




*Field Maps shows previous data input where relevant along with the species and precise address. Measurements such as tree height, DBH, and canopy width are recorded.*

# Land Use and Site Type

What is the land around the tree being used for? What kind of space is the planting site?


Commercial, Sidewalk Cutout


Institutional, Maintained Park


Multi-family Residential, Sidewalk Planting Strip


Single Family Detached, Front Yard

# Assessing **Survivorship**


Alive


Standing Dead


Stump


Removed

Unknown

# Assessing **Vigor** – Canopy Fullness

**[1]** 90% to 100% full


**[2]** 90% to 75%


**[3]** 75% to 50%


**[4]** 50% or less


*From left to right, Swamp White Oaks (Quercus bicolor) decreasing in vigor.*

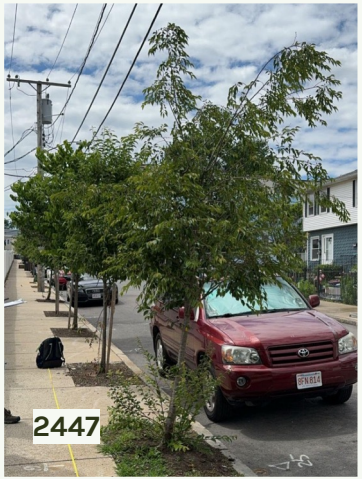
Roman, L. A., van Doorn, N. S., McPherson, E. G., Scharenbroch, B. C., Henning, J. G., Östberg, J. P., ... & Vogt, J. (2020). Urban tree monitoring: A field guide. *Gen. Tech. Rep. NRS-194. Madison, WI: US Department of Agriculture, Forest Service, Northern Research Station. 48 p., 194*, 1-48.

# Assessing Tree **Condition**– Structure and Health

Diseased Leaves

Bark damage


**Good:** Tree is healthy, no damage to bark or leaves




**Fair:** Some damage to bark or leaves that affects health


**Poor:** Damage to bark or leaves that significantly impacts health

Trunk damage

Basal Sprouts

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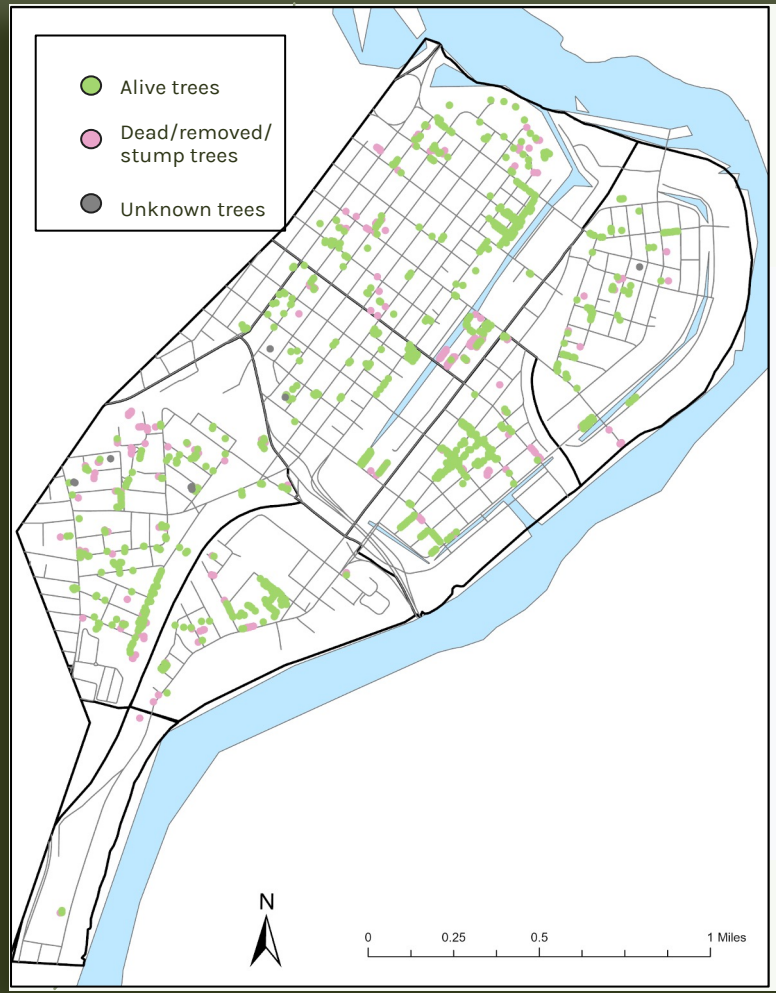
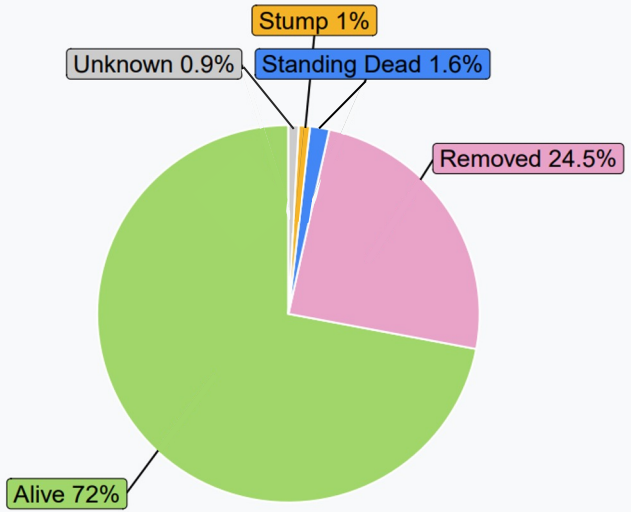
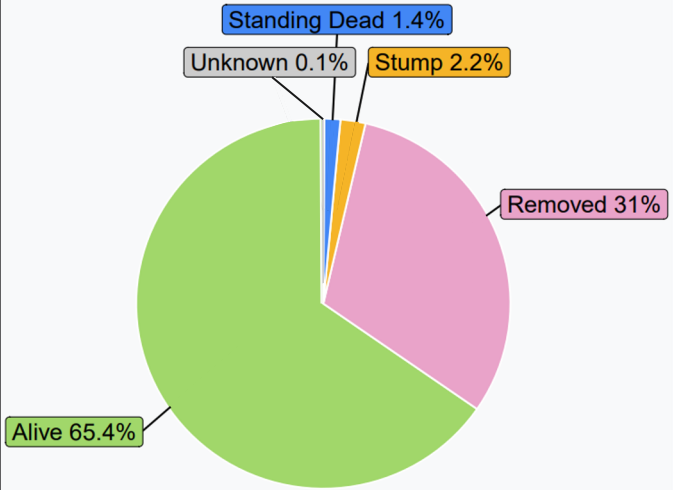



# Holyoke Overall Survivorship




| Years Planted | Survivorship |
|---|---|
| 2014-16 | 59.4% |
| 2017-19 | 69.1% |
| 2020-23 | 92.7% |

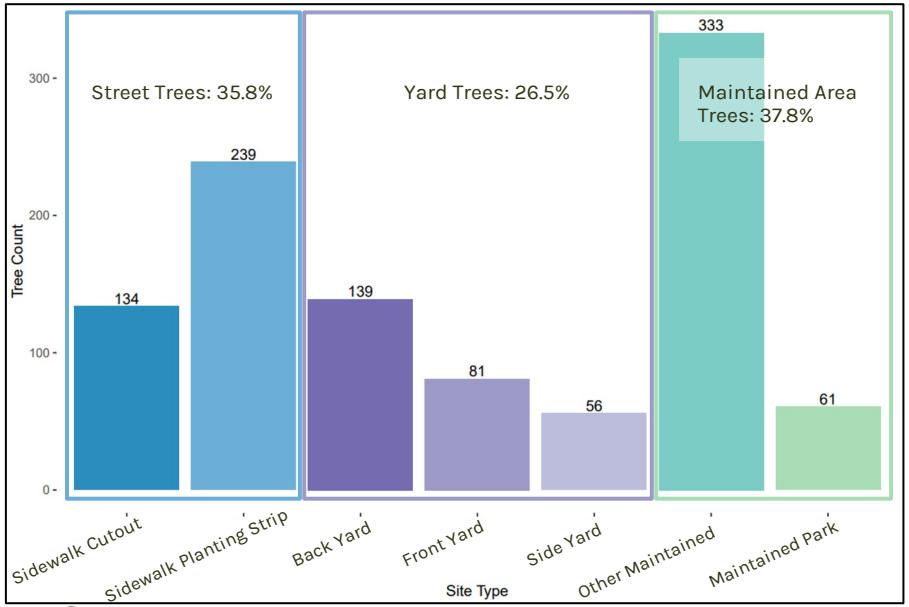

# Chelsea Overall Survivorship

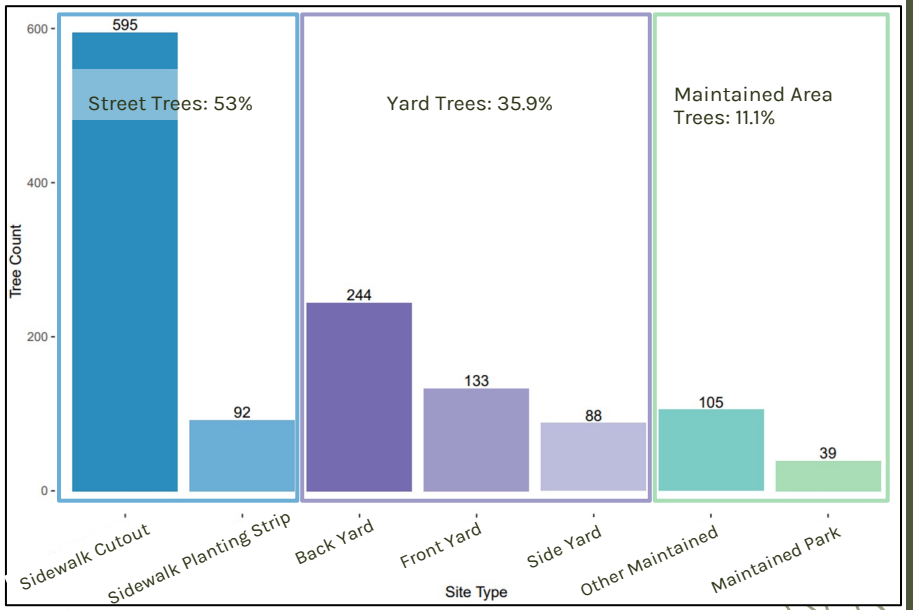



| Years Planted | Survivorship |
|---|---|
| 2014-16 | 56.8% |
| 2017-19 | 68.8% |
| 2020-23 | 81.7% |

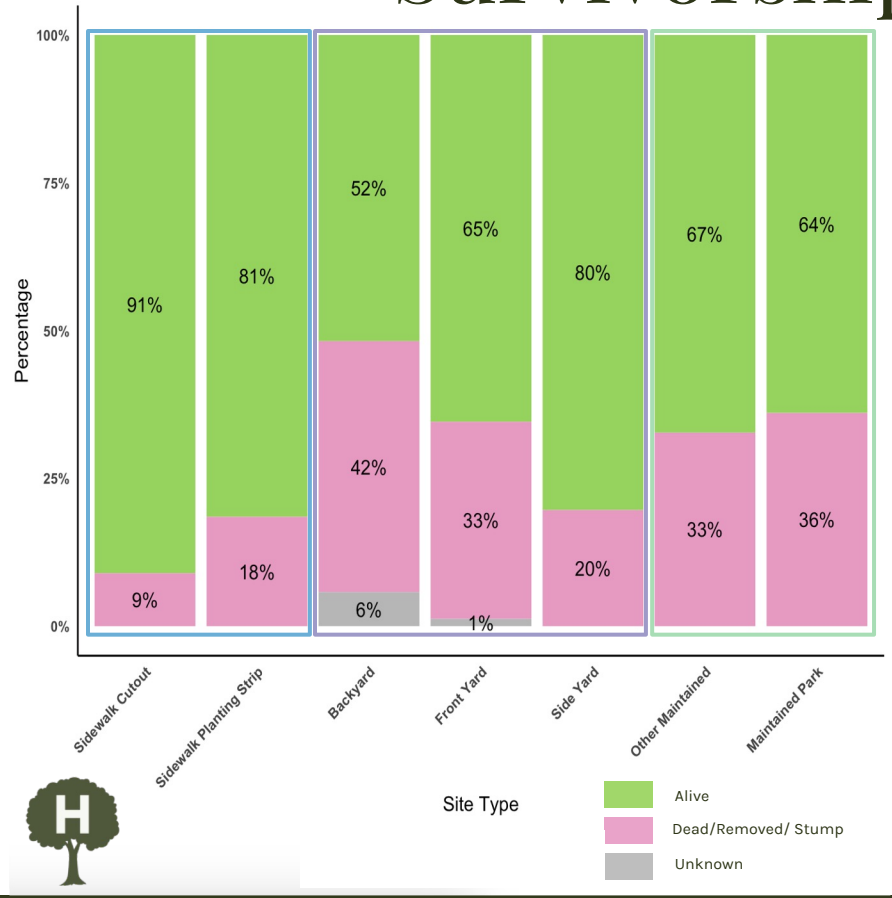
# Tree Count by Site Type

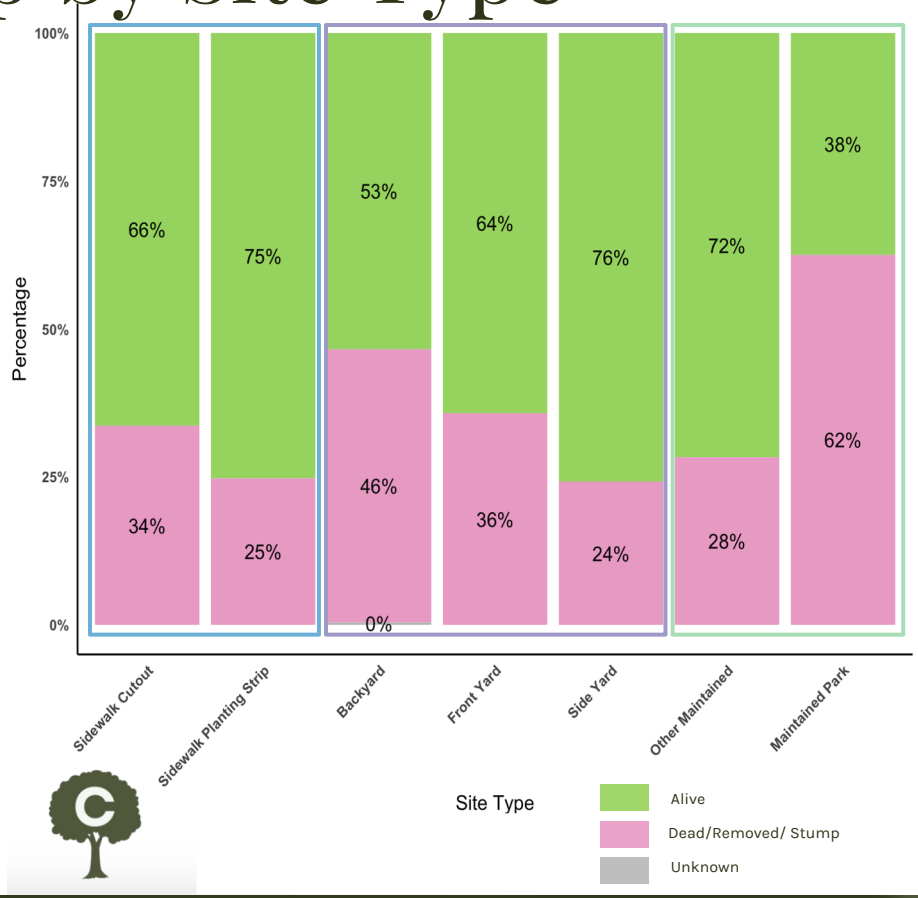
**"Other maintained"** areas includes lawns on industrial or commercial property, public housing, and religious institutions.



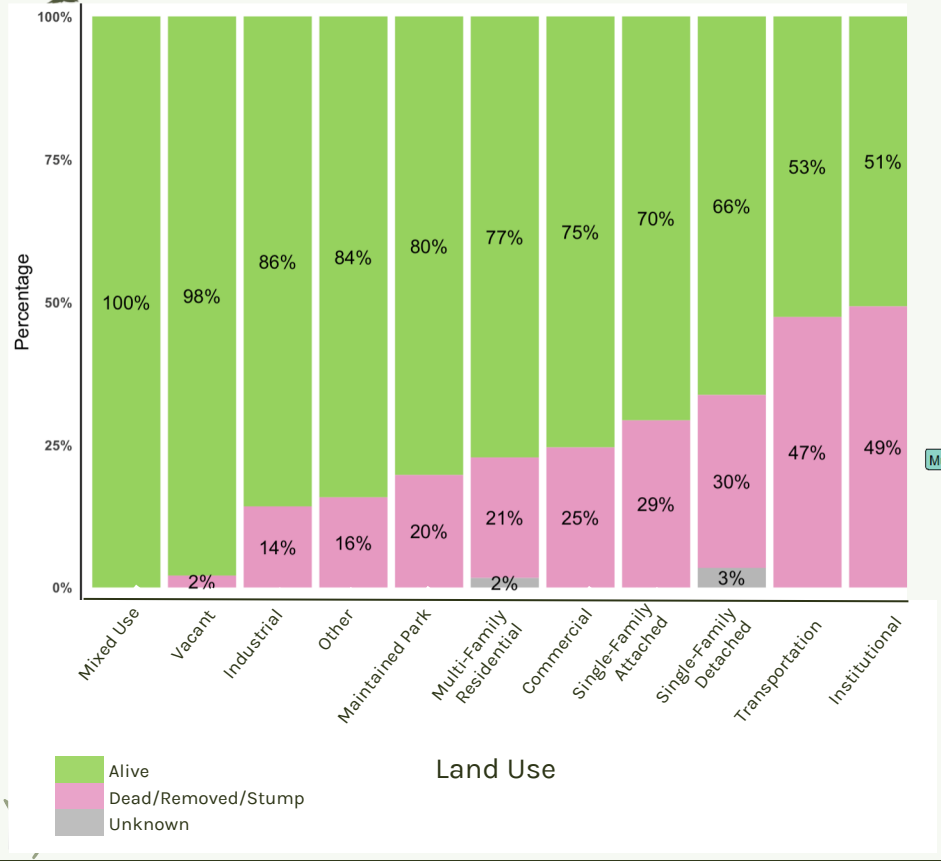



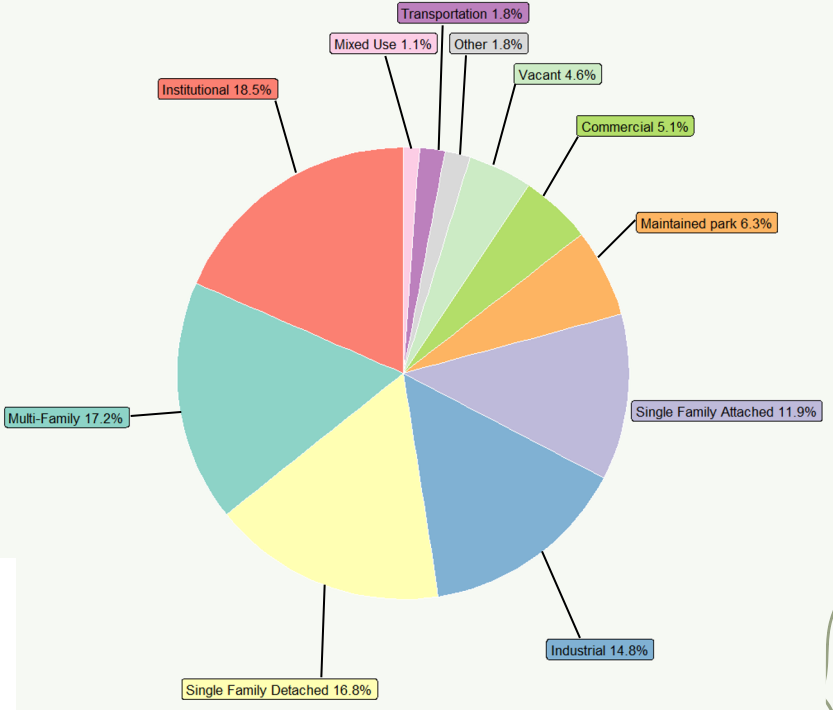
# Survivorship by Site Type



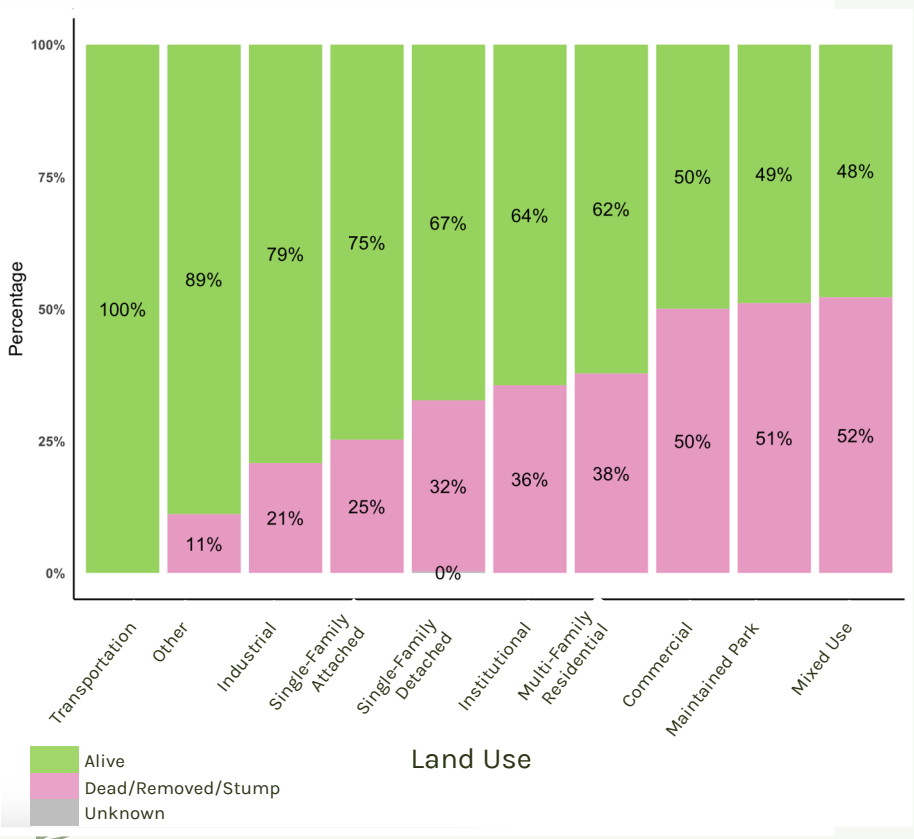
# Survivorship and Count by Land Use

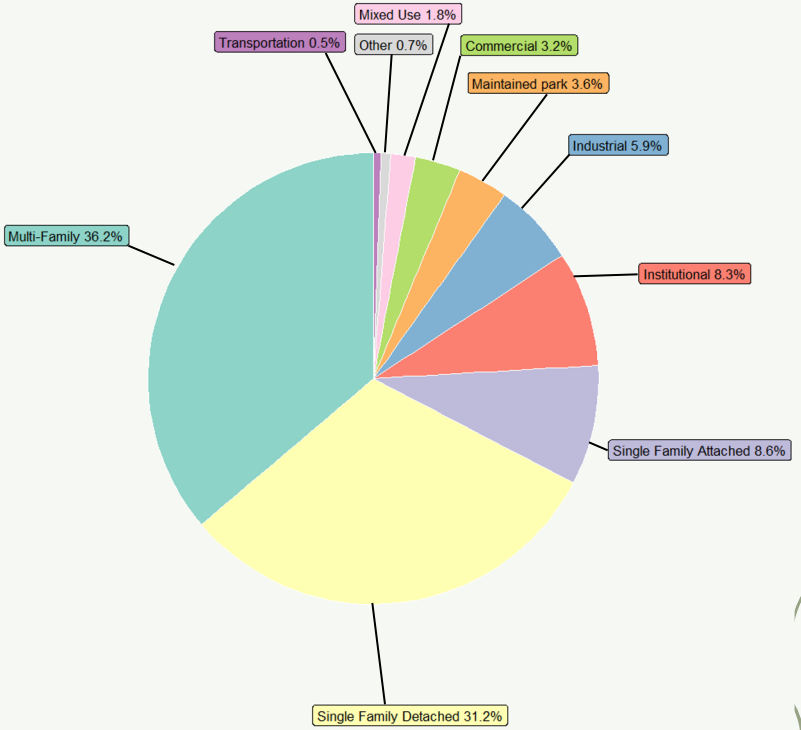



Percent of trees per land use

# Survivorship and Count by Land Use

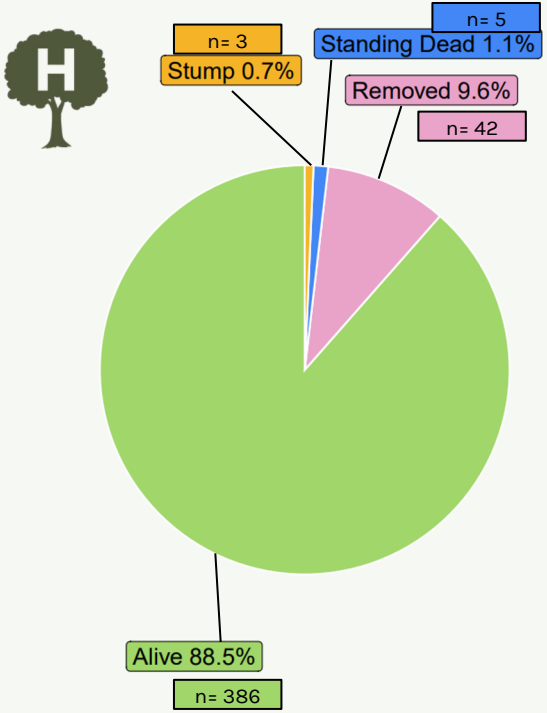


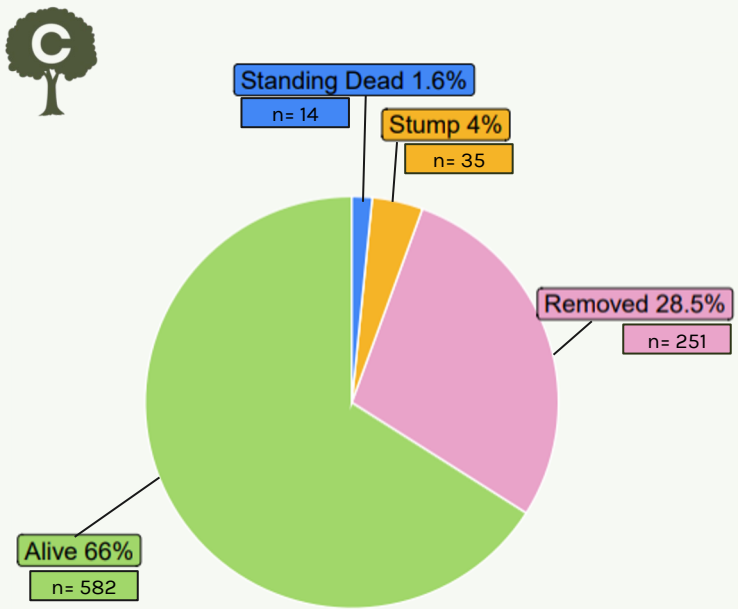

Percent of trees per land use

# Survivorship of Public Trees

436 Public Trees

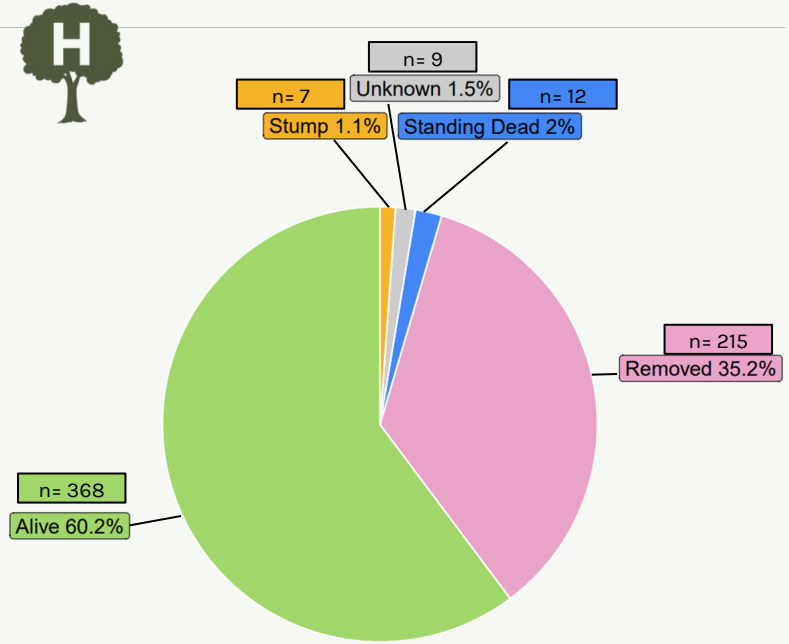



882 Public Trees

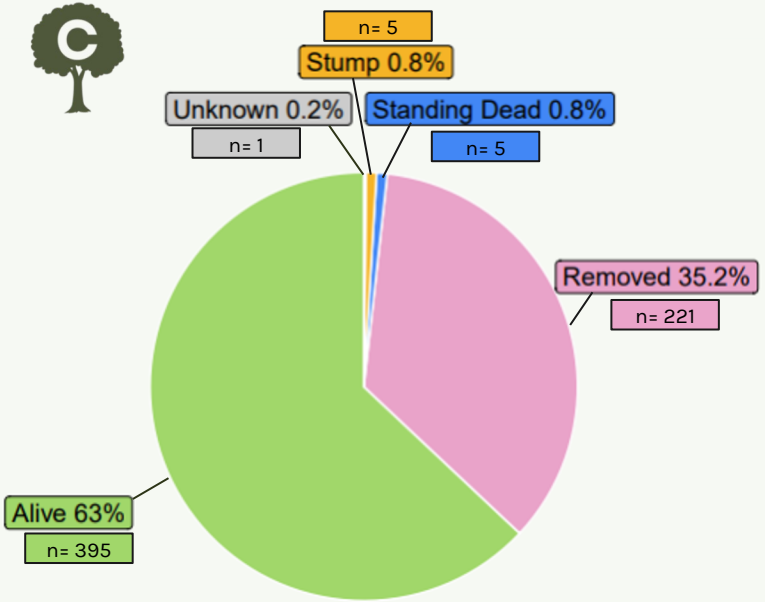


# Survivorship of Private Trees

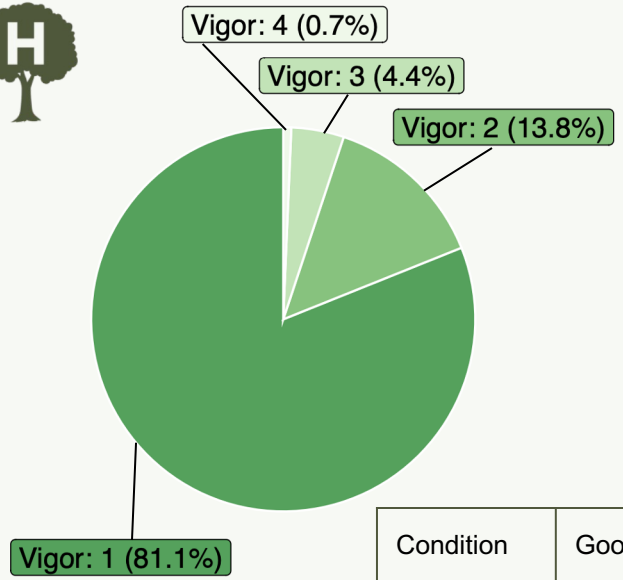
611 Private Trees

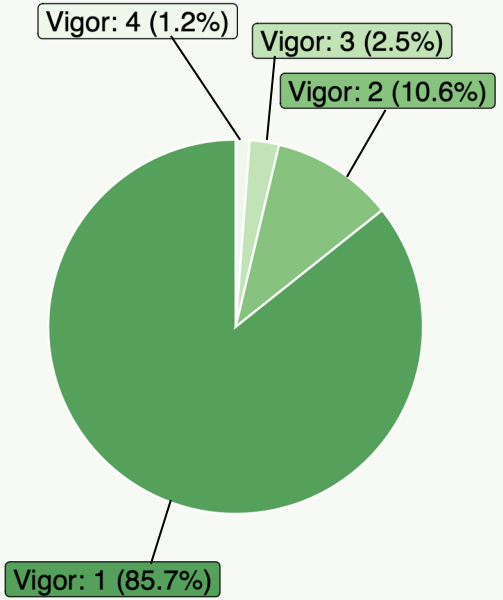



627 Private Trees



# Health of Living Trees



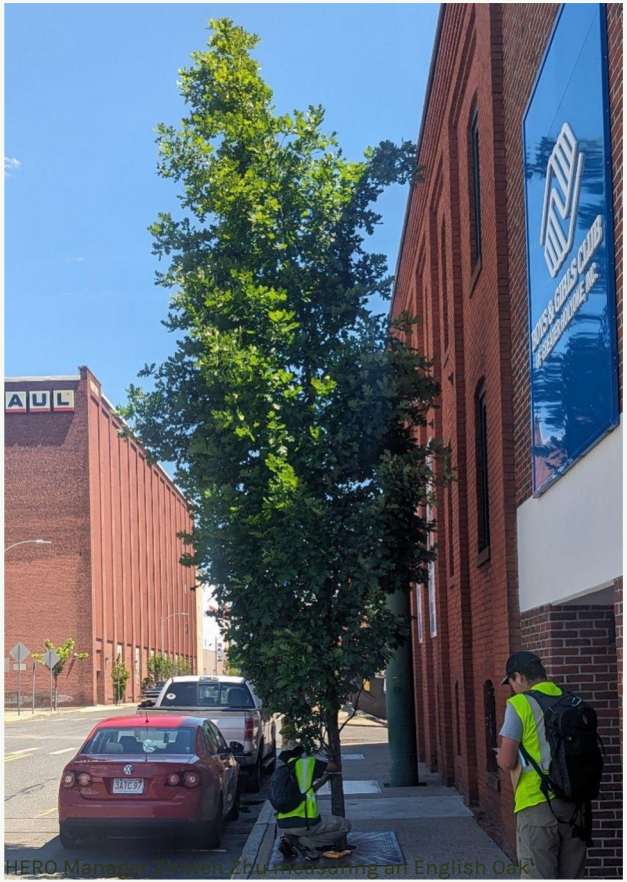




| Condition | Good | Fair | Poor |
|---|---|---|---|
| Holyoke | 83.1% | 15.2% | 1.8% |
| Chelsea | 81.8% | 15.6 | 2.6% |

# 2017 Resurvey


A Tulip Tree (*Liriodendron tulipifera*) in Mallory Park, Holyoke, in 2017

That same Tulip Tree in 2024




HERO Manager Zhiwen Zhu measuring an English Oak (*Quercus robur)* in front of the Holyoke Boys and Girls Club in 2017

Manager Tanner and Fellow Jack measuring the same English Oak in 2024

# Resurvey Statistics

Taking another look at the trees planted between 2014 and 2016.
Trees surveyed in 2017 and 2024

- **731 Trees surveyed:**
  - 341 Private
  - 417 Public
- **Survivorship:**
  - 426 alive
  - 305 dead, removed, or stump

**62 species*

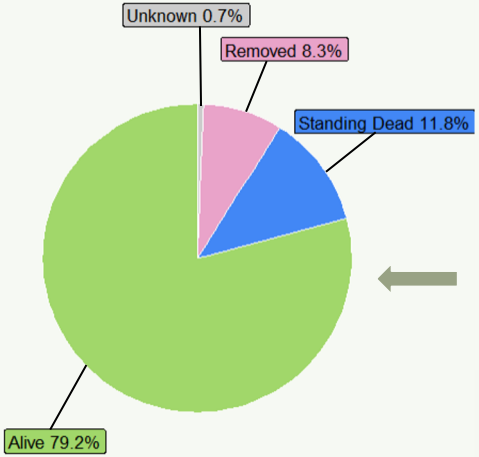

An American Sweetgum (*Liquidambar styraciflua*) in Holyoke being surveyed by former HERO manager Marc (left) and current fellow Kalon (right)

- **385 Trees surveyed:**
  - 60 Private
  - 325 Public
- **Survivorship:**
  - 224 alive
  - 161 dead, removed, or stump

**57 species*

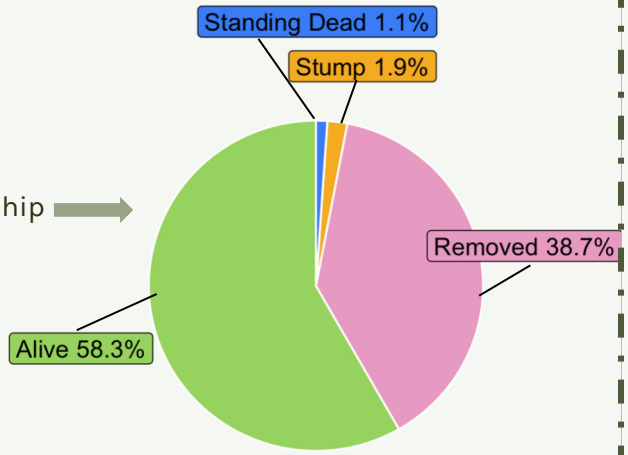
# Resurvey Sample Survivorship

## Surveyed in 2017 & 2024



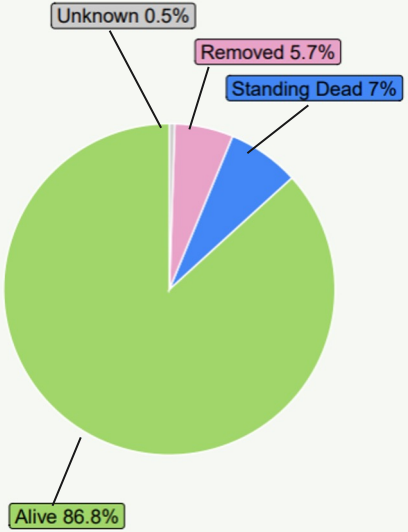

Survivorship in 2017

Current Survivorship

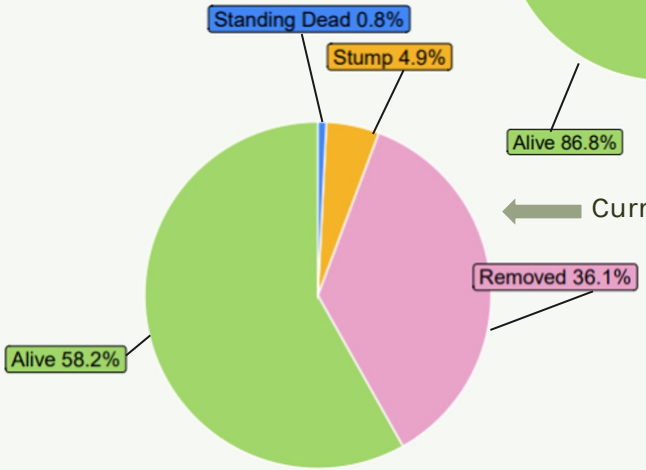



H

Survivorship in 2017



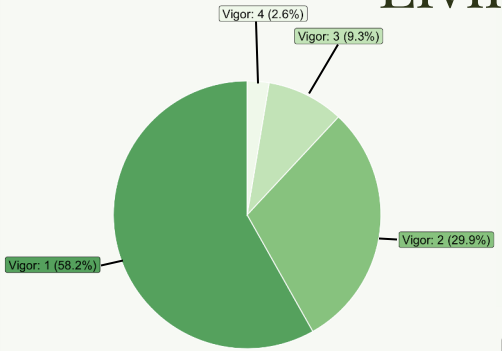

Current Survivorship



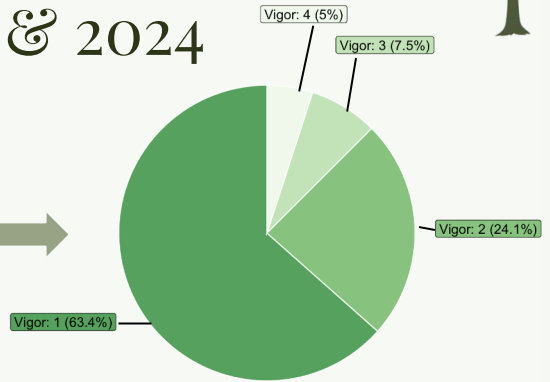

C

# Resurvey Sample Health

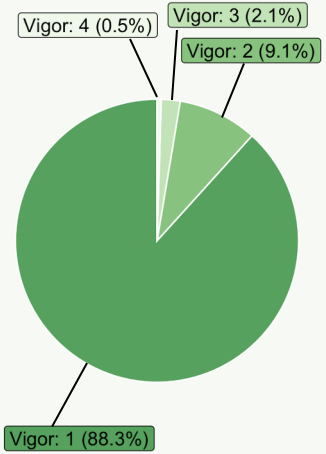
## Living Trees Surveyed in 2017 & 2024



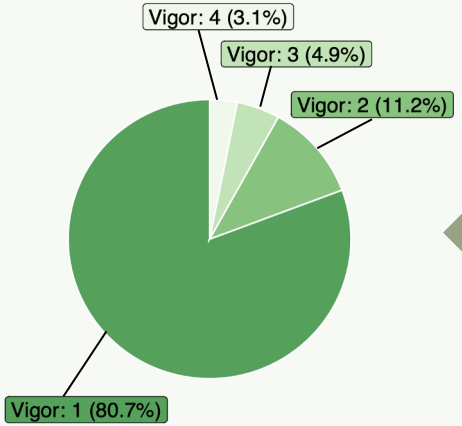

Vigor in 2017




Vigor in 2017




Vigor in 2024




Vigor in 2024

# Summary of Tree Assessment

## Overall

Holyoke has higher survivorship (72%) than Chelsea (65.4%)

Trees planted between 2020 and 2023 have 11% higher survivorship in Holyoke (92.7%) than Chelsea (81.7%)

Public Trees have higher survivorship than private in both cities

## Tree Health

Over 80% of alive trees have a condition of good and vigor of 1.

Re-surveyed trees in 2024 have higher vigor in Chelsea and Holyoke than in 2017

## Land Use and Site Type

**Site Type:**
Sidewalk planting strips, cutouts, and side yards have high survivorship in both cities

Backyard trees and maintained park trees have lower survivorship

**Land Use:**
Institutional is the largest land use type in Holyoke and has the lowest survivorship

Site Type has an impact on tree survivorship across both cities

HERO 2024 Research Objectives and Study Areas

Biophysical Field Methods and Data Collection

Tree Assessments and Statistics

Species and Growth Analysis

Interview Analysis and Takeaways

Conclusions

# Species and Genus Statistics and Distributions

| | Both Cities | Holyoke | Chelsea |
|---|---|---|---|
| **Trees Surveyed** | 2,343 | 1,055 | 1,296 |
| **Species Surveyed** | 108 | 75 | 83 |

**Tulip Tree**

**Overall Both Cities Survivorship**
Alive: 41.1% [37]
Dead: 58.9% [53]

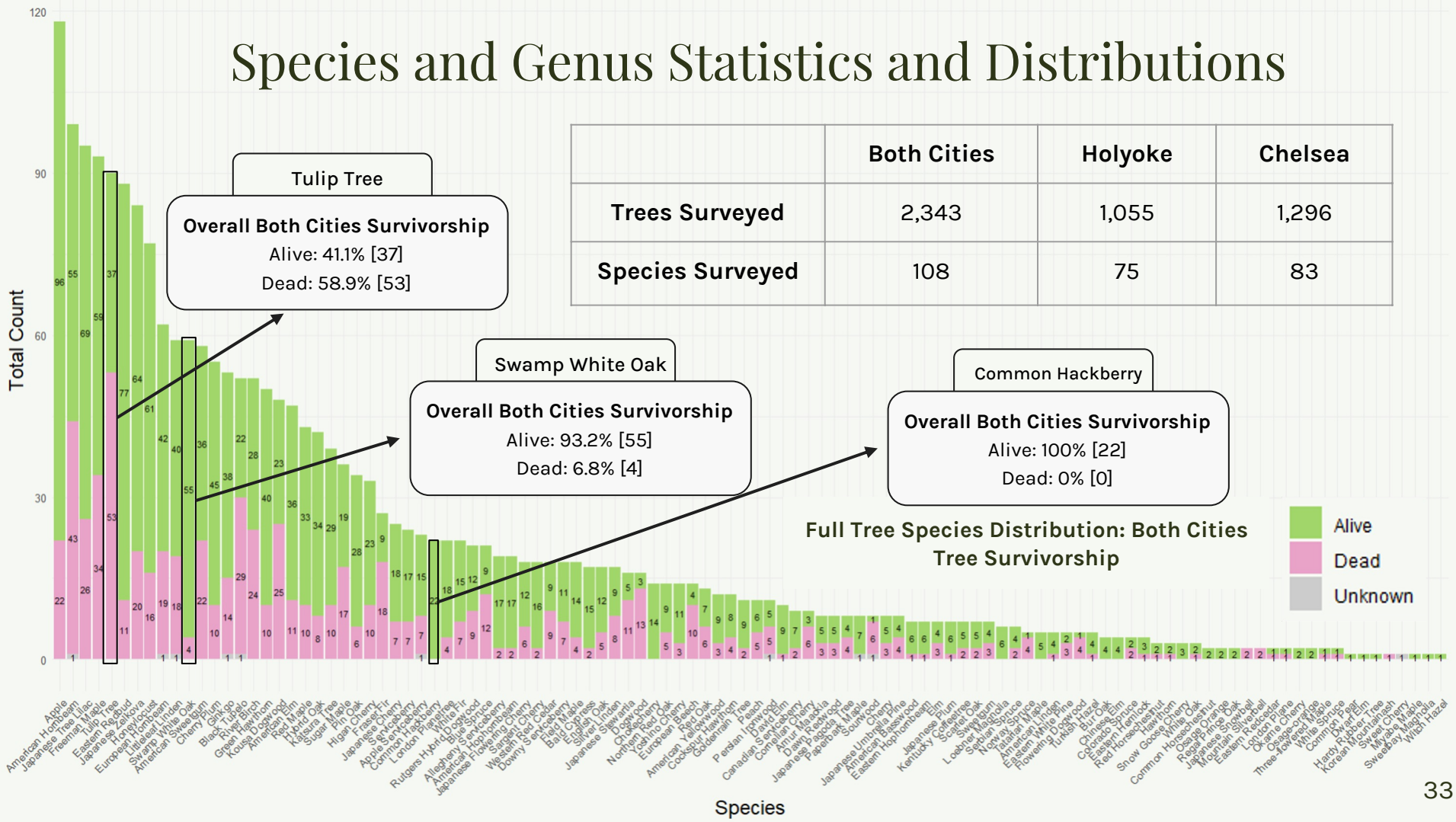
**Swamp White Oak**

**Overall Both Cities Survivorship**
Alive: 93.2% [55]
Dead: 6.8% [4]

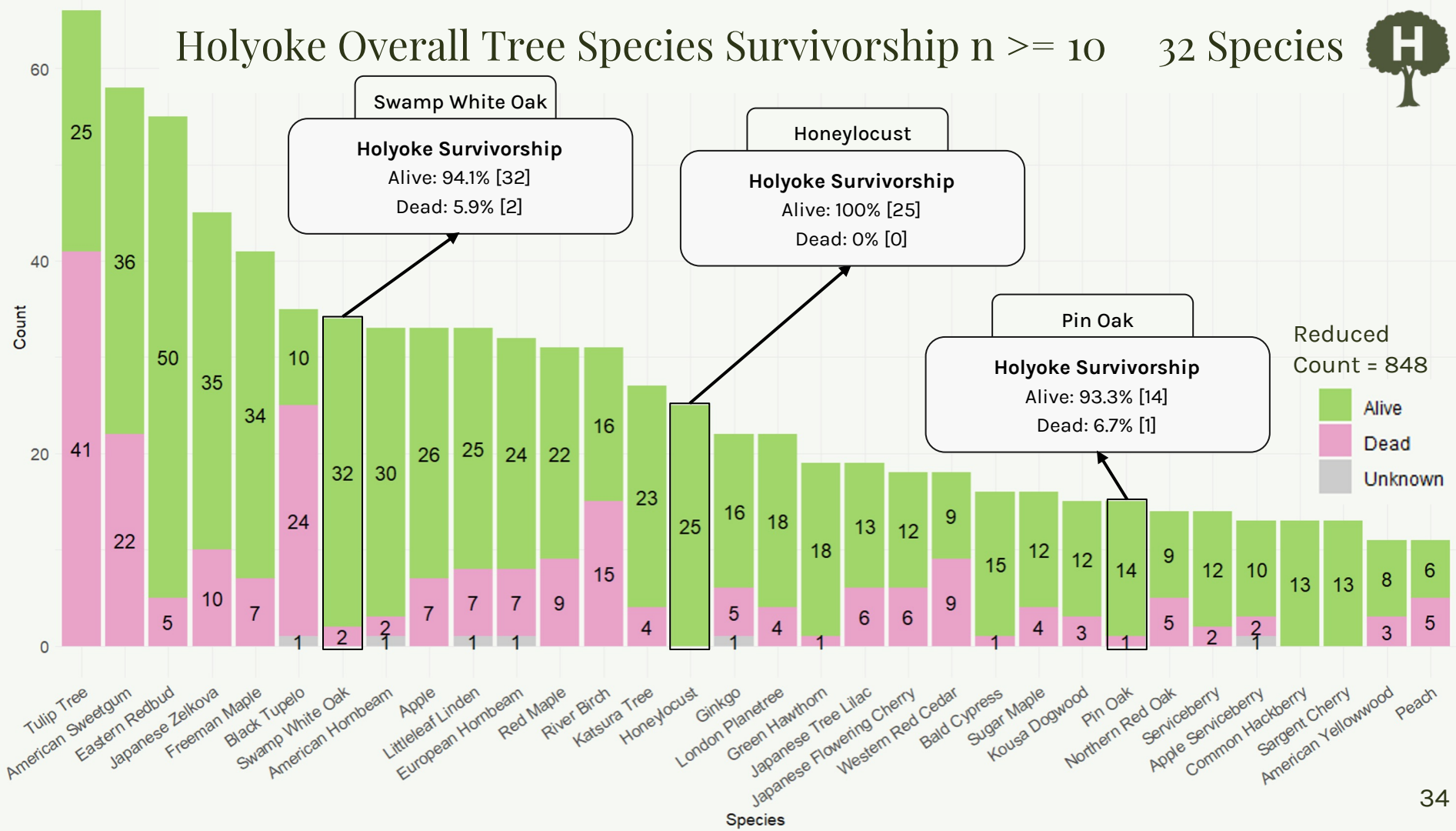
**Common Hackberry**

**Overall Both Cities Survivorship**
Alive: 100% [22]
Dead: 0% [0]

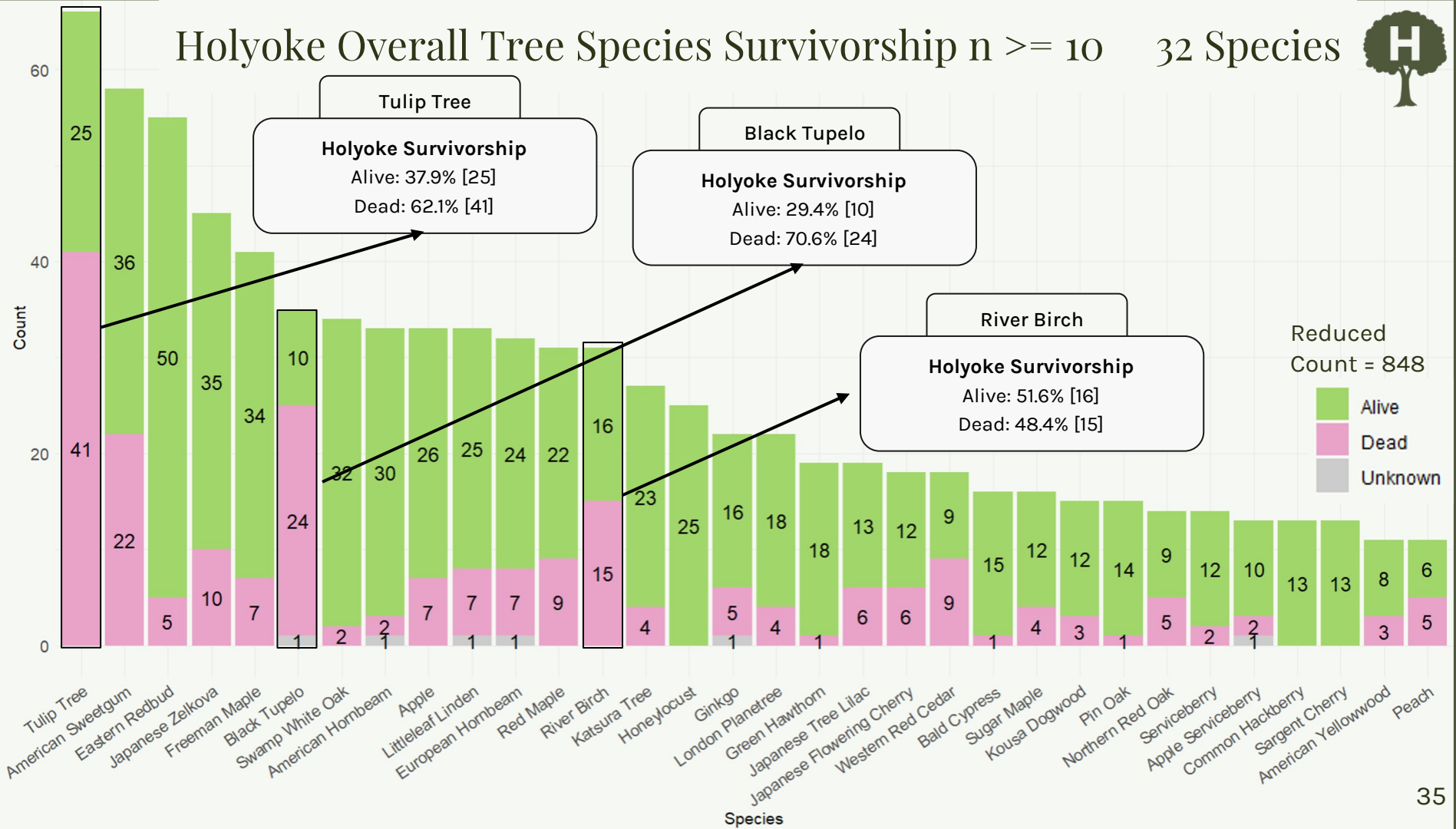
**Full Tree Species Distribution: Both Cities Tree Survivorship**



# Holyoke Overall Tree Species Survivorship n >= 10 32 Species



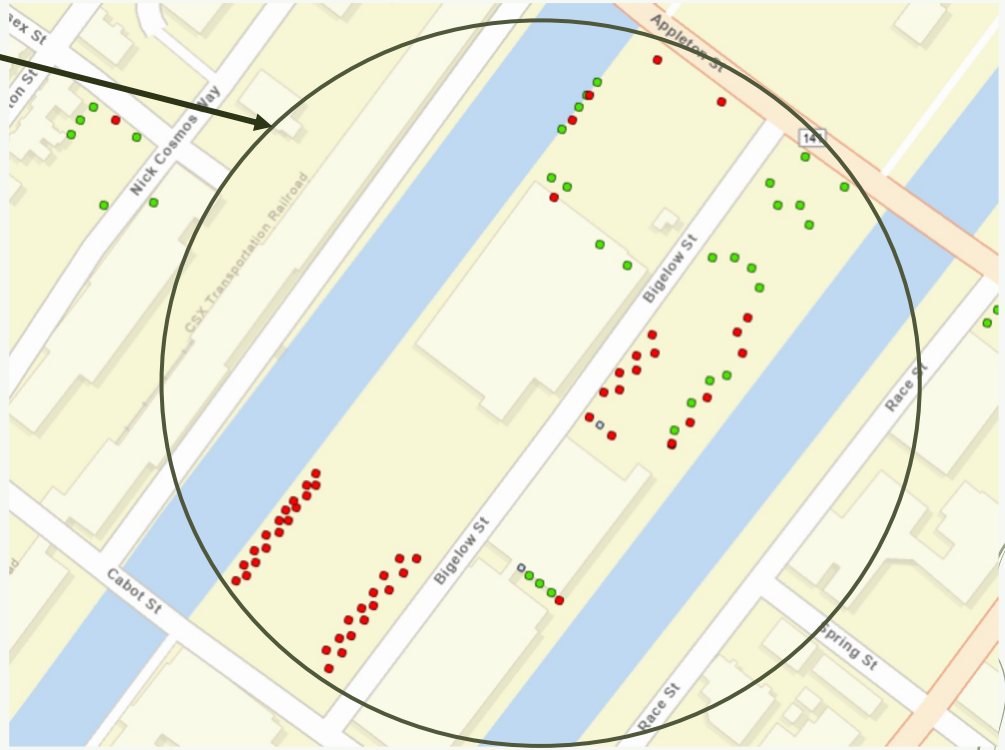
# Holyoke Overall Tree Species Survivorship n >= 10 32 Species



# Survivorship statistics are heavily influenced by individual sites with lots of trees

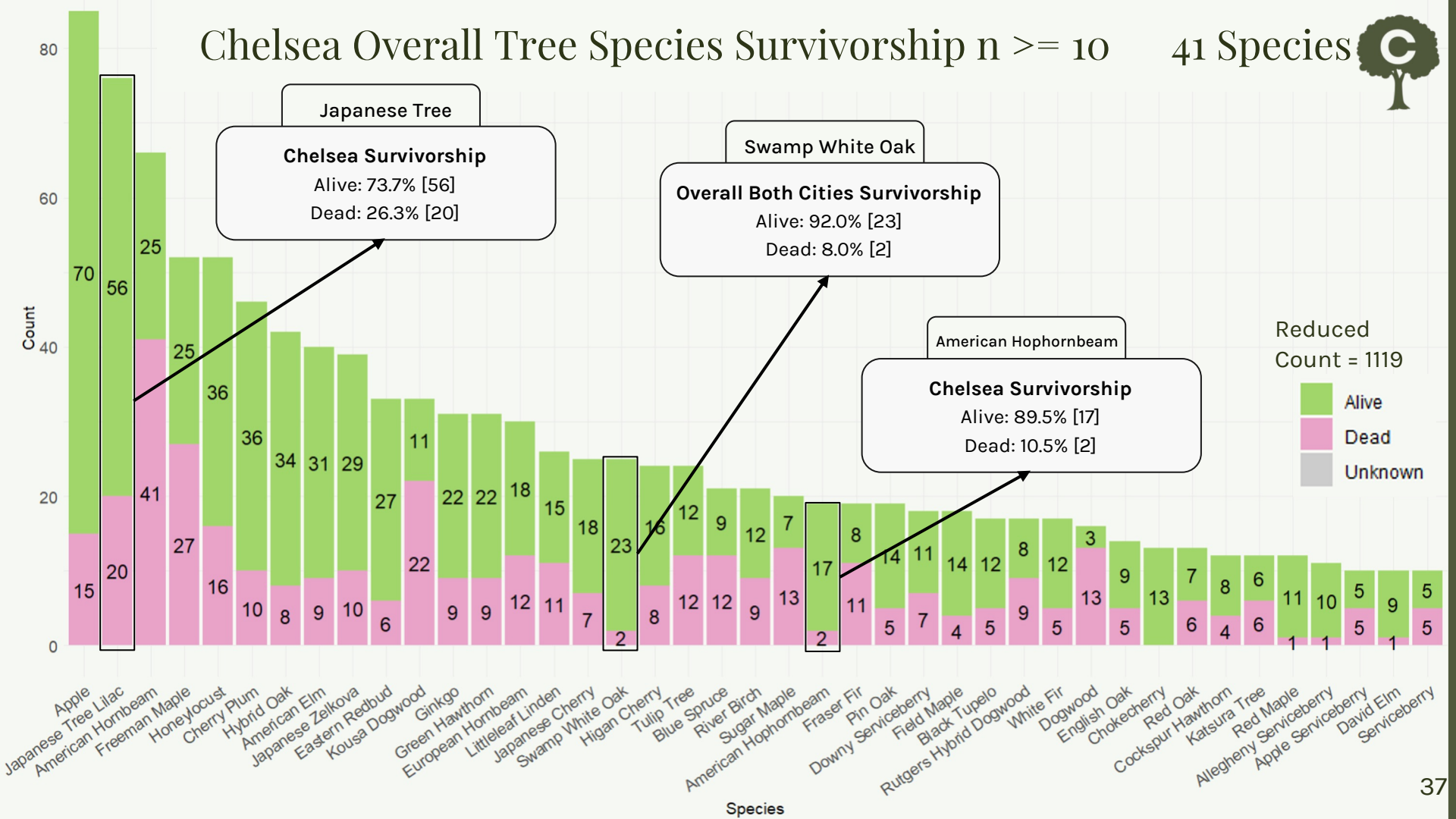
- Example: 100 Bigelow Street, Holyoke: **60 / 87 trees removed as of 2024.**
- If you remove this single property from statistical analysis:

| Species | Percent Change in Overall Survivorship without 100 Bigelow |
|---|---|
| American Sweetgum | **+ 10.02** |
| Black Tupelo | **+ 33.09** |
| Tulip Tree | **+ 10.12** |
| River Birch | **+ 24.86** |



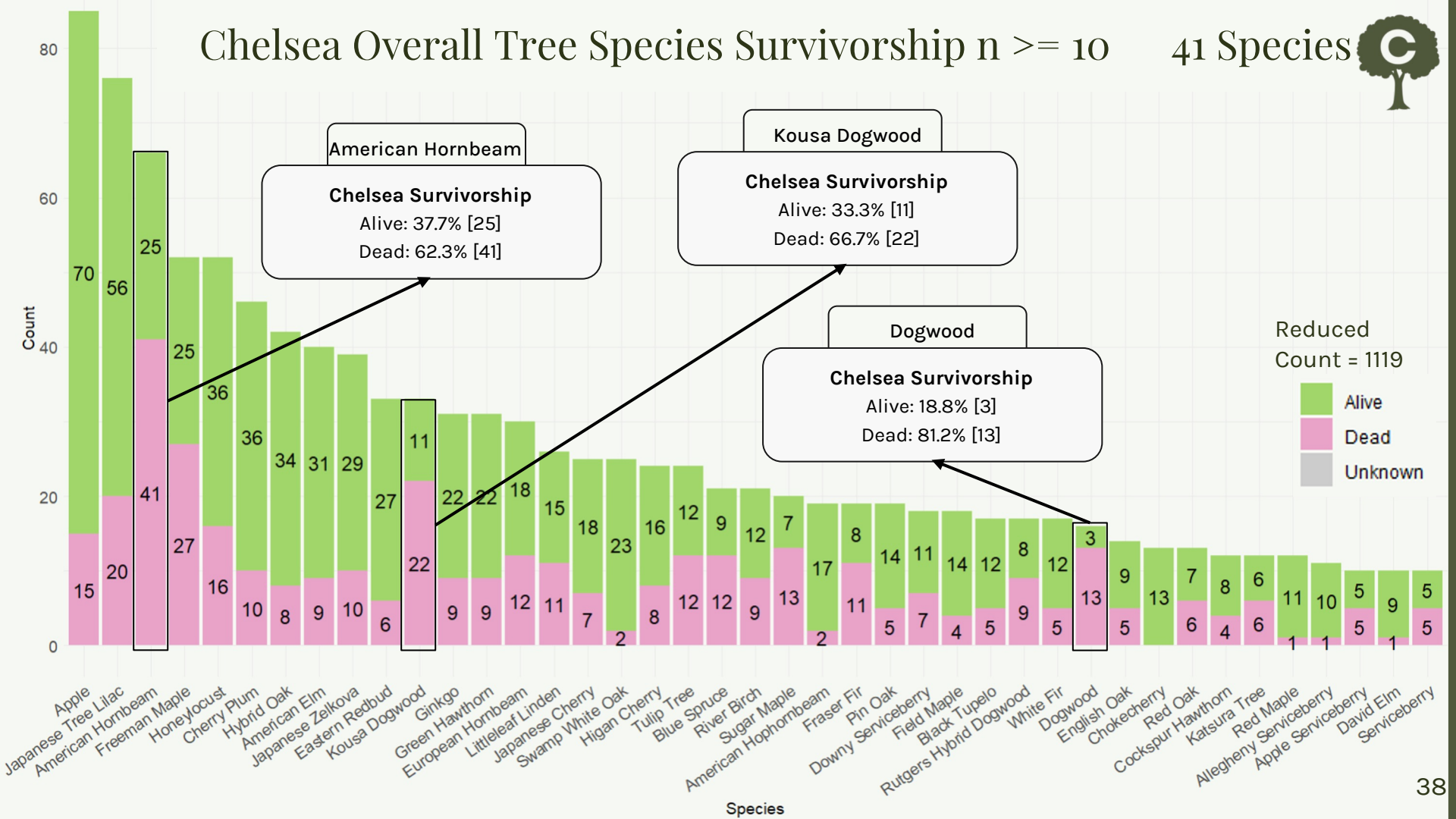
# Chelsea Overall Tree Species Survivorship n >= 10

41 Species

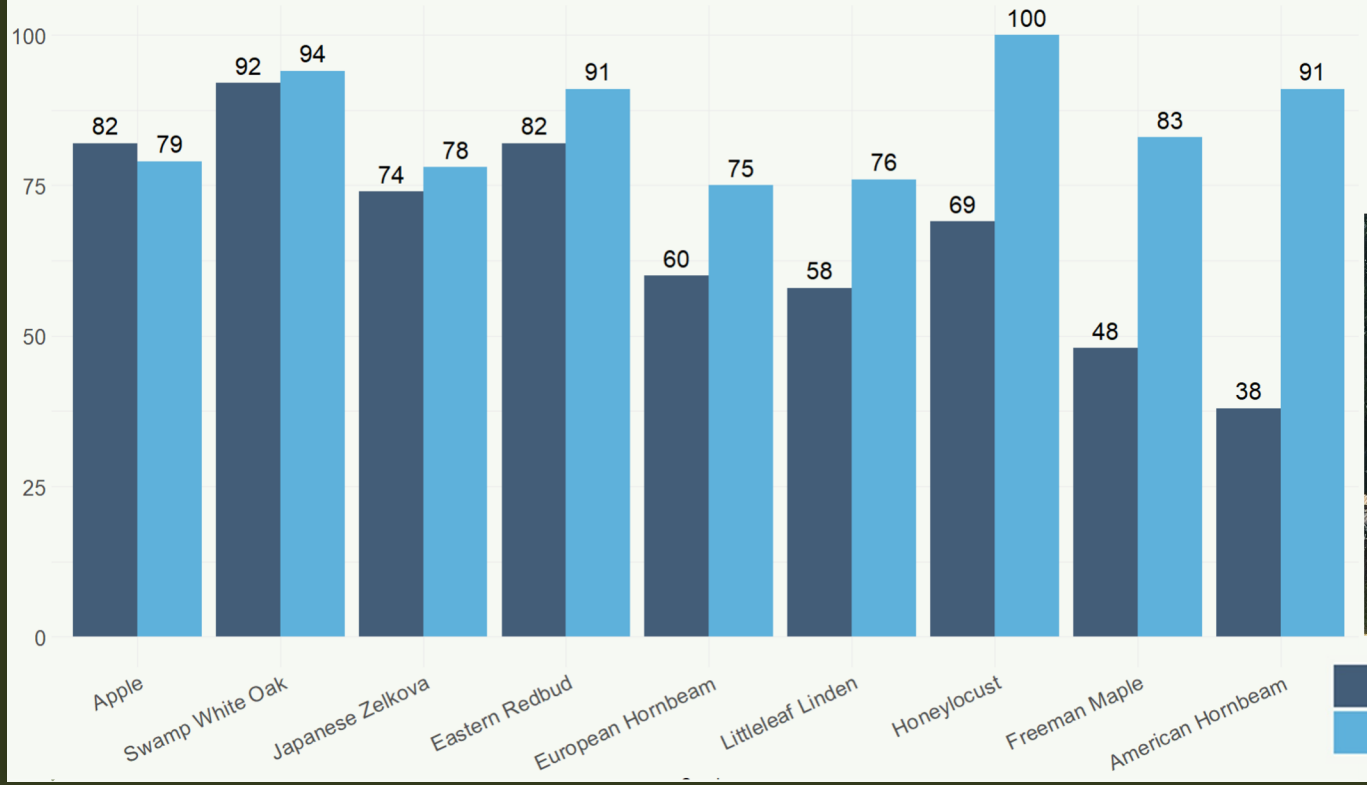


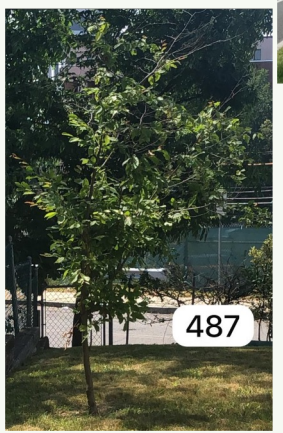
# Chelsea Overall Tree Species Survivorship n >= 10

41 Species



# Percent Survivorship Comparison Between Chelsea and Holyoke



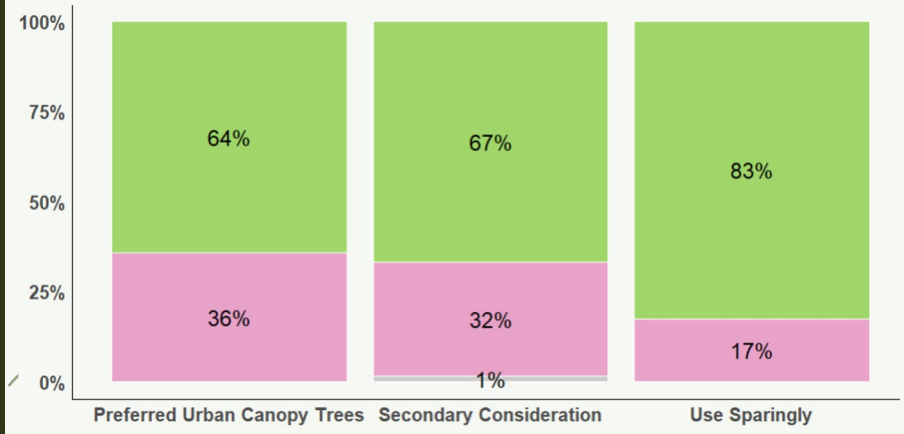

*American Hornbeams: Above Holyoke, Left Chelsea*

# DCR/GGCP Tree Categories (March 2024) Survivorship Distribution

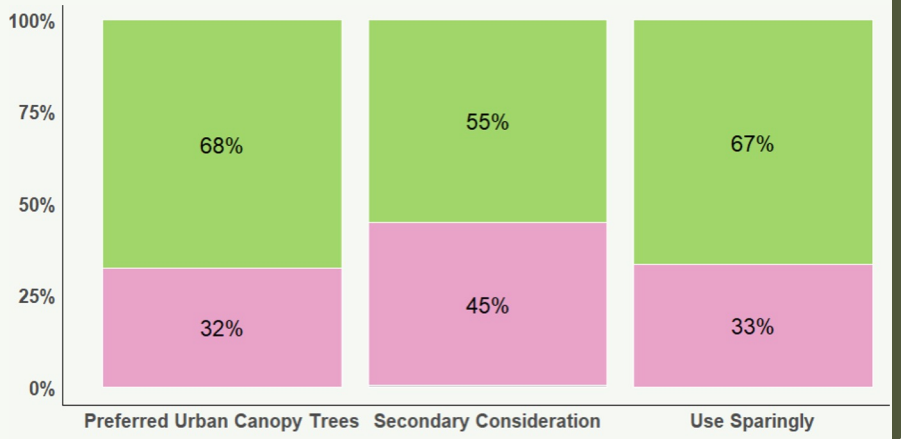
| | Preferred | Secondary | Sparingly |
|---|---|---|---|
| Examples | Honeylocust, Black Tupelo, Oaks (non Fastigiate), American Elm, Tulip Tree | Red Maple, Freeman Maple, Evergreens, Fastigiata | Dogwood, Apple, Japanese Tree Lilac |

Honeylocust (*Gleditsia triacanthos*) in a Sidewalk Cutout

## Holyoke n=699

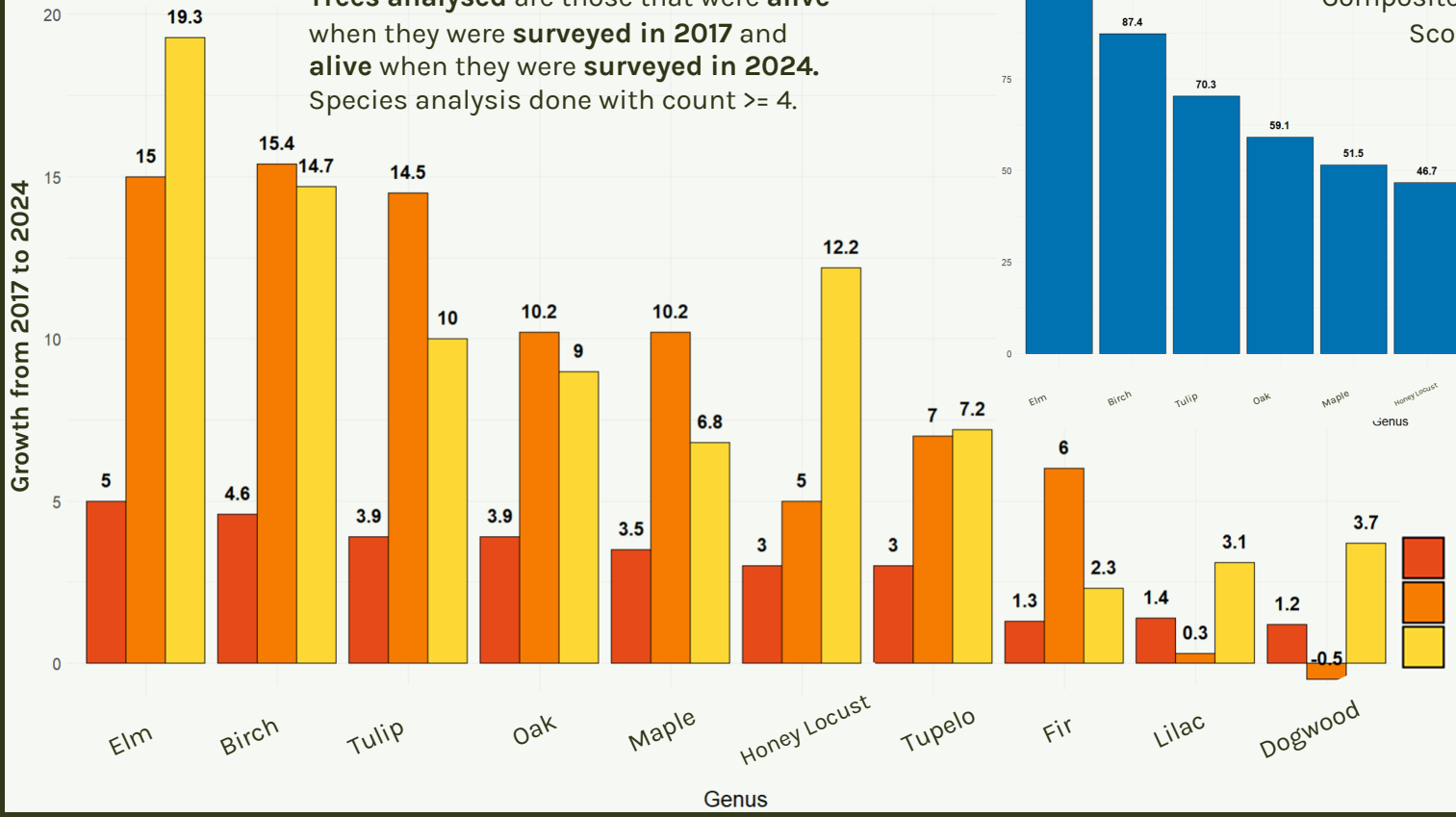



## Chelsea n=856



# Tree Growth Measures: Change by Genus

**Trees analysed** are those that were **alive** when they were **surveyed in 2017** and **alive** when they were **surveyed in 2024.** Species analysis done with count >= 4.







Reduced Count = 588

# Notable Tree Genus Composite Growth Index

| | Species | Success Index | Resurvey Survivorship | Growth Index | Count |
|---|---|---|---|---|---|
| Top 4 | Elm | 83.5 | 60% | 99.2 | 12 |
| | Birch | 69.3 | 42% | 87.4 | 7 |
| | Oak | 61.5 | 65% | 59.1 | 84 |
| | Honey Locust | 61.3 | 83% | 46.7 | 54 |
| | Tulip | 59.1 | 43% | 70.3 | 22 |
| | Maple | 58.9 | 70% | 51.1 | 84 |
| | Sweetgum | 56.0 | 63% | 51.7 | 30 |
| | Apple | 41.4 | 68% | 23.7 | 48 |
| Bottom 4 | Lilac | 31.8 | 71% | 5.5 | 24 |
| | Tupelo | 31.6 | 17% | 41.5 | 5 |
| | Fir | 25.3 | 41% | 14.8 | 5 |
| | Dogwood | 11.8 | 25% | 2.8 | 16 |

Table includes 4 Highest and Lowest Composite Growth Index values, and 4 other notable trees

**Growth Index** combines tree growth statistics with survivorship. Growth Statistics include: **Average DBH Change**, **Average Tree Canopy Width Change, Average Height Change** (for each species).

**All Statistics are normalized** on a scale from 0-1 (0-100 for visualization purposes)

**Success Index** is ((dbh + width + height + 2(survivorship))/5)

This **combined metric** analyses **two parts of tree stewardship**: **natural aspects** like expected growth of a tree, and **social aspects** like stewardship and site types which affect survivorship.

# High Performing Tree Species and Genera

**Elm (*Ulmus*)**: Highest (Genus) Growth Index and High Overall Survivorship.

**American Elm (*Ulmus americana*)**

**Oak (*Quercus)***: High Growth Index, Very High Survivorship in Holyoke, Good Survivorship in Chelsea

**Swamp White Oak (*Quercus bicolor*)**: High Growth Index and Highest Overall Survivorship (n >= 25)


**Pin Oak (*Quercus palustris*)**: High Growth Index, Very High Survivorship in Holyoke, High Survivorship in Chelsea

**Hop-hornbeam (*Ostrya*)**

**American Hophornbeam (*Ostrya virginiana*)**: High Survivorship, yet low survey count.

**Birch (*Betula*)**

**River Birch (*Betula nigra*)**: Very High Growth Index, High Survivorship in Holyoke, and Average Survivorship in Chelsea

HERO 2024 Research Objectives and Study Areas

Biophysical Field Methods and Data Collection

Tree Assessments and Statistics

Species and Growth Analysis

Interview Analysis and Takeaways

Conclusions

# Stakeholder Interview Analysis

**Who are the stakeholders?**

- Residents, NGOs, city officials, DCR employees
  - **City partners** includes NGOs and city officials

*Espi and Aidan conducting an interview with a resident in Holyoke*

**For Residents**

1. How do residents perceive the role of trees & DCR's tree planting initiative on their property and in their neighborhood?
2. How do residents' past experiences and beliefs impact tree stewardship?

**For Community Partners/DCR employees**

1. How do city partners and the DCR collaborate — with each other and with residents — to maximize outreach and education surrounding the GGCP and other tree planting initiatives?
2. How have community partners' partnerships and philosophies surrounding inclusion evolved to create a lasting impact and educate residents about tree stewardship?

# Interview Summary

**Residents, City Partners and DCR Employees Contacted**

- Recruited interview subjects through **phone calls** and **convenience sampling**
  - Phone numbers provided by the DCR via a call list based on residents whose property received a GGCP tree, a total of **498** phone calls were made.
  - Spanish interview translation for Spanish-speaking residents
- **27** interviews conducted in Holyoke
  - **22 residents**
  - **5 community partners**
- **24** interviews conducted in Chelsea
  - **19 residents**
  - **5 community partners**
- **3** interviews conducted in Spanish and translated to English
- Total number of interviews conducted: **51**
  - **41 residents**
  - **10 community partners**

**Planted Trees Associated with Interviews**

- **124 trees**
- **30%** of trees associated with interviews planted by GGCP but not part of our sample
- **84%** average survivorship for interviewee's trees

*Adlai, Jack and Espi (not pictured) conducting a phone interview with a resident in Holyoke*

# Community Organizations and City Department Partners

**Holyoke**

- City of Holyoke Conservation and Sustainability Department (Current, **Interviewed**)
- OneHolyoke (Current, **Interviewed**)
- Nuestras Raíces (Former, **Interviewed**)
- Valley Opportunity Council (Former)

**Chelsea**

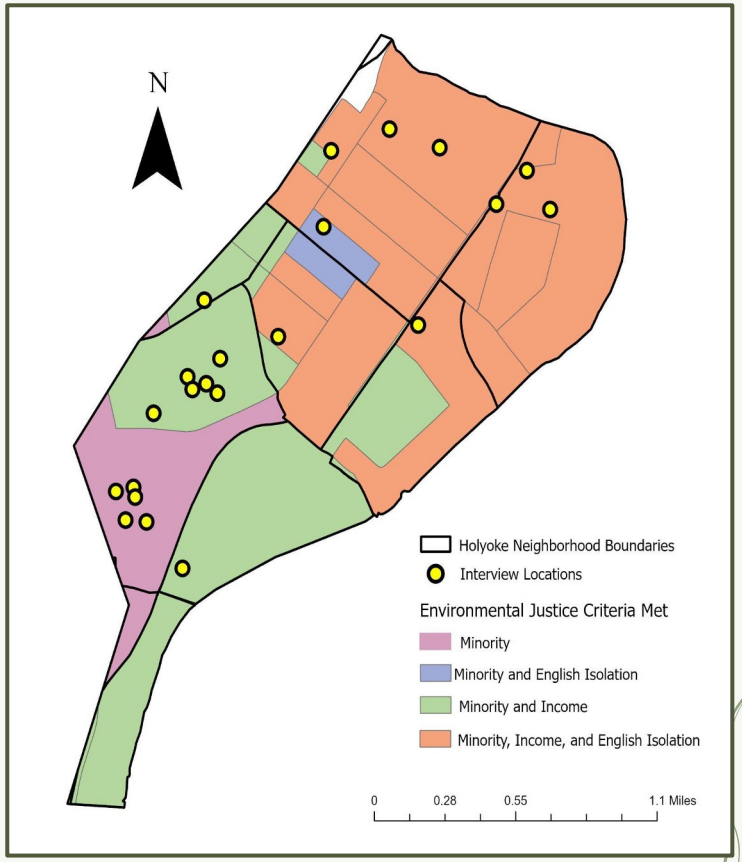
- City of Chelsea Department of Public Works (Current, **Interviewed**)
- GreenRoots (Former)
- La Colaborativa (Former)
- Mystic River Watershed Association (Prospective Partner)

# Holyoke Interview Location and Demographics

| Demographics | Holyoke | Interviewees |
|---|---|---|
| Population | 37,628 | 22 |
| Median Age | 37.5 | 55-64 |
| Bachelor's Degree | 22.20% | 47.62% |
| % Renters | 58.50% | 4.76% |
| Percent Hispanic | 51.70% | 23.53% |
| Percent White | 67.50% | 70.59% |
| Median Household Income | $49,007 | $75,000-$99,999 |
| English Only Household | 57.30% | 60% |

*= field not representative of city demographics*

- Male to female ratio (interviewees): **52% female**
- Average years lived in home (interviewees): **25 years**
- Interviewee demographics probably representative of DCR contact list

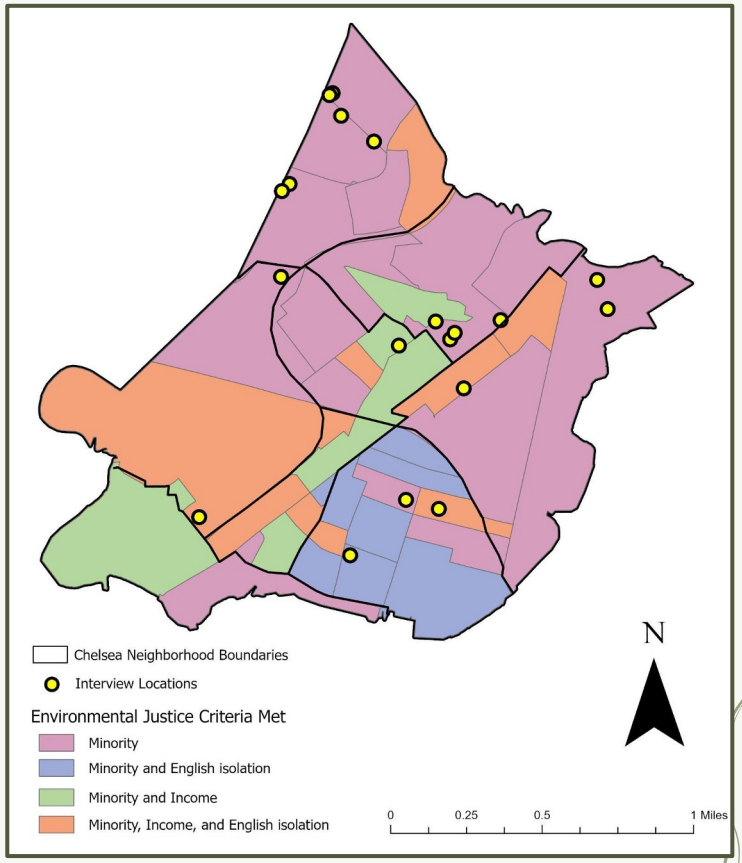


# Chelsea Interview Location and Demographics

| Demographics | Chelsea | Interviewees |
|---|---|---|
| Population | 40,787 | 18 |
| Median Age | 34.5 | 65+ |
| Bachelor's Degree | 21.60% | 55.56% |
| % Renters | 72.10% | 5.56% |
| Percent Hispanic | 67.40% | 22.22% |
| Percent White | 33.90% | 72.22% |
| Median Household Income | $71,051 | $100,000-$149,999 |
| English Only Household | 29.00% | 61.11% |

*= field not representative of city demographics*

- Male to female ratio (interviewees): **61% female**
- Average years lived in home (interviewees): **23.25 years**
- Interviewee demographics probably representative of DCR contact list

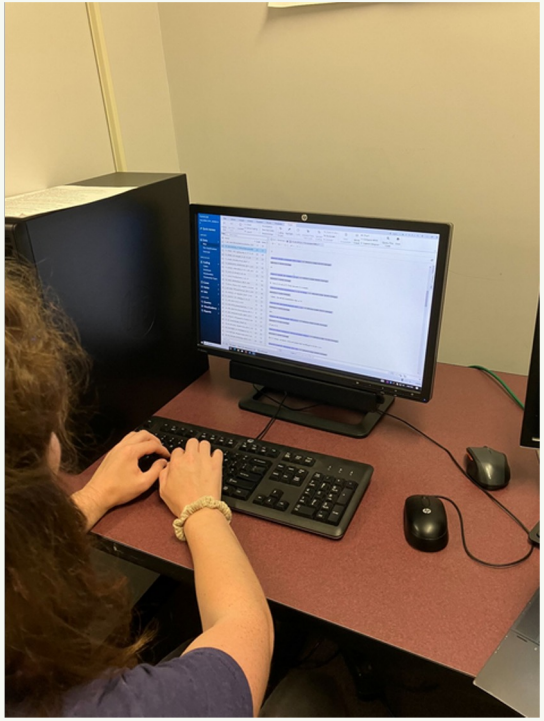


# Processing Interviews

1. **Transcribe** interviews manually and using automatic transcription software
    a. Translated Spanish interviews to English

1. Process interview transcripts using the **Nvivo qualitative analysis software**
    a. **Assign attributes** to interviews to understand how demographics impact our sample
    b. Sort quotes into appropriate **codes**
    c. Code each interview by two HERO team members to ensure **intercoder reliability**

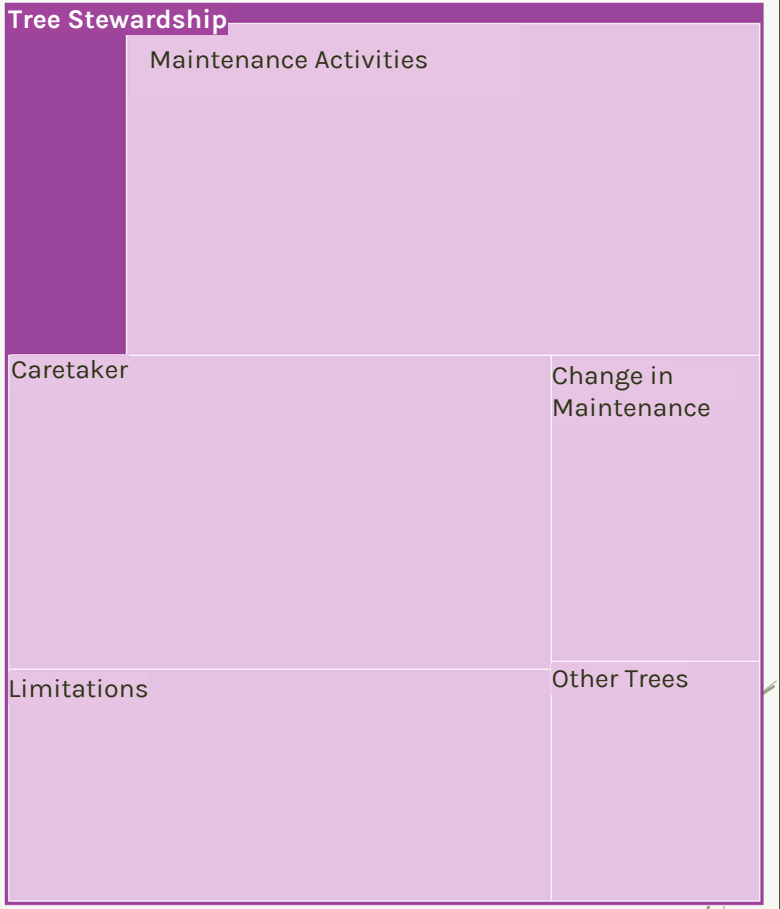
1. Assess emerging themes based on fully coded interview dataset, to understand residents' opinions, perceptions, and experiences with trees and the DCR's planting program



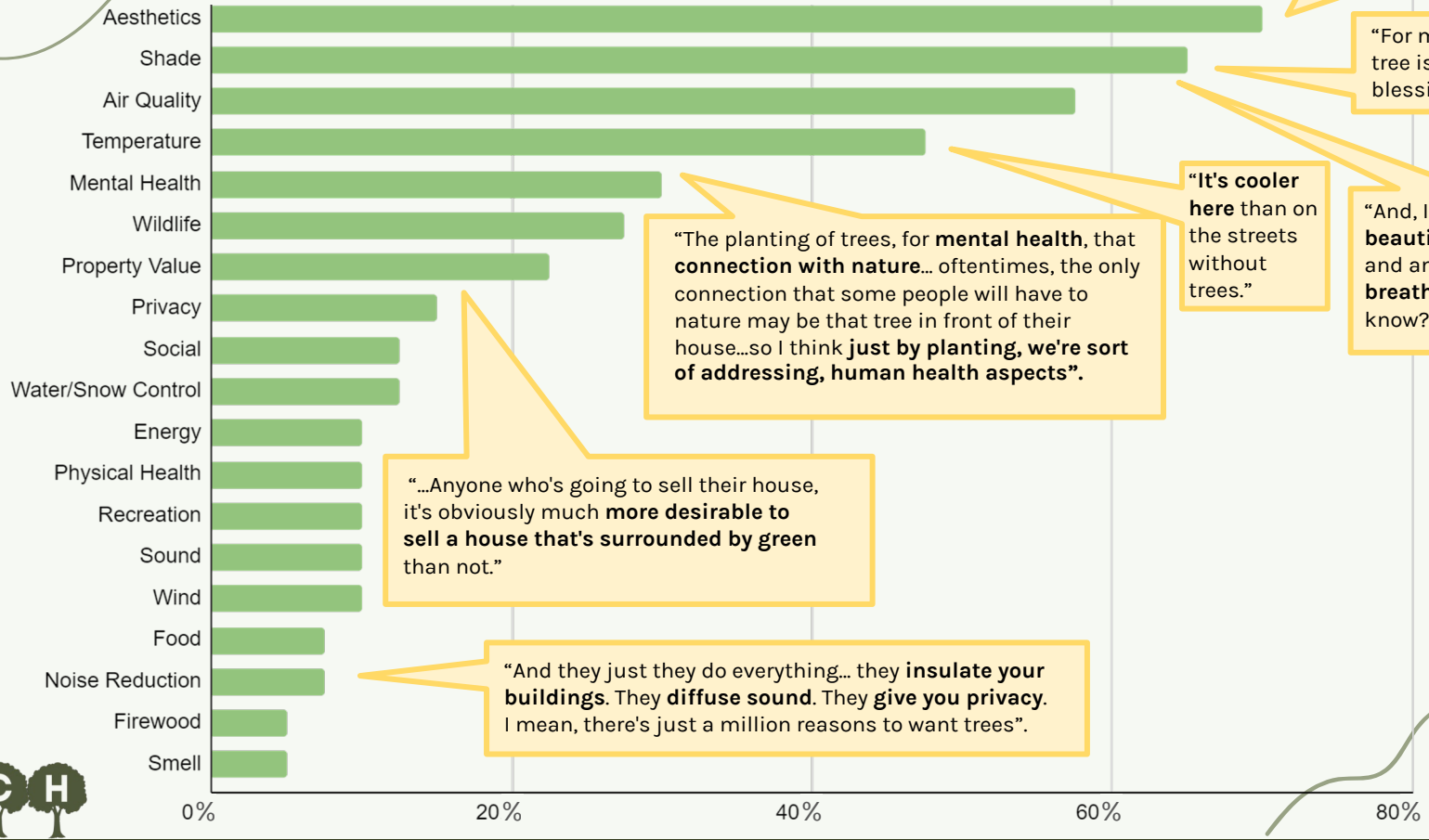
*HERO manager Adlai uses Nvivo software to code interviews*

# Interview Codes

1. **Tree Health**
   a. Removal
2. **Tree Stewardship (TS)**
   a. Caretaker
   b. Maintenance Activities
   c. Change in Maintenance
   d. Limitations
   e. Other Trees
3. **Tree Perceptions (TP)**
   a. Challenges
   b. Motivations
   c. Emotions
4. **GGCP Involvement**
   a. Choice
   b. Spreading the Word
4. **Neighborhood (NB)**
   a. Change
   b. Outdoor spaces
5. **Community engagement (CE)**
   a. Outreach
   b. Feeling heard
6. **Role in the community**
7. **Environmental Concerns**
   a. Environmental Justice



# Resident Perceived Tree Benefits




"Beauty, **sense of place**".

"For me, **the shade** of a tree is very, very blessing".

"And, I mean, look at it. **So beautiful.** You know? And and and the and **when you breathe, it's so nice** You know?"

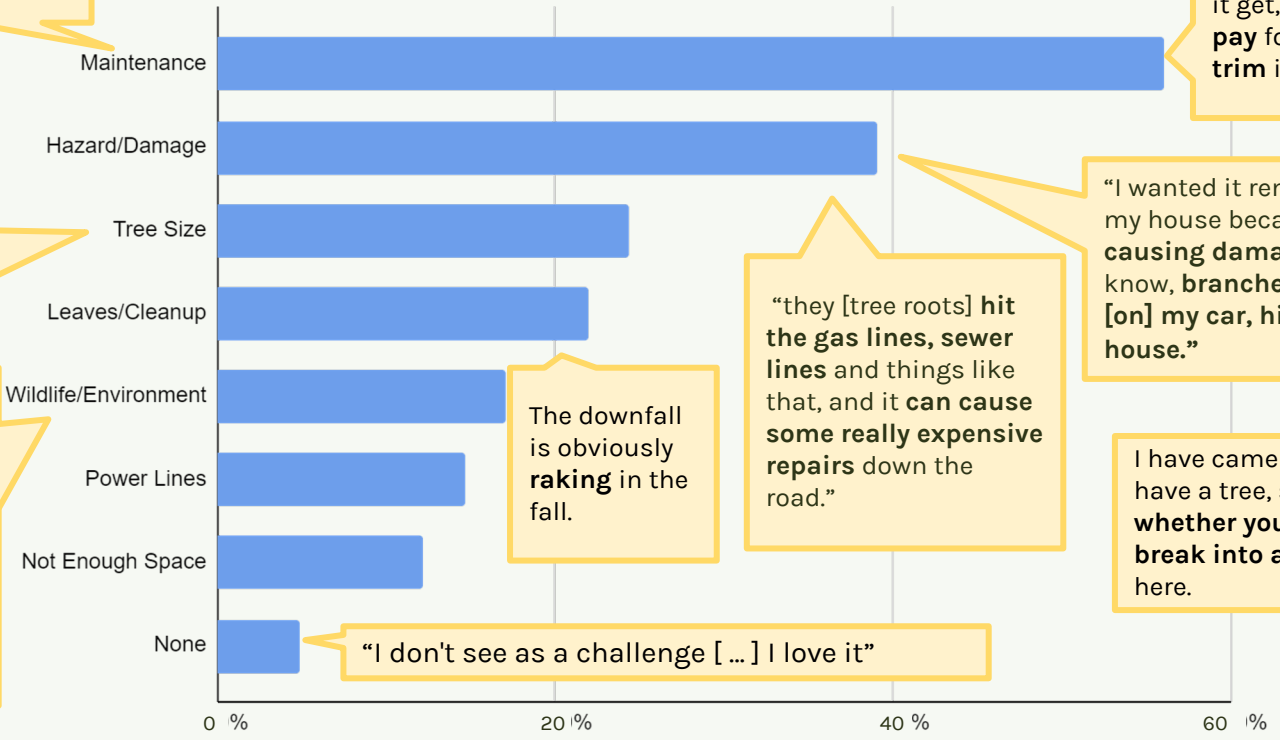
"**It's cooler here** than on the streets without trees."

"The planting of trees, for **mental health**, that **connection with nature**... oftentimes, the only connection that some people will have to nature may be that tree in front of their house...so I think **just by planting, we're sort of addressing, human health aspects".**

"...Anyone who's going to sell their house, it's obviously much **more desirable to sell a house that's surrounded by green** than not."

"And they just they do everything... they **insulate your buildings**. They **diffuse sound**. They **give you privacy**. I mean, there's just a million reasons to want trees".

# Resident Perceived Tree Challenges




"The challenge is **I have to trim them.**"

"every year, I have to trim that tree. And the bigger it get, **the more I have to pay** for somebody to **trim** it"

"We expected it to be **6 feet tall**, and it was **12 feet tall**"

"I wanted it removed from... my house because **it was causing damage** or, you know, **branches are falling [on] my car, hitting my house.**"

"they [tree roots] **hit the gas lines, sewer lines** and things like that, and it **can cause some really expensive repairs** down the road."

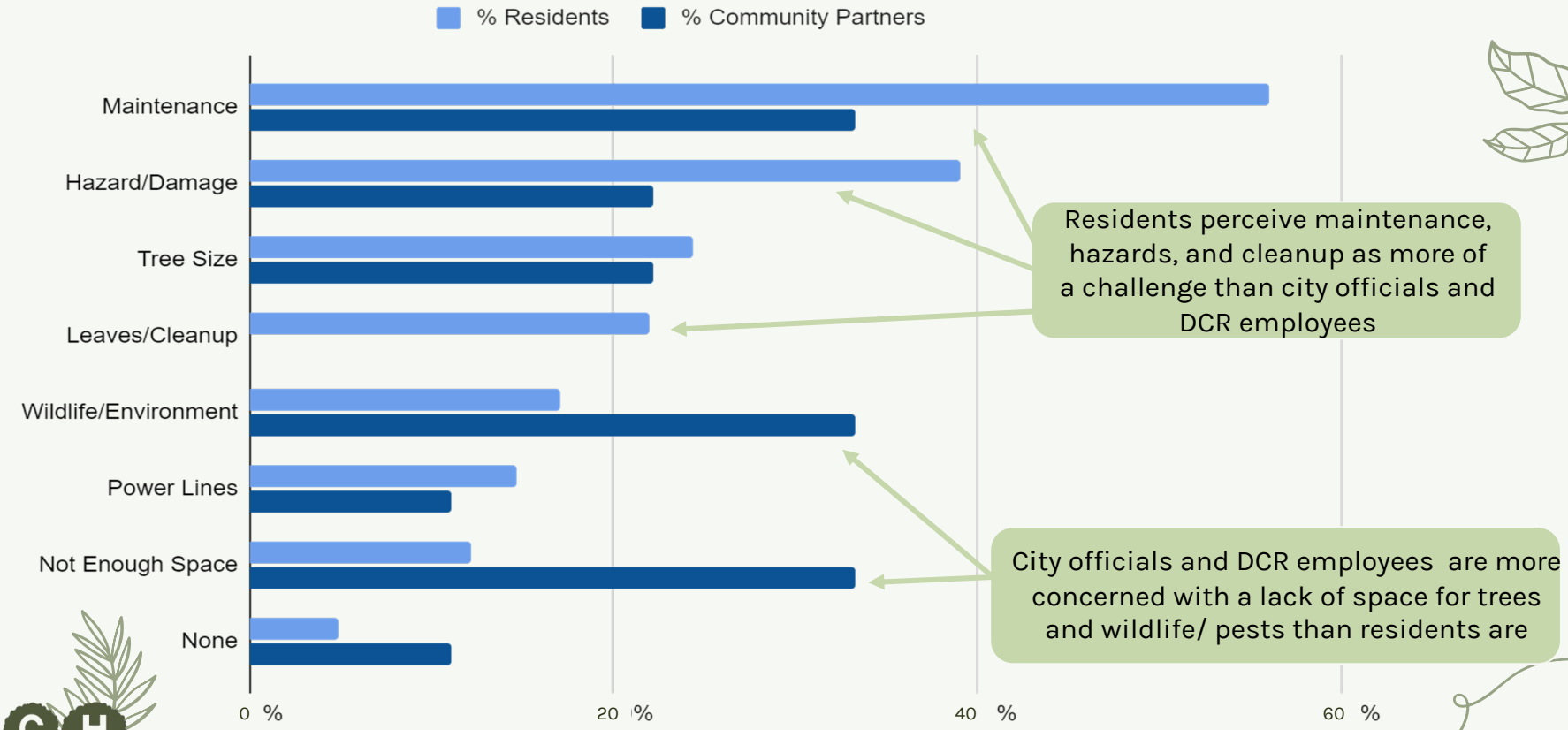
"I had them cut down because I was afraid they were **getting on the roof** and the **squirrels would get in**"

The downfall is obviously **raking** in the fall.

I have cameras, now I have a tree, so **I can't see whether you're trying to break into a car** out here.

"I don't see as a challenge [ ... ] I love it"

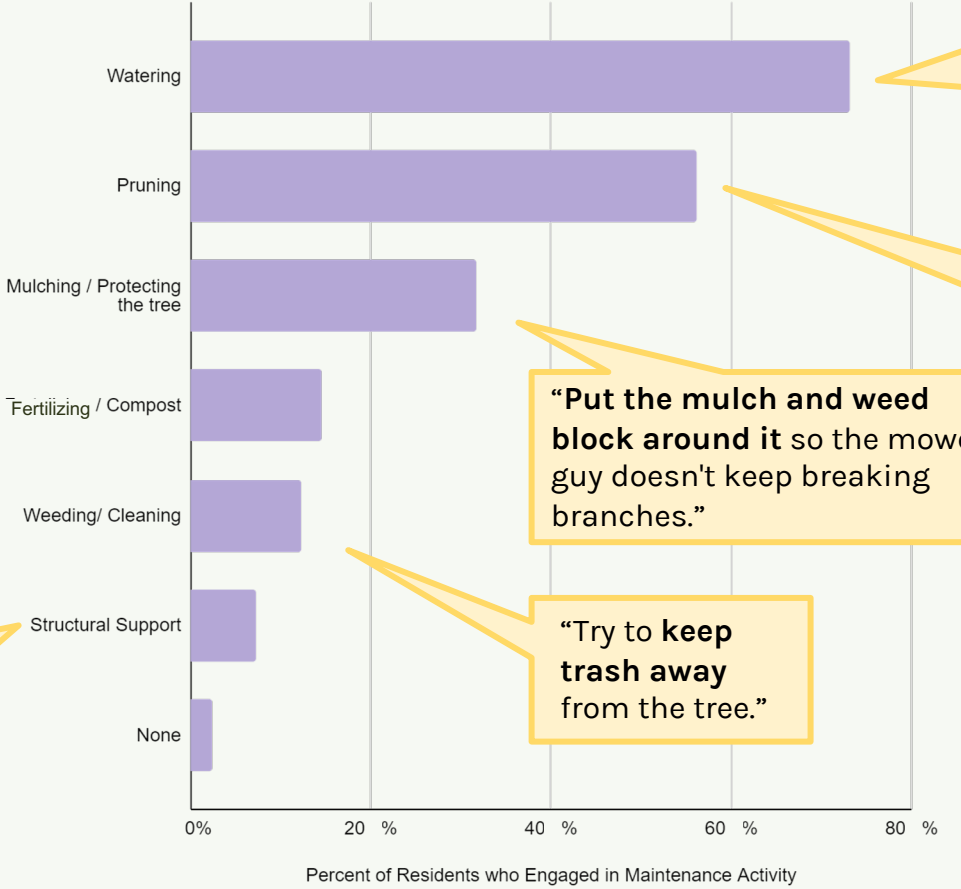
# Resident and Community Partner Tree Challenges Comparison




Residents perceive maintenance, hazards, and cleanup as more of a challenge than city officials and DCR employees

City officials and DCR employees are more concerned with a lack of space for trees and wildlife/ pests than residents are

# Maintenance Activities




"I was told to look out for **giving it water**, and I that's basically the most that I do."

"I water it, and I give them the same thing. **I give them a Miracle Gro**"

"**I had to trim some limbs** so he didn't get smacked in the face."

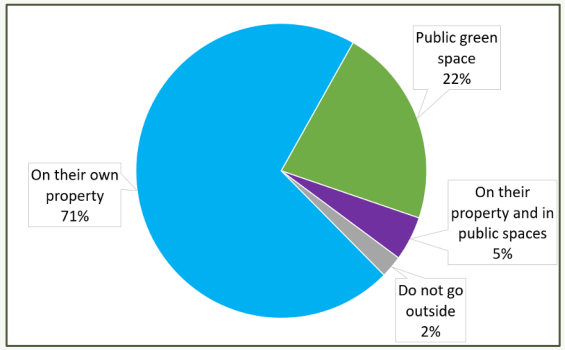
"**Put the mulch and weed block around it** so the mower guy doesn't keep breaking branches."

"It kind of tilted a little bit, and **I tried to straighten it**"

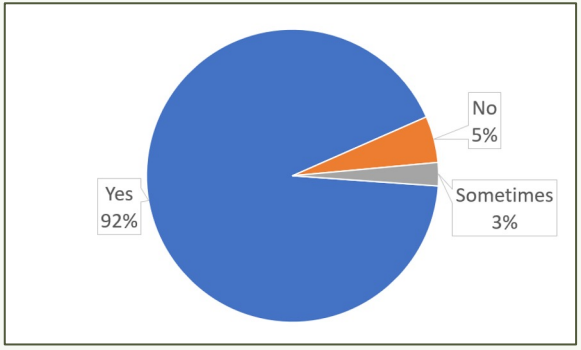
"Try to **keep trash away** from the tree."

# Resident Perceptions of Yards and Outdoor Space

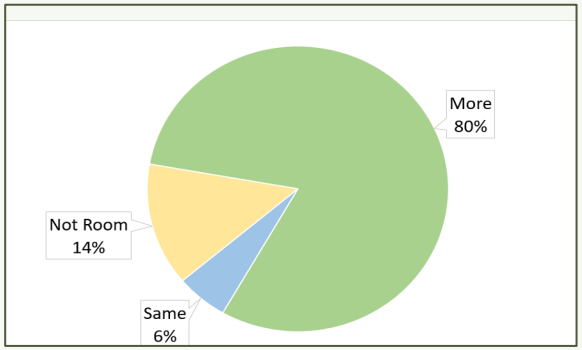
Q: Where do you typically spend time outside?




Q: Do you feel like the outdoor spaces you spend time in are well suited to your needs?




Q: Do you think your neighborhood should have more trees, fewer trees, or the same?




"I think that some of the parks need... I think **they need an arborist to come in** because **they're just well overgrown**."

**"I wish there were places closer to me where I could just go sit in the park**. We do have some good parks here. My ideal neighborhood would have more of them"

"If I didn't have this yard, no. I wouldn't feel like they were suited to my needs. Would I walk to a park if there were one? Yeah. But **where is a nice park kind of walkable to here?**

"I think **the residents of Chelsea deserve much more green spaces**"

# Residents Feel Heard in Local Decision Making

Q: Do you feel listened to in decision making processes surrounding parks, trees, or outdoor spaces in your community?

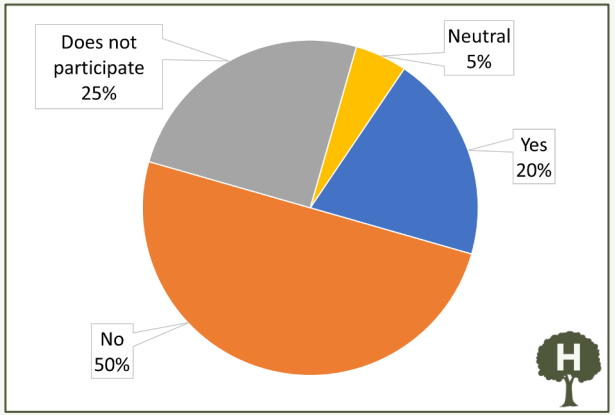
"As far as local parks, **I don't know that any citizen has a voice**. I think it's what business is funding, what campaign will drive the decisions"

"I don't actually feel like there's a big conversation happening around that here in the city of Holyoke, **I don't feel asked**"

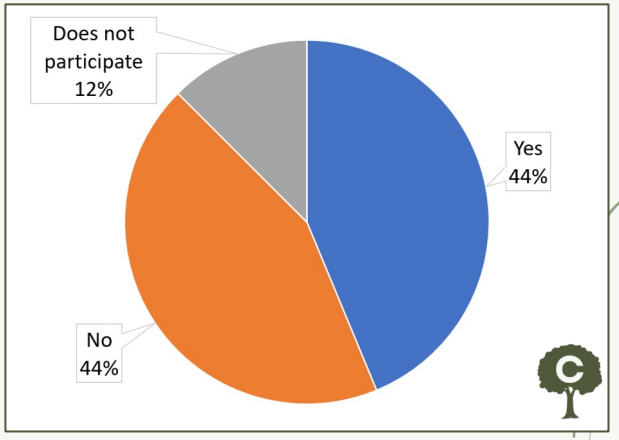
"I do in Chelsea. I think that Chelsea's done a lot, and Everett seems to be doing a lot. It seems like Everett's doing more, but **Chelsea seems to do a real lot**."

"Sometimes I feel like **they don't expect us to really get involved**"

Holyoke:




Chelsea:

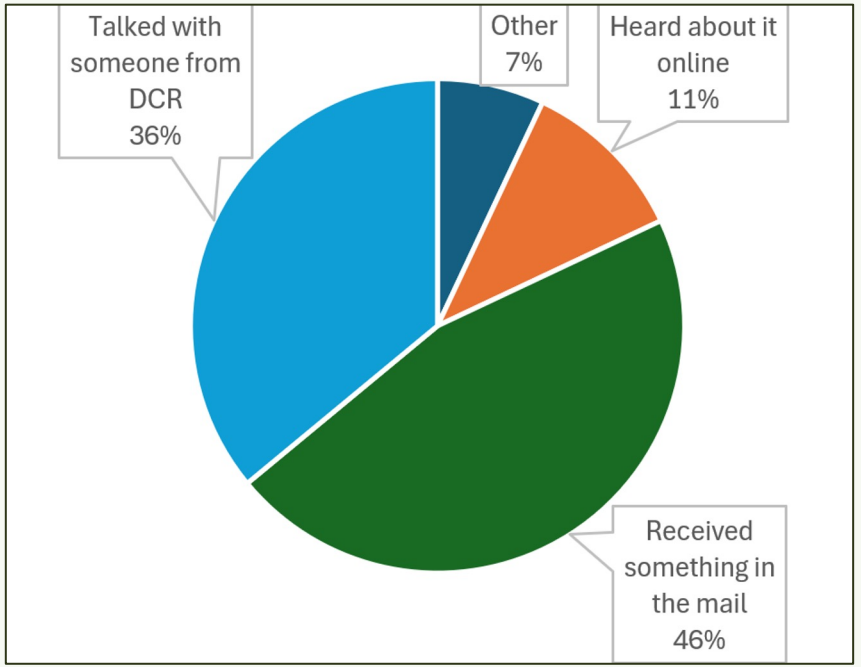


# GGCP Outreach to Residents

"I mean, **I loved how they came around, and they had the little flip book with the photos to show you**, different trees and a kind of sheet with information about them. **It was really helpful**"

"I think there's also, **there should be more advertisement,** promotion, **not too many people know about it**"

How residents first became aware of the GGCP:



# Resident Roles in the GGCP

## Residents as Communicators

- 75% of interviewed residents spoke about the GGCP to others
- 51% spoke about the program with neighbors

"**I talked to my neighbors** about getting some more trees. I think **one of them did get a tree**"

" **I told my friend**, and then she told her mom"

*Front yard plum tree in Holyoke*

## Residents as Negotiators

- 100% of interviewed residents chose the **location**(s) of their tree(s)
- 95% chose the **species**
- 77.5% received the tree(s) they originally requested

"**I did** [choose the location]. The location had to be moved a little bit because I had an irrigation system. They were a little concerned about hitting it."

In Leominster, Pittsfield, Fall River and Chicopee:
31% communicated with family and neighbors
69% percent residents as negotiators

Geron et al., 2023

# Creating and Maintaining Good Partnerships

"My best partnerships are ones where we're **talking multiple times a month**, getting feedback from each other [. . .] **keeping me updated** on changes that are happening, **bouncing ideas**, and then **being receptive to feedback** I give them on their plantings."

"It's just having patience, having good communication, **making sure that everyone is aware of what's going on** in the process, and also **consistent meetings**."

DCR Foresters

Communication

Aligning Goals and Strategies

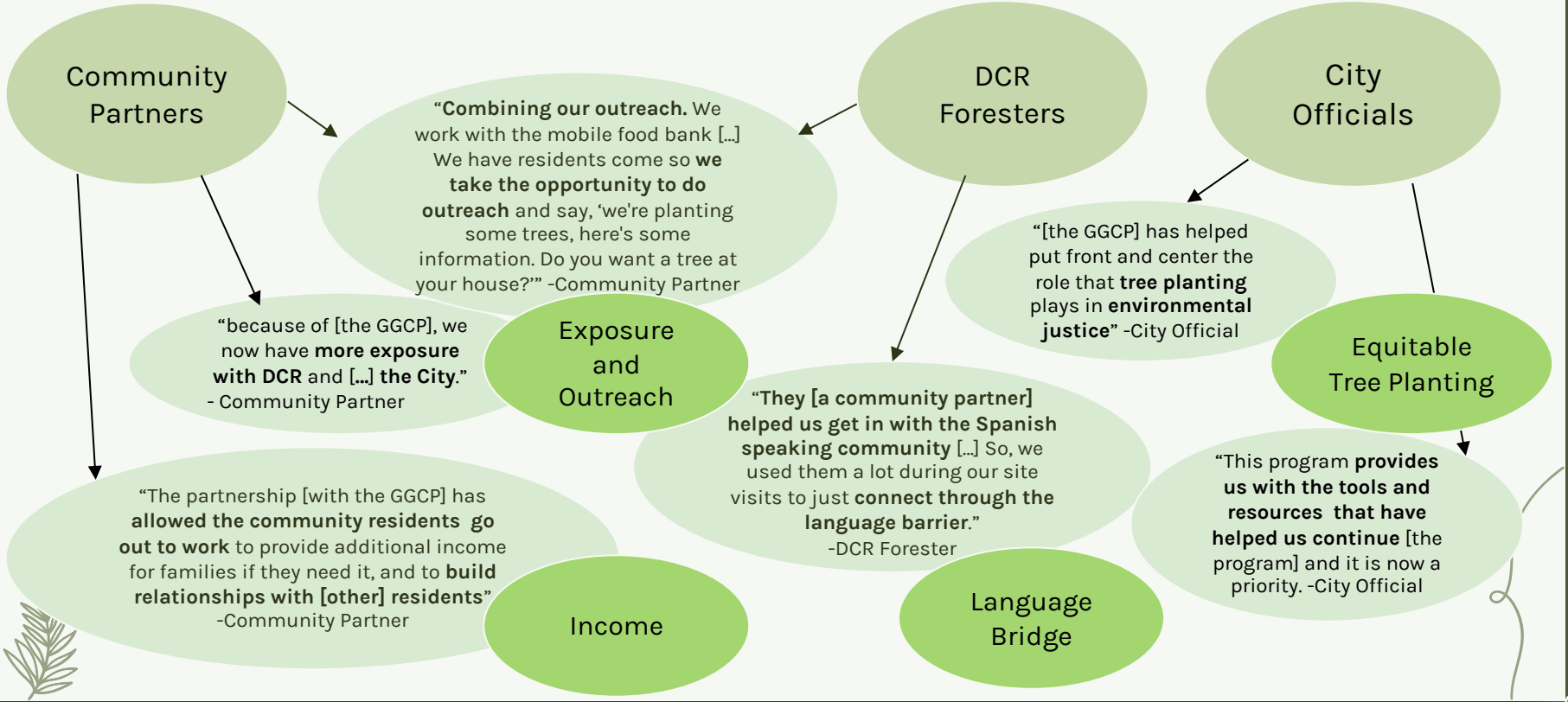
Community Partners

"The best partnerships with nonprofit organizations are ones where the organization can help provide not just conceptual ideas, but **provide another layer of planning, more detailed idea development** and even o**rganizing volunteers** to help execute a project."

"There's **managing when you're gonna do things and who can participate and in what capacity**. We've ended up a few times where we both have grant expenditure deadlines at the same time [which can be] a lot, but w**e are getting better at planning and communicating with each other about our goals and strategizing**."

# Outreach Challenges Faced by Foresters

# Community Partnership Benefits



# Summary of Interview Analysis

## Residents

**Tree Benefits**: Aesthetics, shade, air quality, and mental health

**Tree Challenges:** Maintenance and hazards

**Tree Maintenance:** watering, pruning, and mulching

Many residents reported that their trees were **larger than expected** and felt misled by foresters.

Residents were asked to **rate their experience with GGCP trees**, the average rating was **9.3 / 10**

## City Officials, Community Partners, DCR Employees

DCR is trying to **enhance communication** with community and city partners

DCR Foresters highlighted **language barriers** as the **biggest challenge** surrounding community outreach

**Community partner** organizations are **instrumental** in multilingual outreach


*Entering Chelsea sign from the Everett border*

HERO 2024 Research Objectives and Study Areas

Biophysical Field Methods and Data Collection

Tree Assessments and Statistics

Species and Growth Analysis

Interview Analysis and Takeaways

Conclusions and Future Research

# Key Takeaways from Our Study

## Tree Species

| 5 High Performance* Tree Species | 3 Low Performance** Tree Species |
|---|---|
| American Elm | Dogwood spp. |
| Swamp White Oak | Kousa Dogwood |
| Scarlet Oak | Black Tupelo |
| Pin Oak | |
| River Birch | |

**poor growth index and low survivorship

*high growth index and survivorship

## Tree Health

**Public trees** had higher survivorship than private trees

**Street trees** had high survivorship in both cities.

**Land Use:**

- **Institutional** had most trees planted but lowest survivorship in Holyoke (similar to findings in Breger et al. 2019)
- **Multifamily** had most trees planted but low survivorship in Chelsea.

Majority (>80%) of surviving trees had **Vigor of 1 and Condition of Good.**

## Community Perceptions

**Benefits**

- Residents values trees for their **Aesthetics, Shade, and Air Quality** benefits
- **80%** of residents want more trees in their neighborhood
- **Partnerships around GGCP** allow for combined and increased **outreach, multilingual communication, network building, resource access**

**Challenges**

- **Disconnect between the DCR and English limited** community members in both cities.
- More **community partner engagement**

Breger, B. S., Eisenman, T. S., Kremer, M. E., Roman, L. A., Martin, D. G., & Rogan, J. (2019). Urban tree survival and stewardship in a state-managed planting initiative: A case study in Holyoke, Massachusetts. *Urban Forestry & Urban Greening*, *43*, 126382.

# Holyoke and Chelsea in Context

**Annual Survivorship** takes into account survivorship and the number of years since planting. This metric allows for the comparison of tree cohorts in different planting programs.

| Case Studies | Establishment Annual Survivorship (0 - 5 years) | Post - Establishment Annual Survivorship (6 or more years) |
|---|---|---|
| National Median* (24 cases) | 93.20% | 96.74% |
| Holyoke (2014 - 2024) | 95.3% | 93.8% |
| Chelsea (2014 - 2024) | 90.9% | 94.2% |
| Worcester (2010 - 2023) | 94.9% | 96.8% |

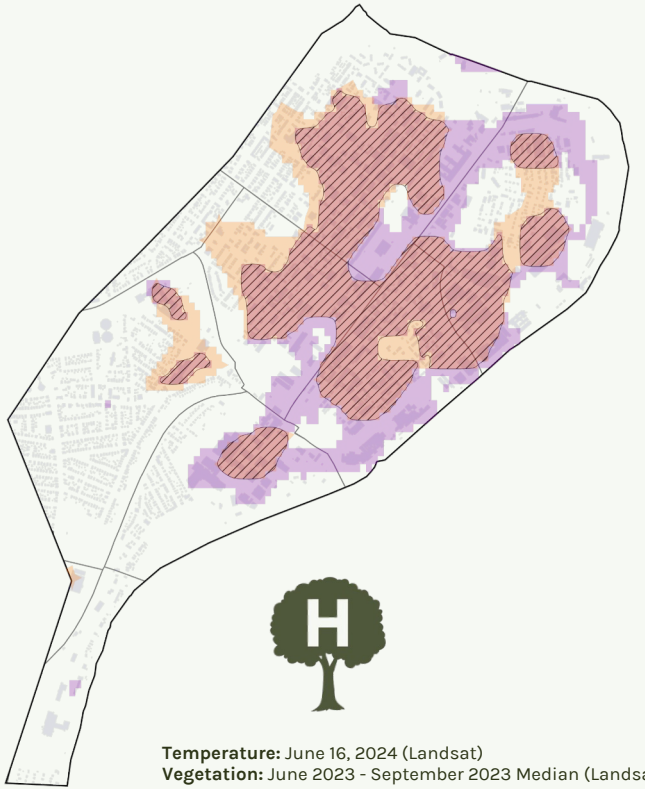
*Hilbert, D. R., Roman, L. A., Koeser, A. K., Vogt, J., & van Doorn, N. S. (2019). Urban tree mortality: A literature review. *Arboriculture & Urban Forestry (AUF)*, *45*(5), 167-200.

# Priority Areas for Future Planting

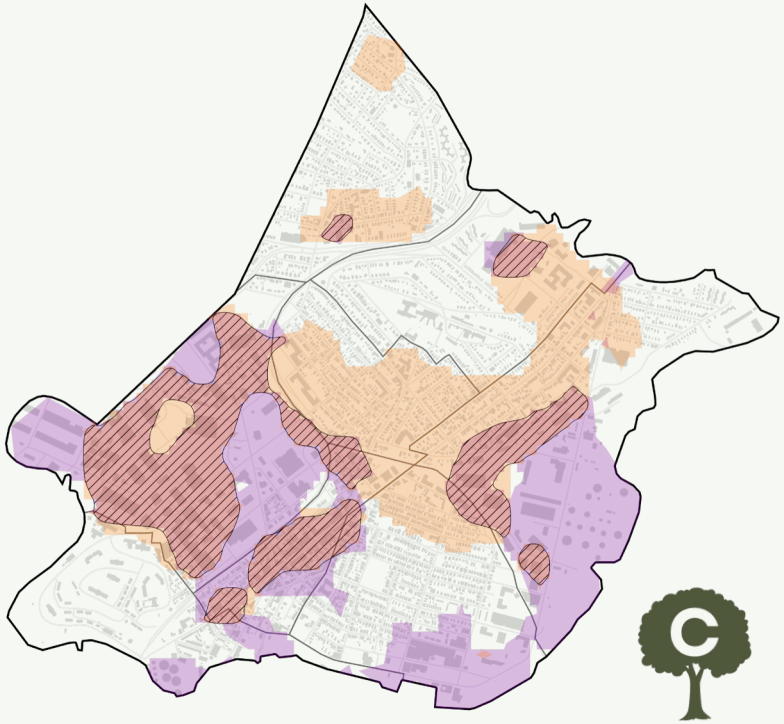
Priority Area (High Temp + Low Vegetation)

High Temperature Hot Spot

Low Vegetation Hot Spot

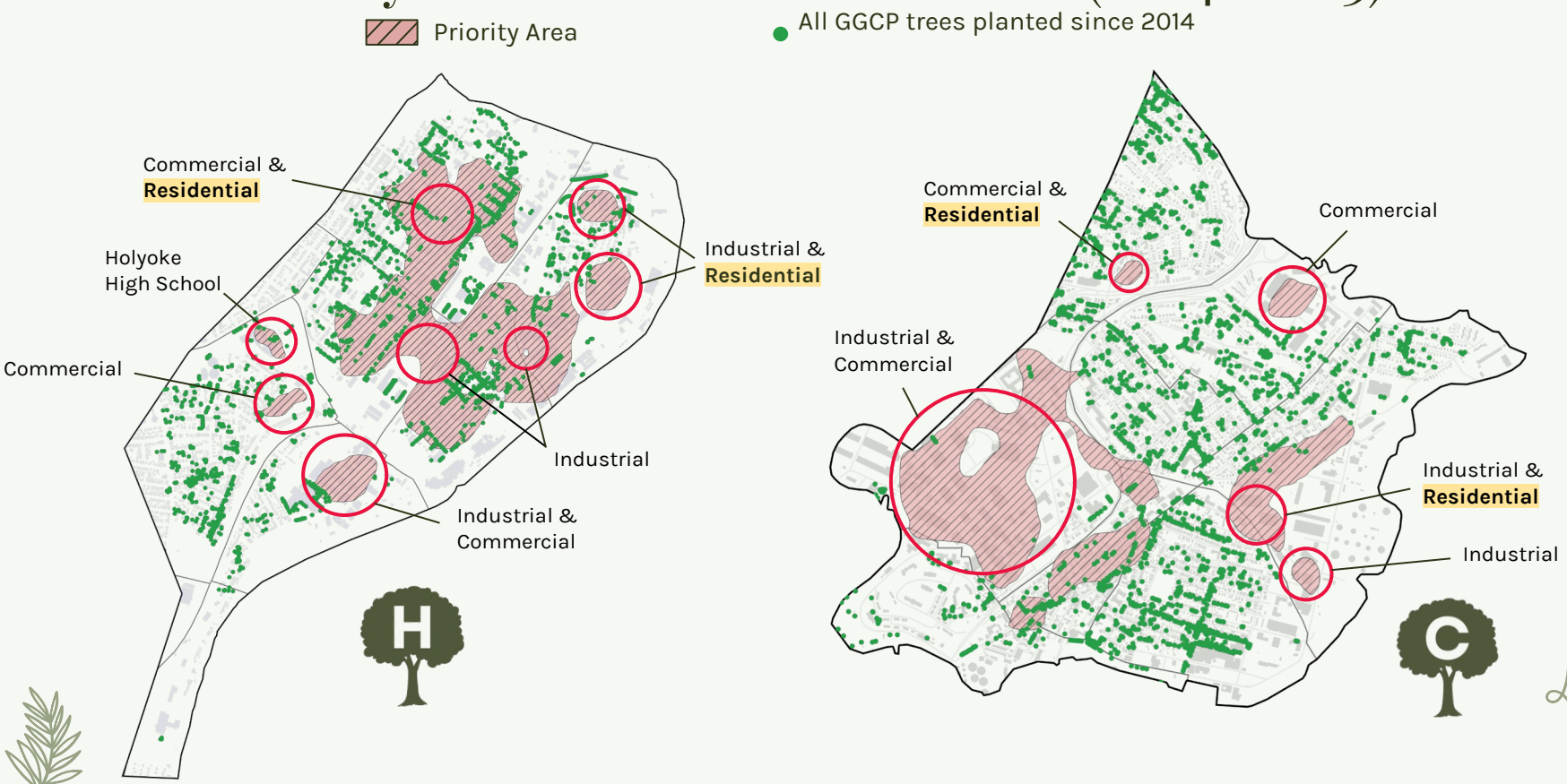



**Temperature:** June 16, 2024 (Landsat)
**Vegetation:** June 2023 - September 2023 Median (Landsat)




**Temperature:** July 17, 2023 (Landsat)
**Vegetation:** June 2023 - September 2023 Median (Landsat)

# Priority Areas & All GGCP Trees (2014-2023)



# Recommendations for GGCP

## Tree Health

**An increase in support for watering of private trees** may increase survivorship.

Encourage planting of **genera with high growth index and survivorship rates.**

Encouraging **collaboration and communication between Gateway Cities Program foresters**

More explicit maintenance agreements especially for **non residential private land receiving many trees.**

*HERO fellow, Kalon plants a dogwood with a DCR Forester*

## Environmental Justice

Increased efforts for **multilingual outreach** in GGCP cities.

Establish and **maintain strong relationships with community partners** to help increase outreach, planting, and survivorship.

Planting in **Priority Areas** could ease social and environmental disparities.

# Thank You!

DCR Foresters
US Forest Service
GGCP Community Partners
City of Chelsea
- Department of Public Works

City of Holyoke
- Conservation and Sustainability Department

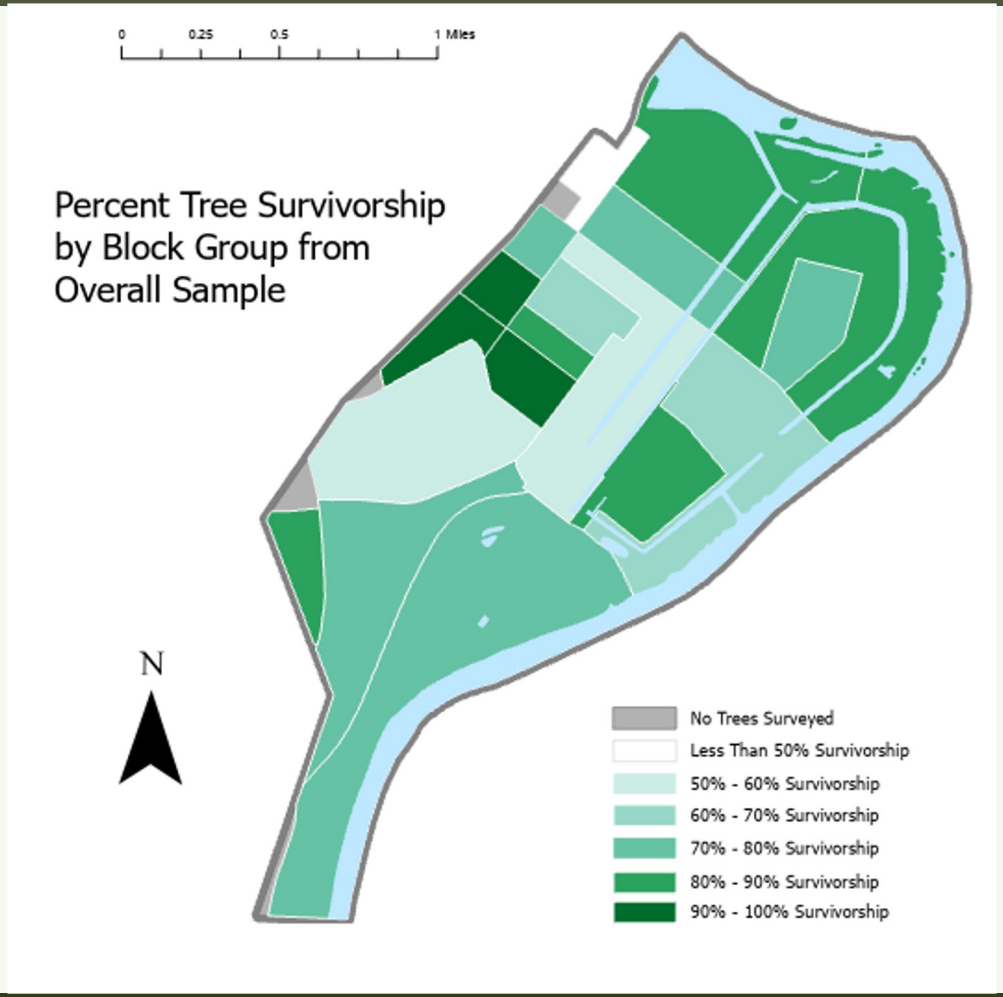
Residents in Chelsea and Holyoke
Clark Geography - Marjorie Miller and Yaa Poku
Clark Marsh Institute Staff - April Carlson
Our wonderful drivers and mentors (Jason, Adlai, Tanner, Nick, and Aidan)
And of course our fantastic Directors Doctors Deborah Martin and John Rogan.


*Juju plants a hornbeam with a DCR Forester*




# Questions?

# Appendix


0
0.25
0.5
1 Miles
Percent Tree Survivorship by Block Group from Overall Sample
N
No Trees Surveyed
Less Than 50% Survivorship
50% - 60% Survivorship
60% - 70% Survivorship
70% - 80% Survivorship
80% - 90% Survivorship
90% - 100% Survivorship

# Resurvey Tree Species Summary

| | Both Cities | Holyoke | Chelsea |
|---|---|---|---|
| **Trees Surveyed** | 1,114 | 729 | 385 |
| **Species Surveyed** | 86 | 58 | 57 |

**Tulip Tree**

**Resurvey Survivorship**
Alive: 42.6% [23]
Dead: 57.4% [31]

**Black Tupelo**

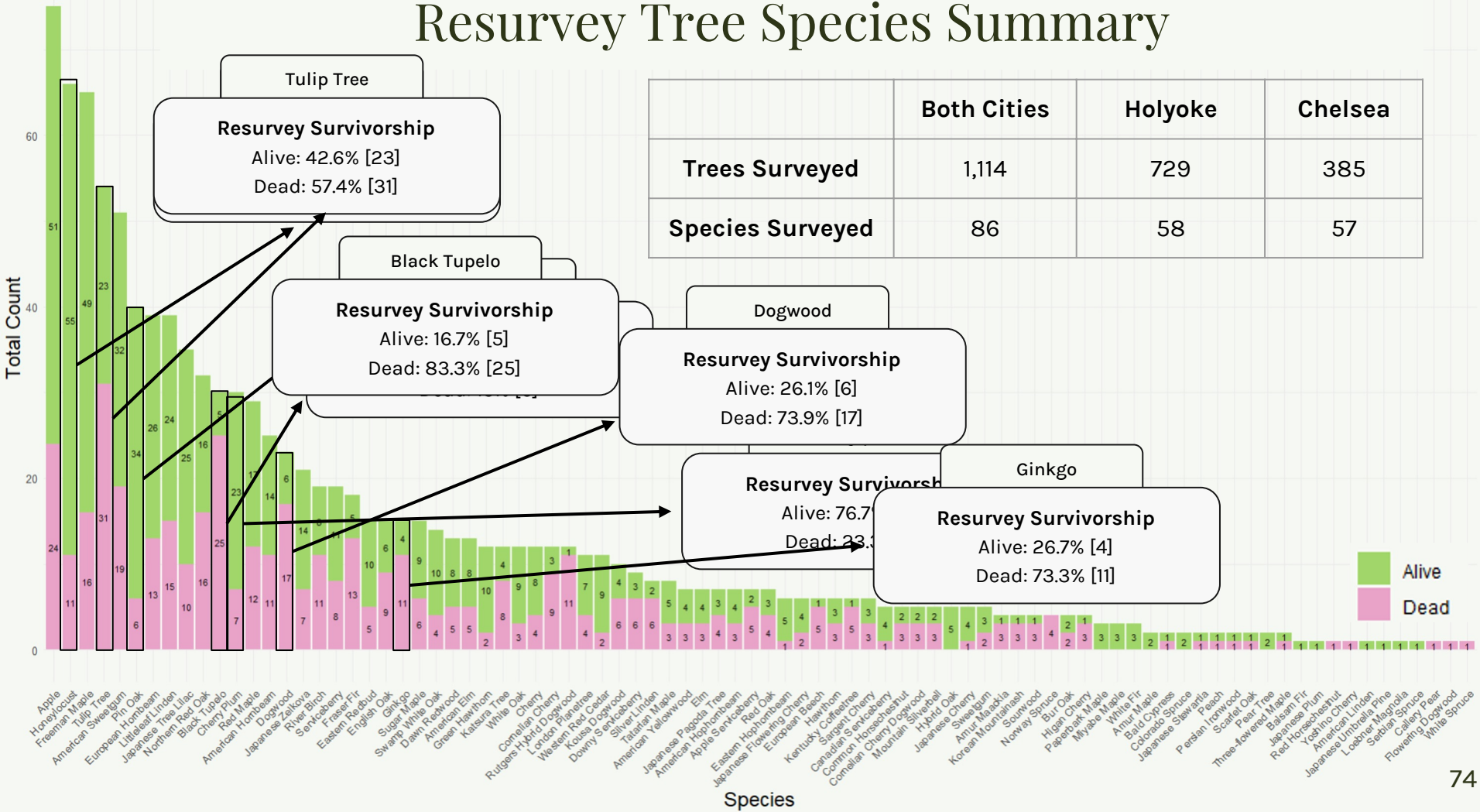
**Resurvey Survivorship**
Alive: 16.7% [5]
Dead: 83.3% [25]

**Dogwood**

**Resurvey Survivorship**
Alive: 26.1% [6]
Dead: 73.9% [17]

**Ginkgo**

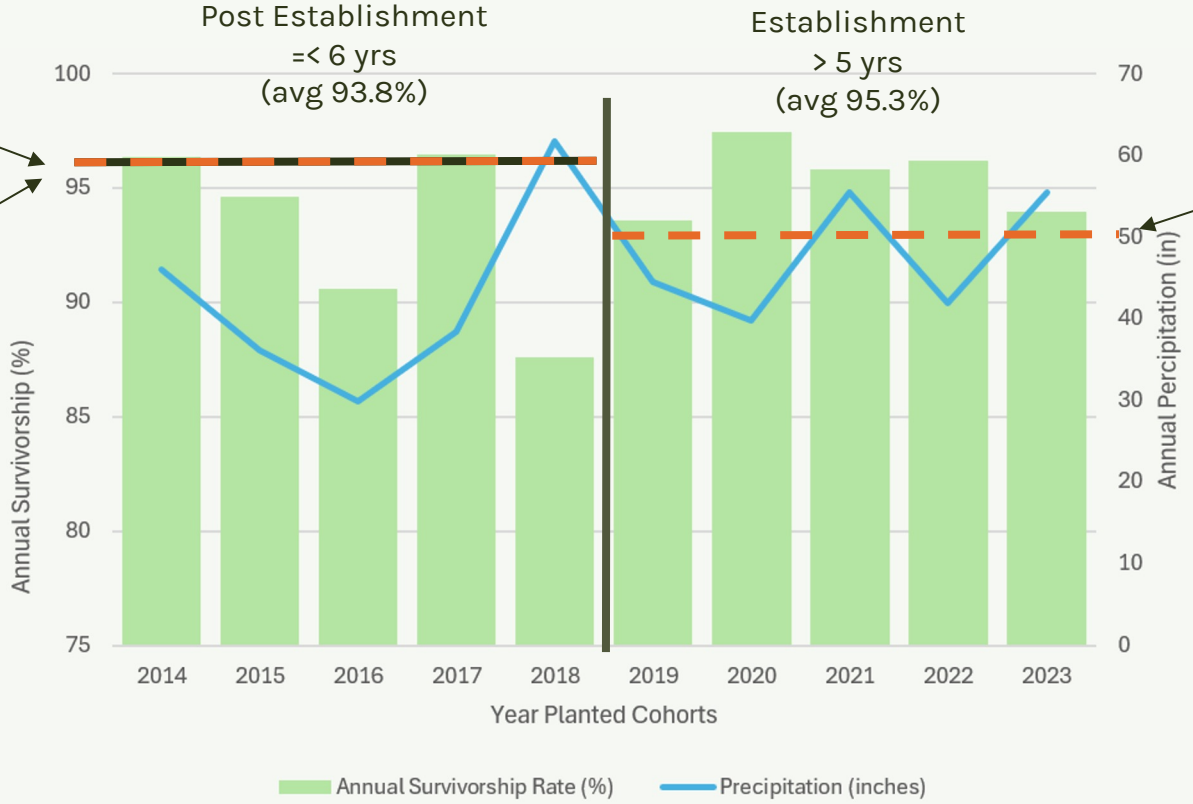
**Resurvey Survivorship**
Alive: 26.7% [4]
Dead: 73.3% [11]



# Holyoke Annual Survivorship

**HERO 2023 Worcester Annual Survivorship = 96.82%**

**National Median Post - Establishment Survivorship Rate = 96.74%**



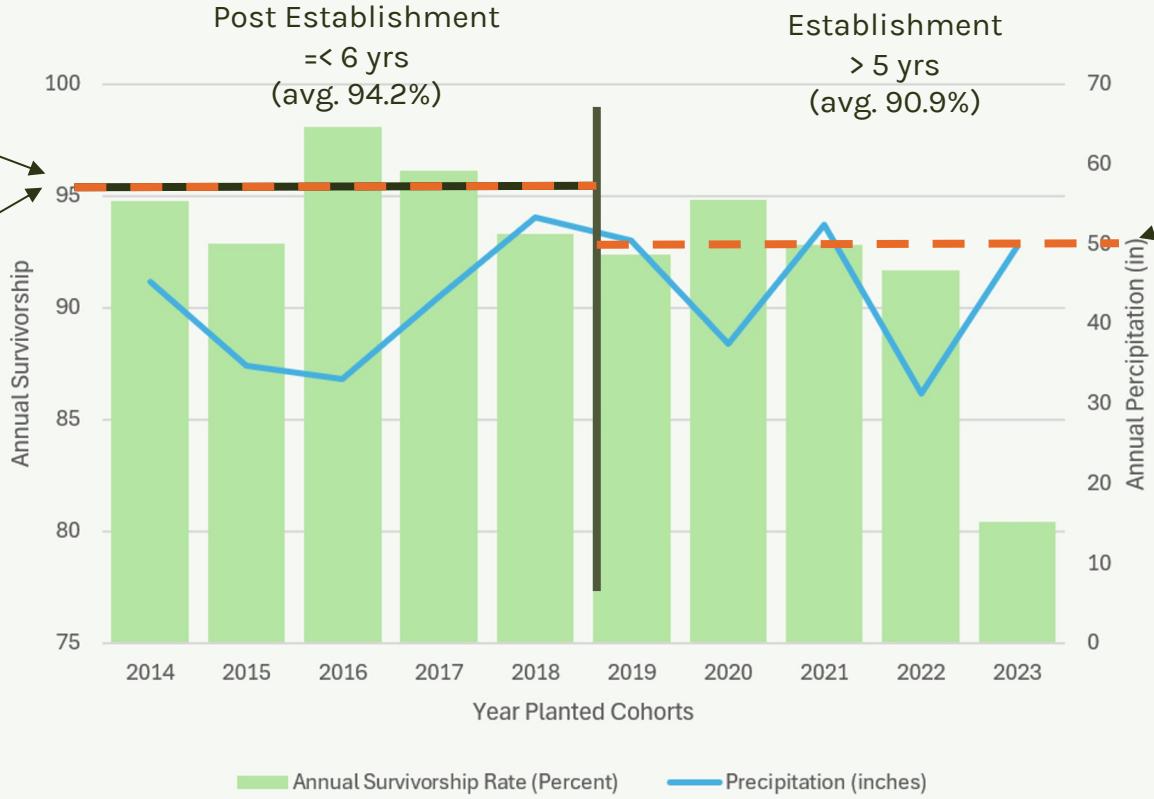

**National Median Establishment Survivorship Rate = 93.20%**


Hilbert, D. R., Roman, L. A., Koeser, A. K., Vogt, J., & van Doorn, N. S. (2019). Urban tree mortality: A literature review. *Arboriculture & Urban Forestry (AUF)*, *45*(5), 167-200.

# Chelsea Annual Survivorship

**HERO 2023 Worcester Annual Survivorship = 96.82%**

**National Median Establishment Survivorship Rate = 96.74%**




**National Median Establishment Survivorship Rate = 93.20%**

*4 of the 9 dead trees planted in 2023 were planted on the same property. The survivorship rate for 2023 trees rises from 80.43% to 89.13%, still the lowest rate in the last 10 years.*


Hilbert, D. R., Roman, L. A., Koeser, A. K., Vogt, J., & van Doorn, N. S. (2019). Urban tree mortality: A literature review. *Arboriculture & Urban Forestry (AUF)*, *45*(5), 167-200.

# Chelsea and Holyoke Overall Tree Assessment Survivorship Summary by Species

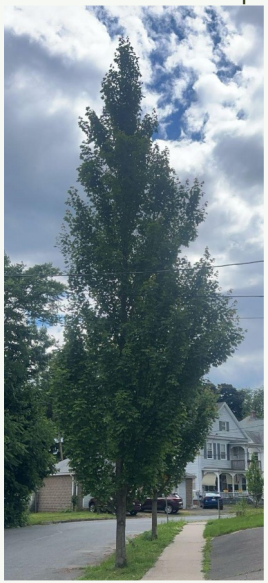
| Top 6 Species | Overall Survivorship | Total Surveyed | Holyoke Surv. | Holyoke n | Chelsea Surv. | Chelsea n |
|---|---|---|---|---|---|---|
| Swamp White Oak | 93% | 59 | 94% | 34 | 92% | 25 |
| Eastern Redbud | 88% | 88 | 91% | 55 | 82% | 33 |
| Cherry Plum | 82% | 55 | 100% | 9 | 78% | 46 |
| Pin Oak | 82% | 34 | 93% | 15 | 74% | 19 |
| Apple | 81% | 118 | 79% | 33 | 82% | 85 |
| Hybrid Oak | 81% | 42 | NA | NA | 81% | 42 |

n=1566

| Bottom 6 Species | Overall Survivorship | Total Surveyed | Holyoke Surv. | Holyoke n | Chelsea Surv. | Chelsea n |
|---|---|---|---|---|---|---|
| Tulip Tree | 41% | 90 | 38% | 66 | 50% | 24 |
| Black Tupelo | 42% | 52 | 29% | 35 | 71% | 17 |
| Kousa Dogwood | 48% | 48 | 80% | 15 | 33% | 33 |
| Sugar Maple | 53% | 36 | 75% | 16 | 35% | 20 |
| River Birch | 54% | 52 | 52% | 31 | 57% | 21 |
| American Hornbeam | 56% | 99 | 91% | 33 | 38% | 66 |

# Mixed Results and Other Interesting Tree Species

**Maple (*Acer*)**: Good Growth Index and Overall Survivorship



**Freeman Maple (*Acer x freemanii*)**: High Growth Index, Holyoke Survivorship 35% Higher than Chelsea

**Hornbeam (*Carpinus*)**

**American hornbeam (*Carpinus caroliniana*)**: Low Growth Index, Holyoke Survivorship 53% Higher than Chelsea

**Tulip (*Liriodendron*)**


**Tulip Tree (*Liriodendron tulipifera*)**: High Growth Index, Very Low Survivorship in Holyoke. Possibly overplanted

**Honey Locust (*Gleditsia*)**


**Honeylocust (*Gleditsia triacanthos*)**: Fair Growth index, ~100% Survivorship in Holyoke, 30% less in Chelsea

**Lilac (*Syringa*)**


**Japanese Tree Lilac (*Syringa reticulata*)**: Very Low Growth Index, Good Overall Survivorship

# Low Performing Tree Species and Genera

**Dogwood (*Cornus*)**: Lowest Growth Index (Genus), Poor Overall Survivorship


**Kousa Dogwood (*Cornus kousa*):** Very Low Growth Index, Good Survivorship in Holyoke, Poor Survivorship in Chelsea


**Dogwood (*Cornus spp.*)**: Lowest Growth Index (Species), Very Poor Survivorship in Chelsea

**Tupelo (*Nyssa)***

**Black Tupelo (*Nyssa sylvatica*):** Low Growth Index, Very Poor Survivorship in Holyoke, Fair Survivorship in Chelsea. Possibly Overplanted

# Ecosystem Services

## Holyoke

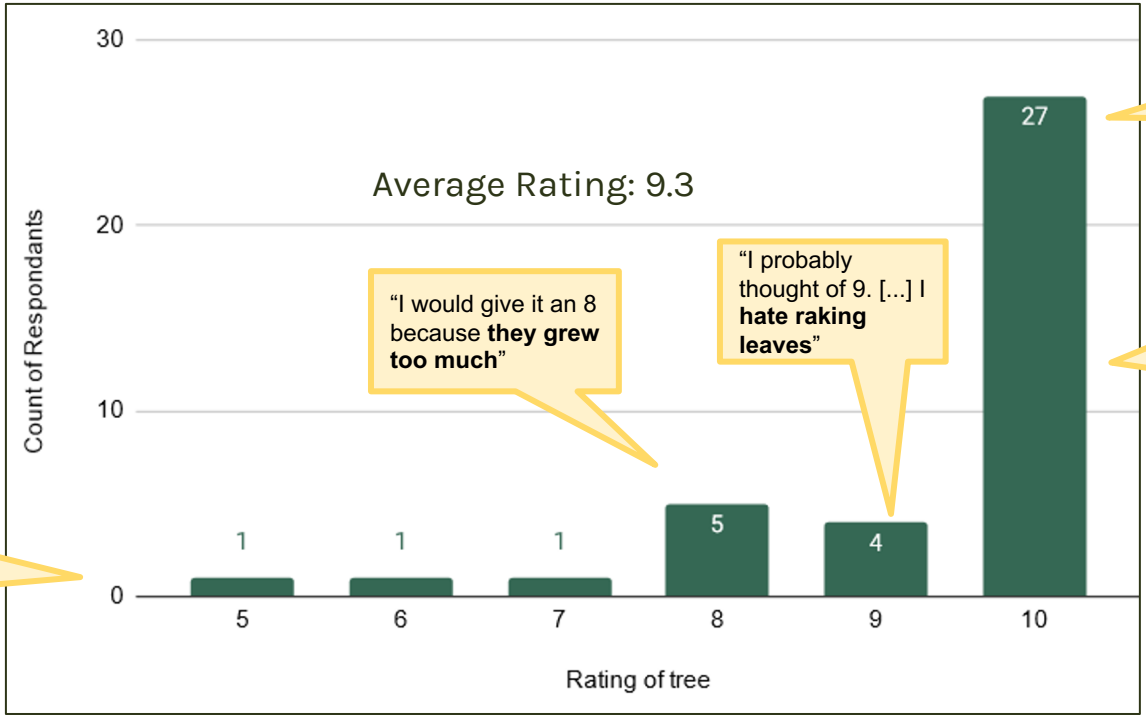
- In 2024, trees in our sample contributed over **$2,683** worth of ecosystem services.
- Trees Sequester **2 tons** of carbon annually.
- Trees remove **32 pounds** of pollution from the air annually
- Trees produce **2.7 tons** of Oxygen annually

## Chelsea

- In 2024, trees in our sample contributed over **$6,226** worth of ecosystem services.
- Trees Sequester **2.4 tons** of carbon annually.
- Trees remove **12 pounds** of pollution from the air annually
- Trees produce **6.3 tons** of Oxygen annually

# Resident experience with GGCP Trees

Q: How would you rate your overall experience with your [GGCP] tree(s) from 1-10?



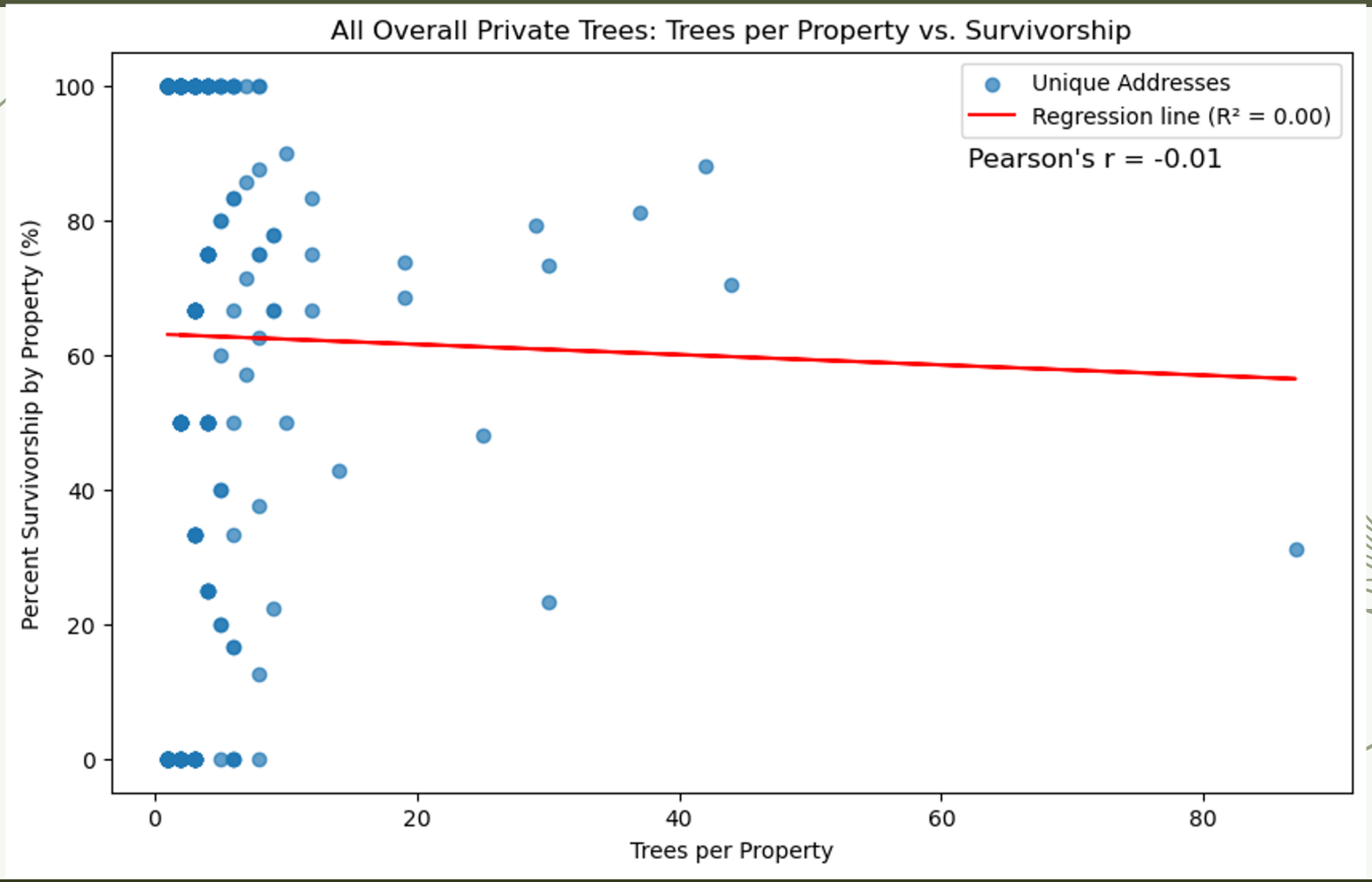

"Well, I think I would rate it a 5 [ ... ] I'm **disappointed** in the way the tree turned out"

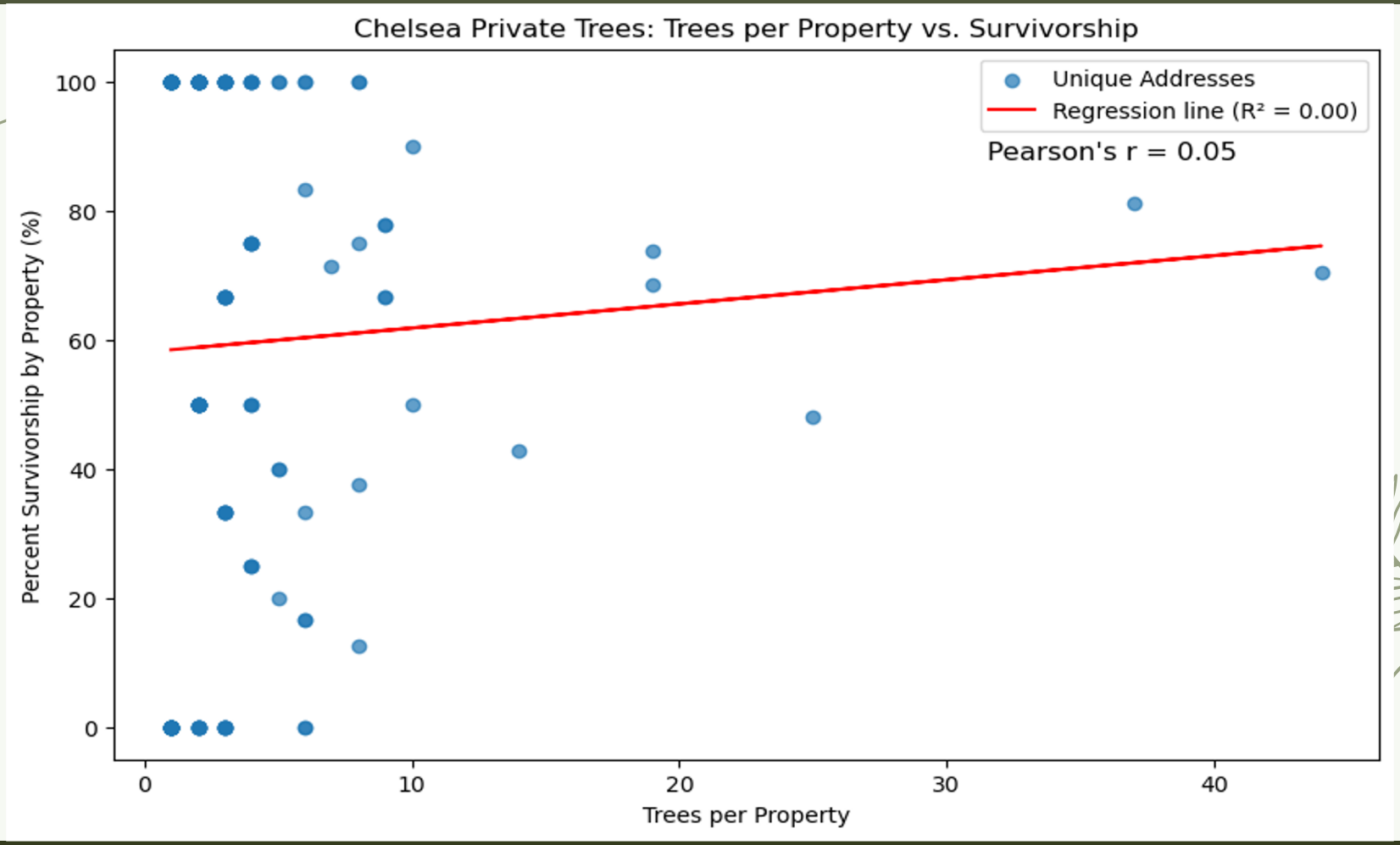
"I would give it an 8 because **they grew too much**"

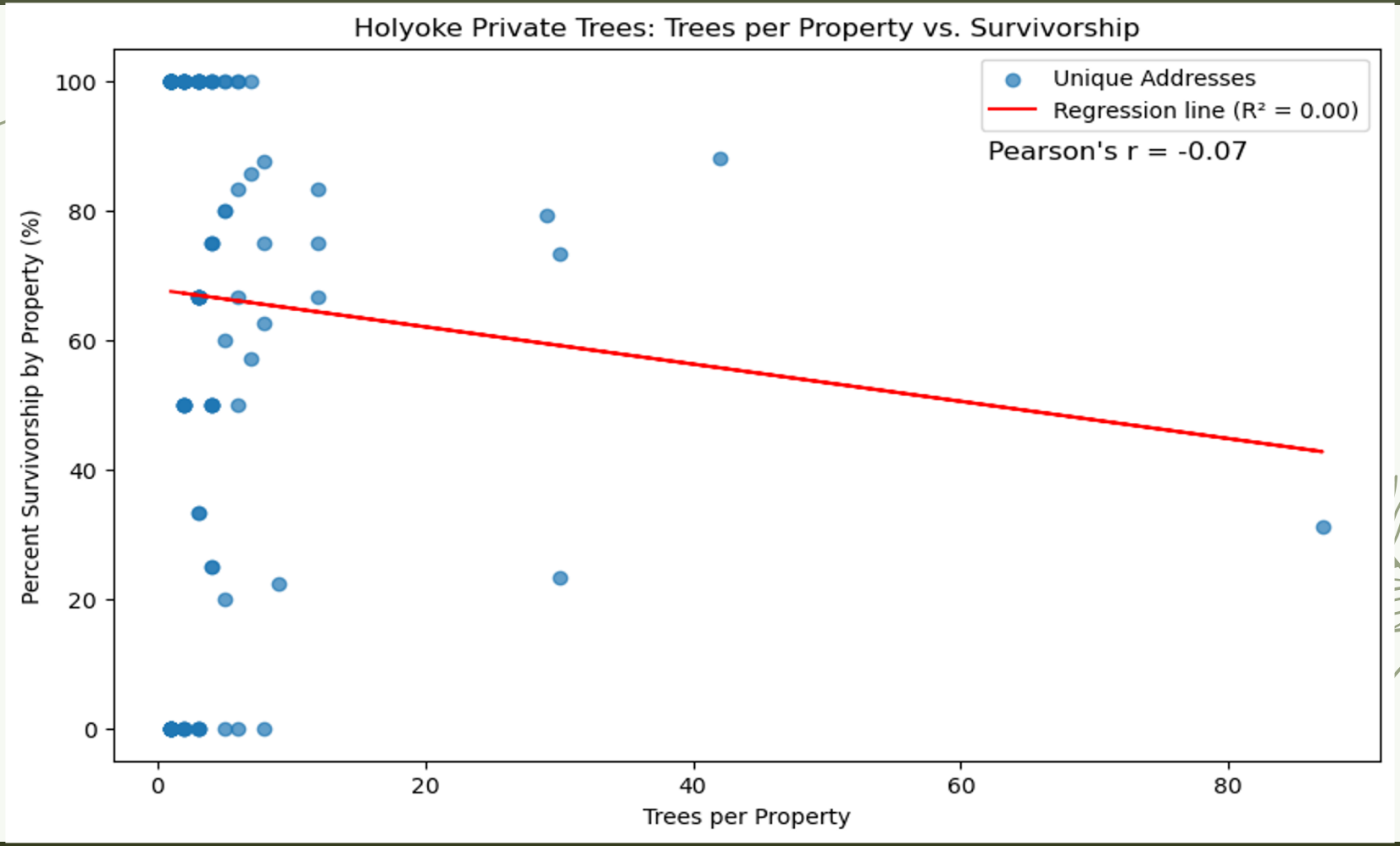
"I probably thought of 9. [...] I **hate raking leaves**"

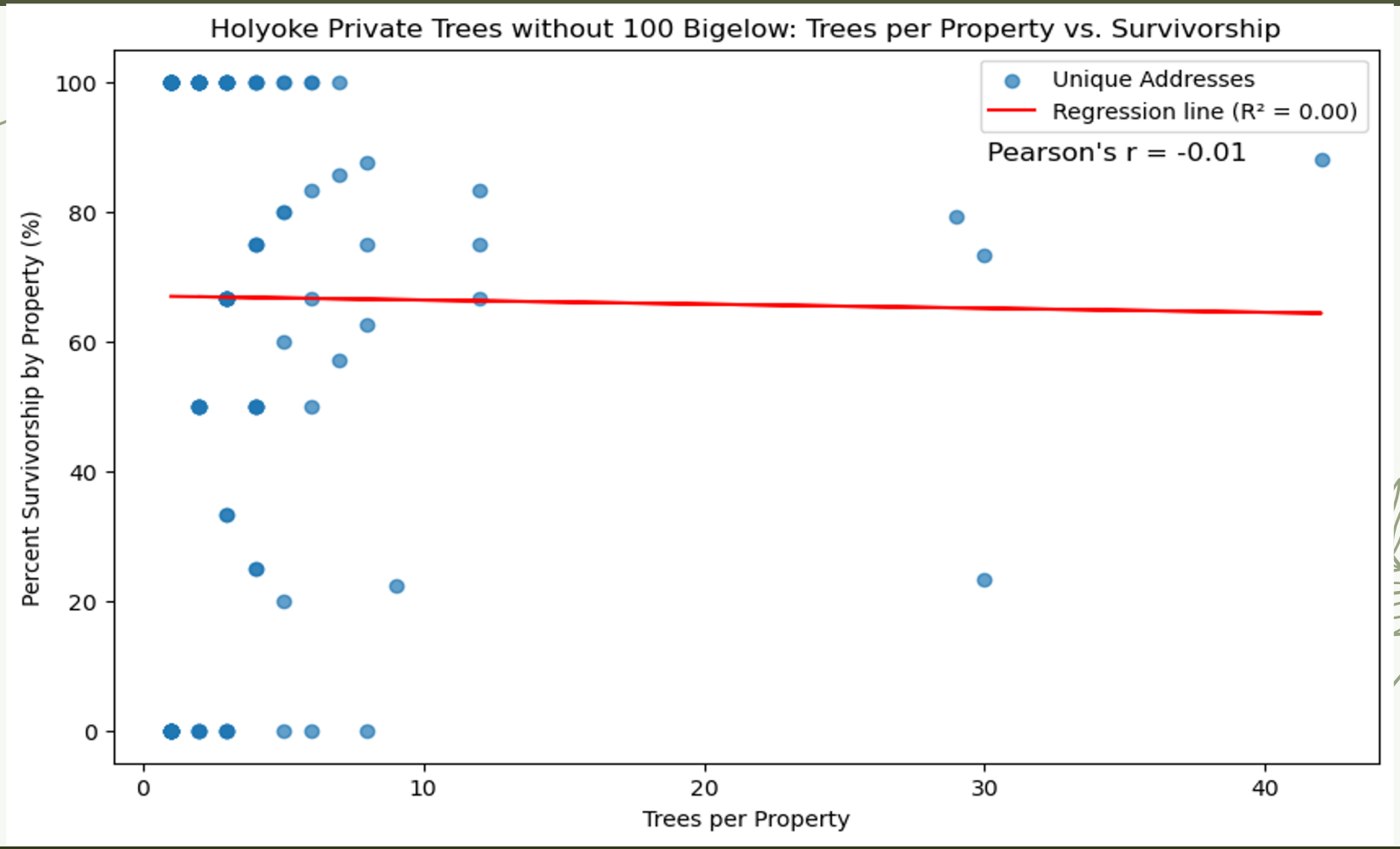
"the **whole experience** was a 10"

10. It's **pretty**. It **doesn't shed**. It doesn't bark. We're **happy to see it grow.** And it survived.


All Overall Private Trees: Trees per Property vs. Survivorship
Unique Addresses
Regression line (R² = 0.00)
Pearson's r = -0.01
Percent Survivorship by Property (%)
Trees per Property
0
20
40
60
80
100


Chelsea Private Trees: Trees per Property vs. Survivorship
Unique Addresses
Regression line (R² = 0.00)
Pearson's r = 0.05
Percent Survivorship by Property (%)
Trees per Property
0
20
40
60
80
100
0
10
20
30
40


Holyoke Private Trees: Trees per Property vs. Survivorship
Unique Addresses
Regression line (R² = 0.00)
Pearson's r = -0.07
Percent Survivorship by Property (%)
Trees per Property
0
20
40
60
80
100


Holyoke Private Trees without 100 Bigelow: Trees per Property vs. Survivorship
Unique Addresses
Regression line (R² = 0.00)
Pearson's r = -0.01
Percent Survivorship by Property (%)
Trees per Property
0
20
40
60
80
100
0
10
20
30
40