Human Environmental Regional Observatory (HERO)

2025 Stakeholder Presentation

Tree Health and Resident Perspectives in Leominster

Worcester Property/Business Owner Perspectives

GREENING THE GATEWAY CITIES
MA Urban Canopy Project

Alicen Civilikas, Aidan Humphreys, Abigail Riseman, Julia Head, Nate Kidd, Jamie Young

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Meet the Research Team!

From Left to Right: Robert Moore, Jamie Young, Alicen Civilikas, Abigail Riseman, Aidan Humphreys, Julia Head, Nate Kidd, and Aidan Caron.

Undergraduate Research Cohort:
Alicen Civilikas, Aidan Humphreys, Abigail Riseman, Julia Head, Nate Kidd, and Jamie Young

Graduate Program Managers:
Aidan Caron and Robert Moore

Directors:
Dr. Nicholas Geron, Dr. Deborah Martin, and Dr. John Rogan

Presentation Outline

1 *Objectives & Study Areas*

2 *Biophysical Methods*

3 *Tree Survey Results*

4 *Leominster Interviews*

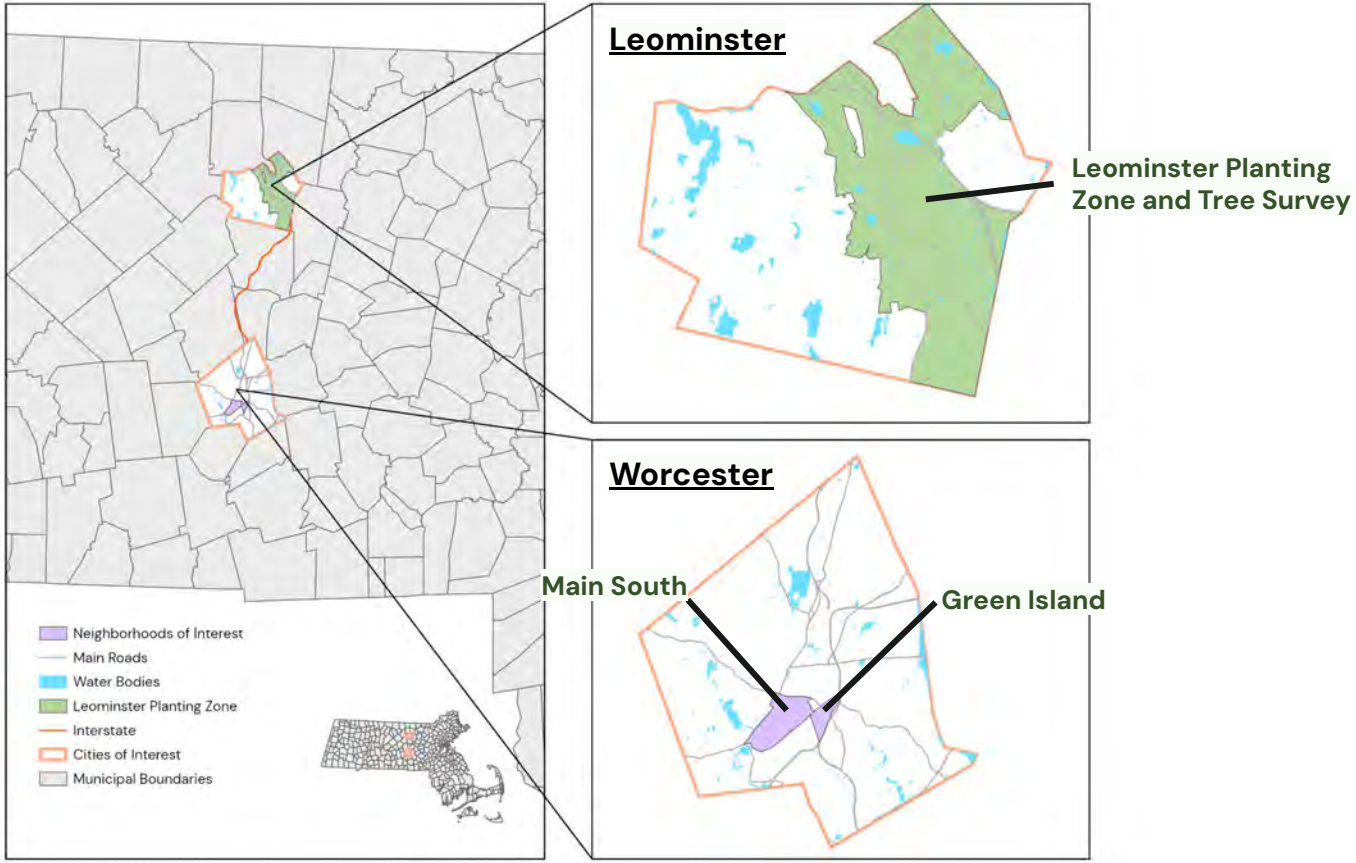
5 *Worcester Interviews*

6 *Conclusions*

Abigail measuring tree height in Leominster

1 Objectives & Study Areas

Study Sites


Leominster
Leominster Planting Zone and Tree Survey
Worcester
Main South
Green Island
Neighborhoods of Interest
Main Roads
Water Bodies
Leominster Planting Zone
Interstate
Cities of Interest
Municipal Boundaries

HERO 2025 Study Objectives

Leominster Tree Survey

Measure the survivorship and growth of Greening the Gateway Cities (GGC) program trees.

Key Questions:

What is the current health and survivorship of planted trees?

How do survival and growth differ by species?

Leominster Interviews

Explore resident perceptions of tree planting and evaluate program coordination among key actors.

Key Questions:

How do Leominster residents perceive trees on their property and in their neighborhoods?

How is tree planting coordinated among DCR, city officials, and community partners?

Worcester Interviews

Examine property and business owner attitudes toward tree planting.

Key Questions:

What motivates business and property owners to accept or reject trees?

What are business owners' preferences towards tree planting on or around their properties?

History of GGC Program in Leominster

2014

Greening the Gateway Cities (GGC) program begins

Chelsea, Holyoke, and Fall River are chosen as pilot cities

GREENING THE GATEWAY CITIES
MA Urban Canopy Project

2016

Planting starts in Leominster

First trees are planted near the Department of Public Works

First planting zone is ~500 acres

2019

Growing Places joins as a Community Partner, assisting with canvassing and raising awareness for the program

HERO surveys trees in Leominster for the first time

Planting zone expands to ~700 acres

GROWING PLACES

2024

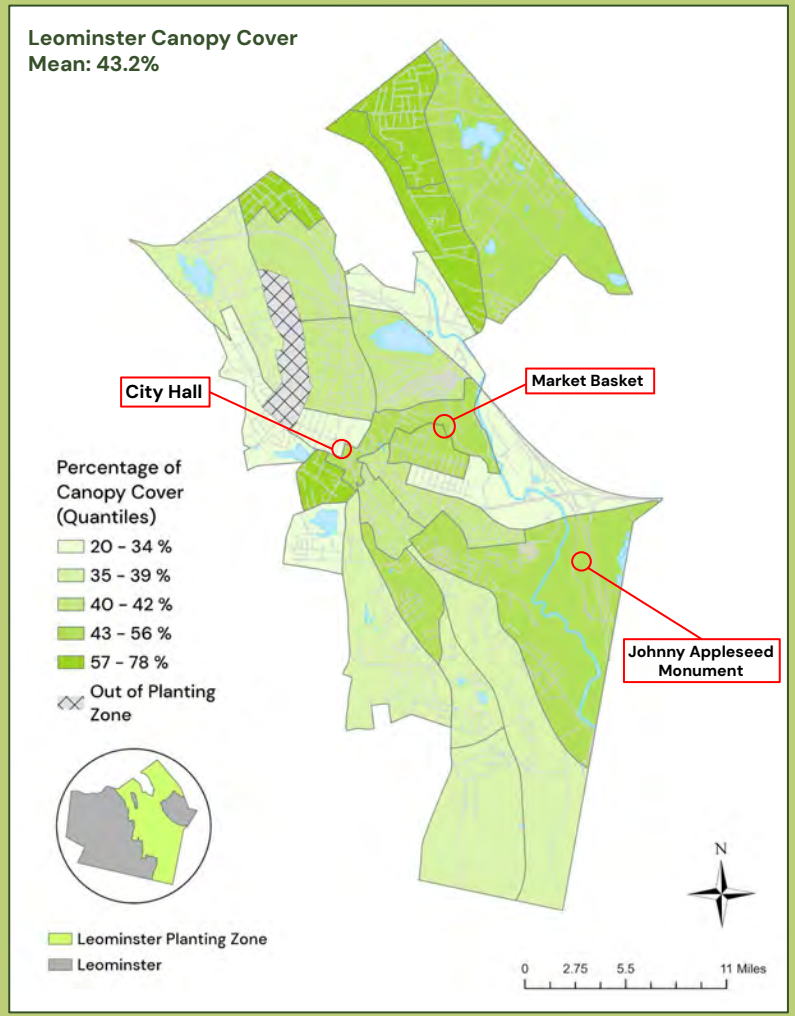
Planting zone expands to all Massachusetts Environmental Justice areas in Leominster

2025

Planting continues

Over 3,500 trees have been planted in Leominster, surpassing the goal of 2,400

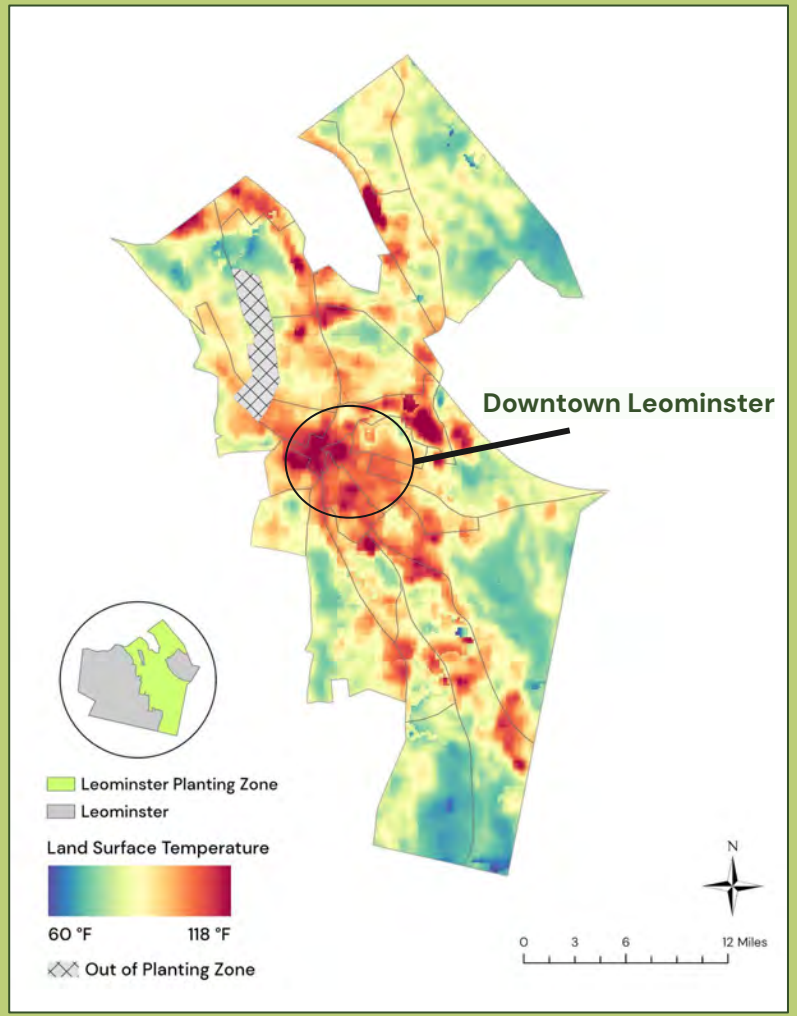
DCR Forester, Nate, and Rob planting a tree together



Leominster

Social Demographics	Leominster	*Massachusetts*
Population	44,209	7,136,171
Population Density	1,519 per sq. mile	901 per sq. mile
White	73.3%	79.0%
Hispanic or Latino	17.1%	13.5%
Mixed Race	12.0%	2.8%
Black or African American	5.4%	9.6%
Asian	3.0%	7.9%
Median Household Income	$81,556	$101,341
Education (persons age 25+ with Bachelor's degree or higher)	32.3%	46.6%
Speak a language other than English at home	24.4%	24.8%

Motivations for Tree Planting



Mean Land Surface Temperature (LST)	88.4 °F
Maximum LST	118.4 °F

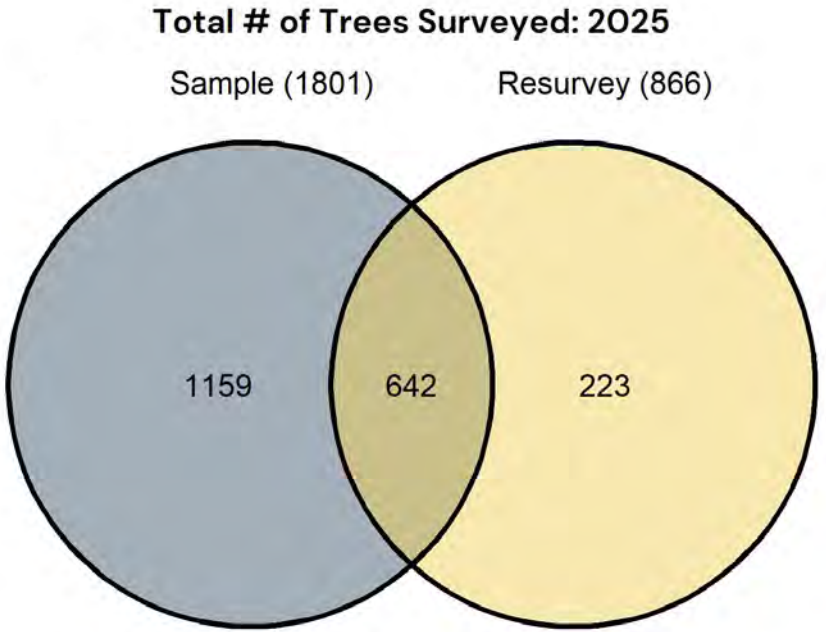
Temperature difference in areas below mean Canopy Cover: + **10.4 °F**

2 Biophysical Methods

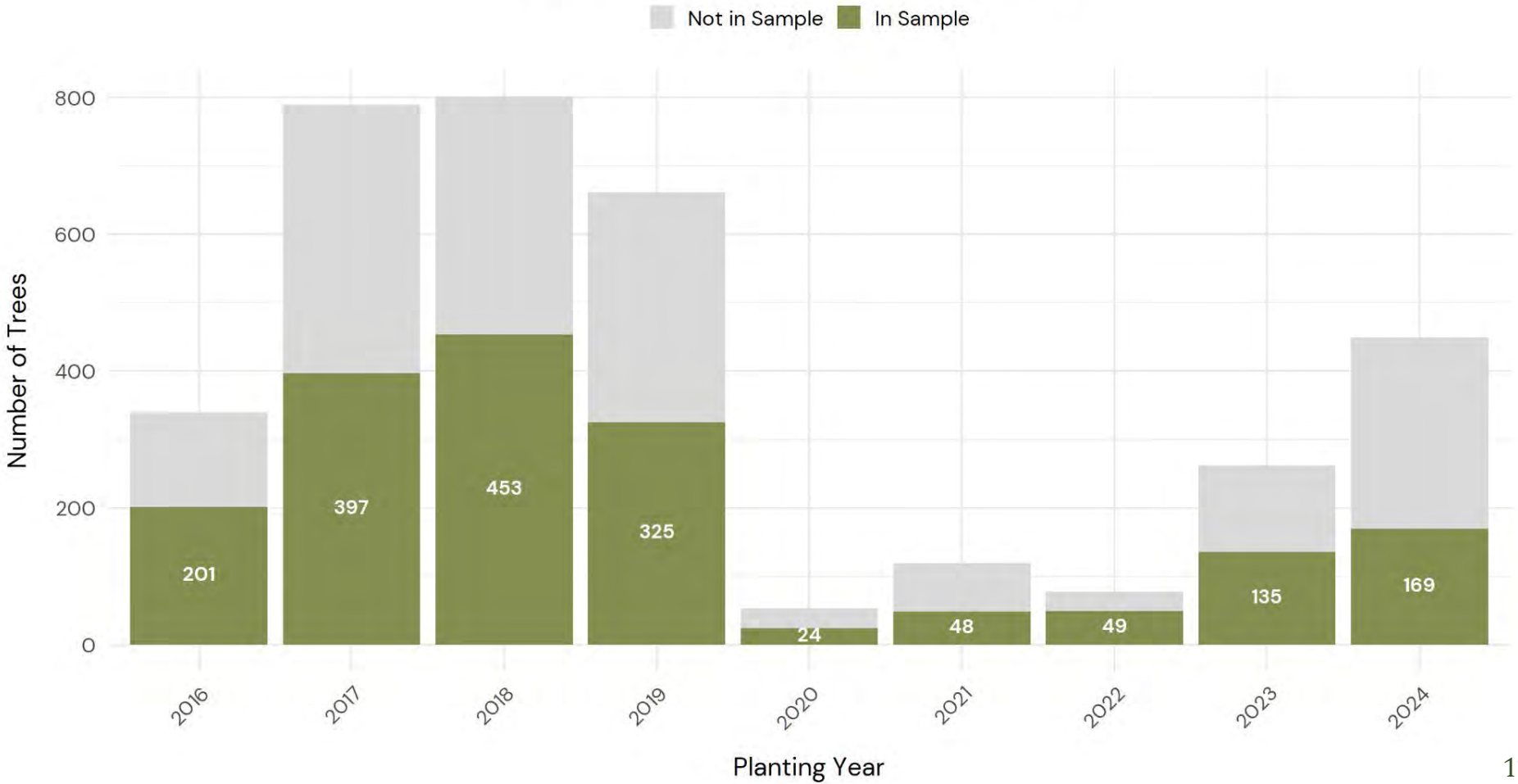
Tree Samples

Tree Sample (1,801)
Mixed sampling strategy
- Surveyed all public trees (658)
- Random sample of private trees (stratified by # of trees per property)

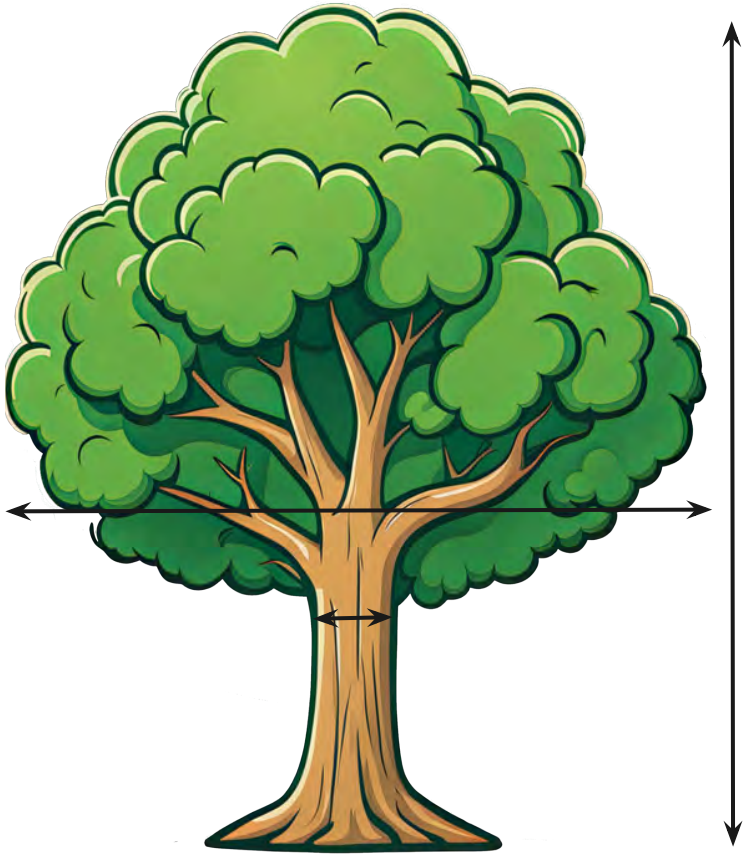
Resurvey (866)
- All trees surveyed by HERO in 2019 were re-surveyed in 2025



Leominster Tree Sample and Total DCR Trees Planted n=1801



Biophysical Field Measurements



Diameter at Breast Height (DBH):
Measured with diameter tape at 54 inches, the closest unobstructed point, or at 12 inches if the tree was too short.

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

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

Data Collection and Input: Field Maps

ArcGIS Field Maps mobile app showing tree ID #500574, a Ginkgo (Ginkgo biloba) in Leominster

Fields	Description	
Property Type	The type of property based on how it is used by humans (ex. Residential)*	Location
Site Type	A tree's immediate location (where applicable)(ex. sidewalk cutout)	
Mortality	Alive, standing dead, stump, or removed	
DBH	Diameter at breast height (54in)	Structure
Tree Height	Height of tree from base of trunk to highest point	
Crown Width	Horizontal width of crown, measured from one edge to the other	
Crown Vigor	Assessment of crown health, considering fullness and leaf discoloration	Health
Condition	Holistic assessment of tree health, including trunk, branch, and crown	
Basal Sprouts	Growths coming from the low base of the trunk or the roots (yes/no)*	
Bark Damage	Punctured, peeled, or cracked bark (major/minor/none)	
Branch Damage	Lost, broken, discolored, or leafless branches (major/minor/none)	

*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

Property Type

What type of space is the planting site?

- Residential
- Street Tree
- Maintained Greenspace
- Institutional
- Commercial
- Vacant
- Other

American Sweetgum (Liquidambar styraciflua)

Residential

European Hornbeam (Carpinaus betulus)

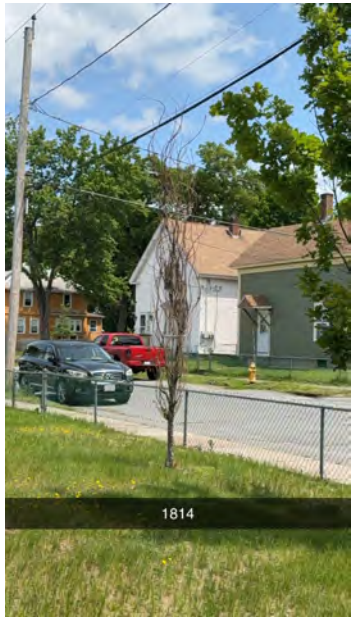
Commercial

Crabapple (Malus)

Street Tree

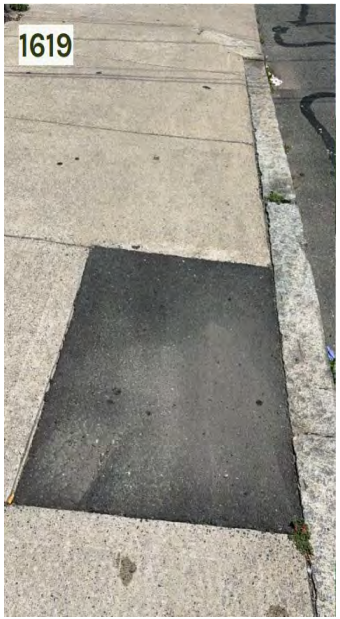
Assessing Survivorship

Alive



Standing Dead

Stump



Removed

Unknown

Assessing Vigor – Canopy Fullness

[1] 90% to 100%

[2] 75% to 90%

[3] 50% to 75%

[4] 50% or less

Discolored Leaves

From left to right, London Planes (Platanus × acerifolia) decreasing in vigor

Assessing Tree Condition – Structure & Health

Bark Damage

Branch Damage

Black Tupelo
(Nyssa sylvatica)

Good

White Fir
(Abies concolor)

Fair

Eastern Redbud
(Cercis canadensis)

Poor

Basal Sprouts

3 Tree Survey Results

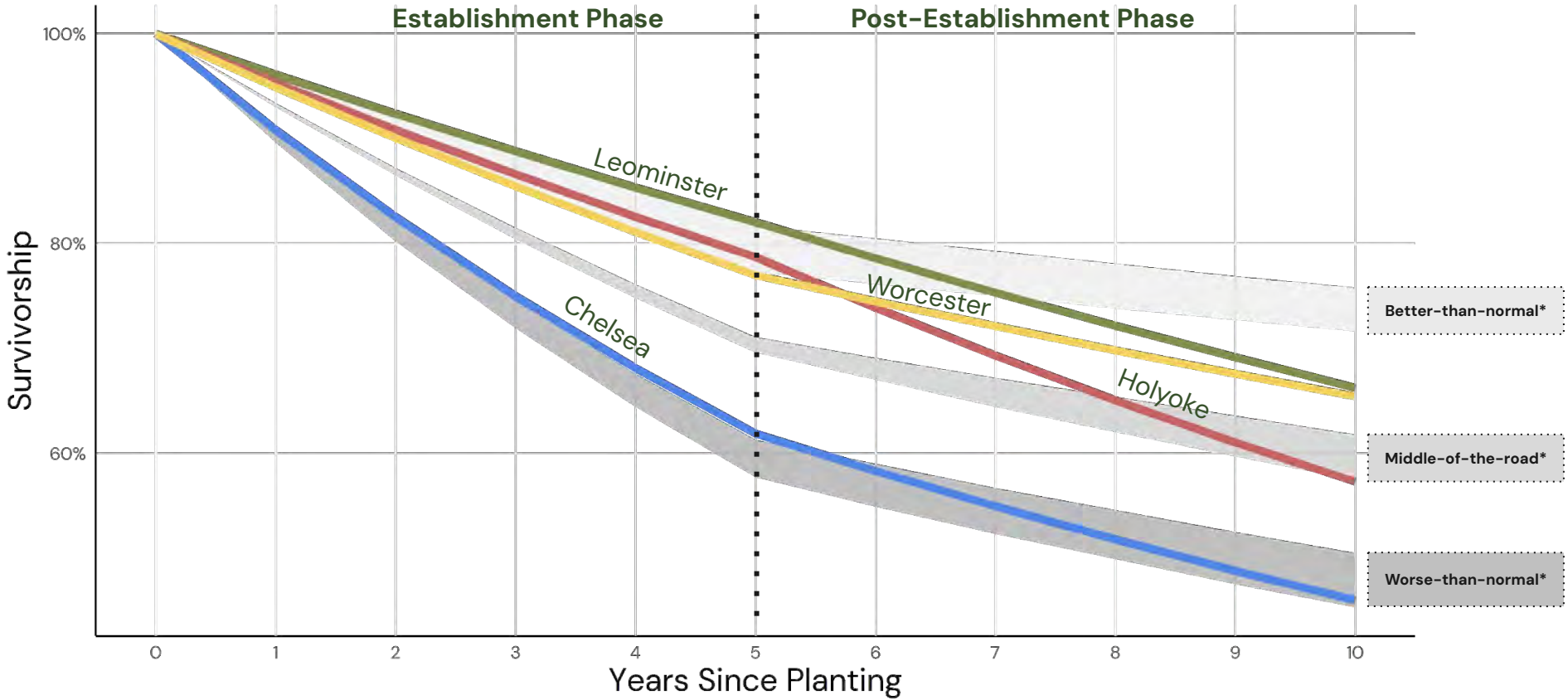
Leominster Annual Survivorship

Annual Survivorship is the percent of trees that survive each year after planting. This metric is helpful for comparing survivorship outcomes across different cohorts and planting programs.

	Establishment Avg. Annual Survivorship *(1 - 5 years after planting)*	**Post-Establishment** Avg. Annual Survivorship *(6+ years after planting)*
National Median*	93.2%	96.7%
Leominster	96.1% (2020-2024)	95.8% (2016-2019)

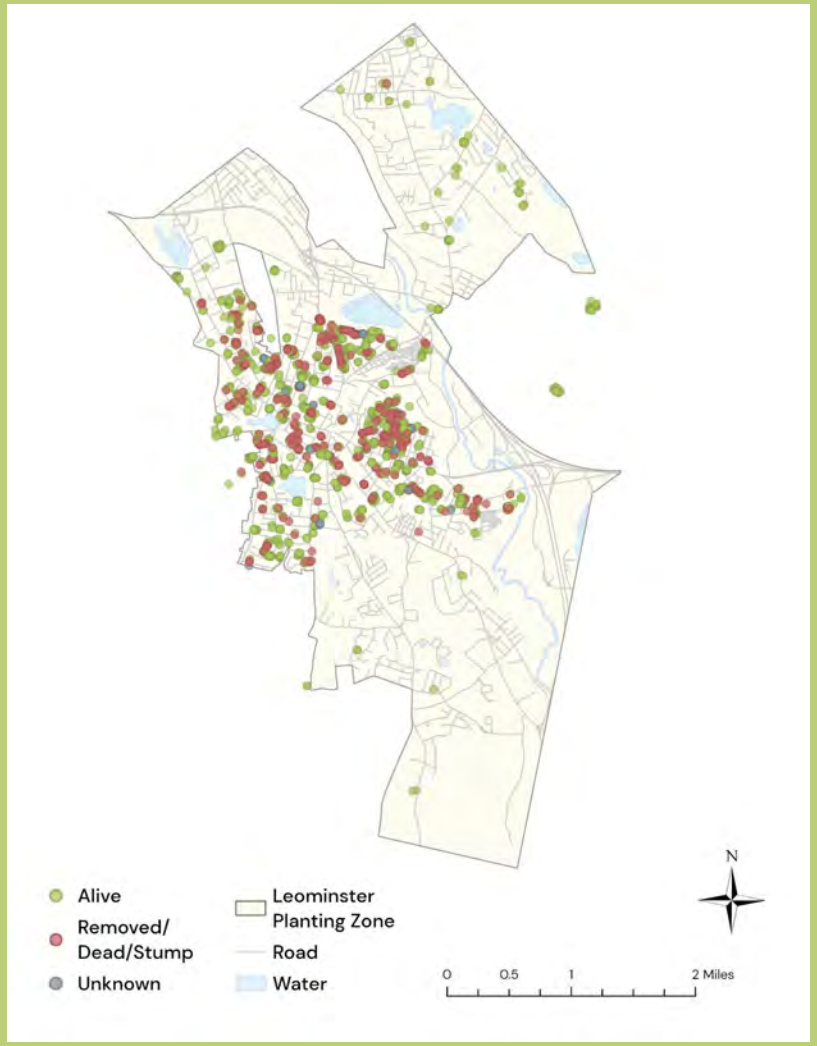
**Hilbert, D. R., Roman, L. A., Koeser, A. K., Vogt, J., & van Doorn, N. S. (2019). Urban tree mortality: A literature review. Arboriculture & Urban Forestry (AUF), 45(5), 167-200.*

Leominster in Context

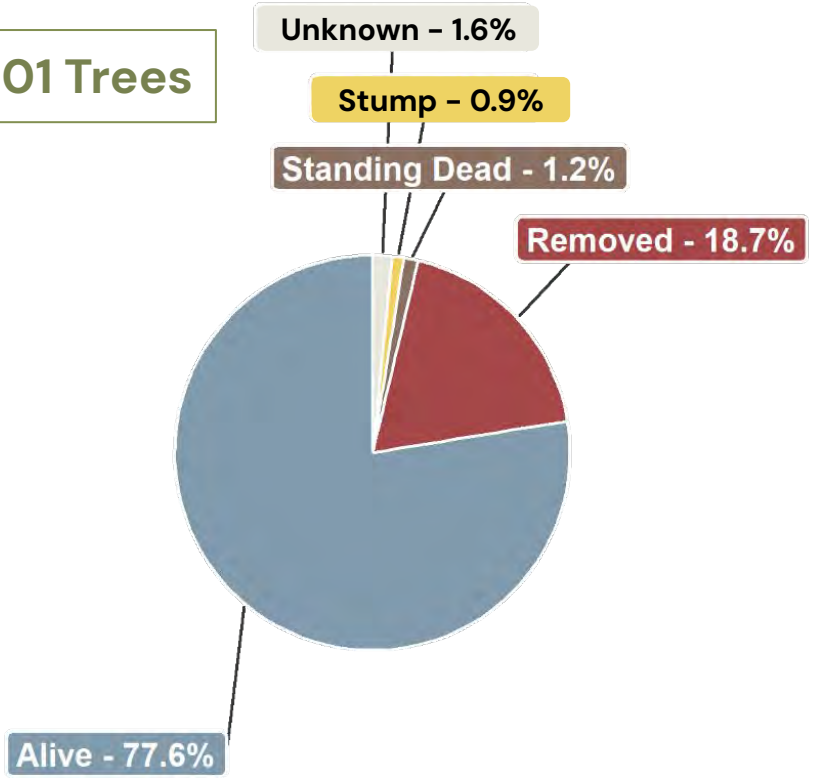


*Hilbert, D. R., Roman, L. A., Koeser, A. K., Vogt, J., & van Doorn, N. S. (2019). Urban tree mortality: A literature review. Arboriculture & Urban Forestry (AUF), 45(5), 167-200.

Tree Sample Survivorship



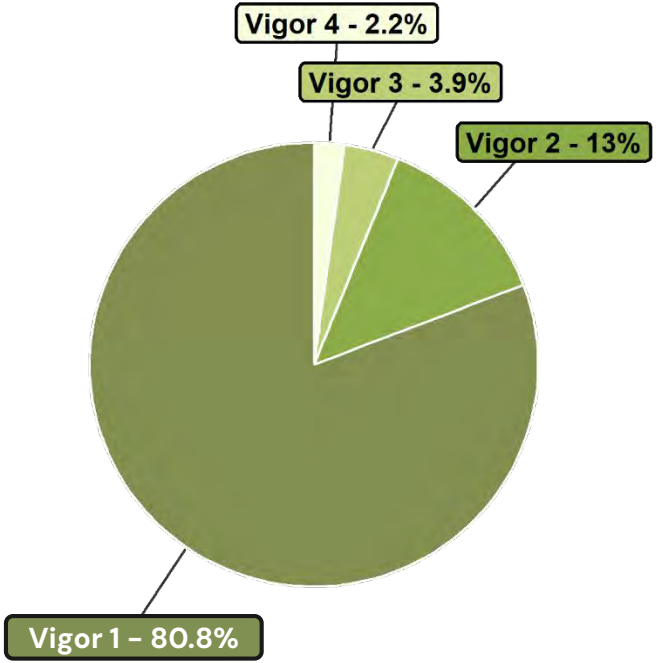
1,801 Trees



Health of Living Trees (n = 1,397)

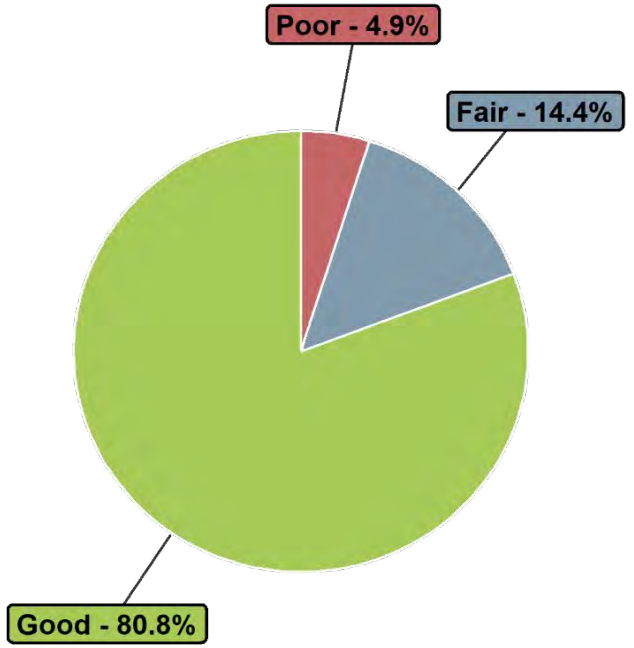
Vigor

Assessment of crown health, considering fullness and leaf discoloration



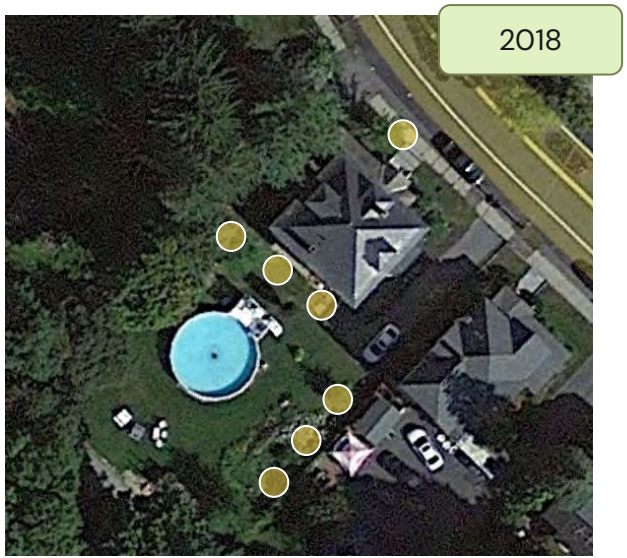
Condition

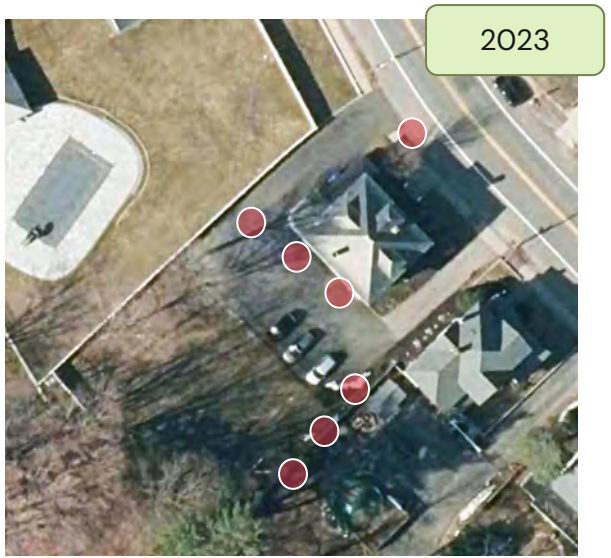
Visual assessment of tree health, including trunk, branch, and crown



Survivorship & Human Influences

Humans can make tree removal decisions independent of tree health or safety concerns. Survivorship statistics can be influenced by sites where trees were removed for reasons other than tree health, often being aesthetics, construction, renovation, and new ownership.*





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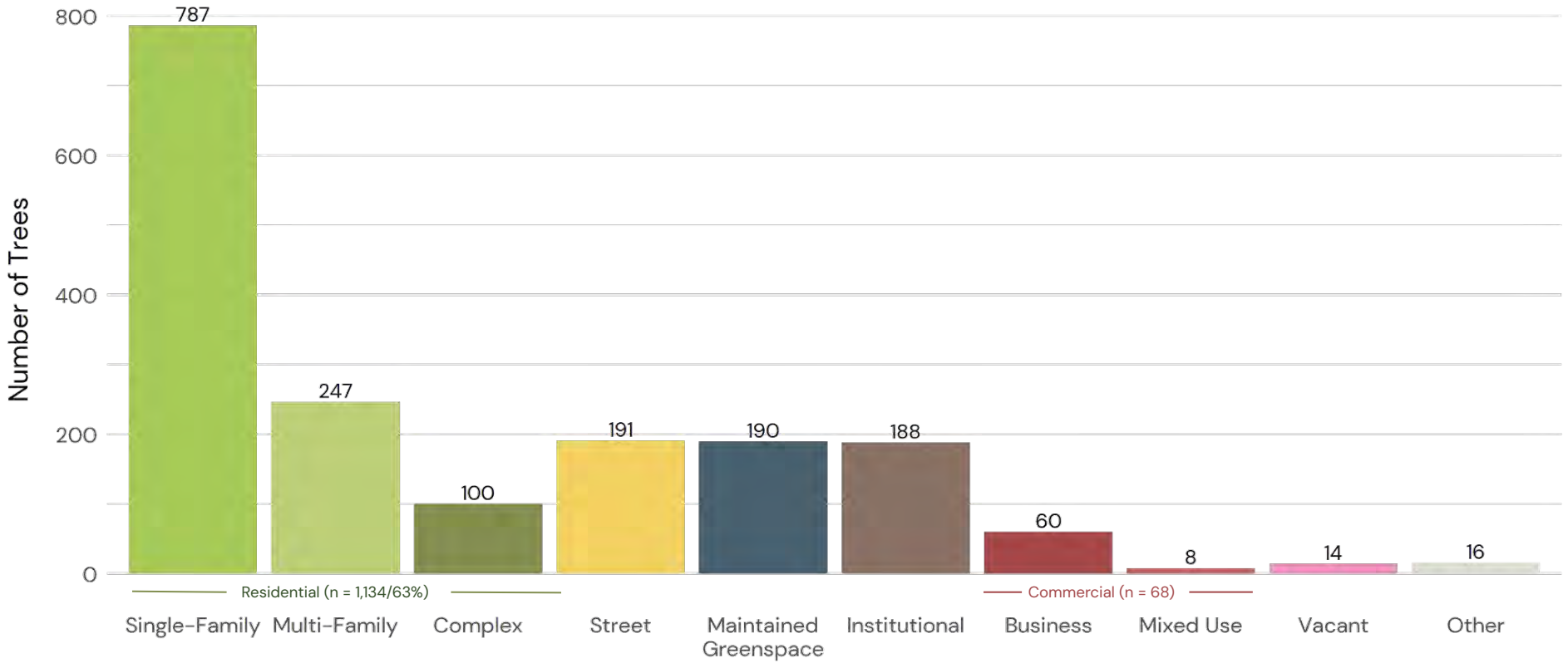
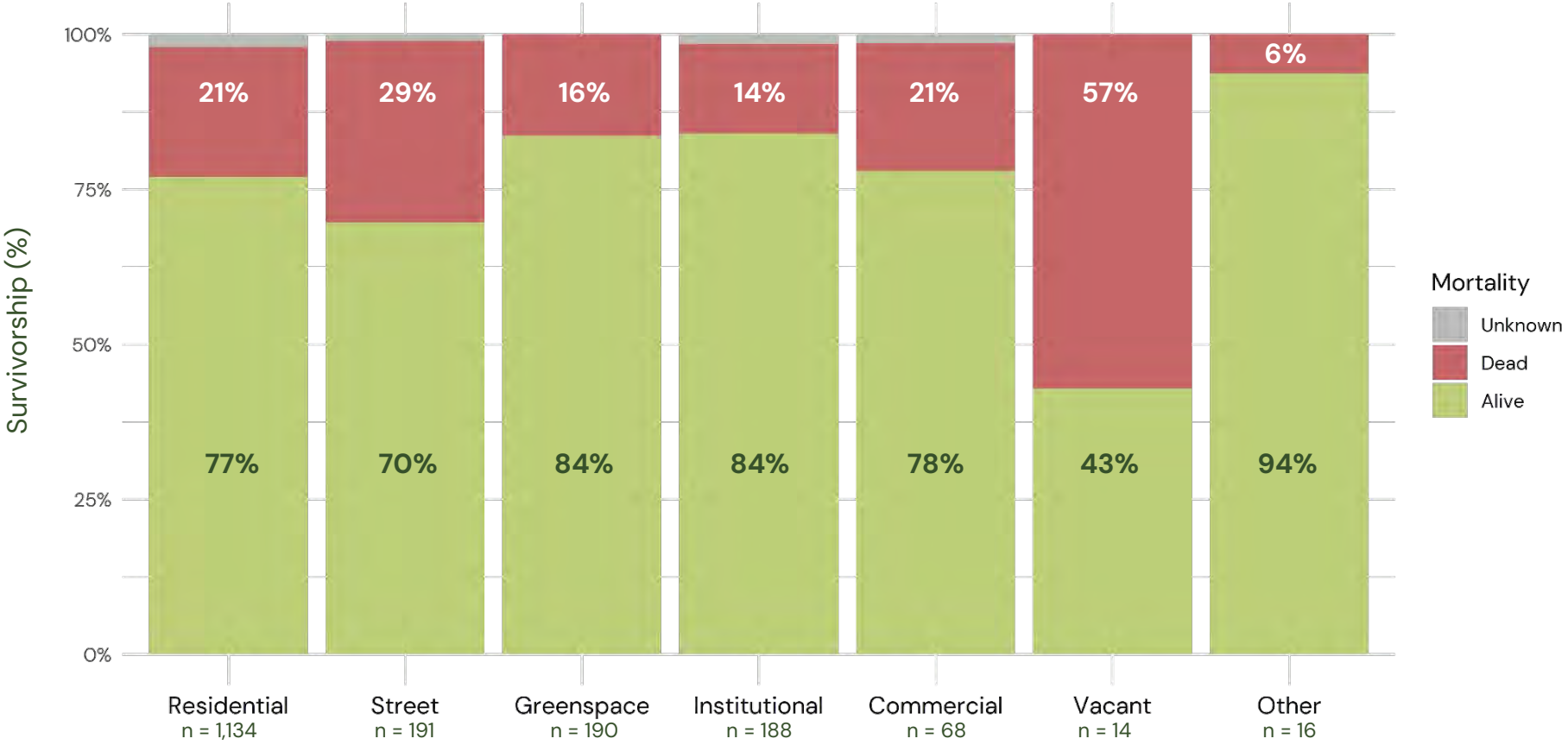
Tree Count by Property Type



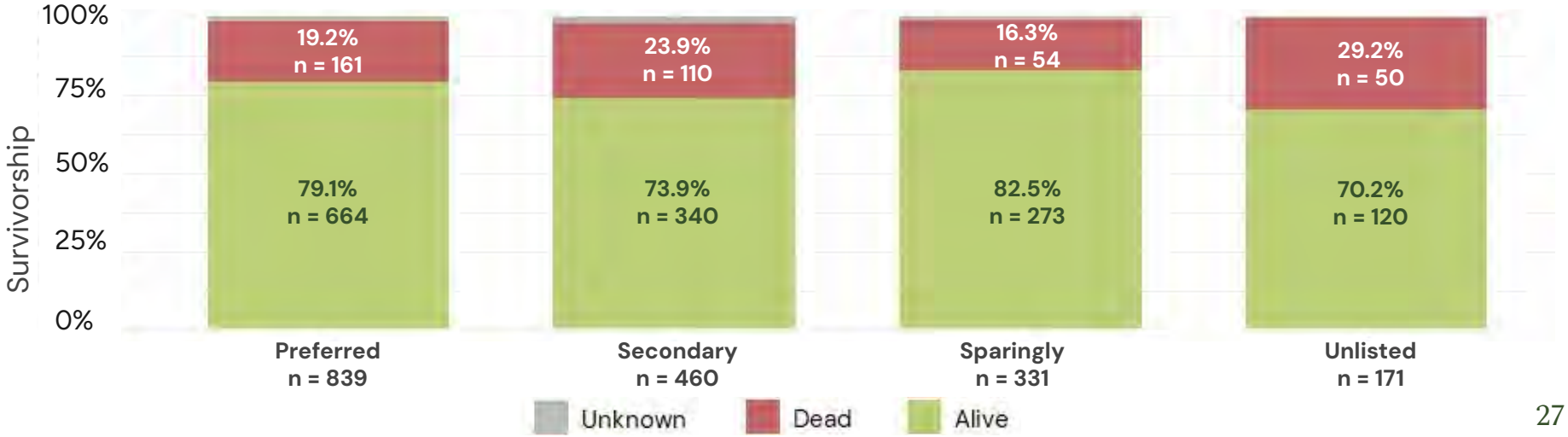
Survivorship by Property Type



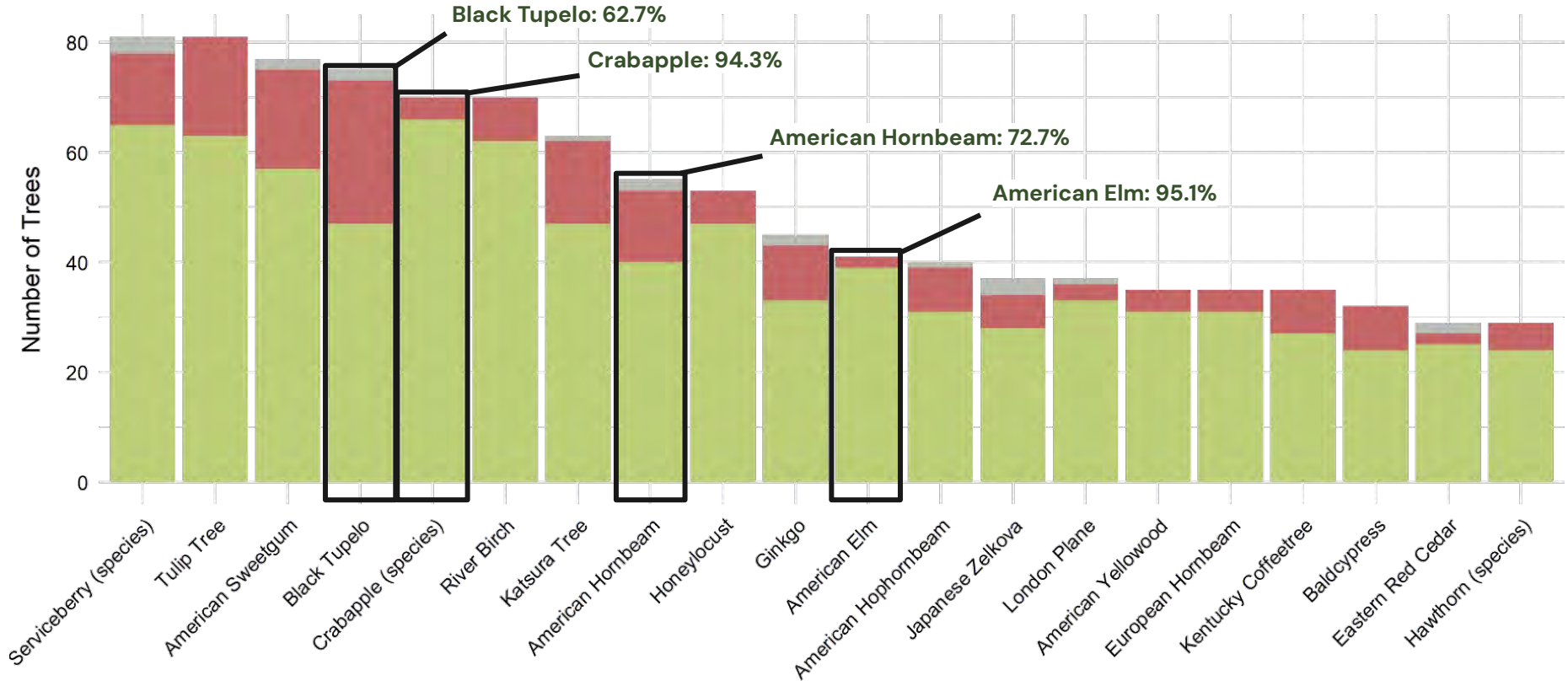
Dead includes stumps, standing dead, and removed trees

Survivorship by DCR/GGC Program Tree Categories

	Preferred Urban Canopy Trees	**Secondary** Consideration	Use **Sparingly**	**Unlisted**
% of Sample	46.6%	25.5%	18.4%	9.5%
Examples	Oaks, Tulip Tree, River Birch, Honey Locust, American Elm, London Plane	Maples, Firs, American Hornbeam, European Beech, Fastigiata	Serviceberry, Crabapple, Dogwoods, Cherry Trees, Japanese Tree Lilac	Sycamore, Western Red Cedar, Hybrids (Oak Hybrid), Broad genera (Elm)

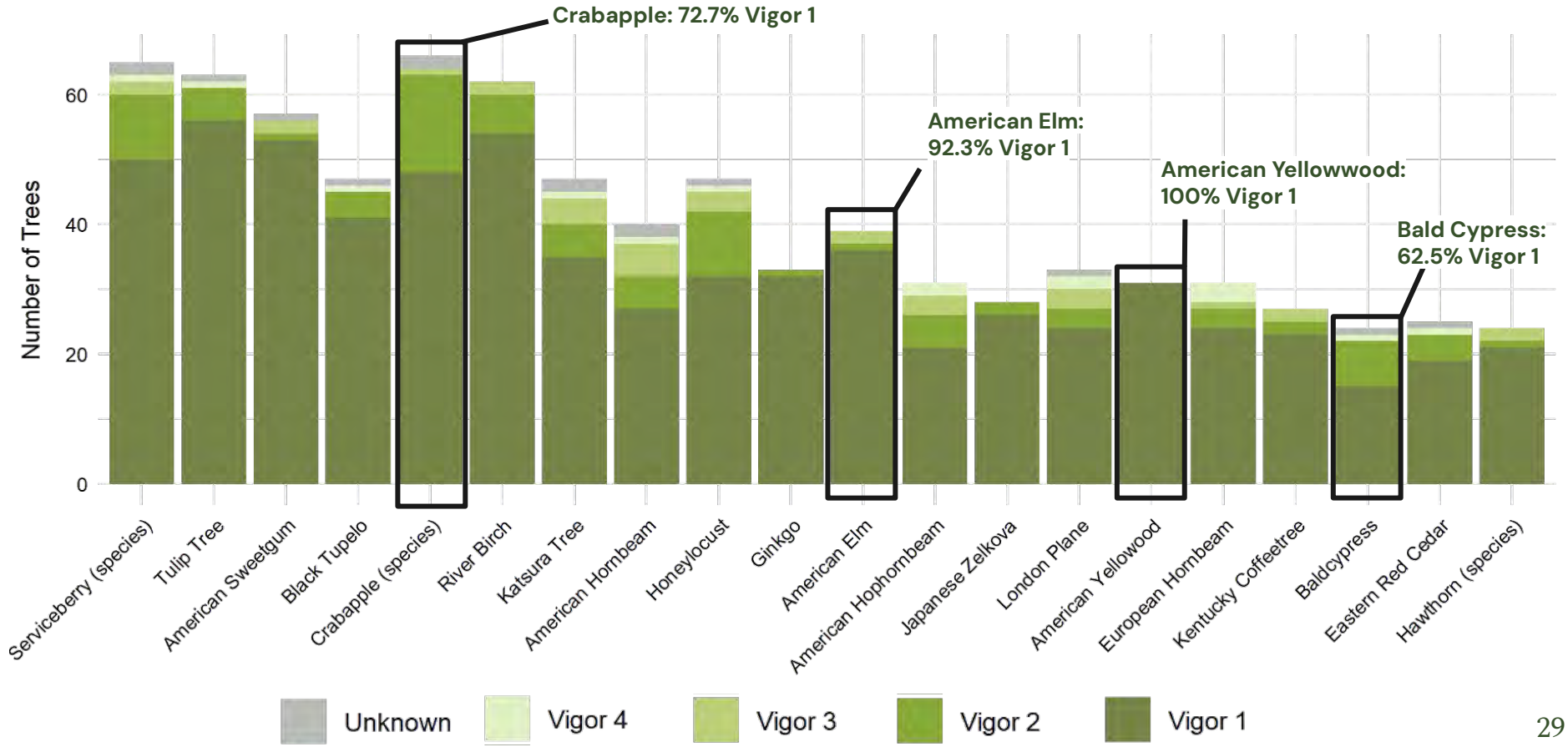


Survivorship by Species (n > 28)



Excludes ~ 30 trees known to be removed for reasons other than dead or dying

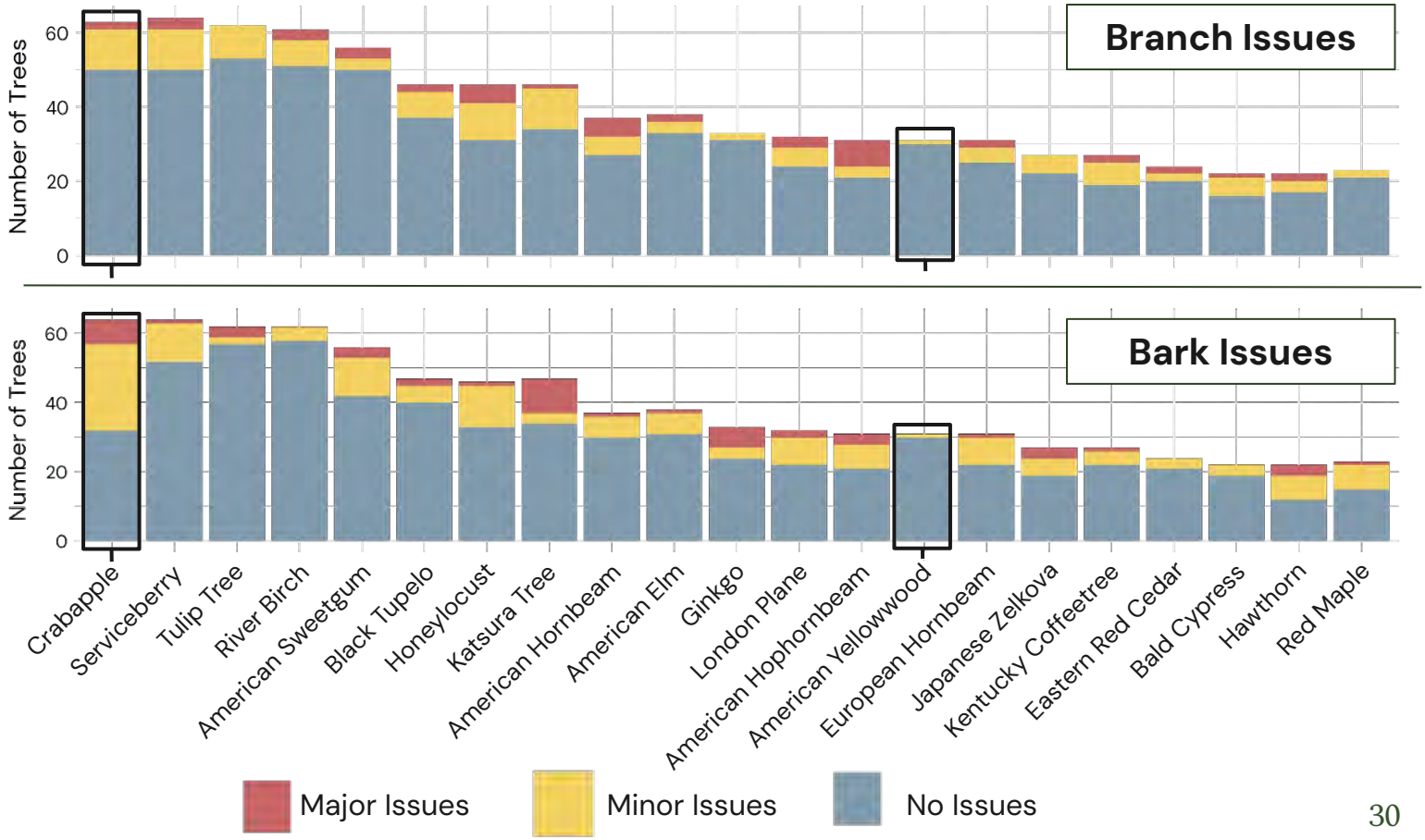
Vigor by Species of Living Trees (n > 28)



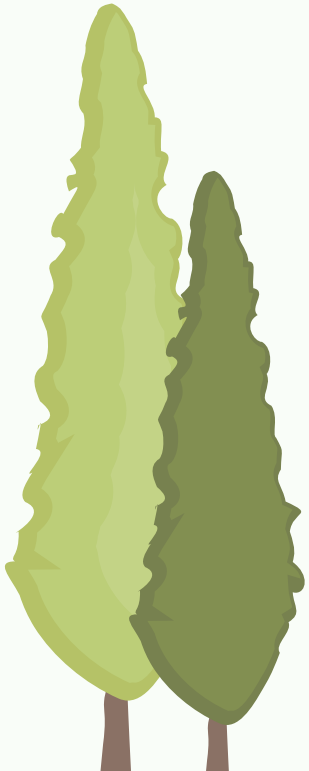
Tree Health Issues by Species (n > 22)

Example of a tree with major branch issues.

Example of a tree with major bark issues.



Summary of Tree Survivorship and Health



Overall Survivorship & Health

Survivorship: Out of our survey of 1,801 trees, 77.6% were alive and 18.7% were removed.

Leominster sees better-than-expected annual survivorship during the establishment phase.

Health: 80.8% of trees were in good condition with a Vigor 1.

Not all removed trees died, but some are removed for development

Planting Context and Performance

Private Trees: Leominster has a large number of trees at private residences compared to other Gateway Cities.

Residential trees had a 77% survivorship rate and street trees had 70% survivorship.

Highest Success: The highest survivorship is in formal green spaces and institutional spaces.

The species with the highest survivorships are American Elm and Crabapple trees

GREENING THE GATEWAY CITIES
MA Urban Canopy Project

LEOMINSTER MASSACHUSETTS · CITY 1915 ·

GROWING PLACES

2019-2025 Resurvey of Leominster Trees (n = 866)

2019 2025

*The same **Tulip Tree** (Liriodendron tulipifera) at a residence that **grew 20.5 ft in height** from 2019-2025*

2019 2025

*The same **Dawn Redwood** (Metasequoia glyptostroboides) in a city pocket park that **lost 3.5 ft in height** from 2019-2025*

2019 Vigor and 2025 Mortality

Vigor 1

Bald cypress (Taxodium distichum) being surveyed by Nick in 2019

	Vigor 2019			
	1	2	3	4
Dead Trees	95	18	7	14
Total Trees	614	99	28	33
Mortality (2019-2025)	15.5%	18.2%	25%	42.4%
Annual Mortality	2.6%	3%	4.2%	7.1%

Vigor 4

The same Bald cypress in 2025 with decreased vigor

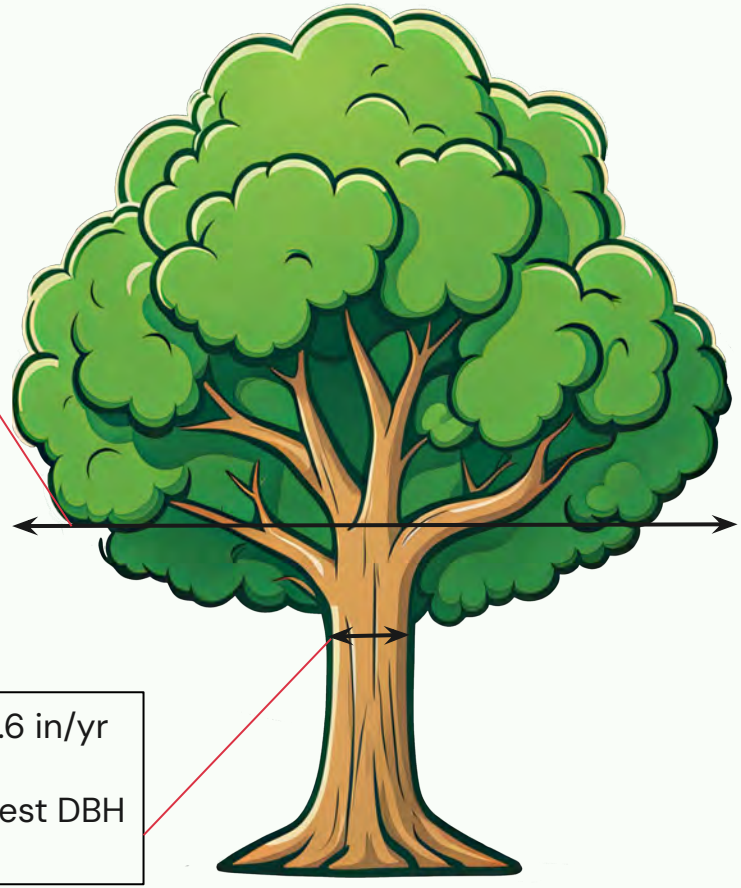
Dead includes standing dead, stumps, and trees that have been removed. 151 Removed/Dead/Stump Trees.

Tree Growth

Canopy Width

River Birches: Median canopy width growth rate of 1.7 ft/yr

A London Plane canopy grew 25.2 feet wider since 2019



Height

Tulip Trees: Median height growth rate of 1.9 ft/yr

4 Freeman Maples at the same address grew over 26 feet since 2019

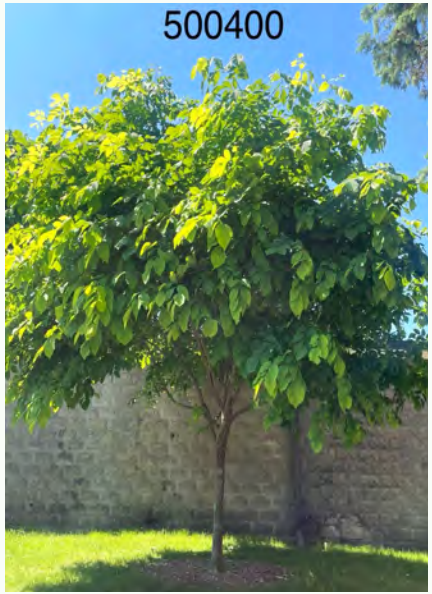
DBH

Elms: Median DBH growth rate of 0.6 in/yr

An American Elm tree had the largest DBH difference since 2019 of 8.5 inches

High Performing Tree Species

Key criteria = High growth rates, high survivorship, vigor, health issues, past planting numbers



American Yellowwood (Cladrastis kentukea): *#1 for vigor 1, low health issues, relatively underplanted (~40)*

American Elm (Ulmus americana): *# 1 for survivorship by species, high proportion of vigor 1, relatively underplanted (~40)*

London Plane (Platanus x acerifolia): *High survivorship, high growth rate, relatively underplanted (~40)*

River Birch (Betula nigra): *High survivorship, high growth rates, high proportion of vigor 1, low health issues*

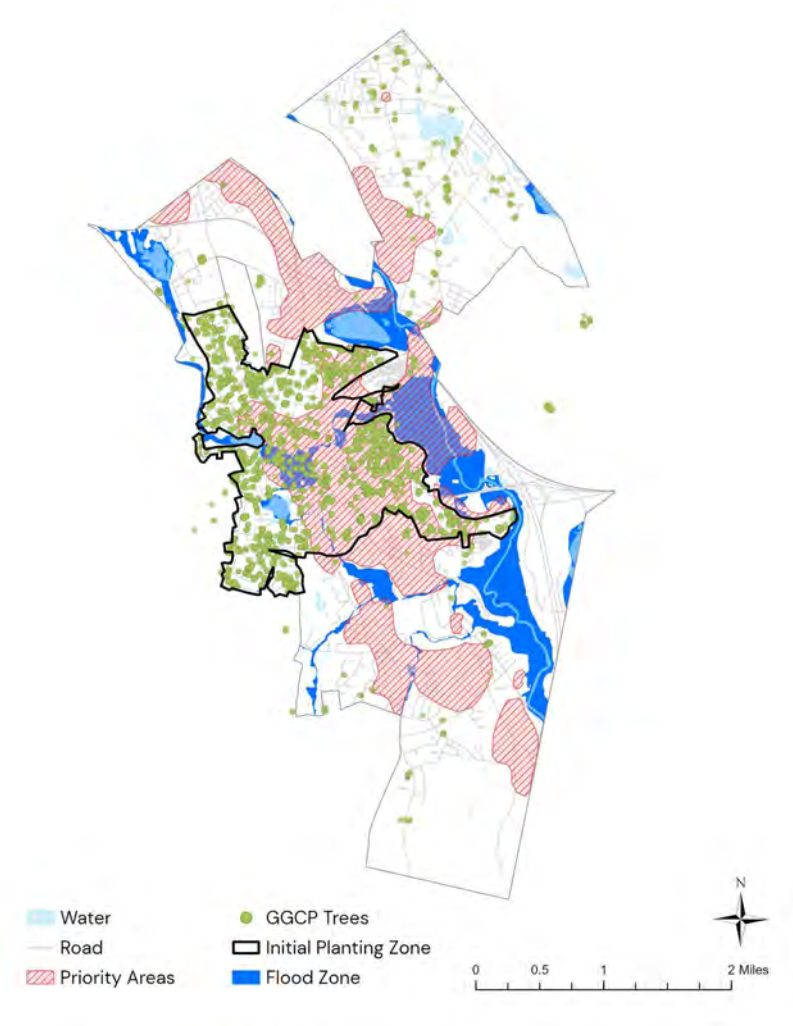
Species to Plant with Caution

Key criteria = Past planting numbers, survivorship, vigor, health issues, and growth rates

Black Tupelo (Nyssa sylvatica): *Low survivorship, lowest proportion of vigor 1, highly planted (~70)*

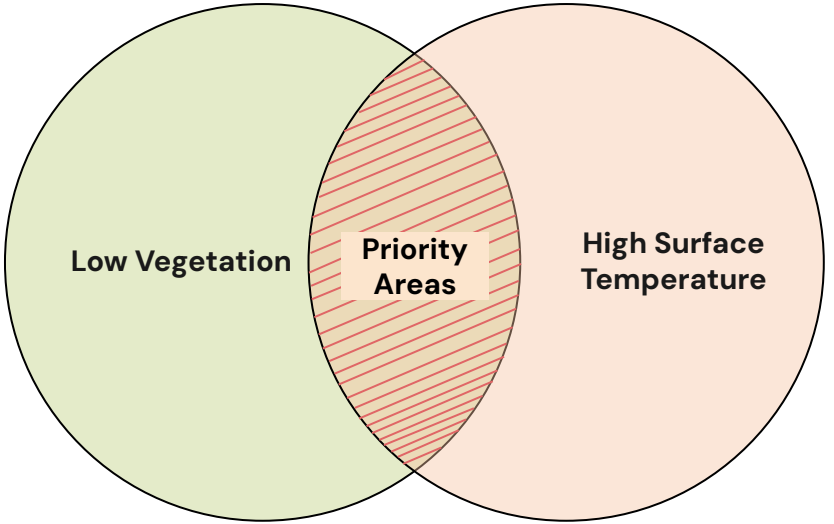
Serviceberry (Amelanchier): *Low proportion of vigor 1, high health issues, highly planted (~80)*

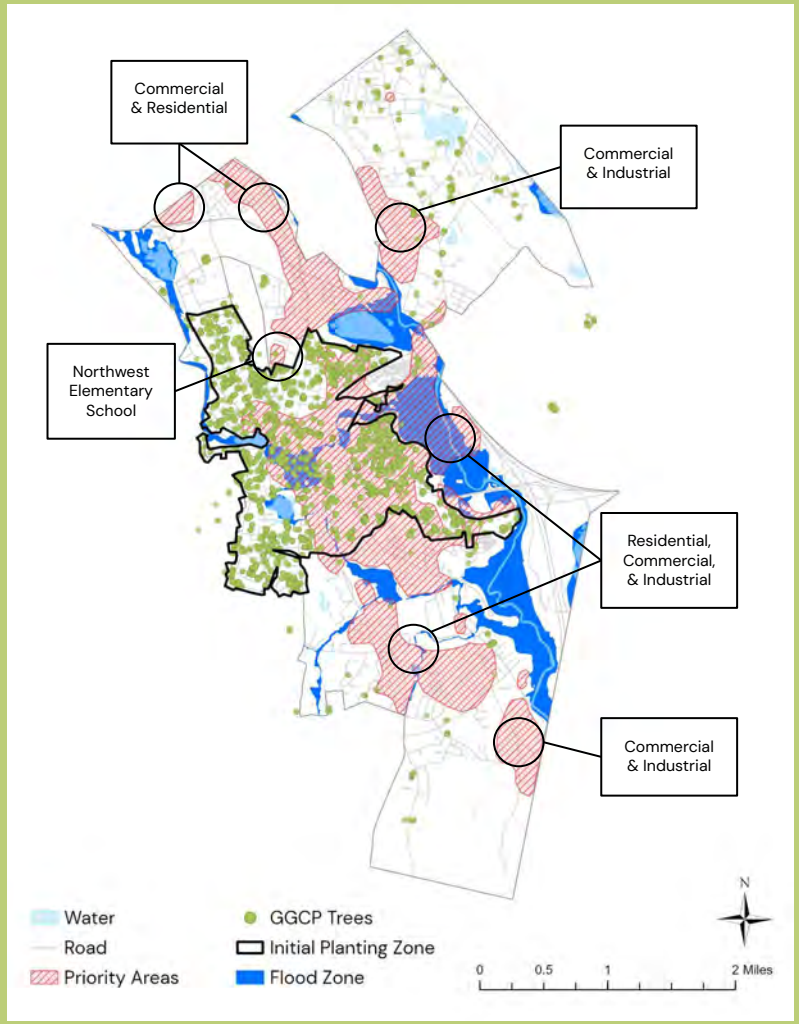
Crabapples (Malus sylvestris): *Low growth rates, low proportion of vigor 1, high health issues, highly planted (~70)*



Priority Areas & GGC Trees (2016-2024)

Priority areas are defined by high surface temperatures and areas with low vegetation.





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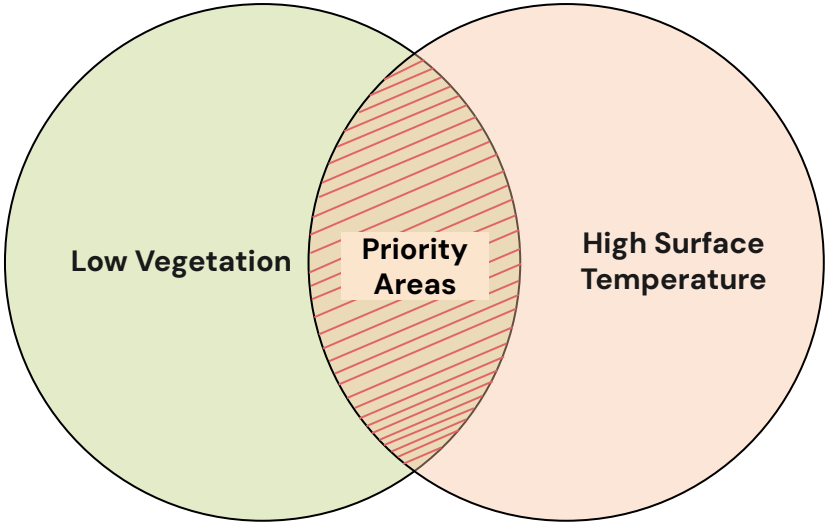
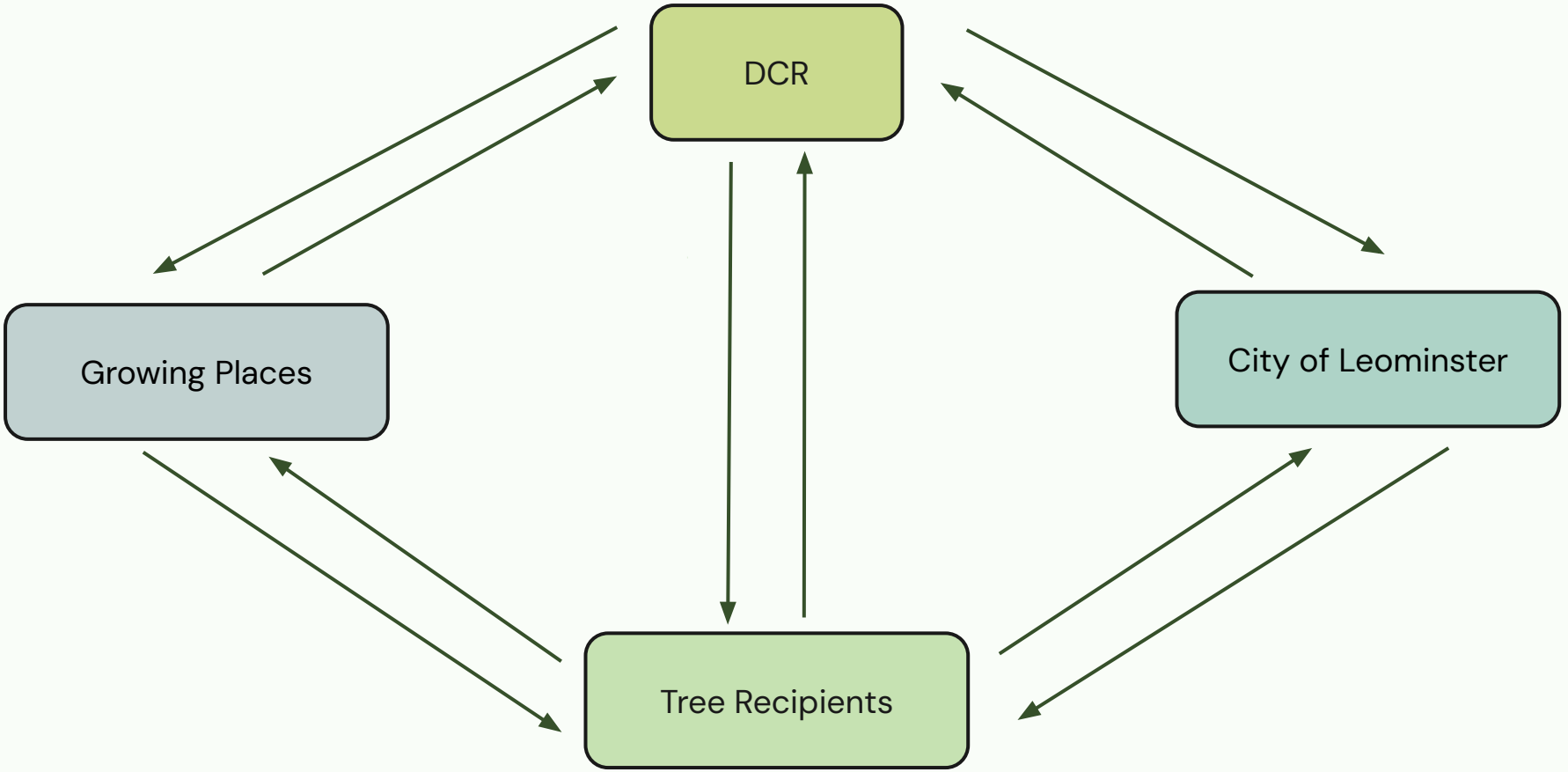


4 Leominster Interviews

GGC Program Stakeholder Roles



Leominster Key Interview Questions

Residents and Recipients

- Perceptions of the role of trees and tree planting initiatives
- Experiences and beliefs that impact tree stewardship

Community Partners, City Officials, and DCR Foresters

- Communication and collaborations to maximize outreach and education about the program
- Community partner's partnerships and philosophies that create a lasting impact and educate residents about tree stewardship
- The city's mission and goals that support the GGC program/other greening programs

Ali and Julia walking in Leominster

Leominster Interview Summary

32 Residents/Recipients Interviewed

- 363 phone calls and in-field convenience sampling
  - 21 interviews scheduled from calls
  - 11 convenience sampling interviews

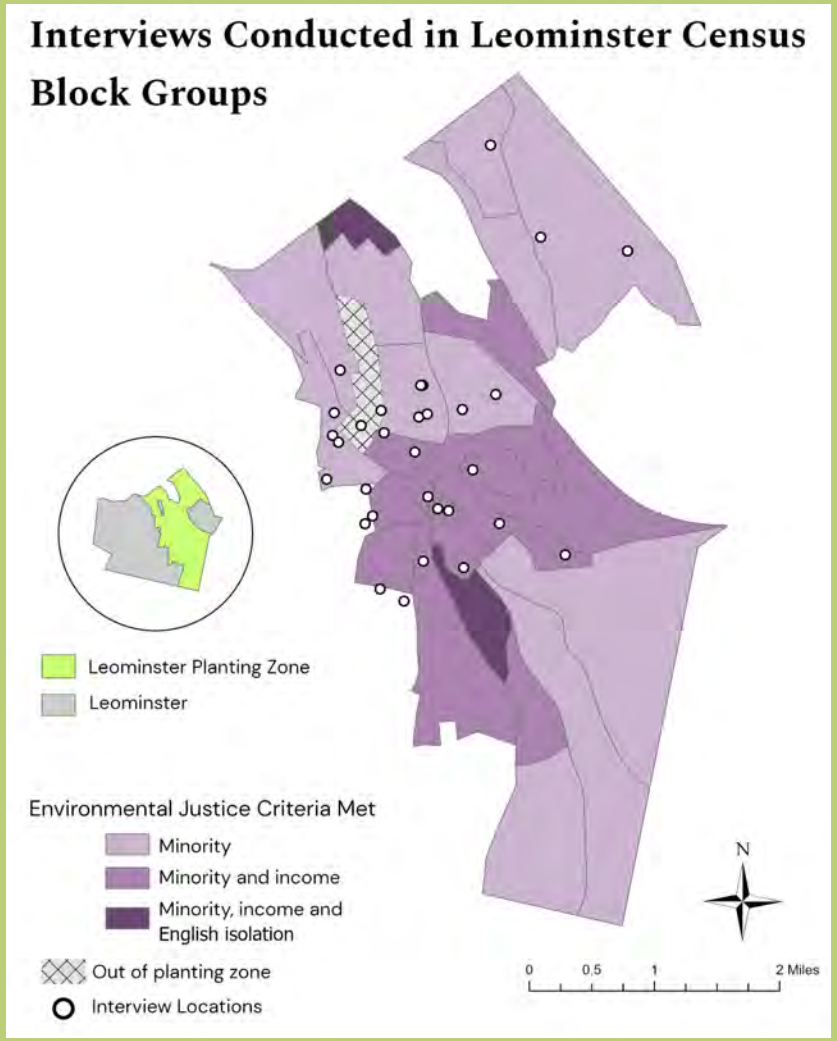
3 Growing Places Employees Interviewed

3 City Government Employees Interviewed

- Recreation Department, Conservation Commission, and Planning Department

1 DCR Forester Interviewed

Ali conducting an interview with a resident



Leominster Interview Location and Demographics

Demographics	Leominster	Interviewees
Population	44,209	32
Median Age	41.8	60
Bachelor's Degree	32.3%	50%
Percent Renters	37.1%	9.7%
Percent White	73.3%	62.5%
Percent Hispanic	17.10%	12.5%
Median Household Income	$81,556	$125,000
English Only Household	75.6%	78.1%

Interviewee Male to Female Ratio: 53% Female

Processing Interviews

1. **Transcribe** using Kaltura and manually

2. **Code/process** transcripts with Nvivo software
   a. **Create** codes that emphasize interview themes
   b. **Sort** interview quotes into the codes
   c. Each interview coded by 2 members to ensure intercoder reliability

3. **Assess** and **quantify** the themes and trends that emerged from the coded data set

Nate coding an interview using NVIVO

Interview Codes

Operations
- a. Program perceptions
- b. Outreach
- c. Partnerships

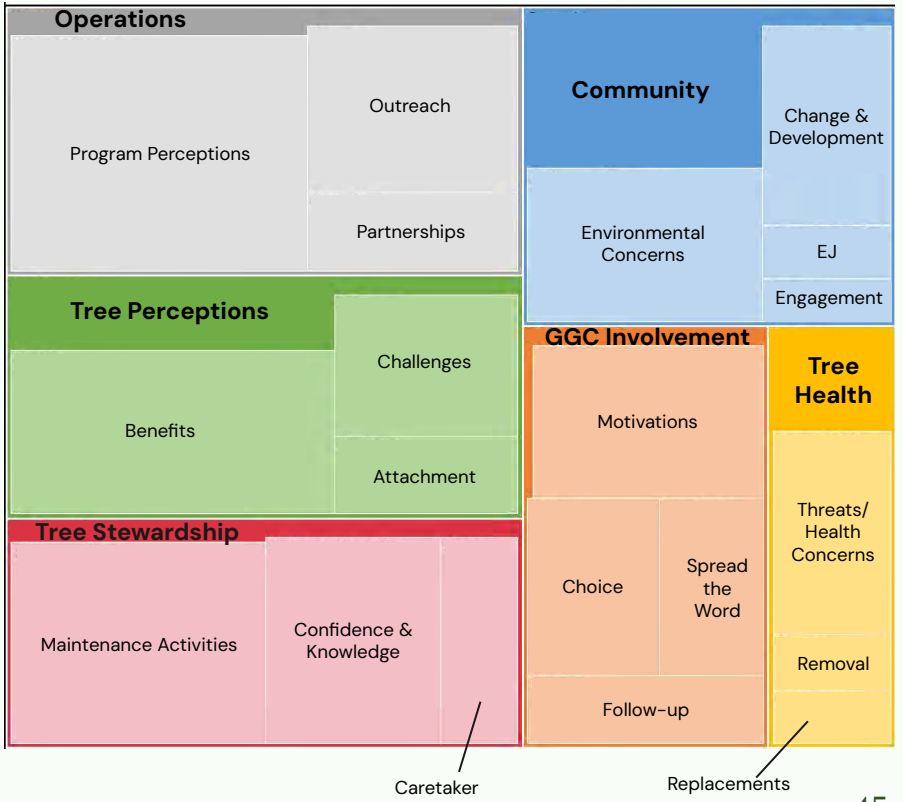
Tree Perceptions
- a. Benefits
- b. Challenges
- c. Attachment

Tree Stewardship
- a. Maintenance activities
- b. Confidence & Knowledge
- c. Caretaker

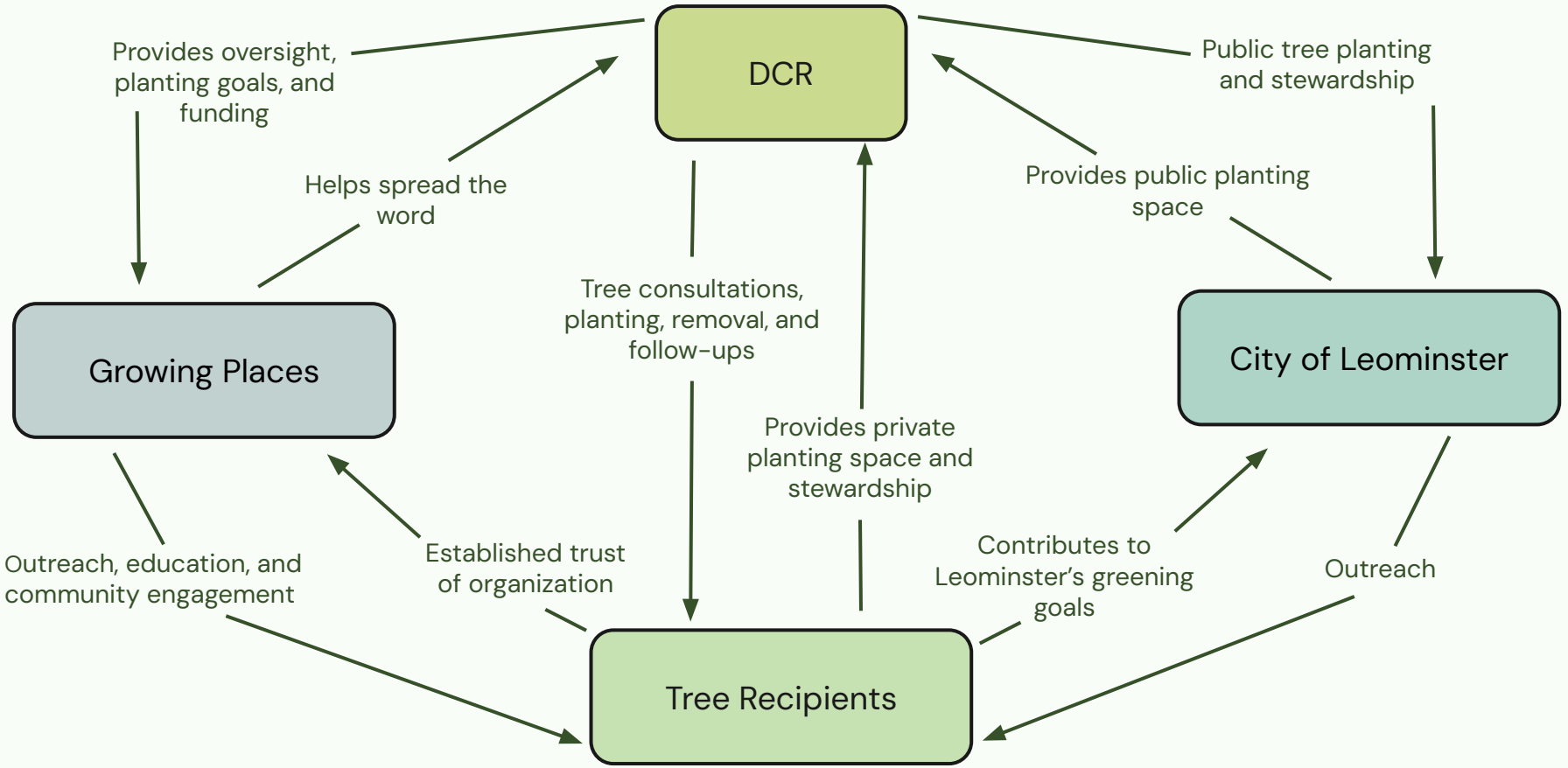
Community
- a. Environmental Concerns
- b. Change & Development
- c. Environmental Justice (EJ)
- d. Engagement

GGC program Involvement
- a. Motivations
- a. Choice
- b. Spread the word
- c. Follow-up

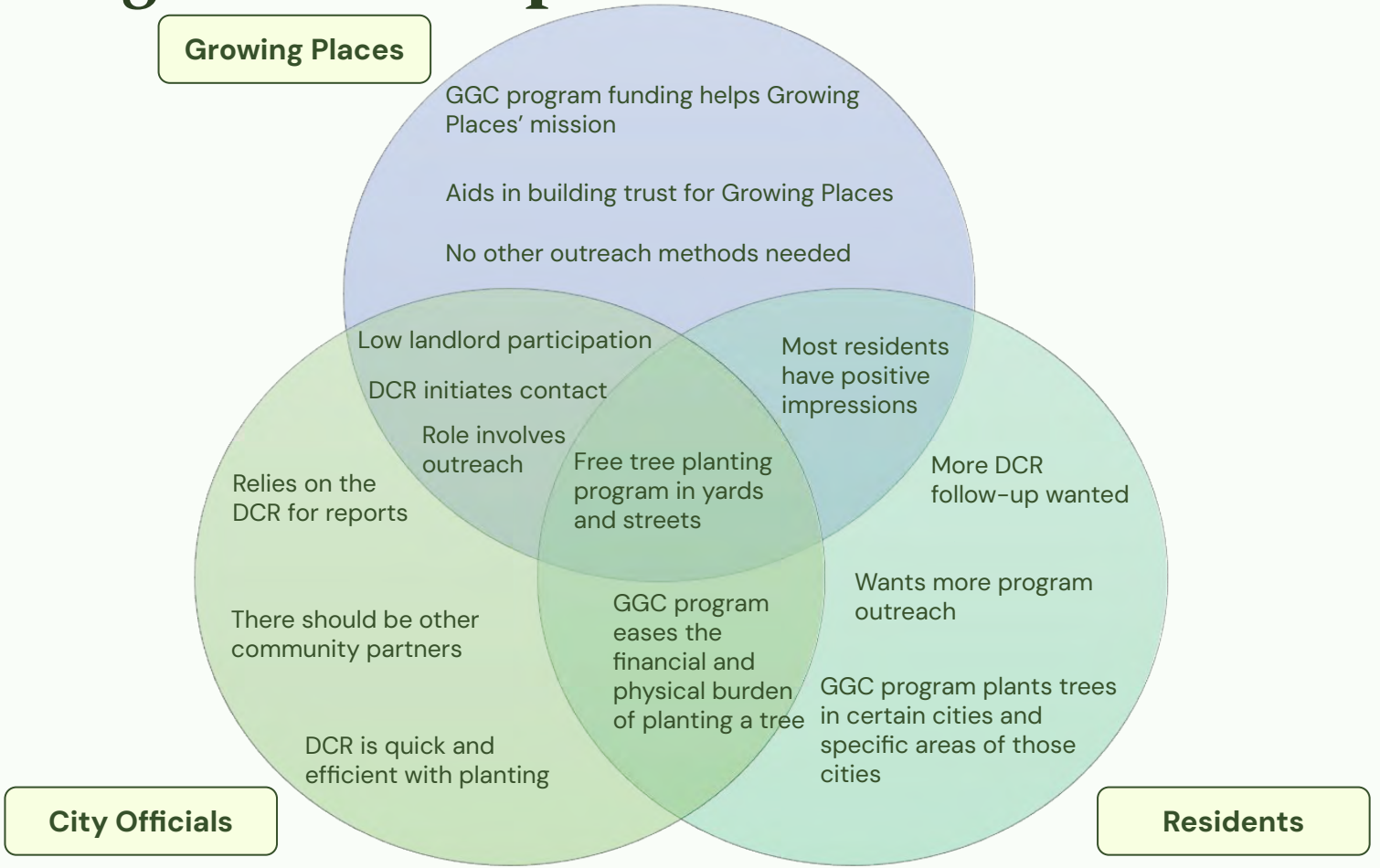
Tree Health
- a. Threats/Health Concerns
- b. Removal
- c. Replacements



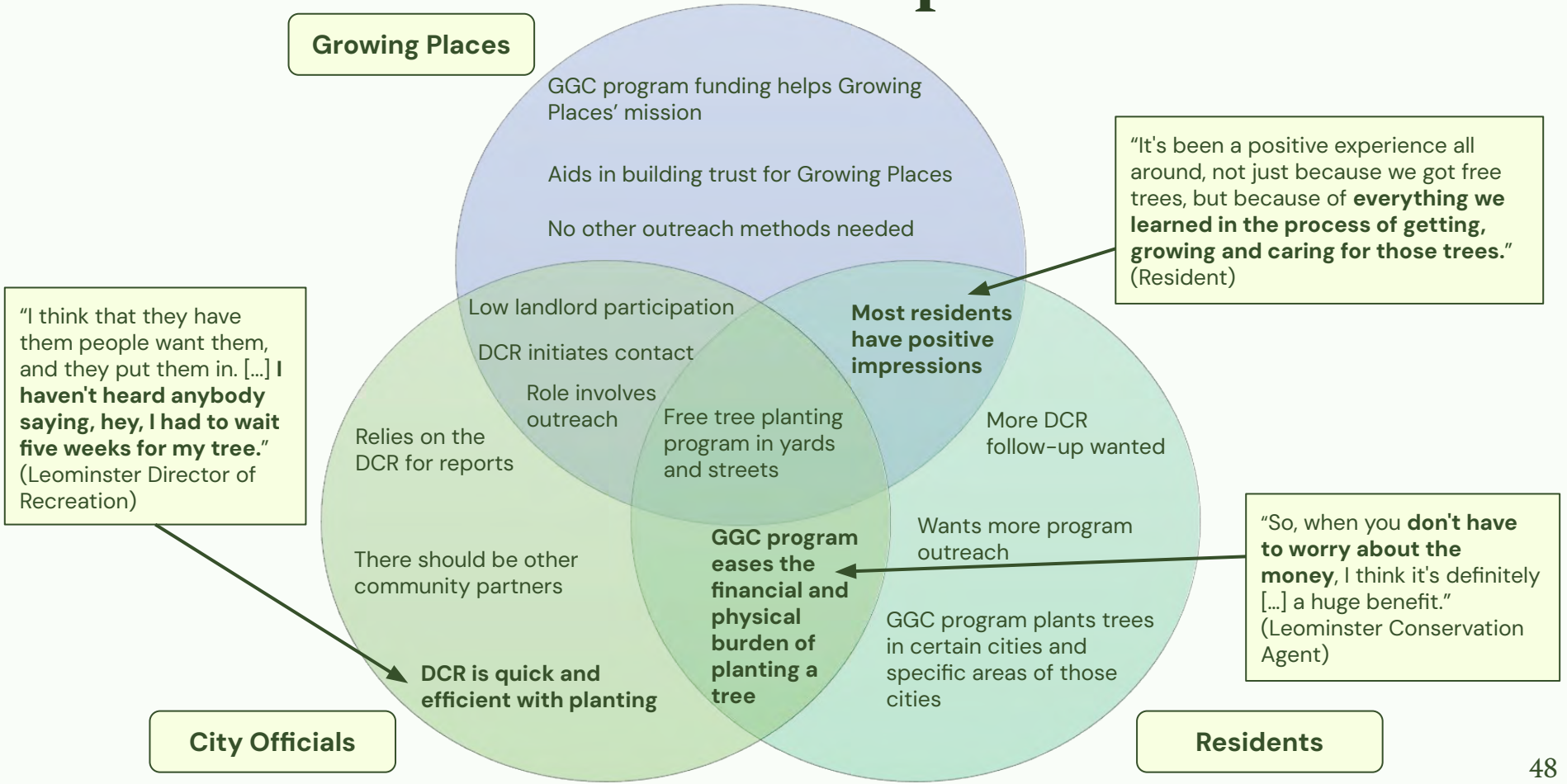
GGC Program Stakeholder Roles



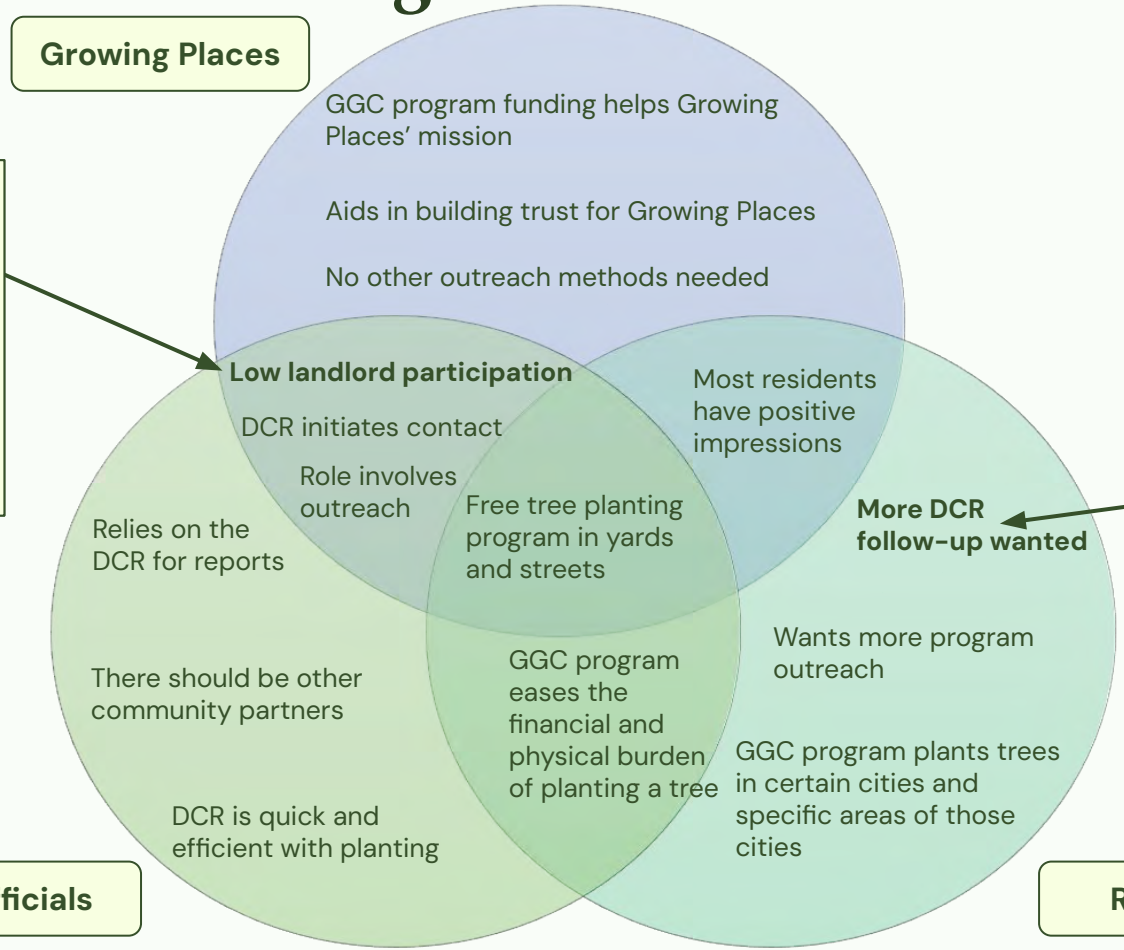
Program Perceptions from Stakeholders



Positive Perceptions



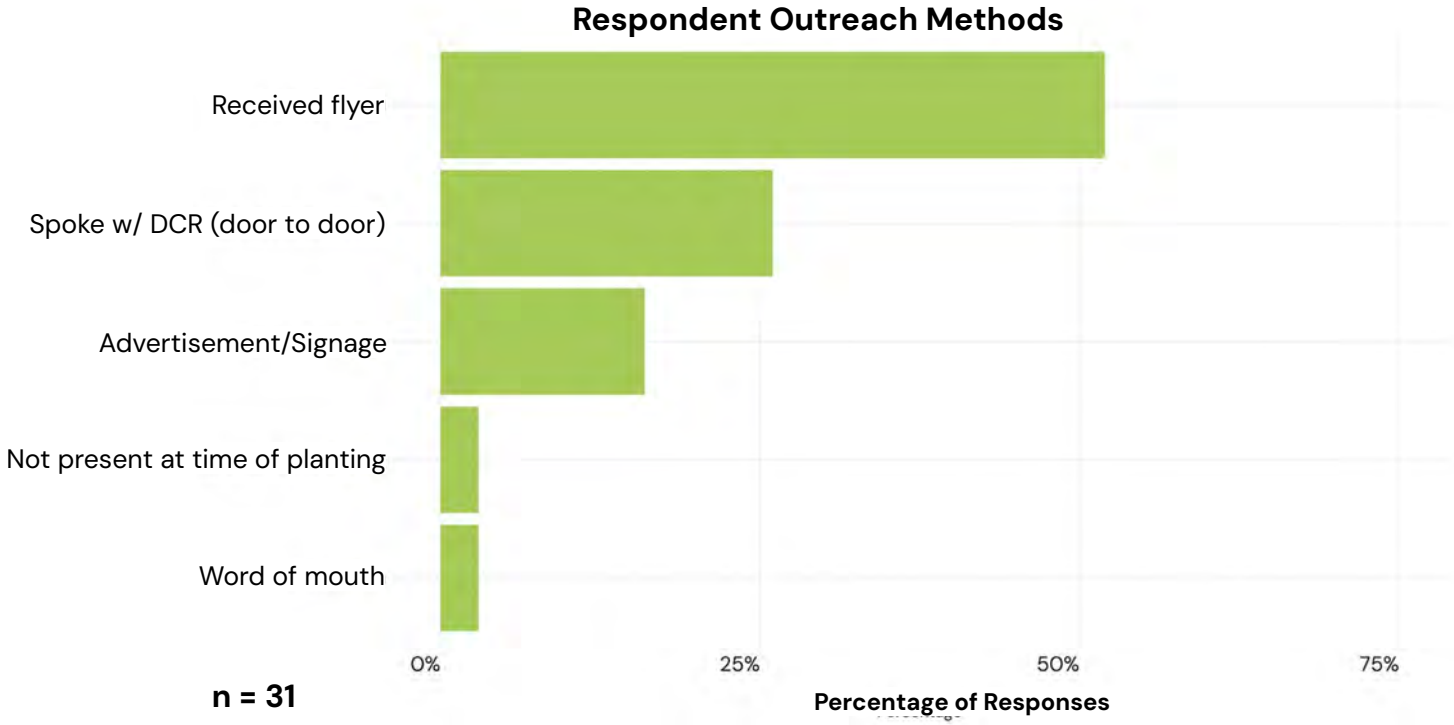
Program Concerns



"I think **our landlord community is not very aware or not very interested.** They may have been made aware and then dismissed the information because they're not interested." (Growing Places Director)

"I would like them to be more available, even if it's just like **a hotline waiting call** and say, 'hey', and they would have the ability to **come and maybe check on it.**" (Resident)

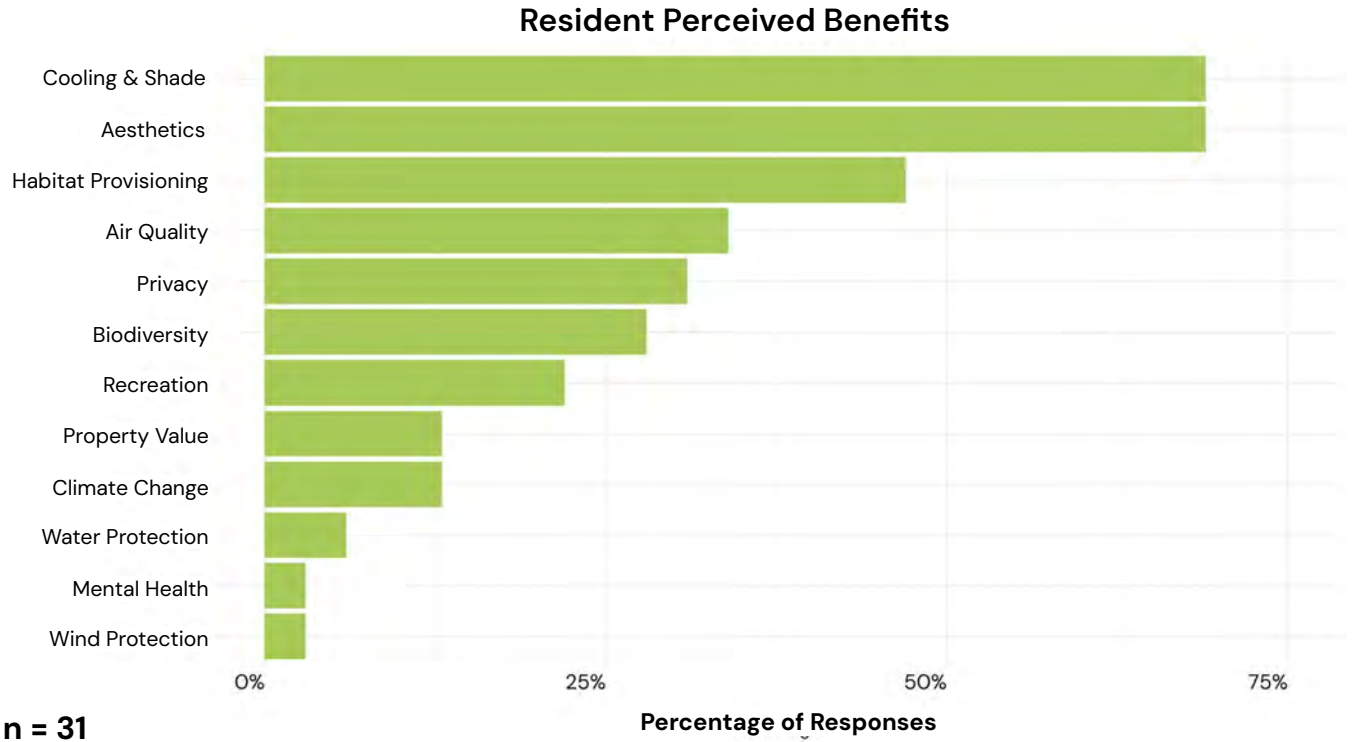
GGC Program Outreach to Residents



n = 31

GGC program advertisement for eligible gateway city residents.

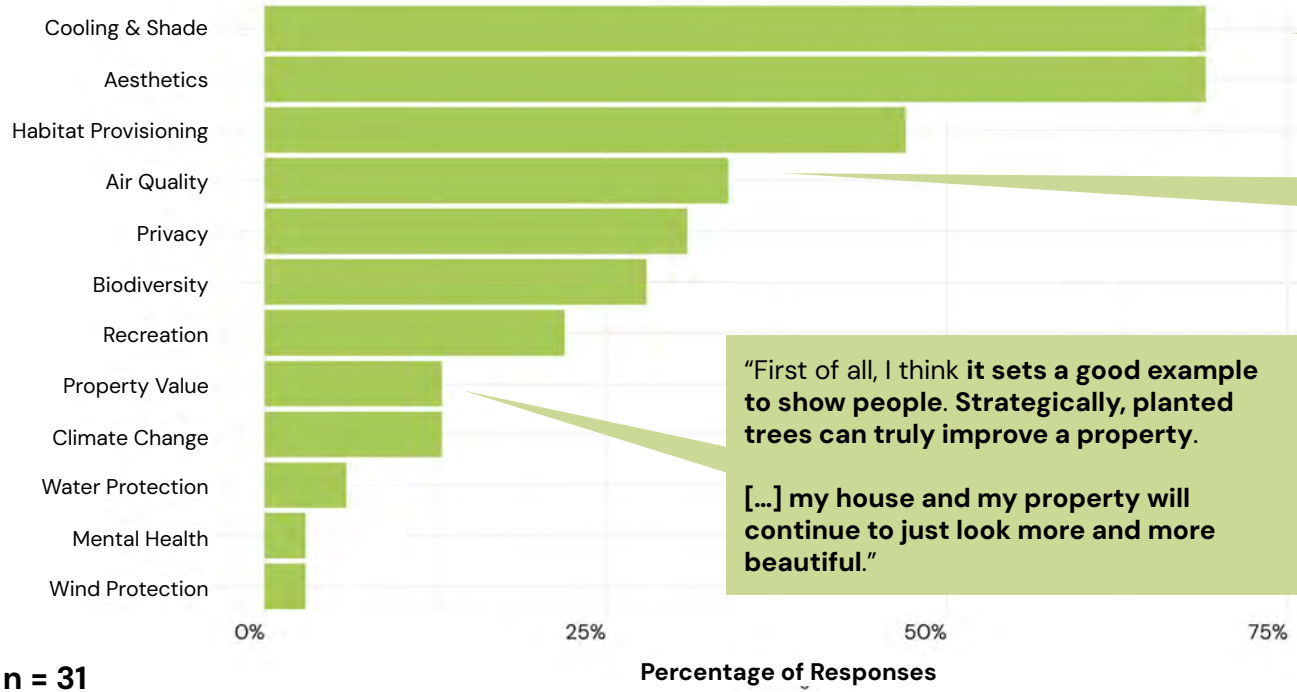
Leominster Resident Perceived Benefits



n = 31

David Elm Tree (Ulmus davidiana)

Leominster Resident Perceived Benefits



n = 31

"I lived in Boston for over 25 years so I'm very aware of tree deserts and the asphalt gets hotter, houses get hotter. So just having trees around is a **very important part of keeping our earth a little cooler**."

"The **air feels fresher**. It creates a lovely environment. Greenery, I feel it can improve any space, no matter how small. I love the bees that come by when the trees do bloom."

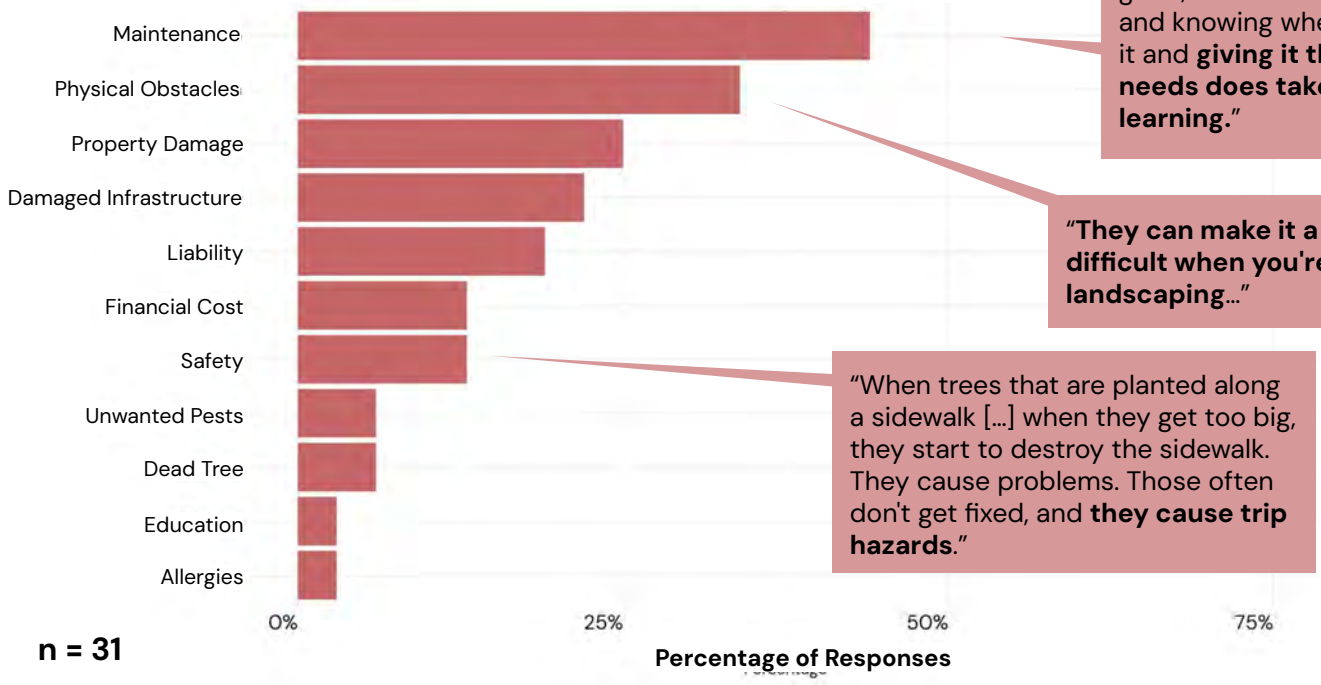
"First of all, I think **it sets a good example to show people. Strategically, planted trees can truly improve a property**.

[...] my house and my property will continue to just look more and more beautiful."

Top 2019 benefits of GGC program trees listed by tree recipients:

1. Shade
2. Aesthetics
3. Energy Efficiency

Tree Recipient Perceived Challenges



n = 31

"It is a living thing [...] and keeping a good, consistent watering schedule and knowing when to water it or feed it and **giving it the best care that it needs does take time, effort, and learning.**"

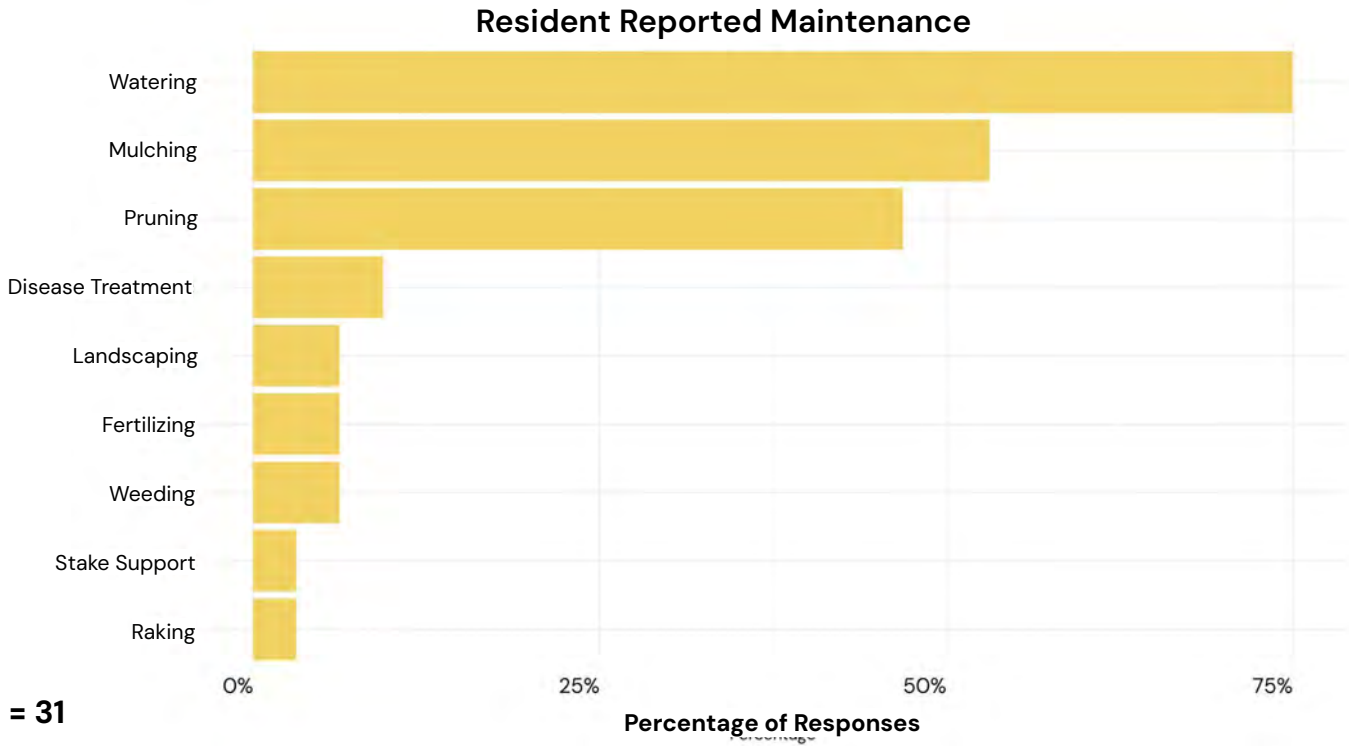
"**They can make it a little difficult when you're landscaping**..."

"When trees that are planted along a sidewalk [...] when they get too big, they start to destroy the sidewalk. They cause problems. Those often don't get fixed, and **they cause trip hazards**."

Top 2019 challenges of trees listed by GGC participants:

1. Maintenance
2. Follow up/Outreach
3. Time & Effort

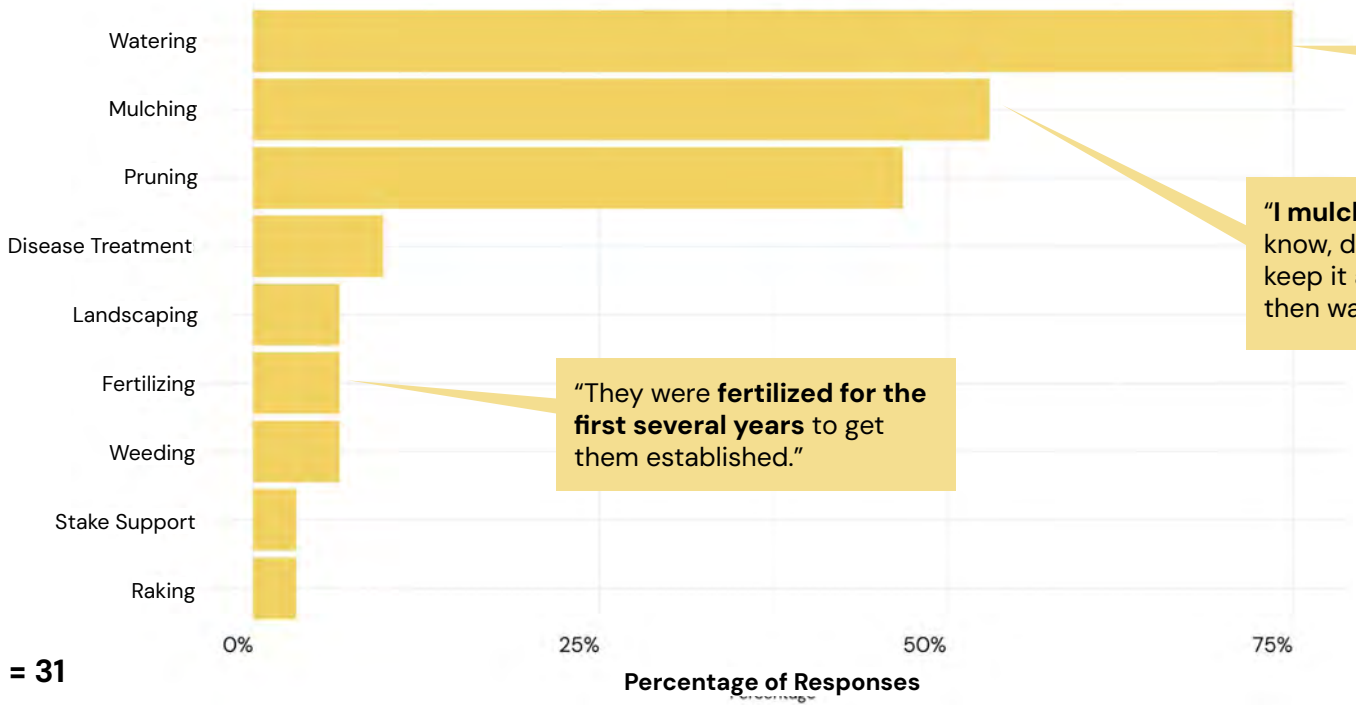
Resident Reported Maintenance



n = 31

Red Horse-Chestnut Tree (Aesculus x carnea 'Briotii').

Resident Reported Maintenance



"**Watering, re-mulching**. We re-mulch it once in five years."

"**I mulched all of those.** You know, did the recommended, keep it away from the trunk and then watered them."

"They were **fertilized for the first several years** to get them established."

n = 31

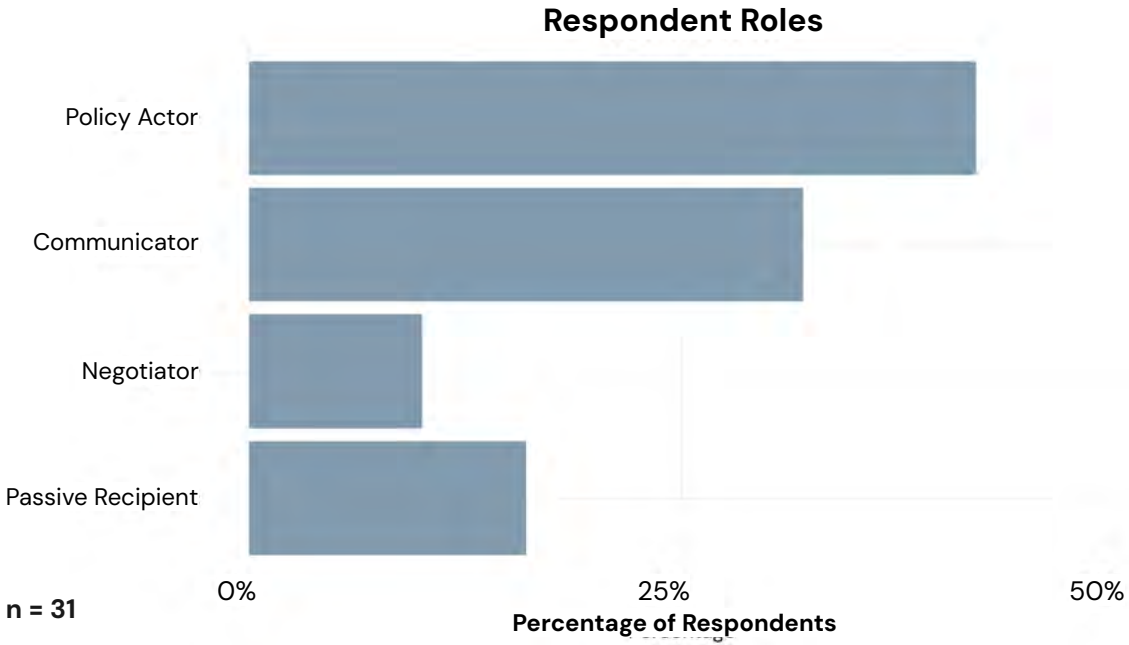
Respondent Roles in the GGC Program

Policy Actor: Communicated to friends, family, or neighbors about the GGC program and negotiated their planted tree species and planting location.

Communicator: Communicated with friends, family, or neighbors about the GGC program.

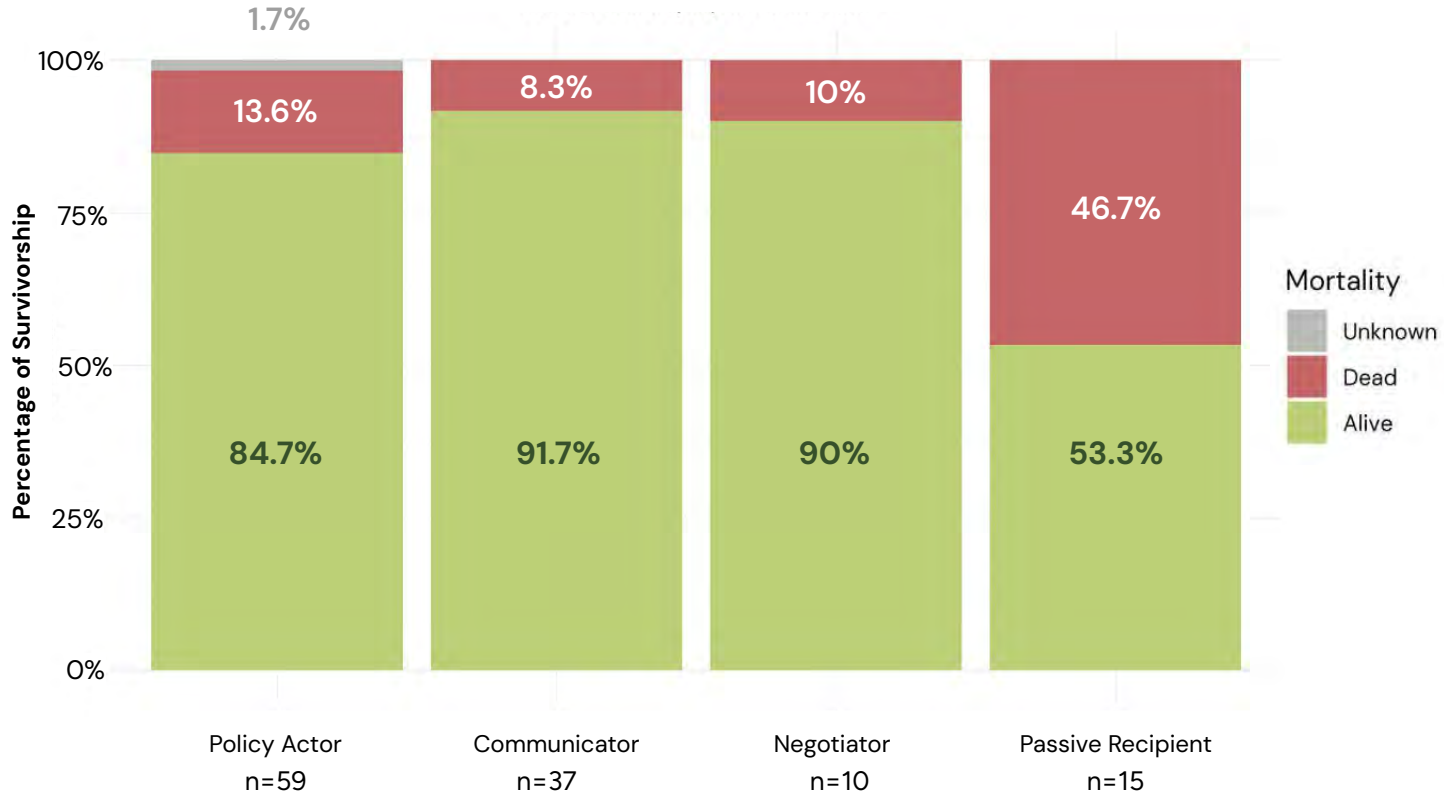
Negotiator: Negotiated for a specific tree species and specific planting location.

Passive Recipient: Did not communicate about the program or negotiate for specific tree species or location.



N.A. Geron, D.G. Martin, J. Rogan, M. Healy, Residents' roles as environmental policy actors using an urban governance framework: A case study of a tree planting program, Cities, Volume 135, 2023, 104201, ISSN 0264-2751, https://doi.org/10.1016/j.cities.2023.104201. . (https://www.sciencedirect.com/science/article/pii/S0264275123000136)

Survivorship by Resident Role

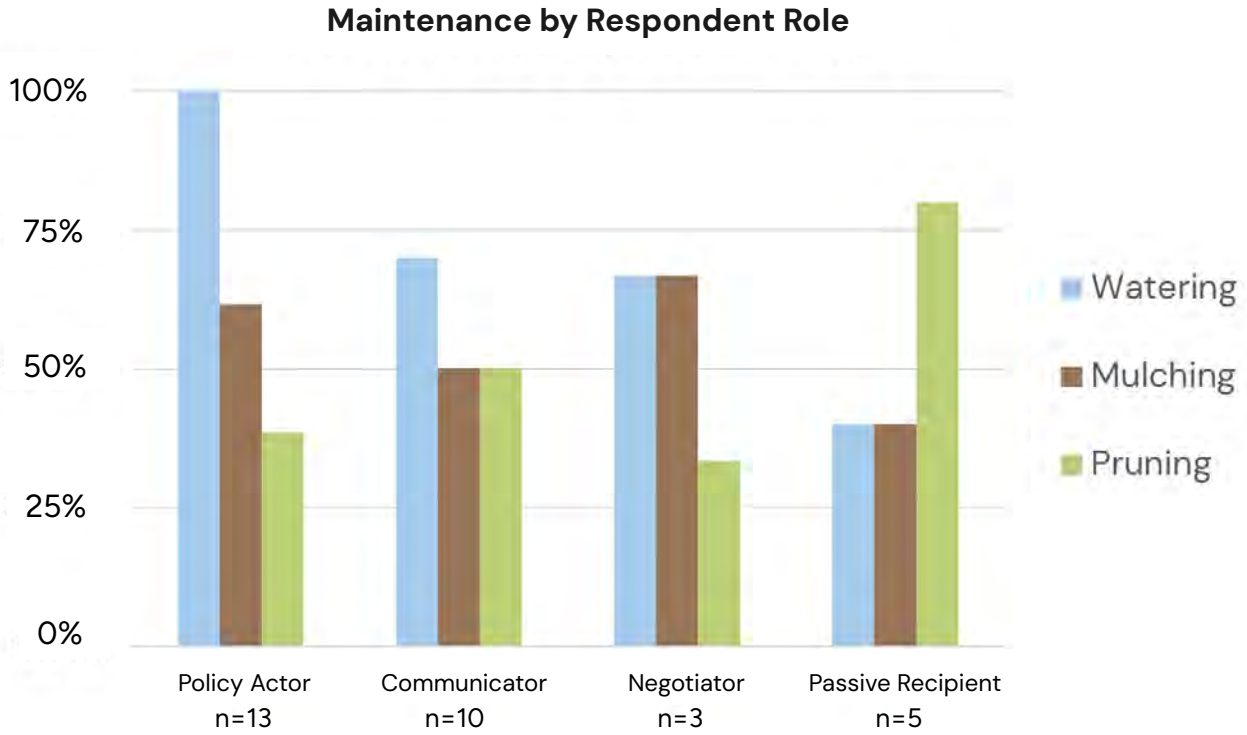


Avg Tree Count per Property by Role:
Policy Actor: 4.5
Communicator: 3.3
Negotiator: 3.7
Passive Recipient: 3

Dead includes stumps, standing dead, and removed trees

N.A. Geron, D.G. Martin, J. Rogan, M. Healy, Residents' roles as environmental policy actors using an urban governance framework: A case study of a tree planting program, Cities, Volume 135, 2023, 104201, ISSN 0264-2751, https://doi.org/10.1016/j.cities.2023.104201. (https://www.sciencedirect.com/science/article/pii/S0264275123000136)

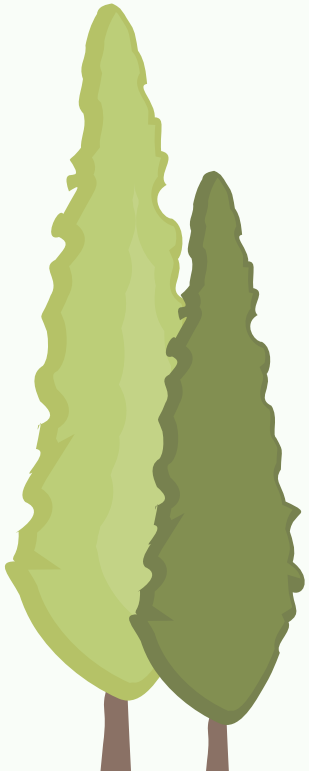
Resident Reported Maintenance Activities by Role



Sassafras Tree (Sassafras albidum)

N.A. Geron, D.G. Martin, J. Rogan, M. Healy, Residents' roles as environmental policy actors using an urban governance framework: A case study of a tree planting program, Cities, Volume 135, 2023, 104201, ISSN 0264-2751, https://doi.org/10.1016/j.cities.2023.104201. (https://www.sciencedirect.com/science/article/pii/S0264275123000136)

Summary of Leominster Interview Analysis



Leominster Residents

Tree Benefits: Aesthetics, shade/cooling, air quality, and habitat provisioning.

Tree Challenges: Maintenance/Upkeep, physical/tree obstacles, and property damage.

Tree Maintenance: Top 3 resident maintenance activities: Watering, pruning, and mulching.

Role Analysis: Engaged residents (Policy Actors, Communicators, Negotiators) perform better in tree stewardship.

Leominster City Officials, Community Partner, and DCR

Community partners and The City of Leominster recognize that **Leominster landlords have low engagement.**

Having programs like GGC program **alleviates the operating costs of TPIs** on community partners and the planting of trees for residents.

DCR's collaboration with The City of Leominster and Growing Places **contributes to the states overall greening goals**.

GREENING THE GATEWAY CITIES
MA Urban Canopy Project

LEOMINSTER MASSACHUSETTS · CITY 1915 ·

GROWING PLACES

5 Worcester Interviews

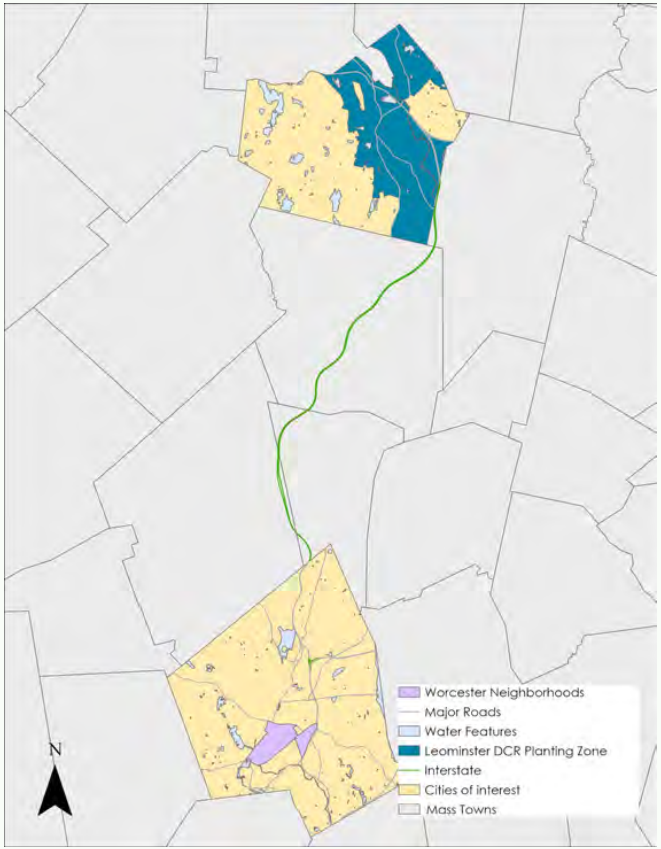
Worcester Research Goals

Objective:

Characterizing property/business owners' **perception of urban tree planting**, identify barriers to planting programs and ways to **overcome** them, and enable **data-driven decision-making** by urban foresters.

Research Questions:

- What are the major reasons business/property owners **do or do not** want to accept trees?
- Do business/property owners perceive any relationship **between trees and the economic success** of their storefront/property?
- How does **willingness to participate in planting programs vary** between property owners and business owners?



GREEN WORCESTER

Study Neighborhoods

Green Island: Mostly commercial, contains Polar Park, Canal District, and Worcester Public Market.

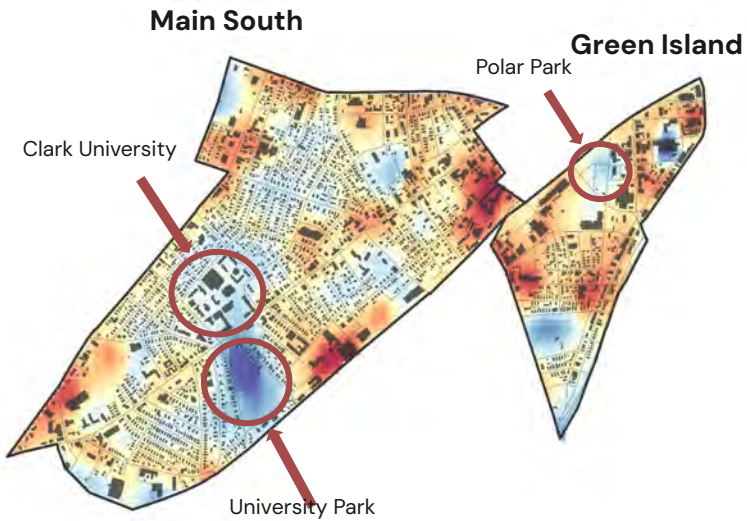
Main South: Mostly residential, contains Clark University and University Park.

Demographics	Main South	Green Island	Worcester	Massachusetts
Population	19,616	2,490	211,286	7,136,171
Median Household Income	$30,622	$38,215	$67,544	$101,341
% Minority	73%	64%	49%	21%

Average Summer Land Surface Temperature (June 2025)

Worcester (Citywide)	93 °F
Main South	101 °F
Green Island	102 °F

Average Land Surface Temperature (LST) of Main South and Green Island, June 2025



Worcester Methods

24 Interviews

21 Property/Business Owners Interviewed

- 18 people reached through canvassing in Green Island and Main South
- 3 scheduled via outreach/phone banking

3 Community Partners Interviewed

- Main South CDC
- Green Island Residents' Group

1 Focus Group Attempted

Surveying:

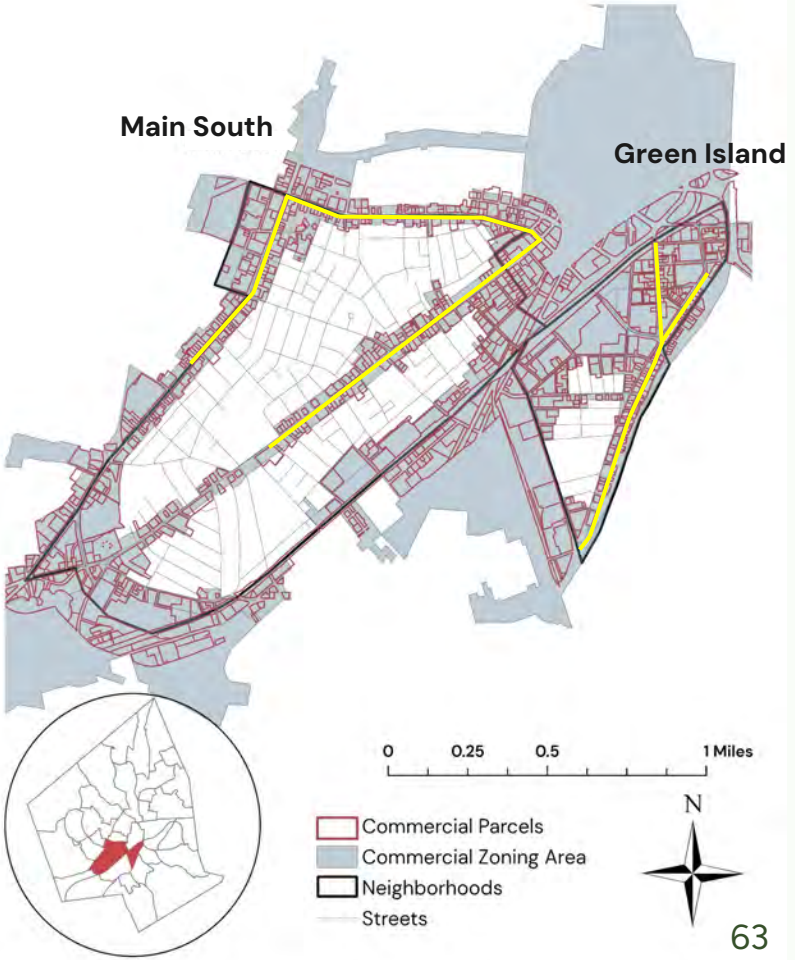
Commercial zone

↓

Parcels with businesses

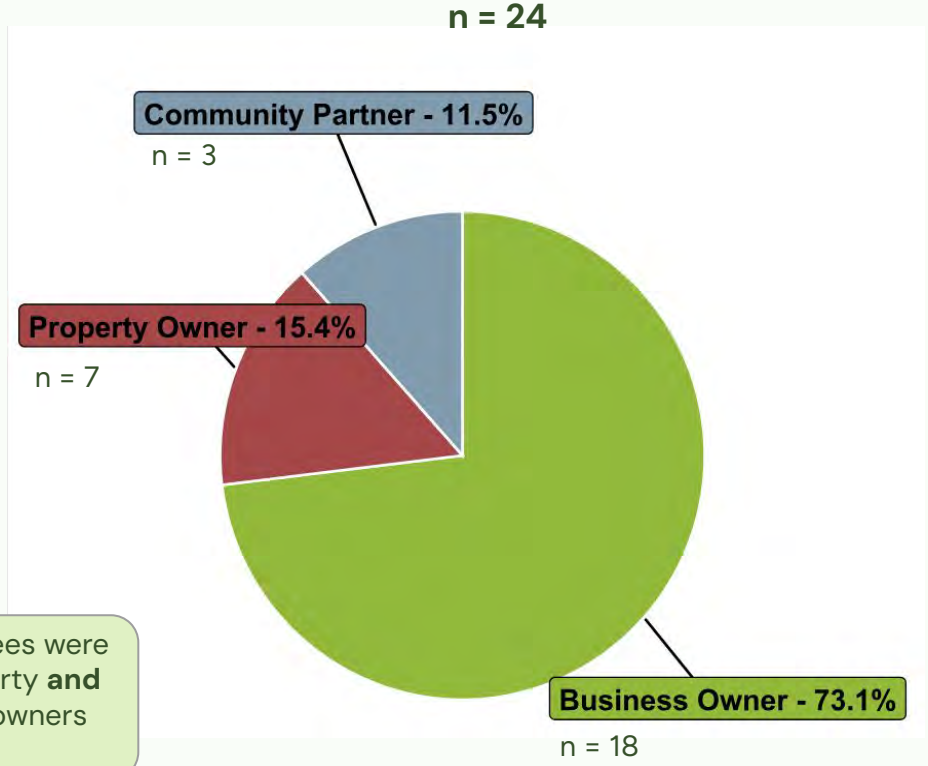
↓

5 streets in 2 neighborhoods



Interview Demographics

Interview distribution



3 interviewees were both property **and** business owners

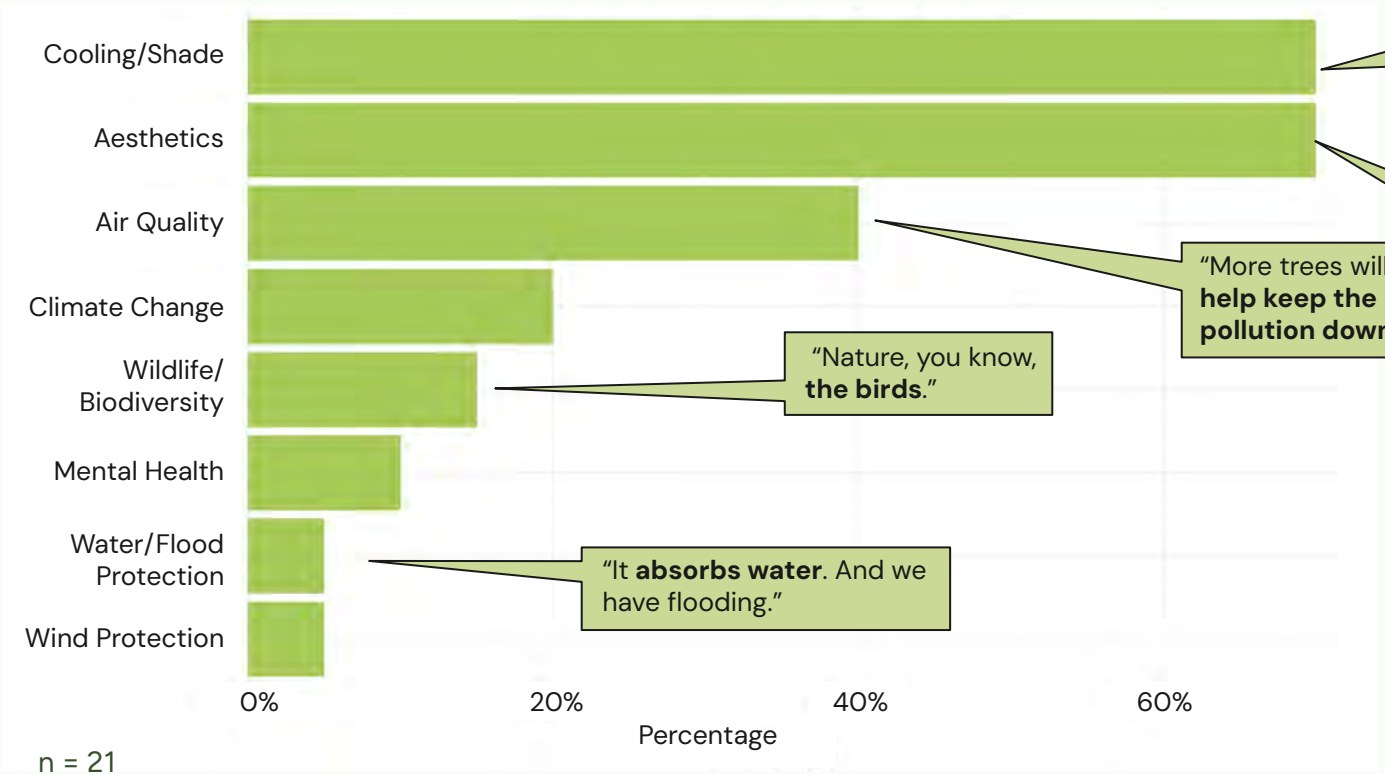
Business types

Business	Number present
Restaurant	5
Hair salon	3
Auto	2
Grocery	2
Retail	2
Laundromat	1
Real estate	1
Convenience store	1
Church	1
Landscaping	1

Property/Business Owner Reception of Trees

Interested lessor Owns property, **expressed interest** in planting. **20%** n =5	**Interested lessee** **No agency** over property decision, **expressed interest** in planting. **65%** n =13
Uninterested lessor Owns property, **not open** to planting. **15%** n =2	**Uninterested lessee** **No agency** over property, **not open** to planting. **5%** n =1

Property/Business Owner Perceived Benefits



"Trees, they can **reduce the temperature**, [...] keeping homes and neighborhoods cooler."

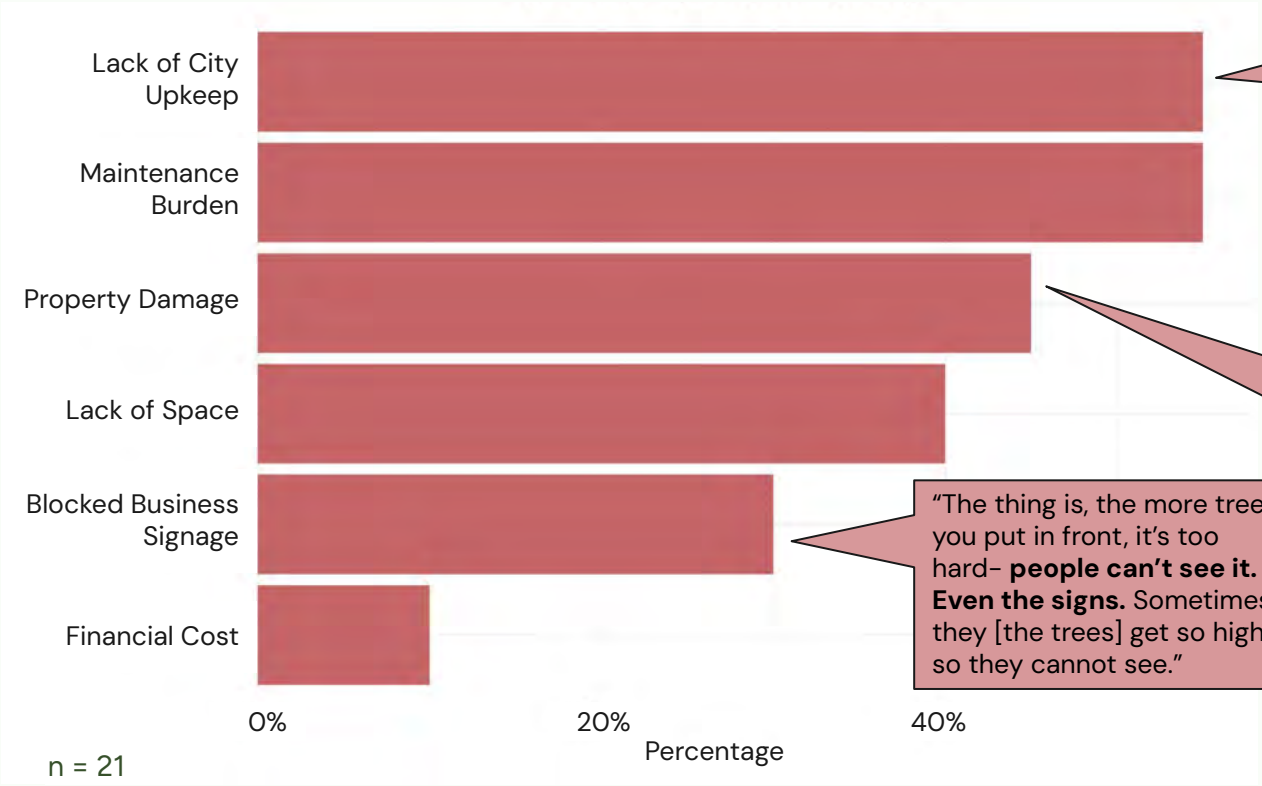
"Aesthetically, they're **pleasing for the eye** [...] Mother Nature put them there for a reason."

"More trees will **help keep the pollution down**."

"Nature, you know, **the birds**."

"It **absorbs water**. And we have flooding."

Property/Business Owner Perceived Barriers



"[T]hey do plantings along Main Street, but **they're not always [...] cared for. They're not always watered.** [...] they don't have foliage, no leaves, no flowers or whatever. Not all of them but some."

"But there is some responsibility to having a tree in front of your house. You have to pick up the leaves, you have to water it. **You have to take care of it, and some people really don't want anything to do with trees on their property."**

"The thing is, the more trees you put in front, it's too hard- **people can't see it. Even the signs.** Sometimes they [the trees] get so high, so they cannot see."

Key Barriers

75% of interviewees had **no knowledge** of the GGC program or the Green Worcester Plan.

55% of interviewees mentioned that distrust in city maintenance **discouraged them** from tree planting and tree planting initiatives.

50% of interviewees answered that they **lacked adequate space** for trees.

“There's not much room to have trees here, just not the space, we physically don't have the space for it.”

65% of interviewees **expressed interest in receiving trees** but do not own the property.

"[T]he building belongs to them. I just rent it. So I've been here 39 years, so they never put a tree as long as I've been here."

Tree in Green Island that will be removed by owner due to its encroachment on the parking lot.

Key Motivations

70% of interviewees answered that trees would contribute to the **curb appeal** of their storefront or property.

"[T]rees looks more beautiful, natural, and it might attract more people."

Every interviewee identified benefits that trees have on the neighborhood, even if they were not open to planting trees on their own property.

70% of interviewees said that they would prefer **more trees** in Worcester rather than having the same number or fewer.

"Oh, always more. Always more oxygen in the world."

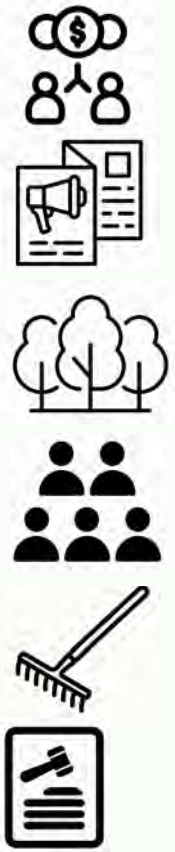
65% of interviewees said that **policy or tax incentives** would encourage them to plant trees.

"[H]ow can I reduce my tax burden pretty actively, it is definitely compelling."

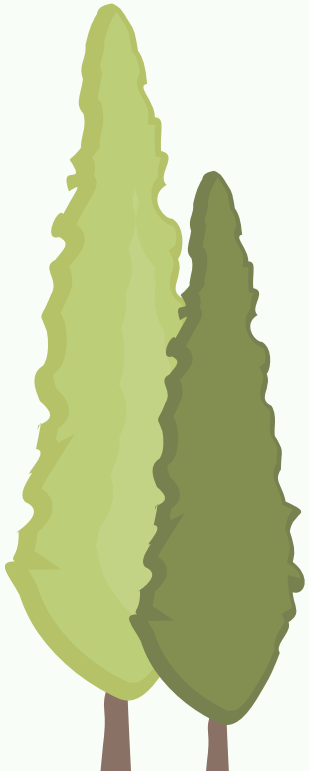
Aidan H. and Nate canvassing in Green Island

Interviewee Recommendations

Funding	"**Discretionary funds**, it's something [that] makes the neighborhoods look a little more appealing."
Marketing	"There's so much opportunity for governments to be **better at marketing,** [...] **having something more interactive** than the dry, bland flyers that [...] say 'free trees'."
City-specific initiatives	"It's not super practical to convince homeowners to plant trees [..] on their own property throughout the city, but **if the city can take initiative and plant 5,000 trees in one footprint**, you're getting a lot of value there."
Neighborhood consultation	"If there was **a section within the planning division** that really worked with groups such as the Community Development Corporation to **implement and support strategic neighborhood -based plans**"
Supportive services	"If they have **people who come in** once in while to clean around and **do a little bit of maintenance**, that would be nice."
Policy enforcement	"If the city recognizes it needs vegetation and trees [...] then it needs to **enforce that through planning regulations**."



Summary of Worcester Interview Analysis



Tree Perceptions

Benefits: Cooling/shade (70%), aesthetics (70%), air quality (40%), climate change mitigation (20%).

Challenges: Perceived lack of city upkeep discourages business/property owners from planting trees (55%) due to maintenance burden (55%) and potential property damage (45%).

Planting Perceptions

Planting barriers: Lack of knowledge surrounding green initiatives, lack of space on properties, businesses may not own their property.

Recommendations: Better tree program marketing, planting on city property, neighborhood input focus, tree maintenance support, enforcement of policies.

Future Goals: We would like to collect more data around city tree perceptions of business and property owners.

Green Island Residents Group

MSCDC
MAIN SOUTH COMMUNITY DEVELOPMENT CORP.

GREEN WORCESTER

WORCESTER A TOWN JUNE 14, 1722 A CITY FEBY. 29, 1848

6 Conclusions

Key Takeaways from Our Study

Tree Health

Annual Survivorship
Establishment Phase: 96.1%
Post-Establishment Phase: 95.8%

Residential trees have higher survivorship than street trees

80.8% exhibit positive health status

Bark/branch damage often leads to low vigor

A poor 2019 vigor is indicative of 2025 mortality

Tree Species

High performing species:
American Elm
American Yellowwood
London Plane
River Birch

Highest survivorship (n>28):
American Elm
Crabapple

Highest vigor (n>28):
American Yellowwood
American Elm

Plant with caution species:
Black Tupelo
Serviceberry
Crabapples

Leominster Perceptions

Positive overall perceptions of GGC program from all stakeholders

Residents identified more tree planting benefits than challenges

Recipients wanted more follow-up and outreach

Different recipient roles affects tree stewardship and survivorship

Landlords are hard to reach

Worcester Perceptions

General lack of awareness of tree planting initiatives

Lack of city upkeep and maintenance burden are the top planting barriers

Key motivations for planting are curb appeal and policy or tax incentives

Property lessees generally open to planting.

Property owners hard to reach

Thank you!

DCR foresters * Growing Places * City of Leominster * Residents of Leominster

Business/property owners of Worcester * Green Island Residents Group * Main South CDC

Clark Geography: Marjorie Miller and Yaa Poku

Clark Marsh Institute: April Carlson











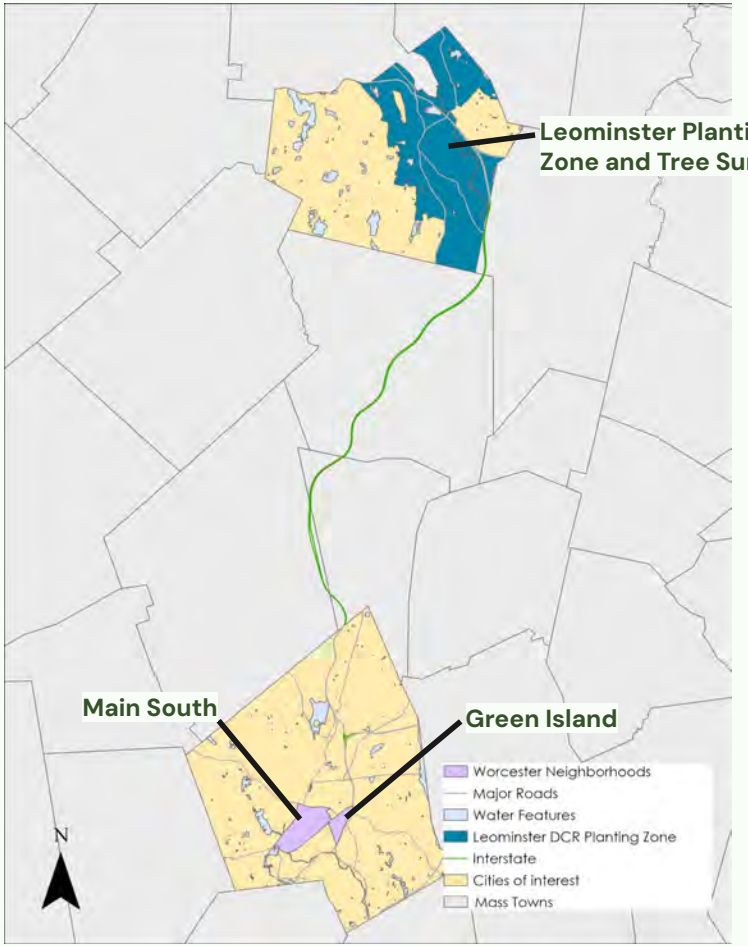




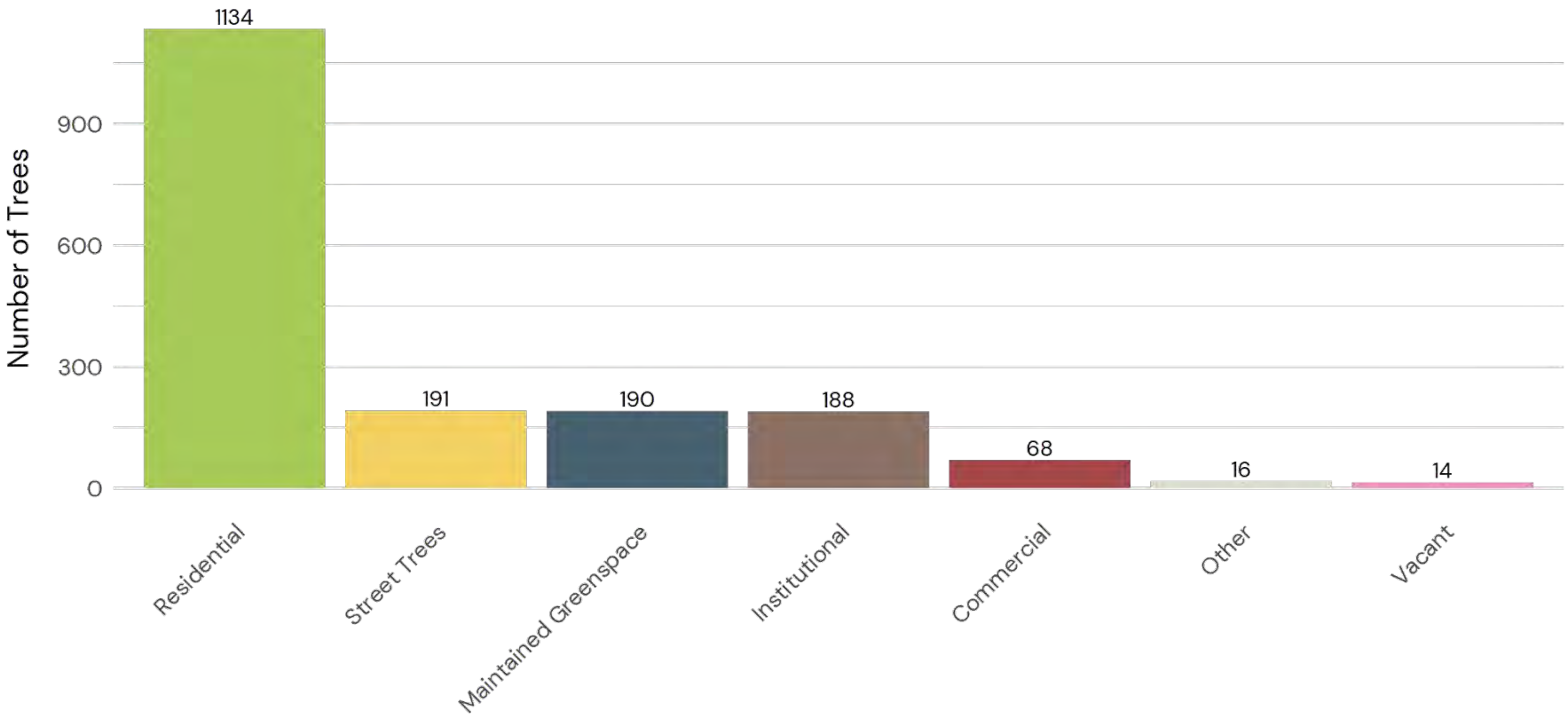

Questions?

Appendix

Study Sites


Leominster Planting Zone and Tree Survey
Main South
Green Island
Worcester Neighborhoods
Major Roads
Water Features
Leominster DCR Planting Zone
Interstate
Cities of interest
Mass Towns
N

Tree Count by Property Type



Private Trees

Single Family Homes, Multi Family Homes, Commercial Properties

Freeman Maple (Acer freemanii)

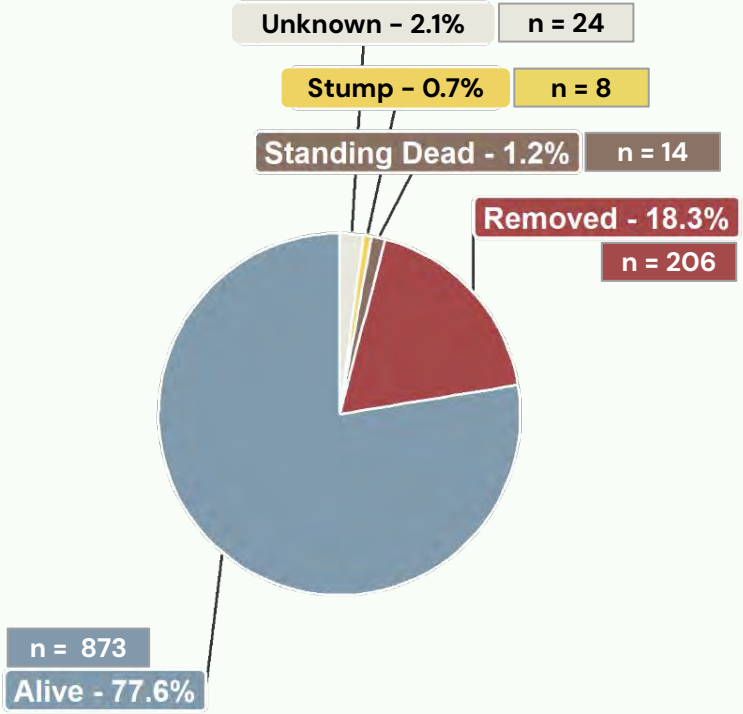
Public Trees

Parks, Sidewalks, Cemeteries, Institutional, Housing Complexes, Vacant Areas

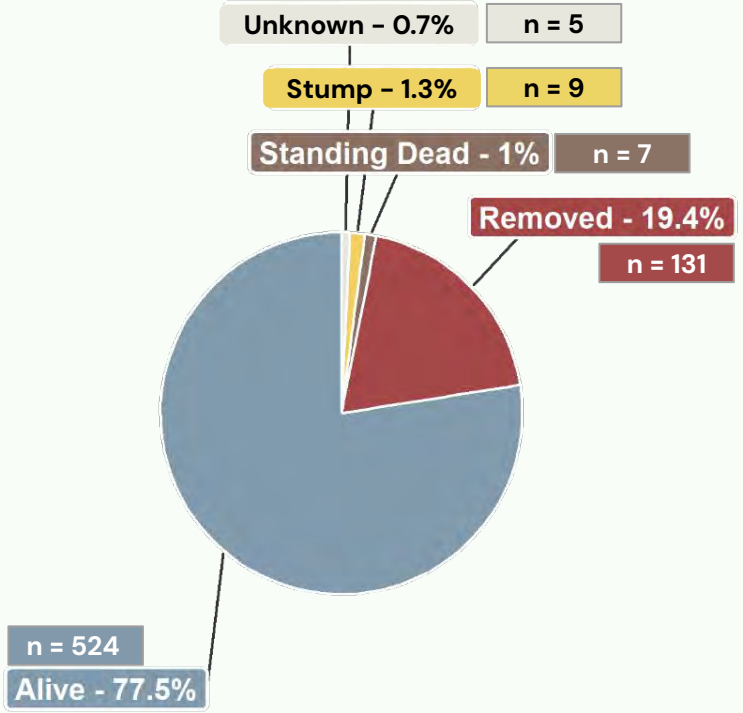
Zelkova (Zelkova serrata)

Survivorship of Public vs. Private Trees

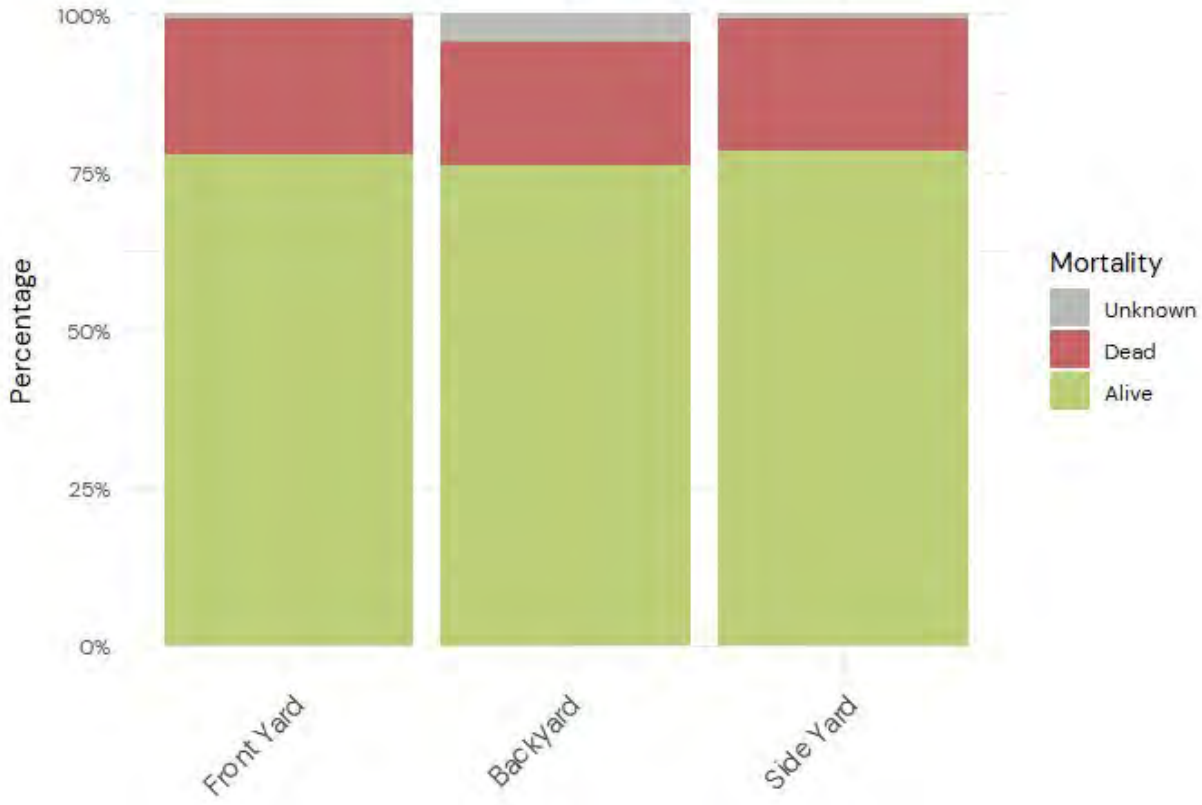
1,125 Private Trees (62%)



676 Public Trees (38%)

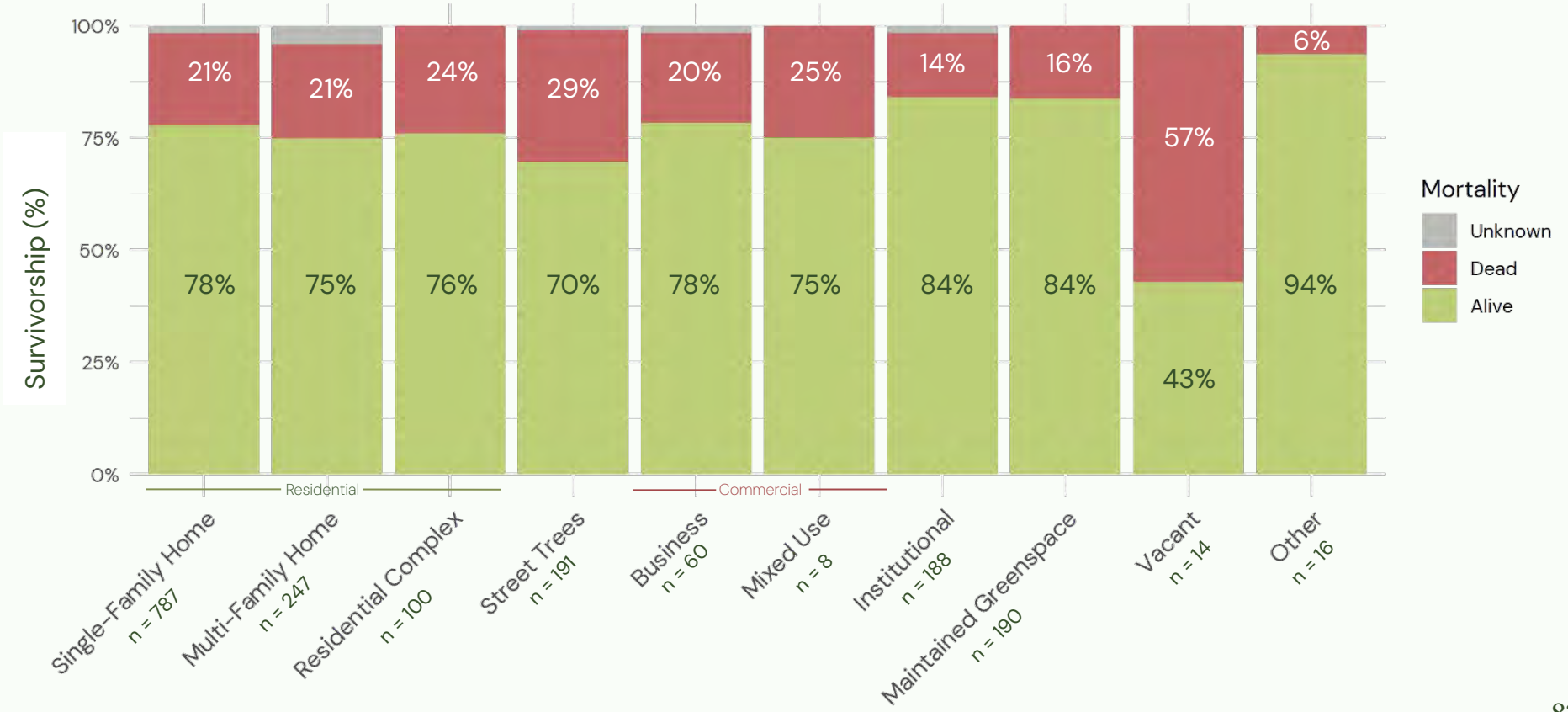


Tree Survivorship by Yard Type



Survivorship by Property Type

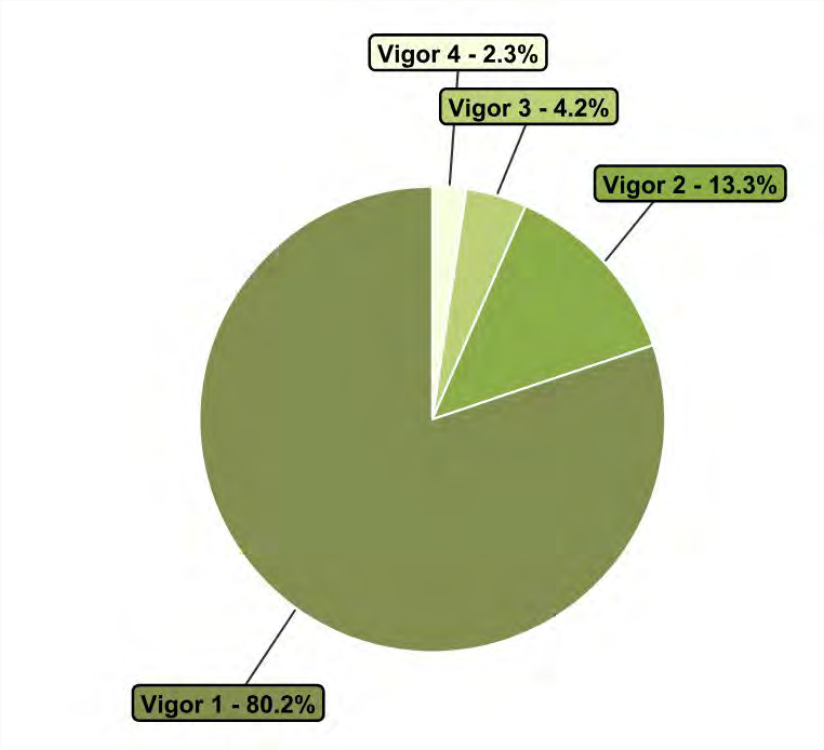
Dead includes stumps, standing dead, and removed trees



Health of Resurvey Trees

866 Total Trees, 651 Living Trees

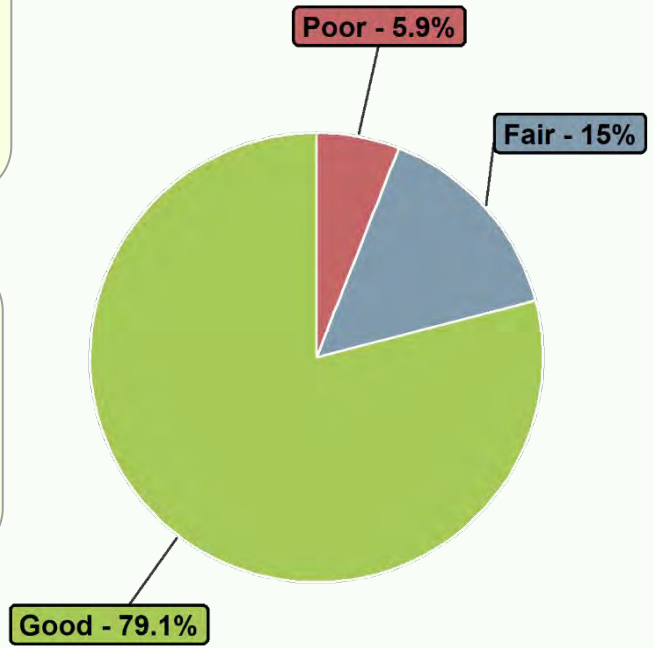
Vigor



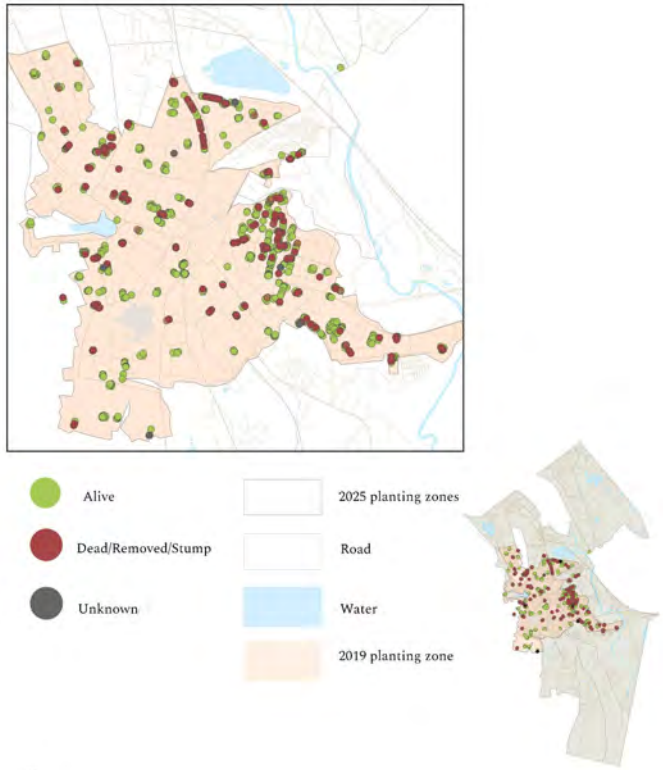
215 trees surveyed both in 2019 and 2025 were marked as removed, standing dead, or stump

Condition and vigor definitions remain the same as mentioned previously

Condition



Resurvey Sample Survivorship

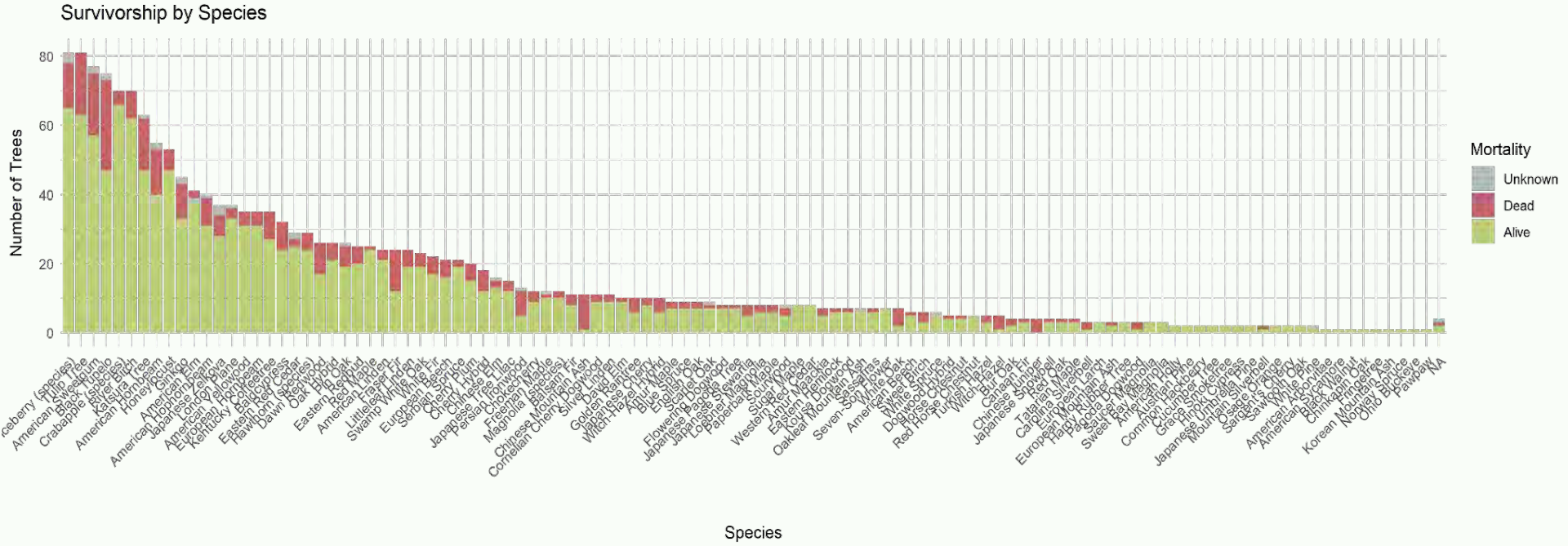


866 Trees

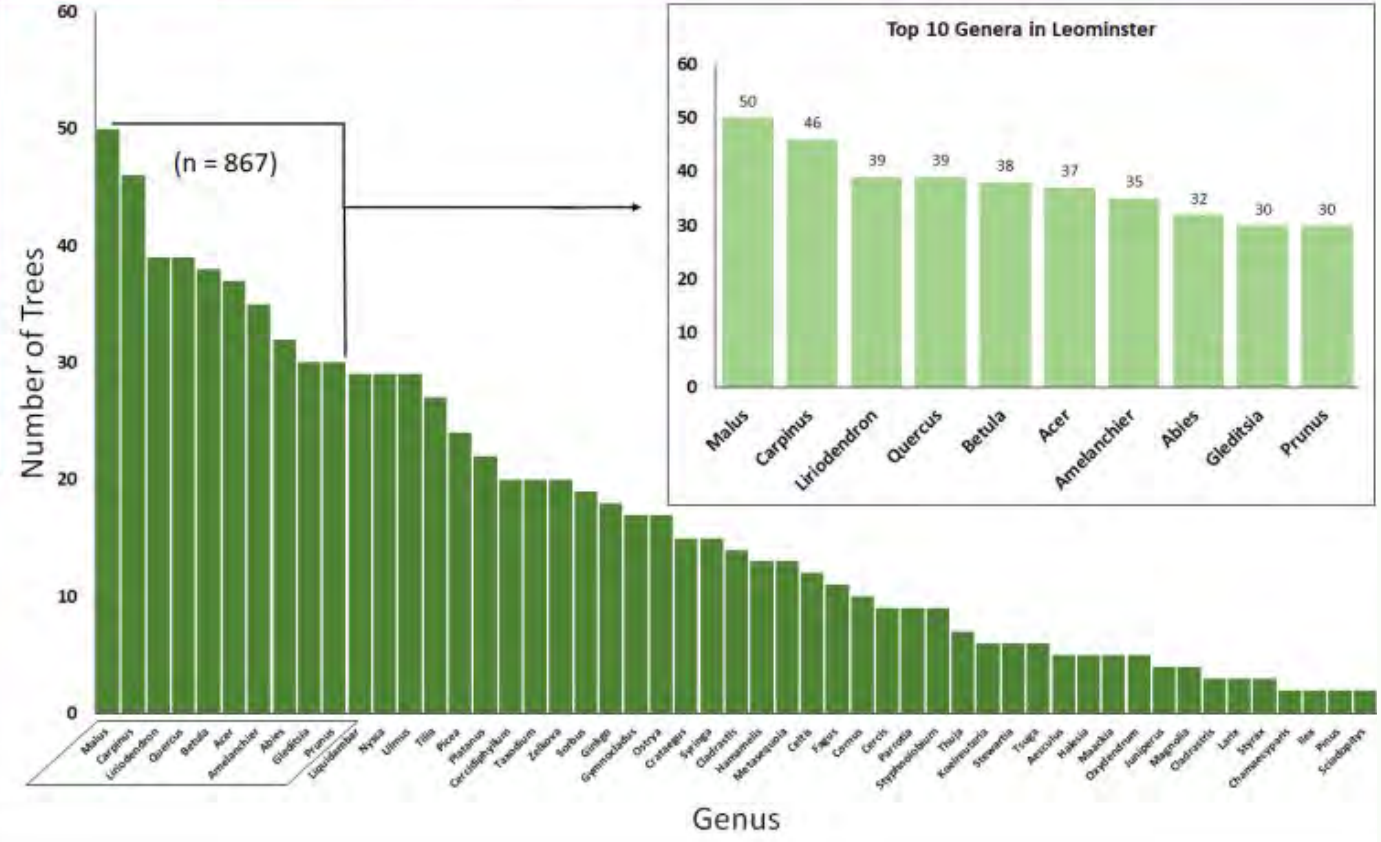
Tree condition	Tree number	Percentage of total resurvey sample
Alive	651	75.2%
Stump	12	1.3%
Standing dead	10	1.2%
Removed	185	21.4%
Unknown	8	0.9%

23.9% dead

Survivorship by All Species



2019 Leominster Genus Distribution

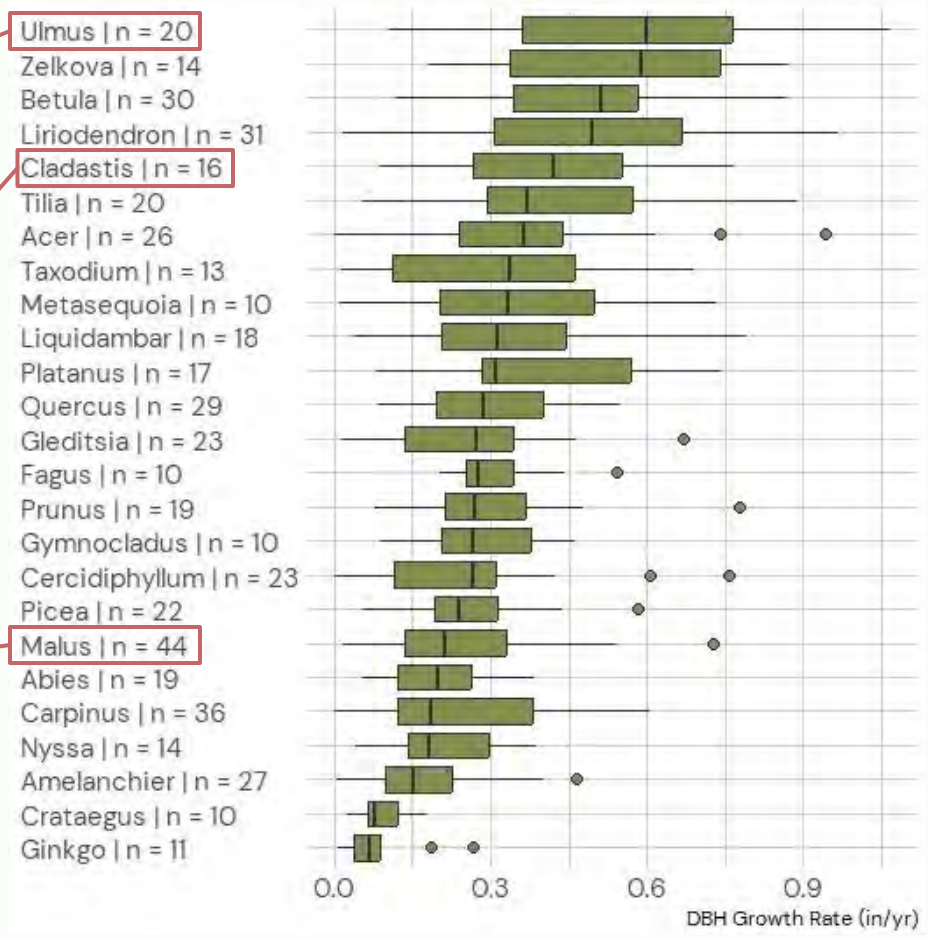


Tree Growth: DBH Growth Rate by Genus

Elms: Highest median DBH growth rate of 0.6 in/yr; wide range among individual trees

American Yellowwoods: Median DBH growth rate of 0.4 in/yr; all 16 trees were rated vigor 1 and good condition in 2025

Apples/Crabapples: Most planted genus from this sample; median DBH growth rate of 0.2 in/yr



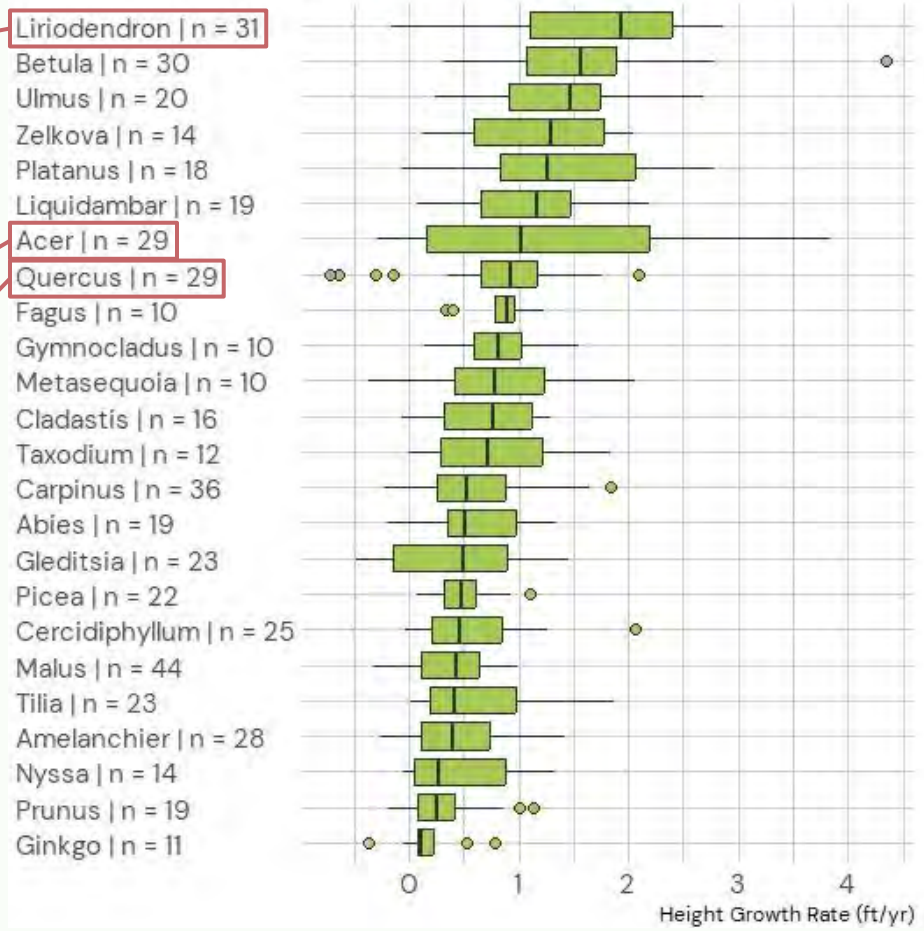
Reduced Count = 507
n >= 10

Tree Growth: Height Growth Rate by Genus

Tulip Trees: Highest median height growth rate of 1.9 ft/yr

Maples: Median height growth rate of 1 ft/yr; very wide range of growth rate among individual trees (38% fastigiate variants)

Oaks: Median height growth rate of 0.9 ft/yr; a more consistent range than Maples (62% fastigiate variants); 4 shrinking outliers



* Negative height growth rates are likely due to branch breakage or resident pruning; height measuring method has changed since 2019

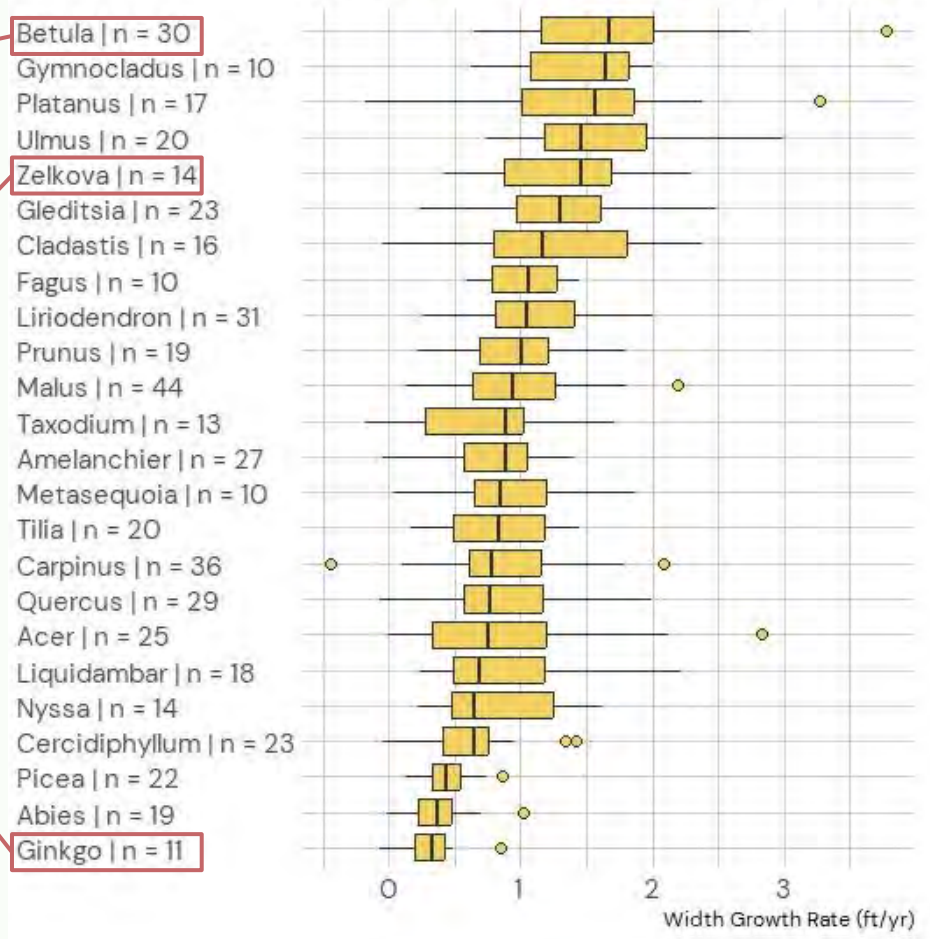
Reduced Count = 512
n >= 10

Tree Growth: Canopy Width Growth Rate by Genus

River Birch: Highest median width growth rate of 1.7 ft/yr

Japanese Zelkova: Median width growth rate of 1.5 ft/yr; all 14 rated vigor 1 or 2; many improved in vigor from 2019 to 2025

Ginkgo Trees: Median width growth rate of 0.3 ft/yr; lowest median growth rate by all metrics (DBH, height, and width)



* Negative width growth rates are likely due to branch breakage or resident pruning

Reduced Count = 500
n >= 10

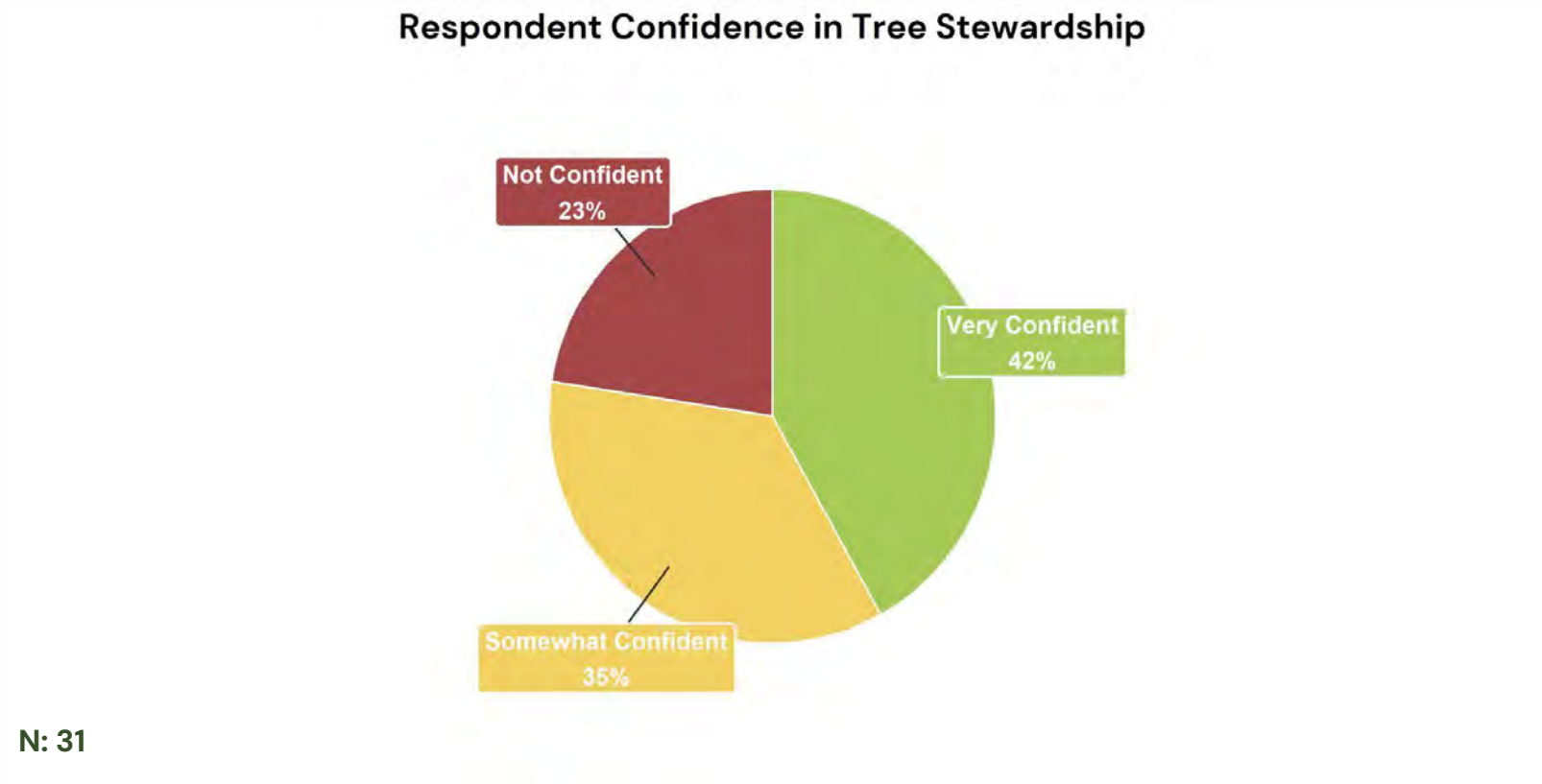
High Performing Tree Species and Genera

	Genus #1	Genus #2	Genus #3	Genus #4	Genus #5
DBH Growth Rate	Ulmus (0.6 in/yr)	Zelkova (0.59 in/yr)	Betula (0.5 in/yr)	Liriodendron (0.5 in/yr)	Cladrastis (0.42 in/yr)
Height Growth Rate	Liriodendron (1.93 ft/yr)	Betula (1.57 ft/yr)	Ulmus (1.48 ft/yr)	Zelkova (1.29 ft/yr)	Platanus (1.26 ft/yr)
Canopy Width Growth Rate	Betula (1.67 ft/yr)	Gymnocladus (1.65 ft/yr)	Platanus (1.57 ft/yr)	Ulmus (1.47 ft/yr)	Zelkova (1.46 ft/yr)
Survivorship (total > 30)	Malus (94.3%)	Ulmus (91%)	Platanus (89.5%)	Gleditsia (88.7%)	Cladrastis (88.6%)

Most Planted	Quercus (113)	Carpinus (93)	Amelanchier (81)	Liriodendron (81)	Liquidambar (80)

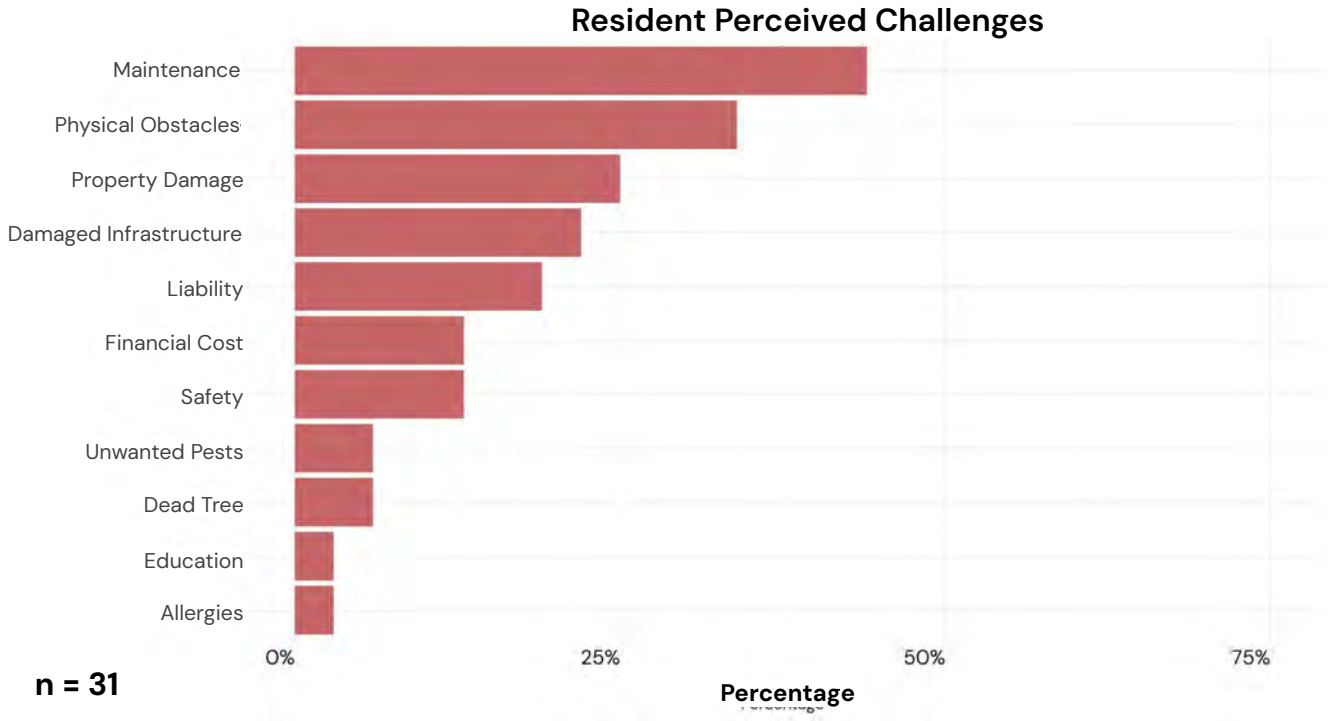
Start - Ulmus (blight resistant cultivars), Cladrastis, Platanus, Betula
Stop - Amelanchier, Nyssa, Malus

Respondent Roles in the GGC Program



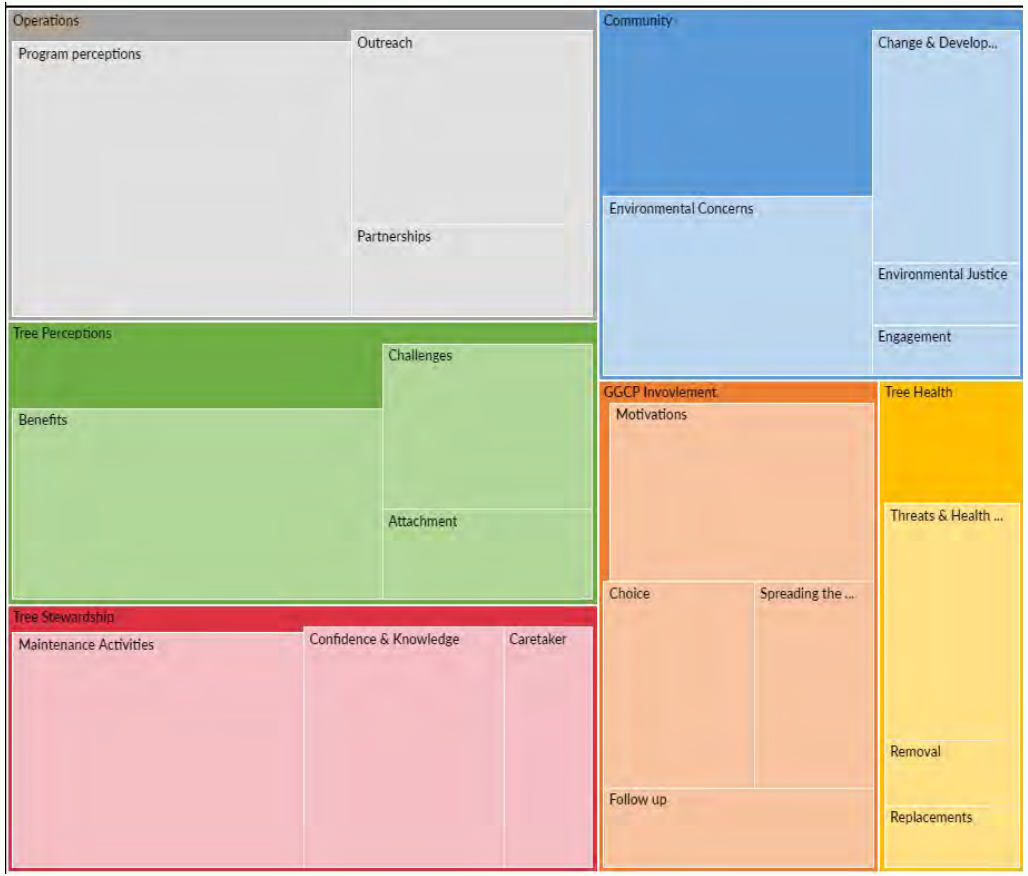
N: 31

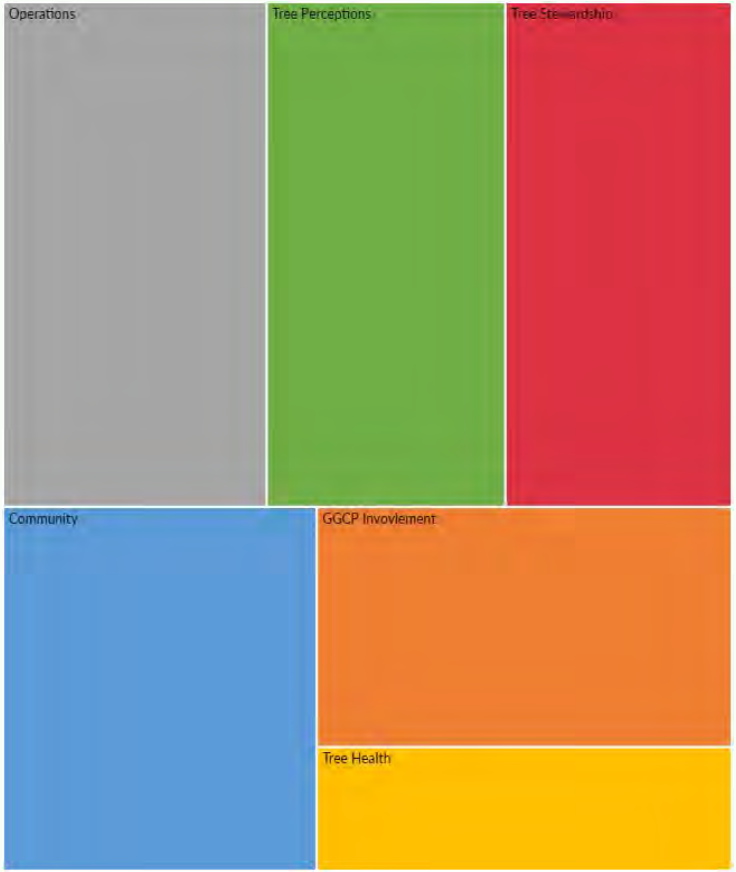
Tree Recipient Perceived Challenges



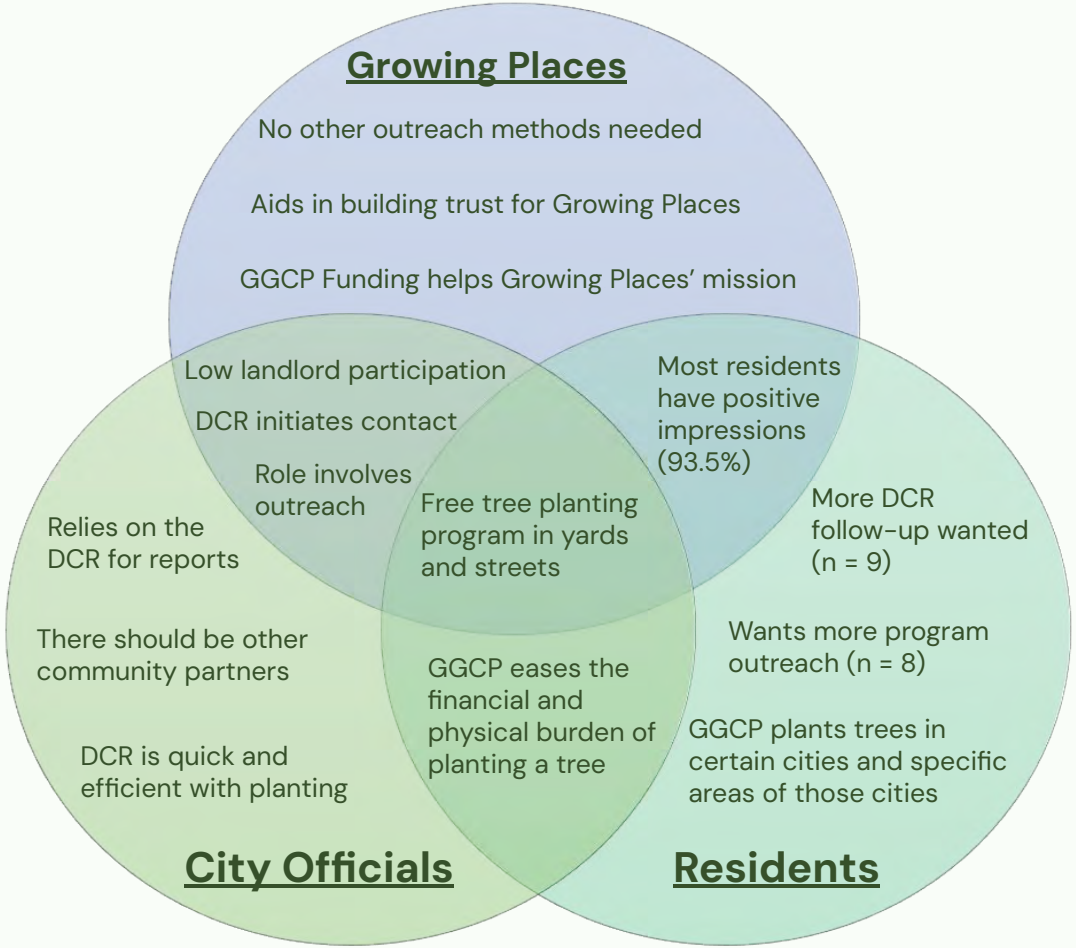
n = 31

Codes Hierarchy Charts

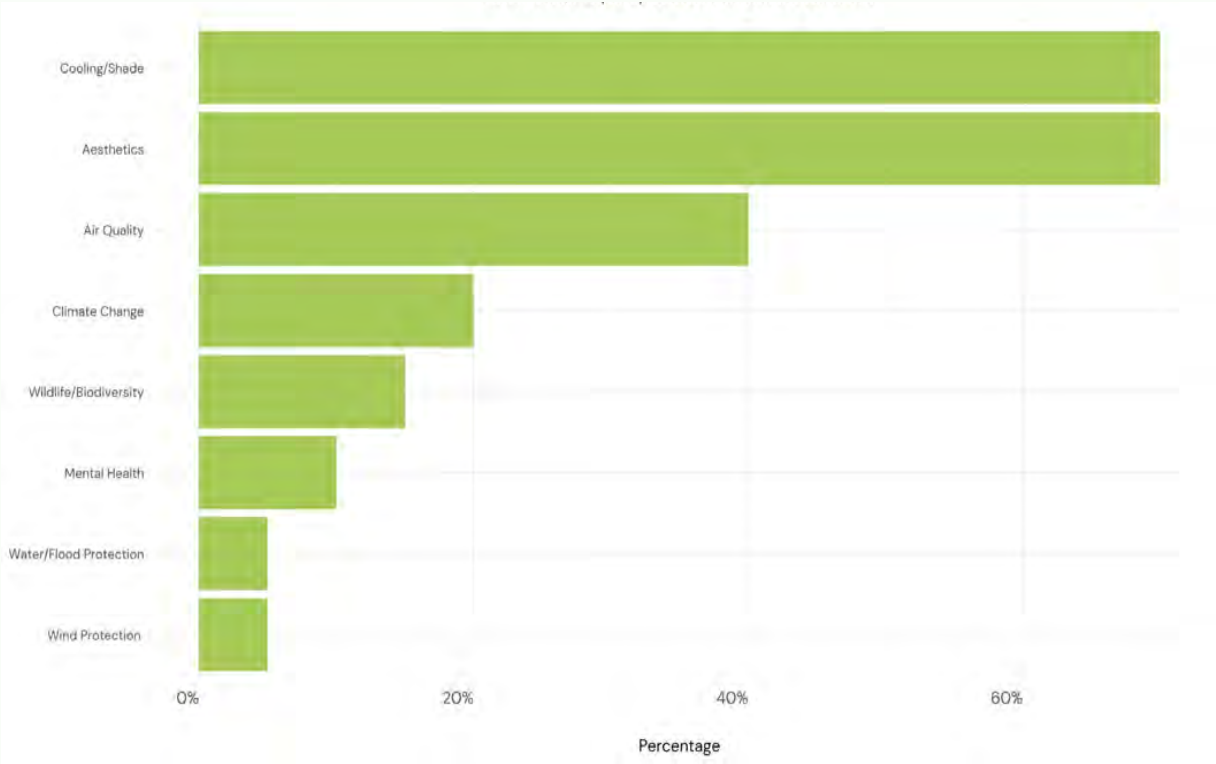




Program Perceptions from Stakeholders (Includes n Counts)



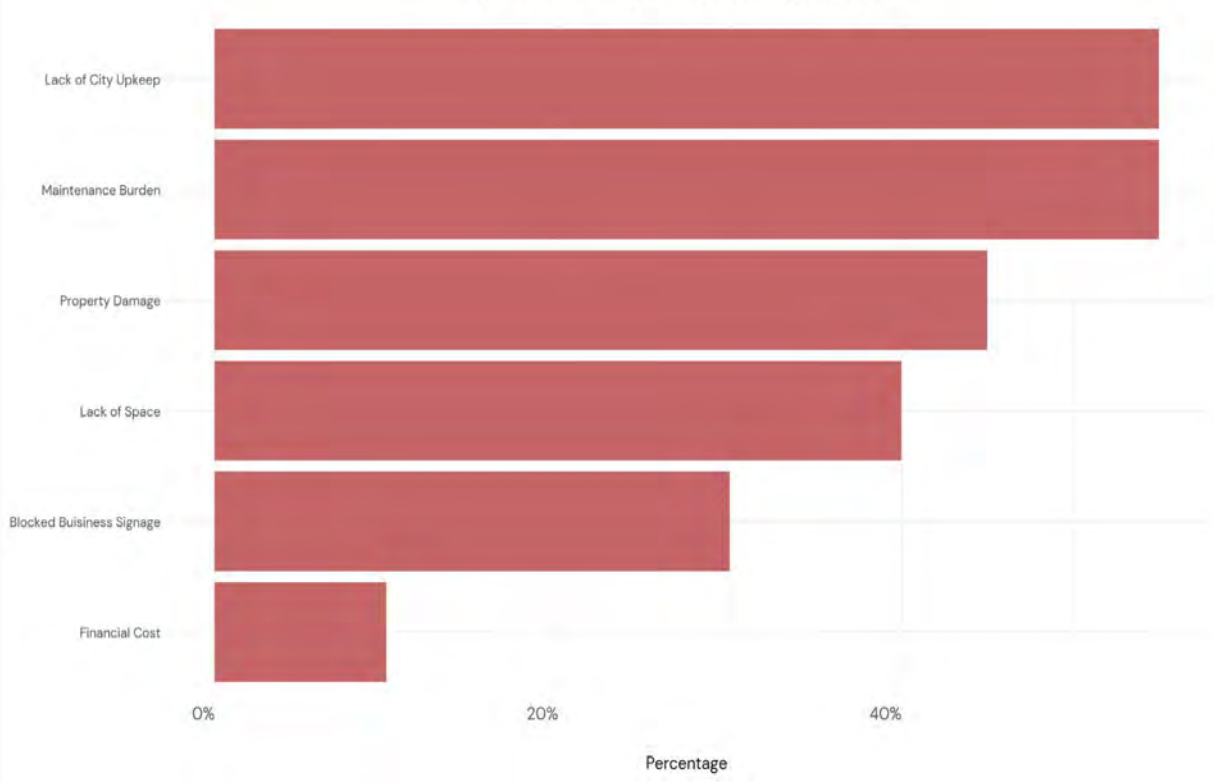
Property/Business Owner Perceived Benefits



Top benefits of trees listed by interviewees:

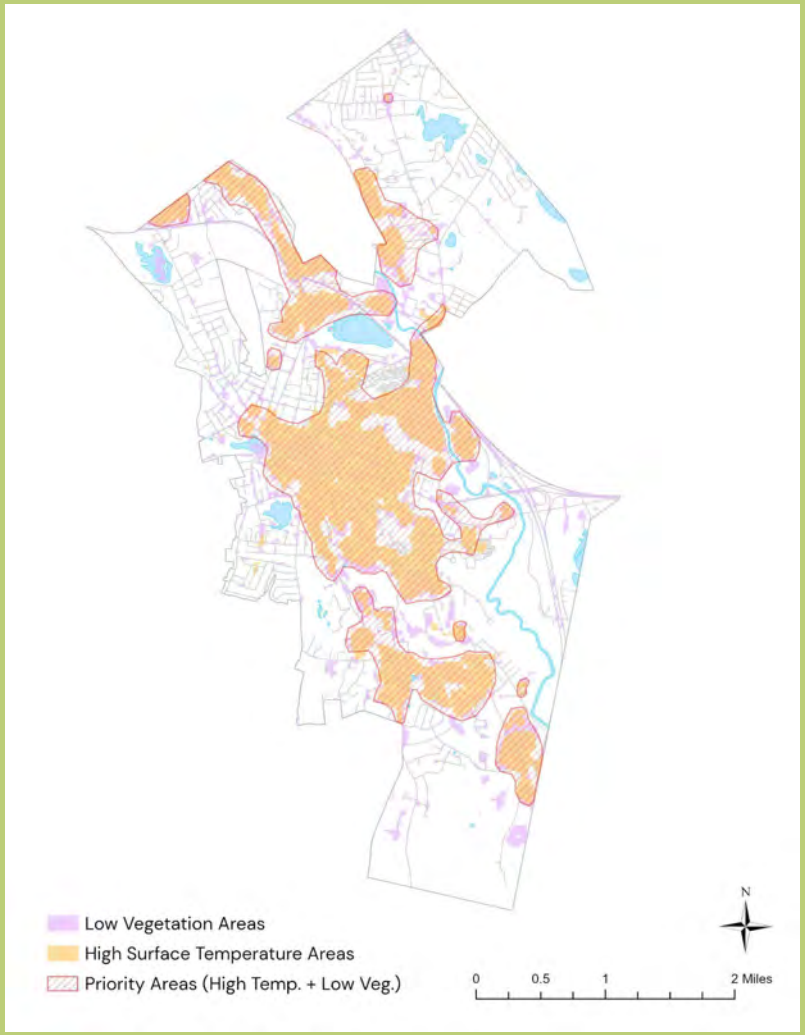
1. Cooling/Shade: 70%
2. Aesthetics: 70%
3. Air Quality: 40%

Property/Business Owner Perceived Barriers



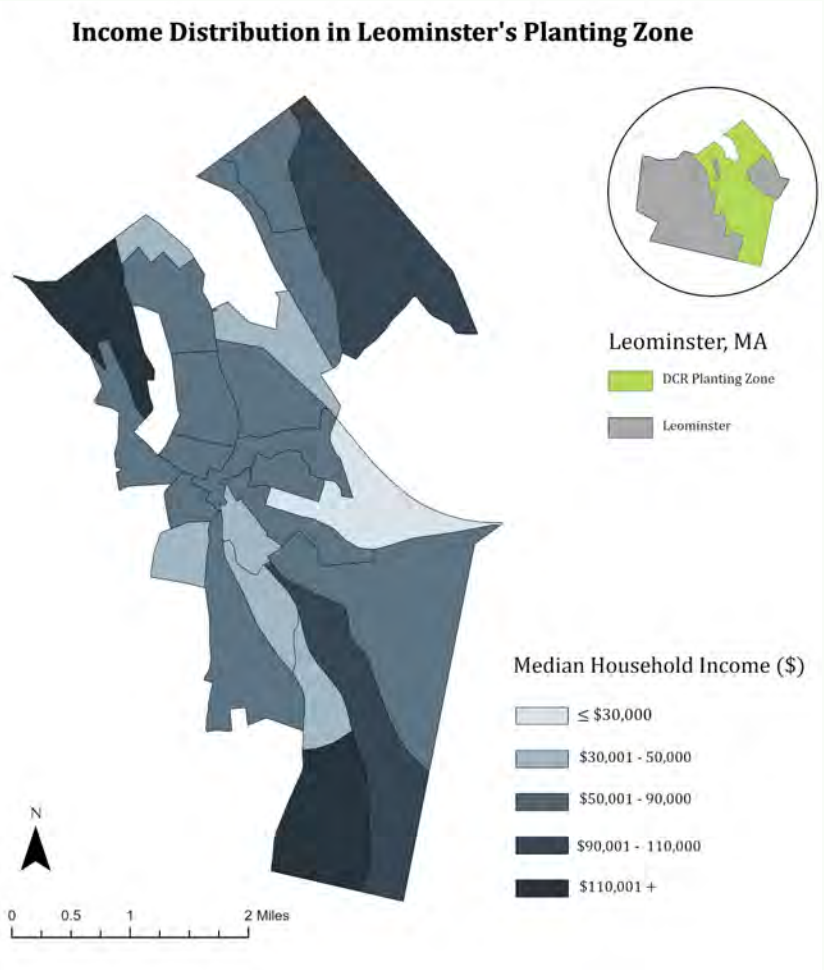
Top barriers of tree planting listed by interviewees:

1. Lack of city upkeep: 55%
2. Maintenance burden: 55%
3. Property damage: 45%

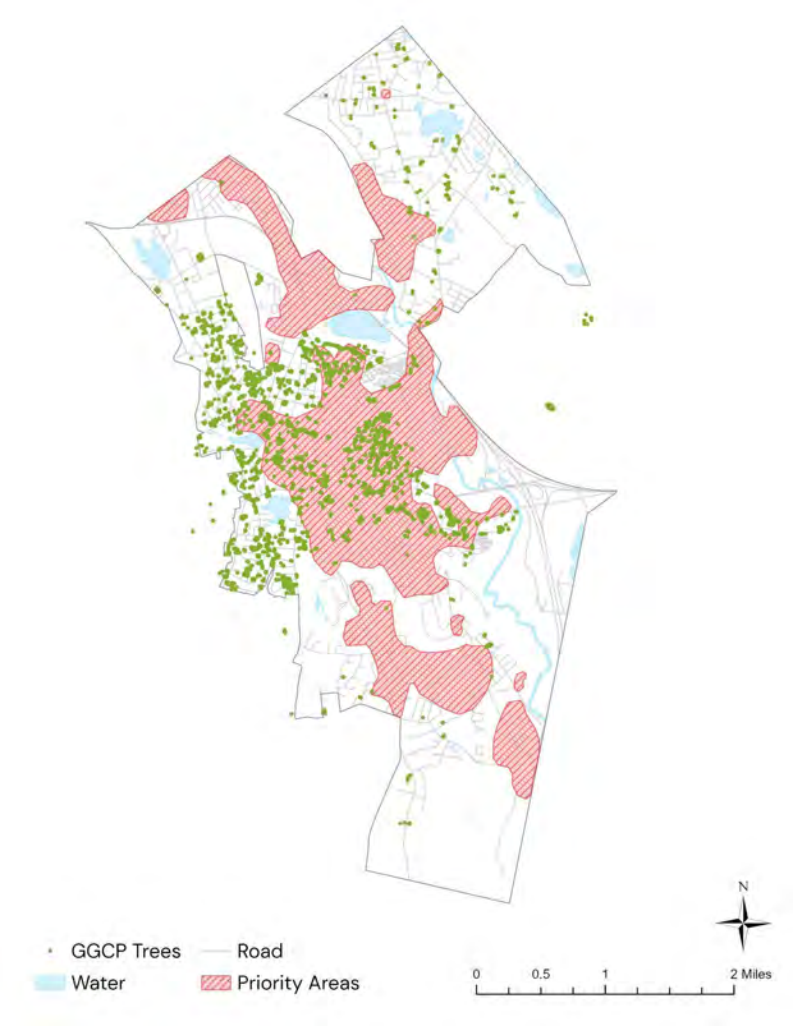


Priority Areas for Future Planting

Priority areas defined by high surface temperatures and low vegetation.

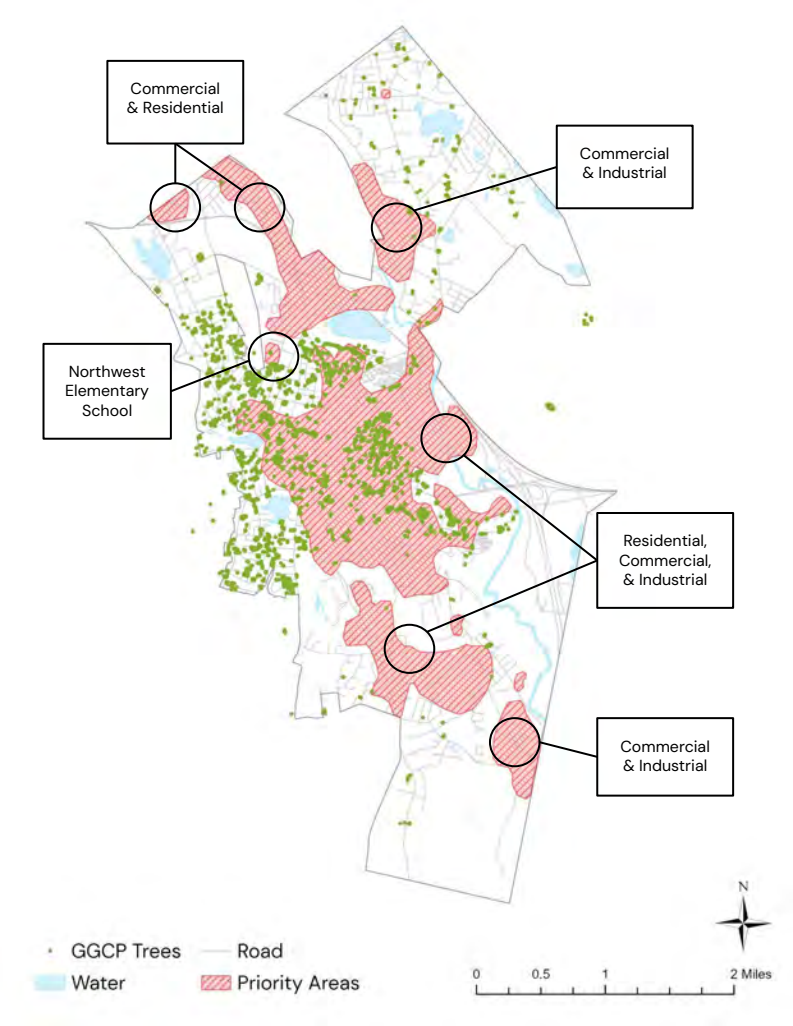

Income Distribution in Leominster's Planting Zone
Leominster, MA
DCR Planting Zone
Leominster
Median Household Income ($)
≤ $30,000
$30,001 - 50,000
$50,001 - 90,000
$90,001 - 110,000
$110,001 +
N
0
0.5
1
2 Miles

Priority Areas & GGCP Trees (2016-2024)



- Priority areas are defined by high surface temperatures and areas with low vegetation.

Priority Areas & GGCP Trees (2016-2024)



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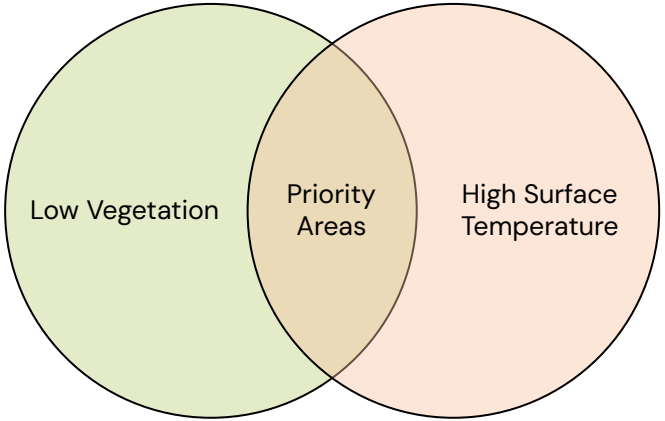
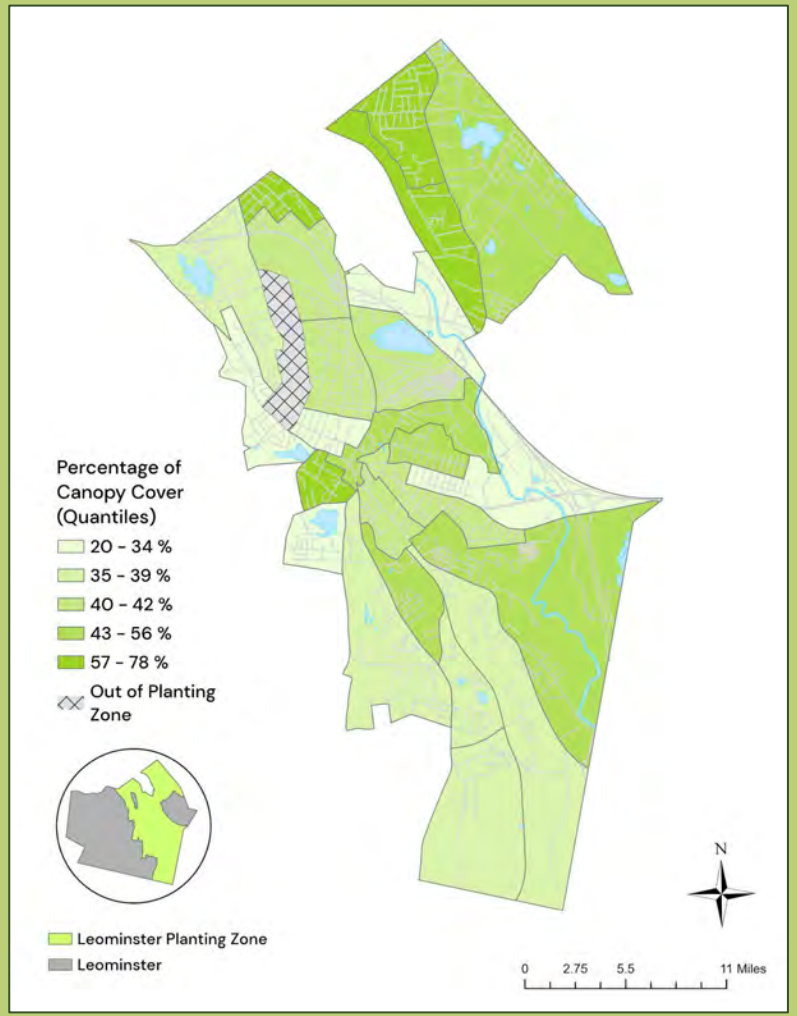




Planting Zone Canopy Cover by Block Groups

Maximum Canopy Cover	78.16%
Minimum Canopy Cover	19.7%
Mean Canopy Cover	43.23%
Average Canopy Cover of Block Groups with income under $50,000	39.4%

Worcester Methods

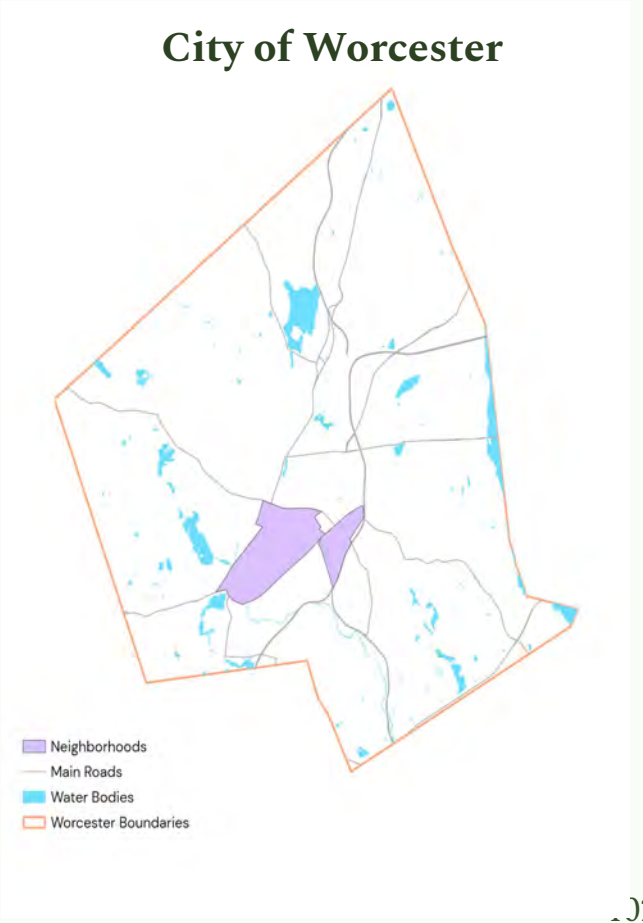
21 Property/Business Owners Interviewed

- 18 canvassed in Green Island and Main South
- 3 scheduled via outreach/phone banking

3 Community Partners Interviewed

- Main South CDC
- Green Island Residents' Group

1 Focus Group Attempted



Fonts Example – DM Sans

Fonts Example - Spectral

Near-Black font color - #36502a

~32 pt titles
~20 pt headers

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