Greening the Gateway Cities

Human-Environment Regional Observatory (HERO)

July 11th, 2019

Novak Chen, Juliette Gale, Sadie Murray,
Shannon Reault, Benjamin Ryan and Cindy Sellers

CLARK UNIVERSITY · UMass Amherst · dcr Massachusetts · Greening the Gateway Cities · Growing Places · BEAT Berkshire Environmental Action Team · HERO

Meet the Research Team

Undergraduate Research Cohort

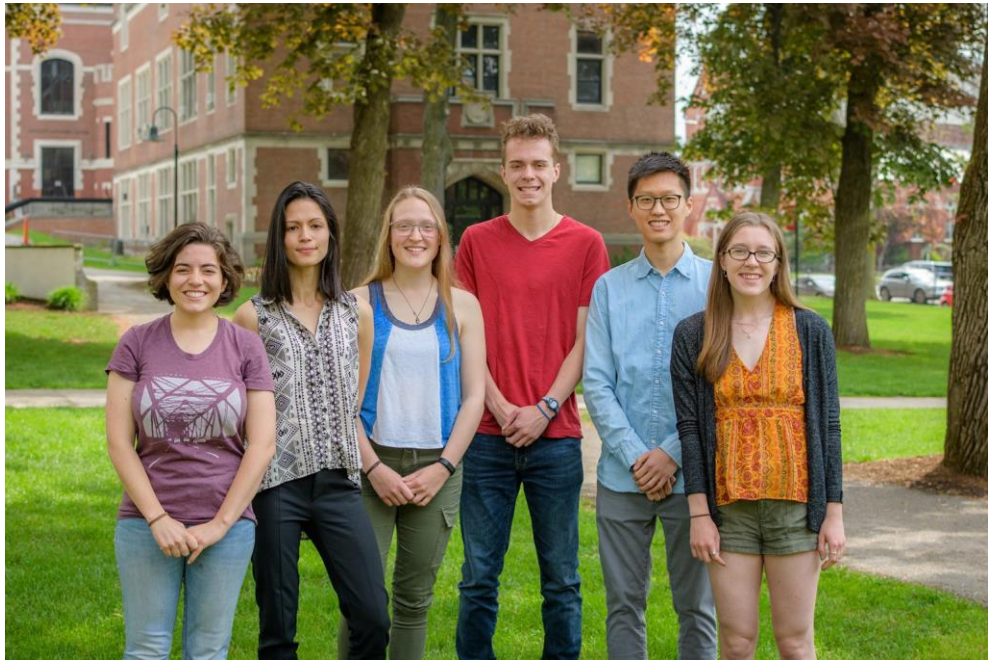
Novak Chen, Juliette Gale, Sadie Murray, Shannon Reault, Benjamin Ryan and Cindy Sellers

Graduate Mentors

Nicholas Geron and Marc Healy

Directors

Deborah Martin and John Rogan



From left to right: Sadie, Cindy, Juliette, Ben, Novak, Shannon

Outline

Introduction

- HERO Program
- Greening the Gateway Cities

Tree Survey

- Methods
- Results

Interview Response

- Framework
- Analysis

Conclusions

- Tree Survey
- Interview Response

The HERO Program:
HERO's 20th Year

Undergraduate-graduate-faculty experience researching human-environment relationships in Massachusetts

Current Research Focus:

- Urban tree health
- Tree stewardship and organizational networks

What We Do:

- Summer research
- Individual research projects during academic year

2014 HERO Fellow looking at an Asian Longhorned Beetle

2015 HERO Fellows Working in the HERO Lab

2017 HERO Fellows conducting field work

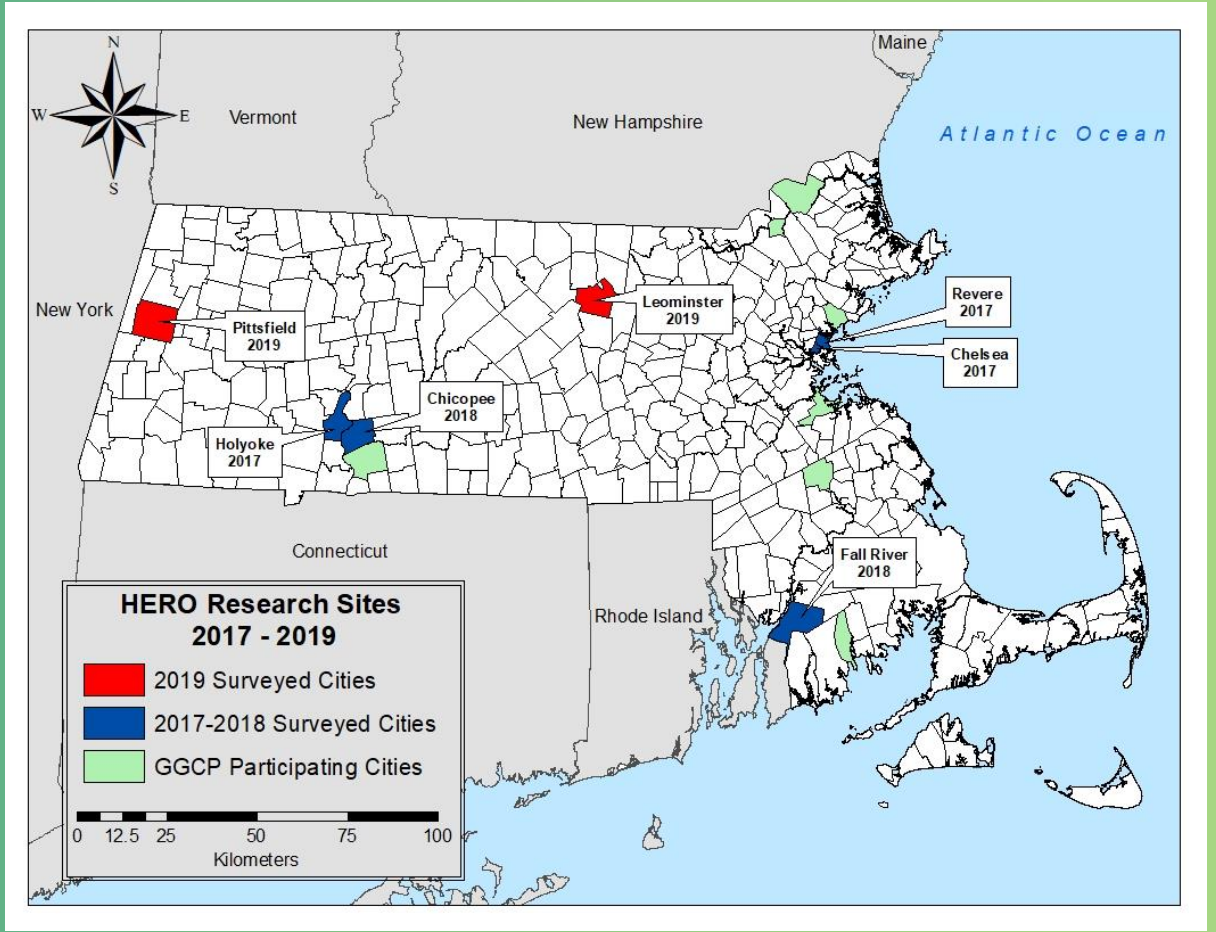
2018 HERO Fellows conducting an interview with Fall River community member

Greening the Gateway Cities Program (GGCP)

The goal of the GGCP is to increase tree canopy cover in Massachusetts' Gateway Cities to increase energy efficiency in urban residential areas.

Target Areas:

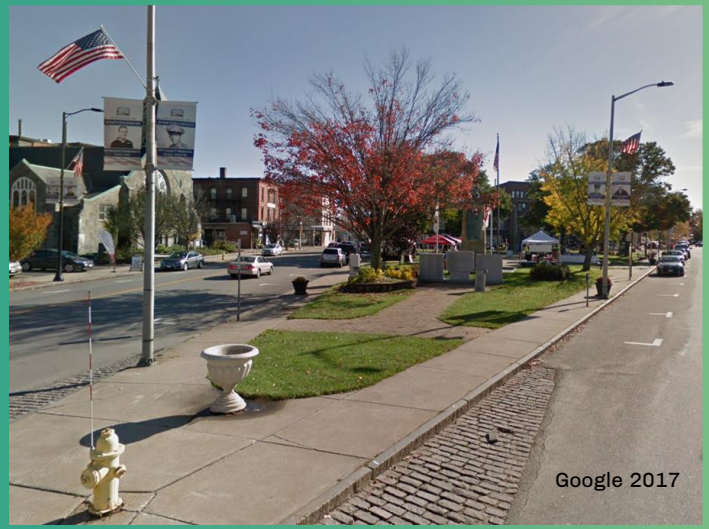
- Low tree canopy
- Old Housing Stock
- High Wind Speeds
- Large Renter Population
- Environmental Justice Neighborhoods



What is a “Gateway City”?

- Industrial urban centers
- Populations between 35,00 to 250,000
- Median household income and educational attainment below state average

Leominster



Monument Square, Leominster Center

Pittsfield

Park Square, Pittsfield Center

Characteristics of Leominster

Population: 41,823

Median Household Income: $57,610

Massachusetts: $74,167

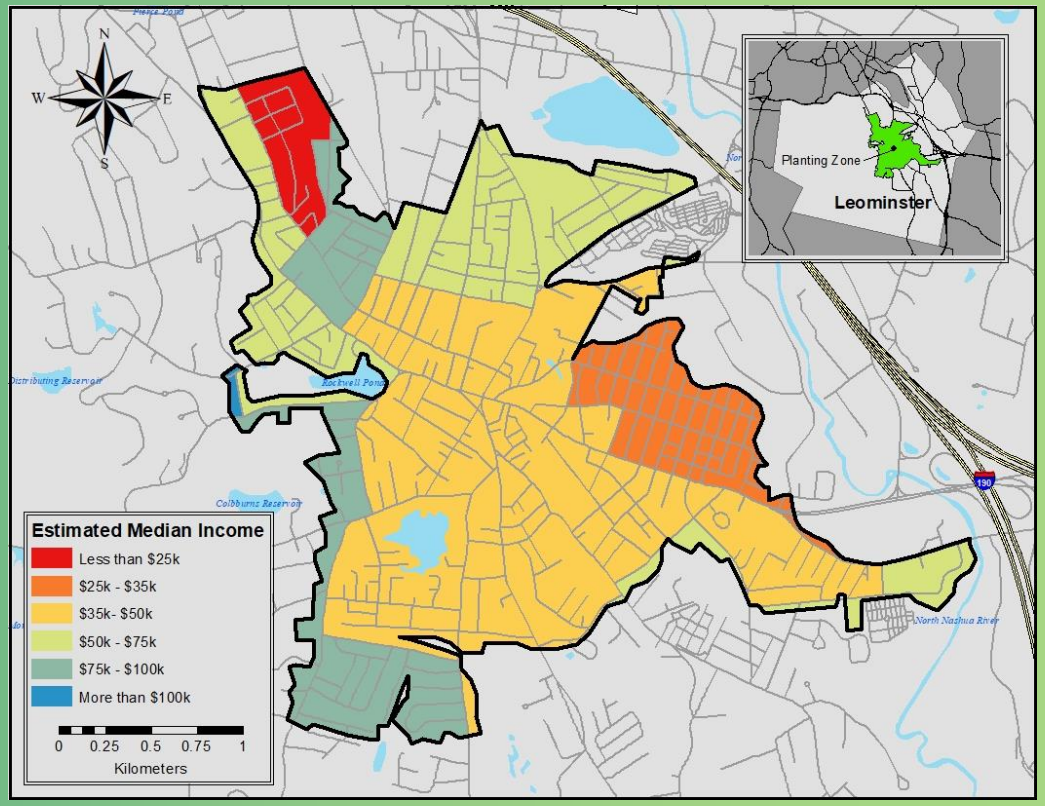
Demographic Distribution:

White: 83.3 %
Black or African American: 5.3 %
American Indian and Alaska Native: 0.1%
Asian: 3%
Two or more races: 3%
Hispanic or Latino: 17.8%
White alone, not Hispanic or Latino: 71.6%

Education:

25 years or older with BA or higher: 28.1 %

Massachusetts: 42.1%



U.S. Census Bureau. (2018, July 1)

Characteristics of Pittsfield

Population: 42,533

Median Household Income: $46,871

Massachusetts: $74,167

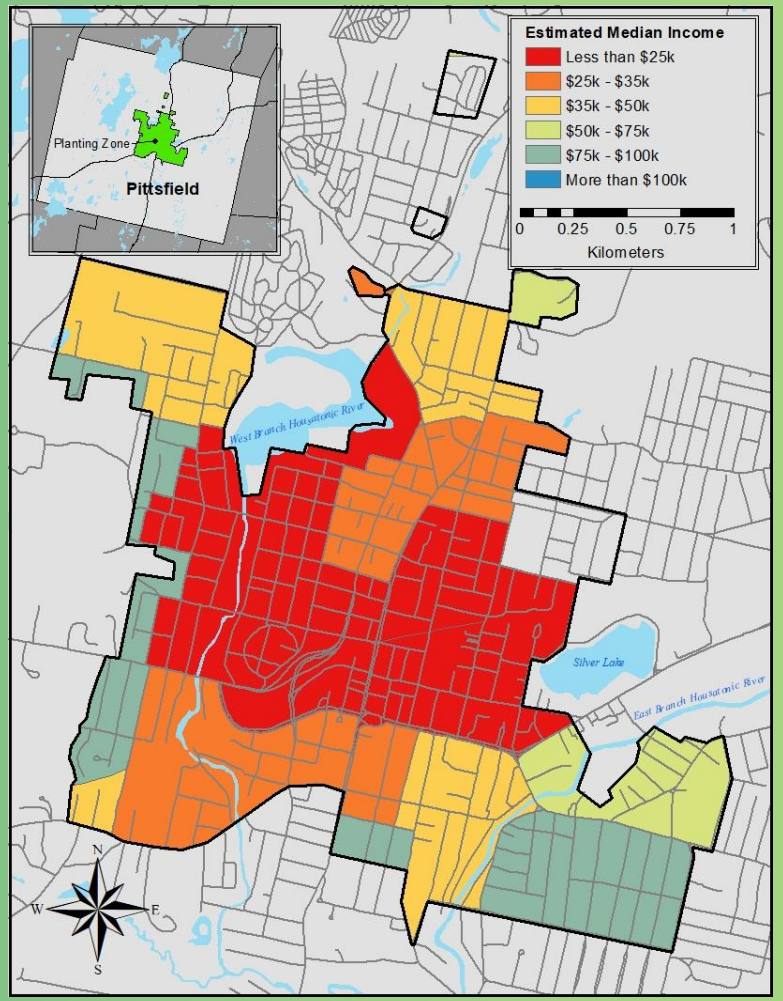
Demographic Distribution:

White: 87.4 %
Black or African American: 4.7 %
American Indian and Alaska Native: 0.4%
Asian: 2%
Two or more races: 3.5%
Hispanic or Latino: 6%
White alone, not Hispanic or Latino: 84.4%

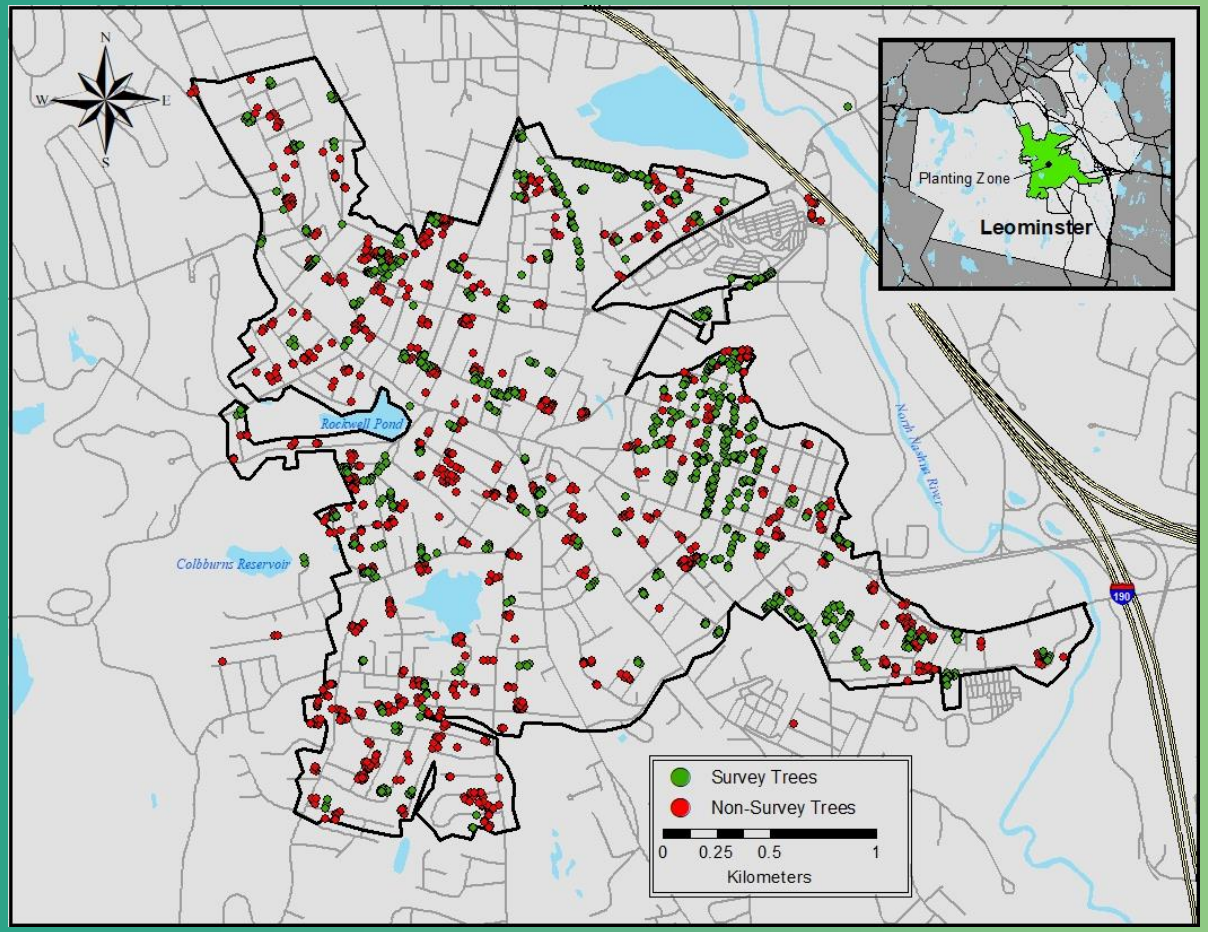
Education:

25 years or older with BA or higher: 28.1 %

Massachusetts: 42.1%



U.S. Census Bureau. (2018, July 1)



Leominster Tree Planting Locations

Total DCR Trees Planted: 1920 trees

First Plantings: Spring 2016

Trees Surveyed: 45.16% of planted

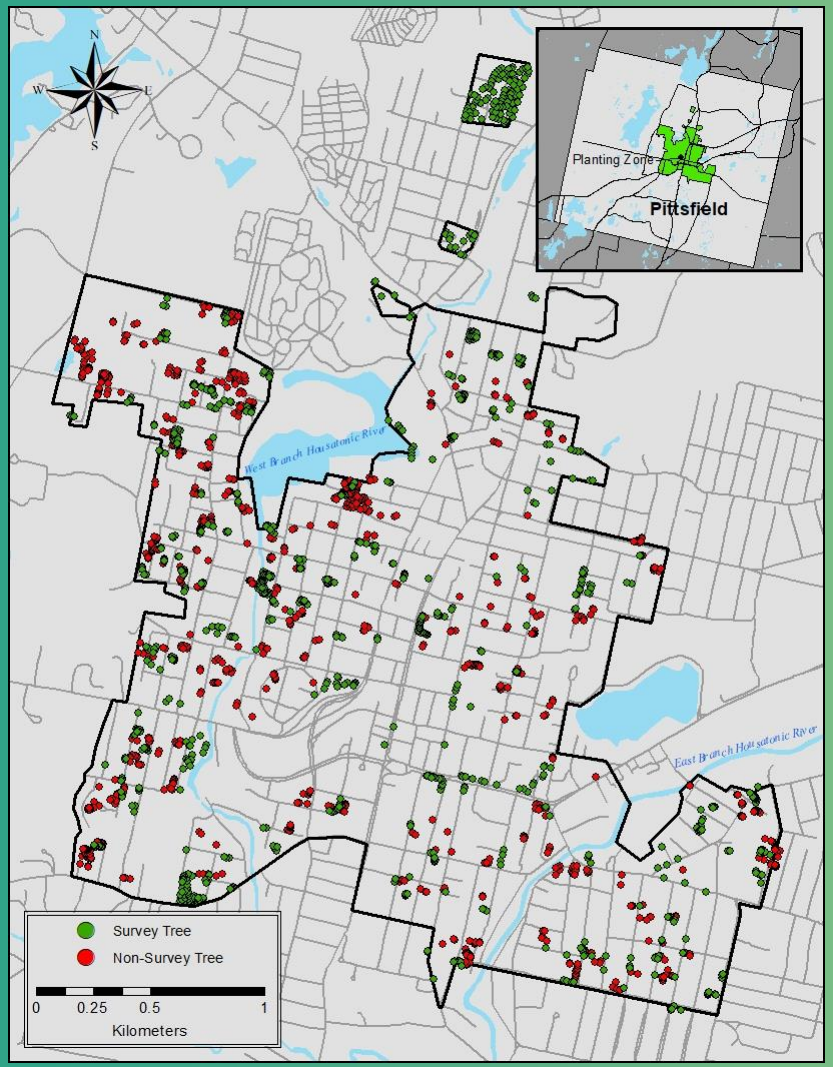
- **Total**: 867 trees
- **Private**: 436 trees
- **Public**: 431 trees

Canopy Cover

- **Citywide**: 64.22%
- **Planting Zone**: 38.43%

Impervious Surface

- **Citywide**: 17.09%
- **Planting Zone**: 47.06%



Pittsfield Tree Planting Locations

Total DCR Trees Planted: 1870 trees

First Plantings: Spring 2016

Trees Surveyed: 49.52% of trees planted

- **Total**: 926 trees
  - **Private**: 577 trees
  - **Public**: 349 trees

Canopy Cover

- **Citywide**: 56.80%
- **Planting Zone**: 27.16%

Impervious Surface

- **Citywide**: 13.23%
- **Planting Zone**: 48.56%

Research Questions

What are the biophysical factors and the social networks that influence tree health in the GGC program?

How does tree health in 2019 compare to previous HERO results?

Tree Survey:

- What is the survivorship of the trees planted in Leominster and Pittsfield?
- How does tree health compare across the two cities?
  - By genus
  - By location
  - By tree characteristics

Interviews:

- How do actors communicate amongst each other?
- How is tree stewardship approached and implemented?
- What are the discourses associated with the program?

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Sampling Method

Eastern Redbud

White Fir

Example of Sampling Method

Data Collection

Mortality

Vigor

Site Type

Land Use

American Elm

American Elm

Western Red Cedar

Height

DBH

Width

Distance to Impervious

Japanese Tree Lilac

Roman. 2015

Data Collection Sheet

Name: BR Name: NC Name:

TreeID: 607082 Species: Liriodendron tulipifera 'Fastigiata' Sector #: 12

Date Planted: 5/13/2017 Tree Comments: Some bark damage Field Notes: Resident came over and asked how trees were doing

Resident or Owner Name: Marc Healy

Address: 133 Fenn Street

City: Pittsfield

Resident Tel: 999-999-9999

Date Measured: 6/4/2019 Interview ☐

Site Type: SP Land Use: SFR-D

Lawn Care: Y N (N/A) Triple Decker ☐

Mortality: (A) SD R S U Basal Sprouts: (Y) N Vigor Class: 1 (2) 3 4 5

DBH1: 1.2 @ height: 54 DBH4: @ height:

DBH2: @ height: DBH5: @ height:

DBH3: @ height: DBH6: @ height:

Width 1: 3 ft 5 in Width 2: 4 ft 4 in

Dist. to impervious 1: 2 ft 2 in Dist. to impervious 2: 1 ft 8 in

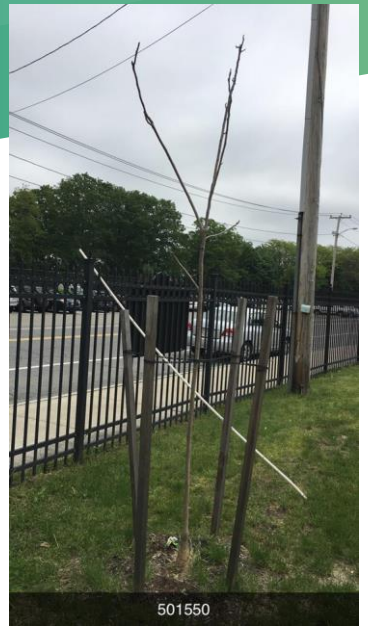
Height: 11 ft 6 in

Notes for Supervisory Review:

Mortality

Crabapple

Alive



Kentucky Coffee

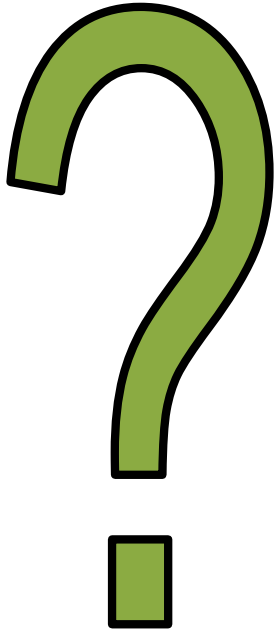
Standing Dead

Kentucky Coffee

Removed

Tulip Tree

Stump



Unknown

Vigor

Cornelian Cherry Dogwood

1

Healthy

River Birch

2

Slightly Unhealthy

Tulip Tree

3

Moderately Unhealthy

Ware Oak

4

Severely Unhealthy

Japanese Snowbell

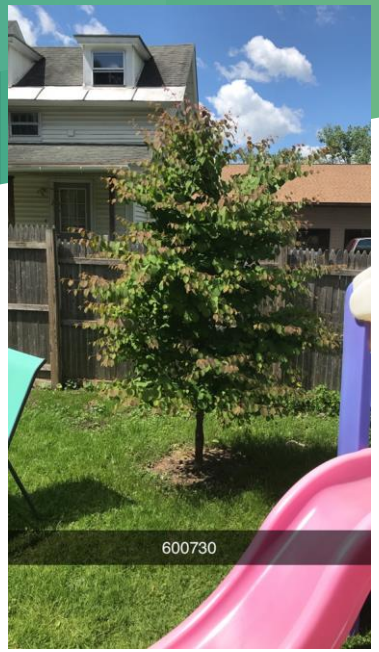
5

Dead

Site Type

European Hornbeam

Front Yard



Ware Oak

Back Yard

American Elm

Sidewalk
Planting Strip

Faser Fir

Maintained
Park

American Hornbeam

Other
Maintained

Land Use

Tulip Tree

Single Family Residential

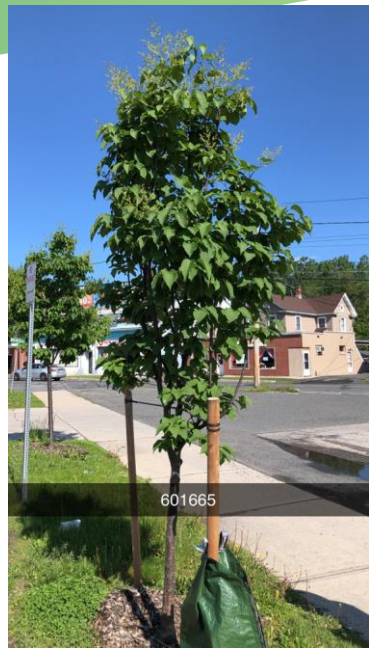
Attached/Detached

Persian Ironwood

Multi-Family Residential

Black Gum

Maintained Park



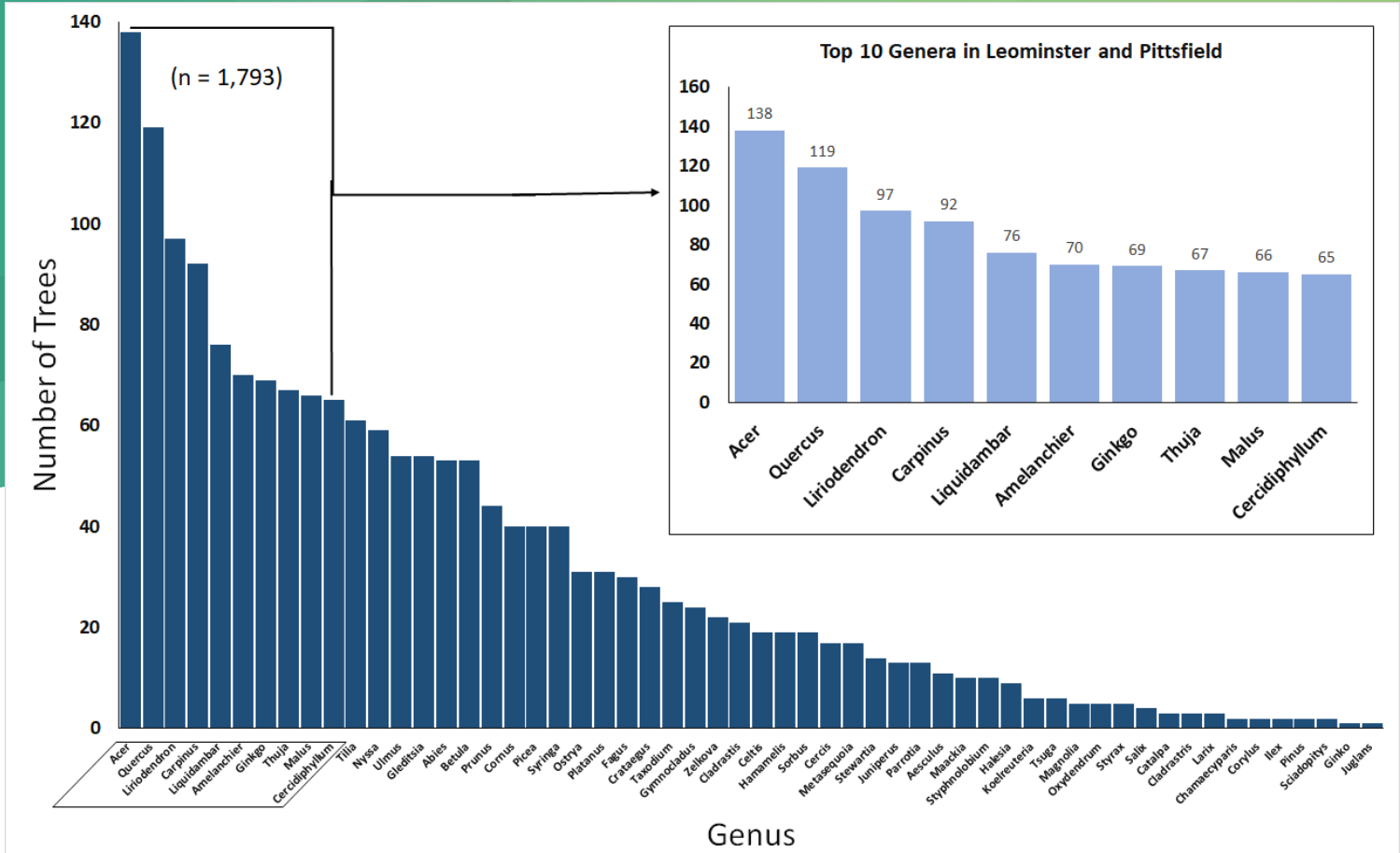
Japanese Tree Lilac

Commercial

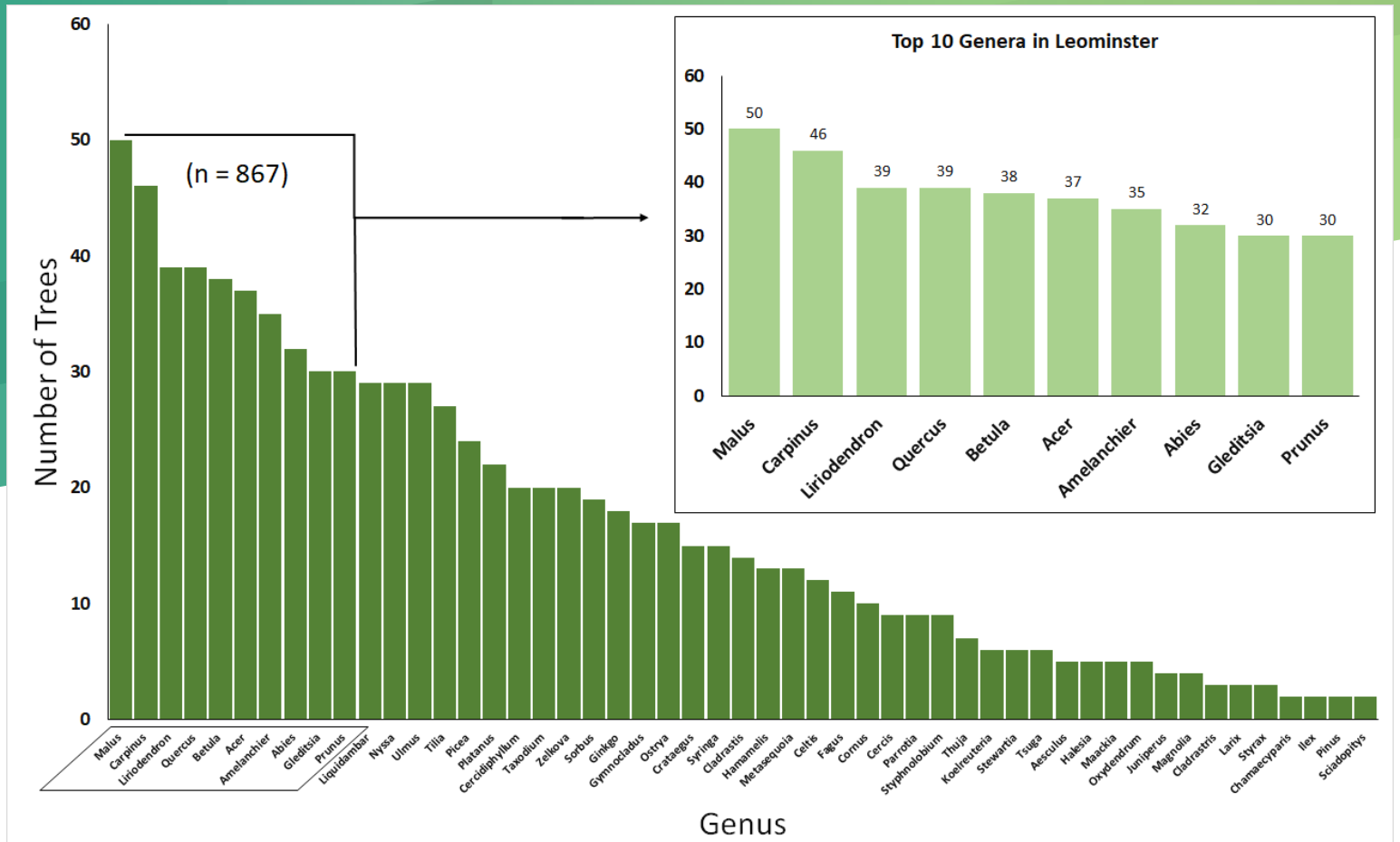
Sargent Crabapple

Institutional

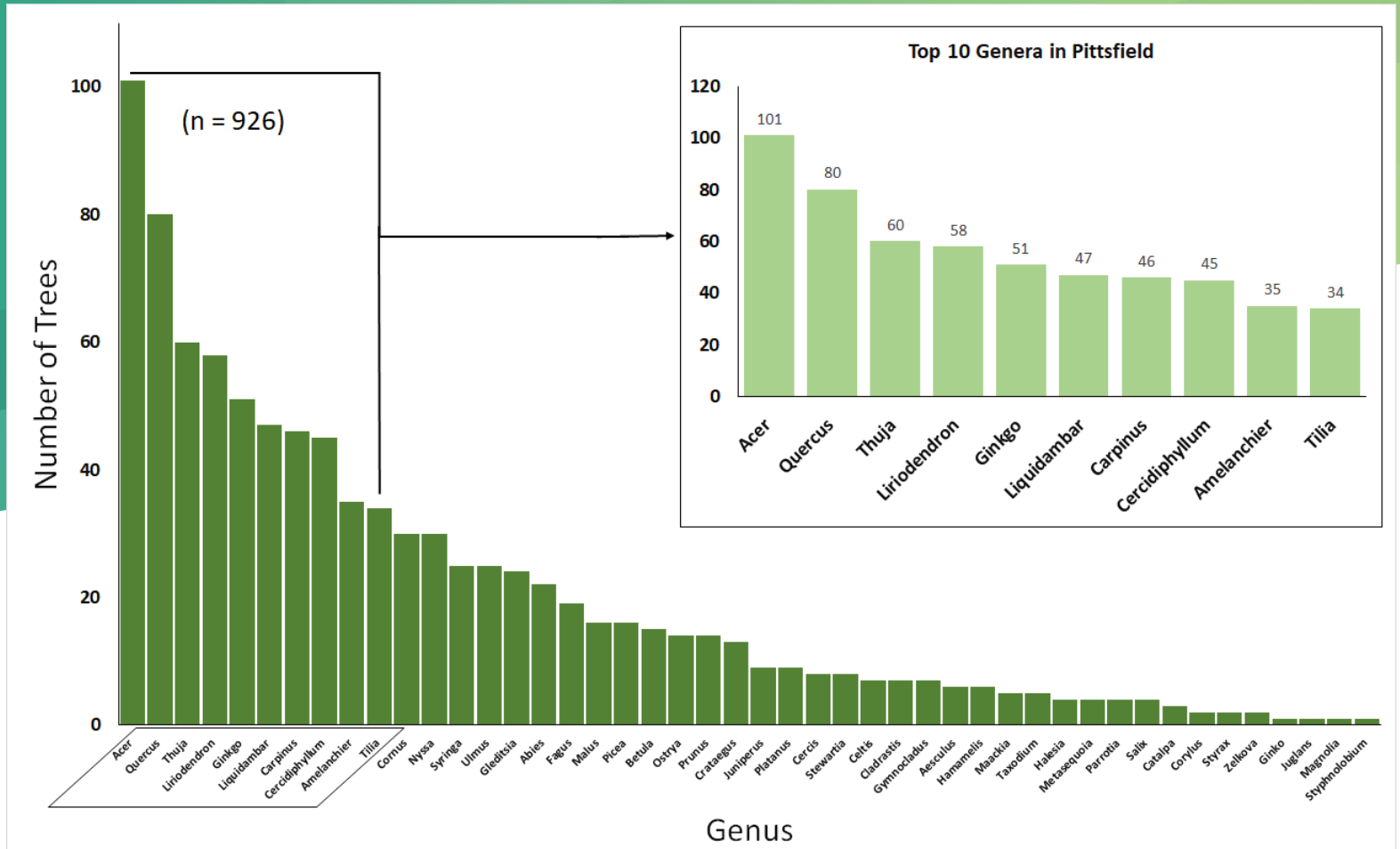
Genus distribution in Leominster and Pittsfield



Genus distribution in Leominster

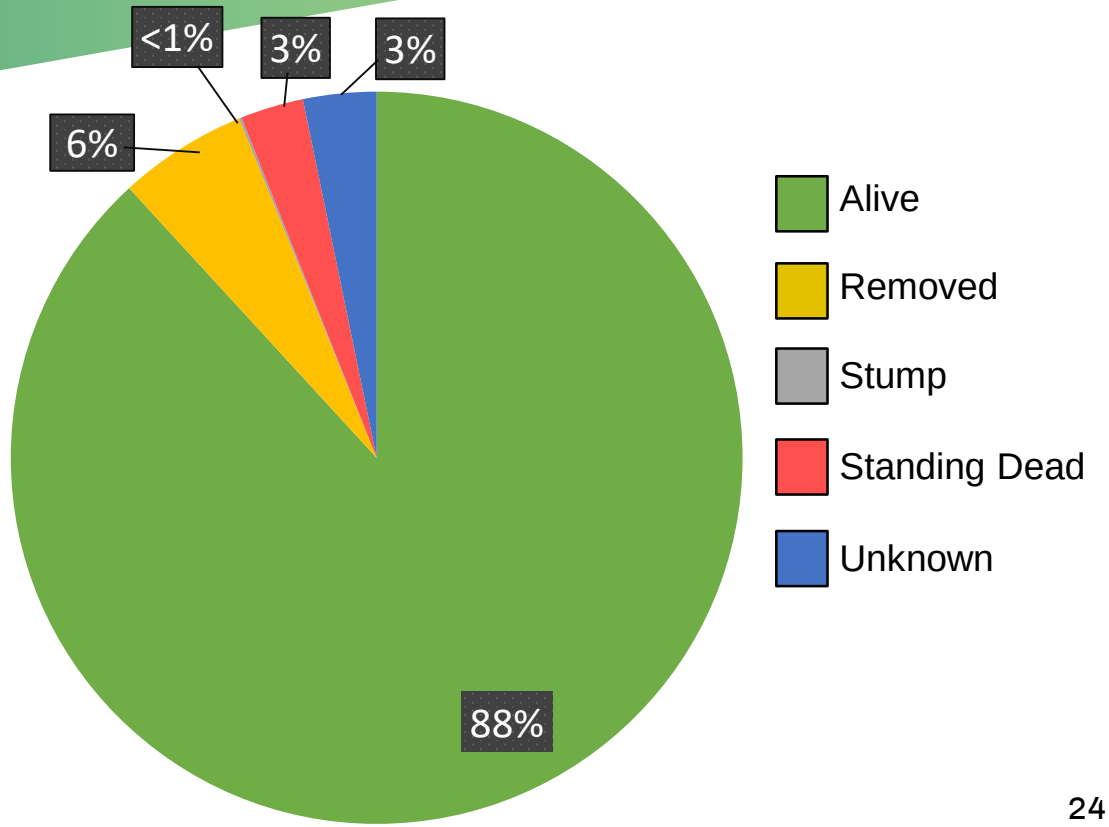


Genus distribution in Pittsfield

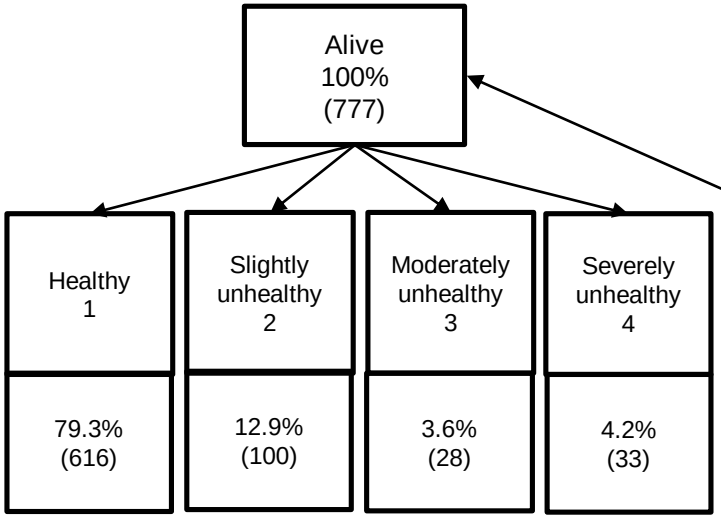


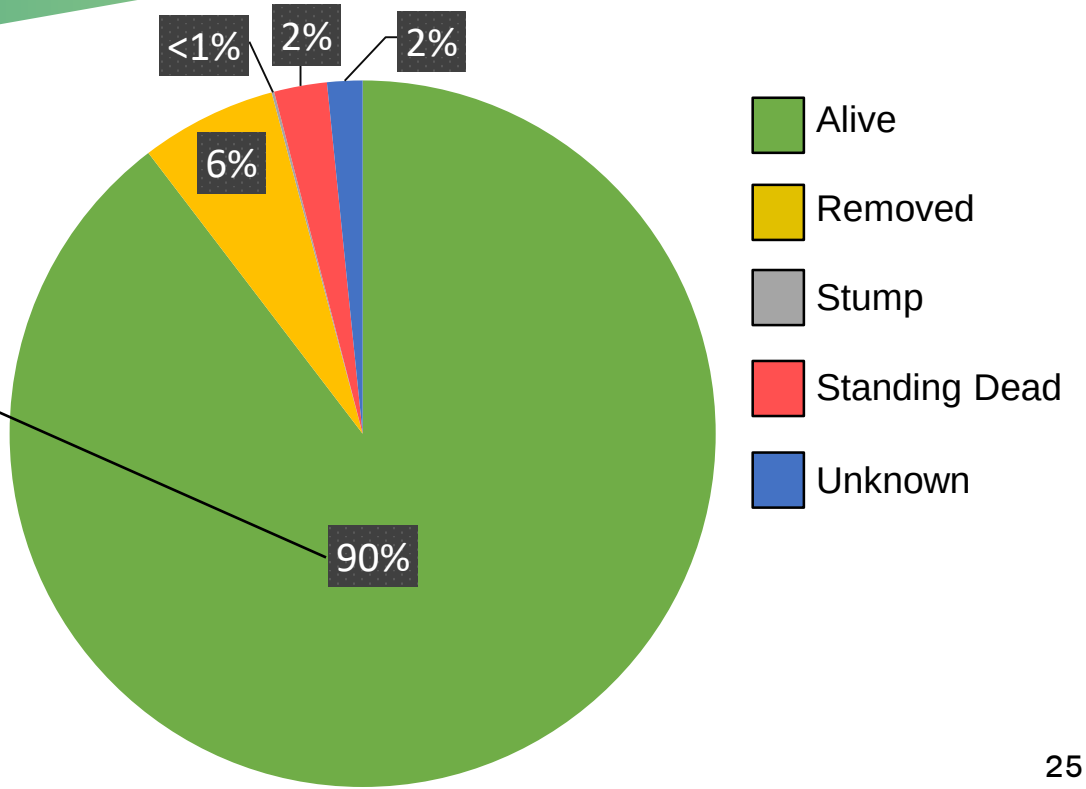
Survivorship: All Trees

Cities	Alive %
Holyoke	78%
Chelsea	86%
Fall River	92%
Chicopee	92%

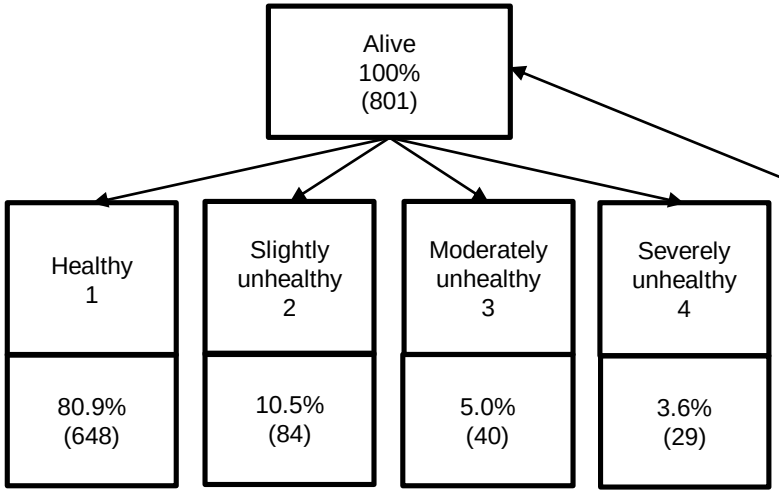


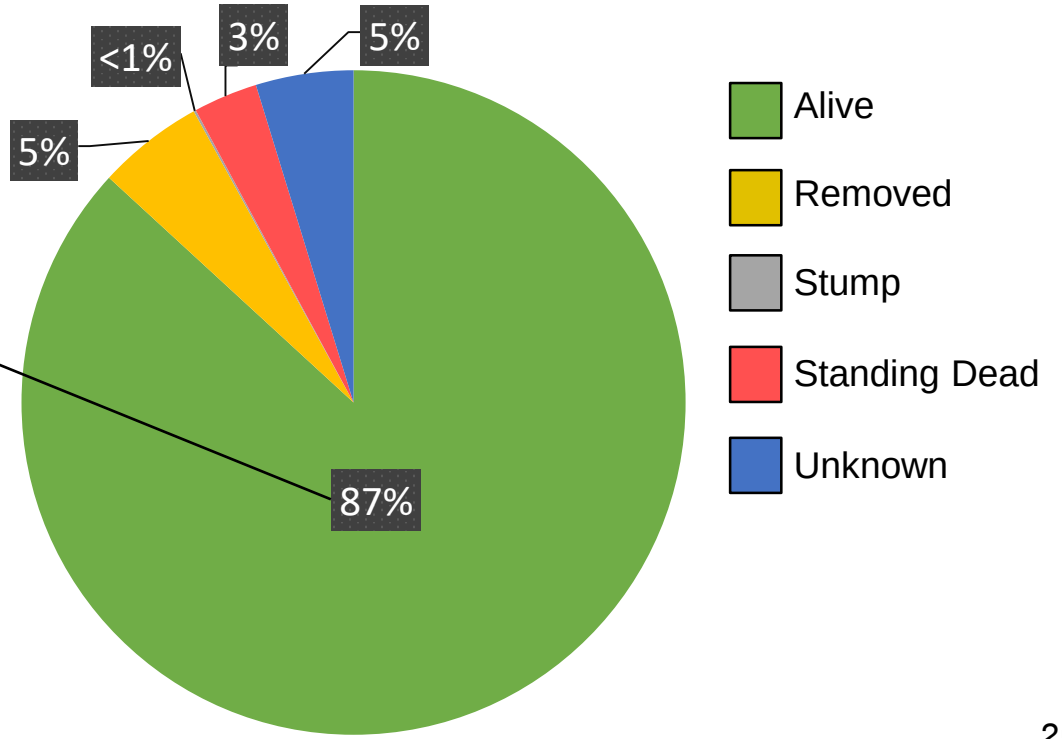
Survivorship: Leominster



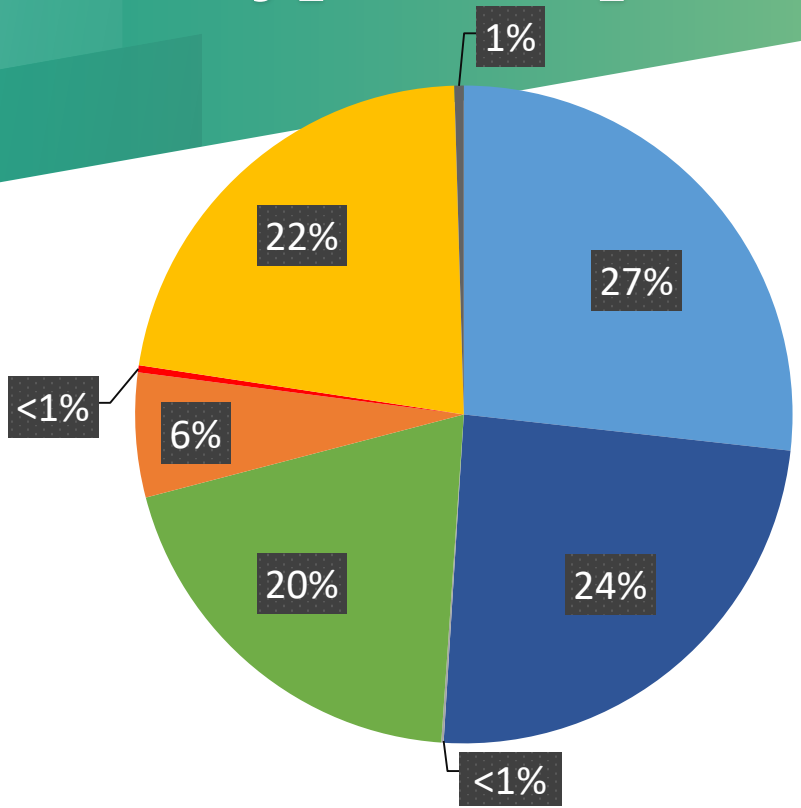


Survivorship: Pittsfield



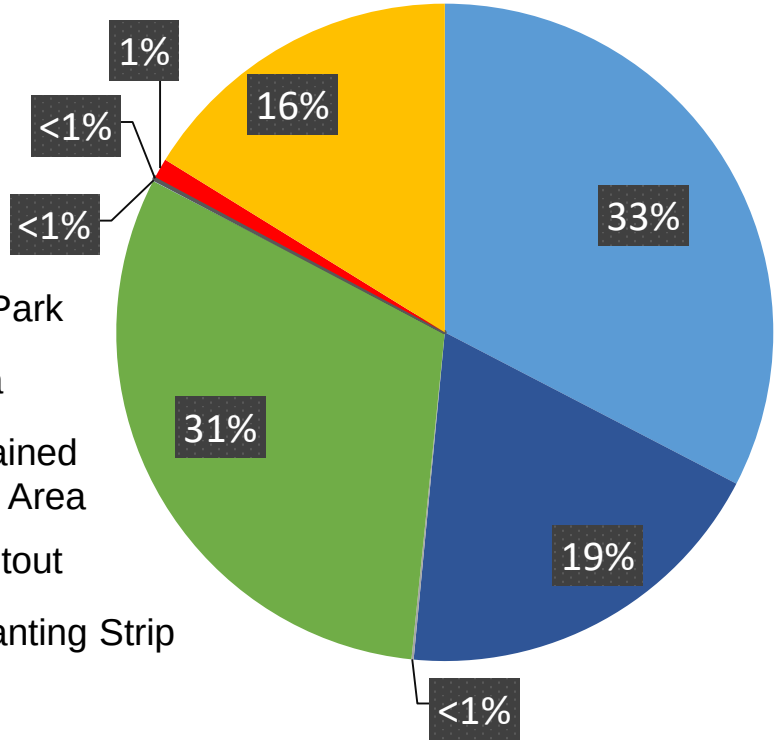


Site Type Composition



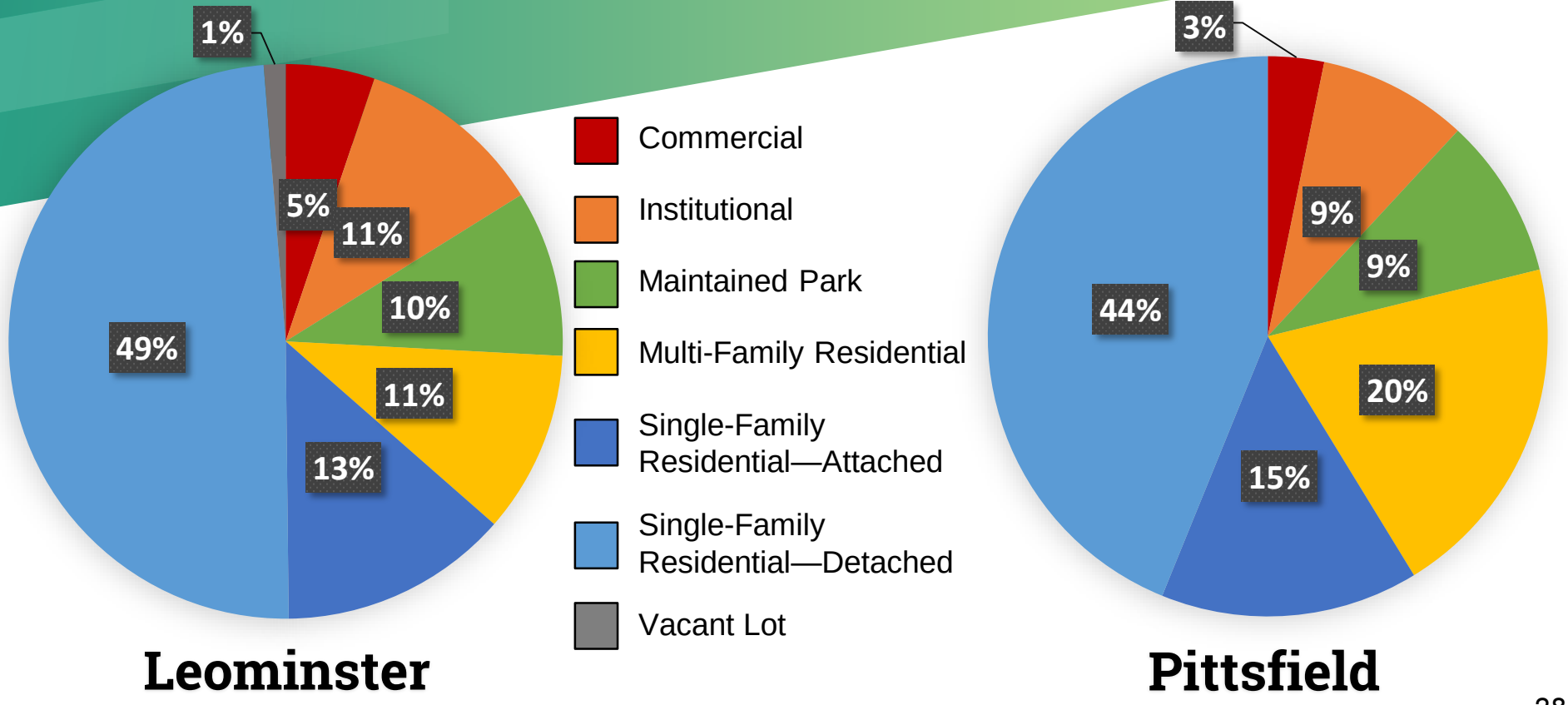
Leominster

Back Yard
Front Yard
Median
Maintained Park
Natural Area
Other Maintained Landscaped Area
Sidewalk Cutout
Sidewalk Planting Strip
Side Yard



Pittsfield

Land Use Composition

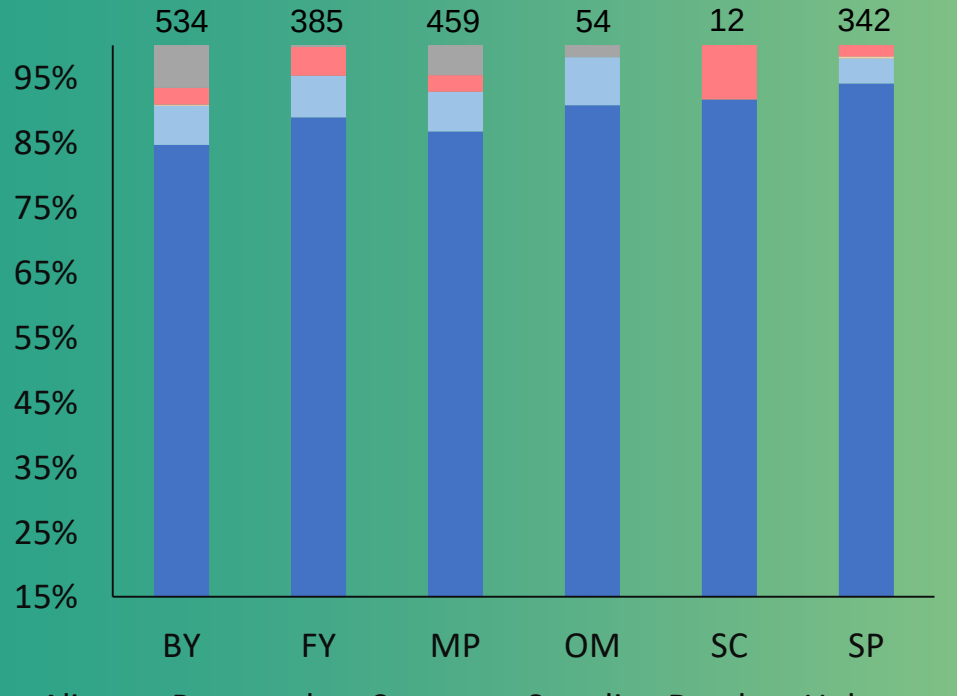


Leominster

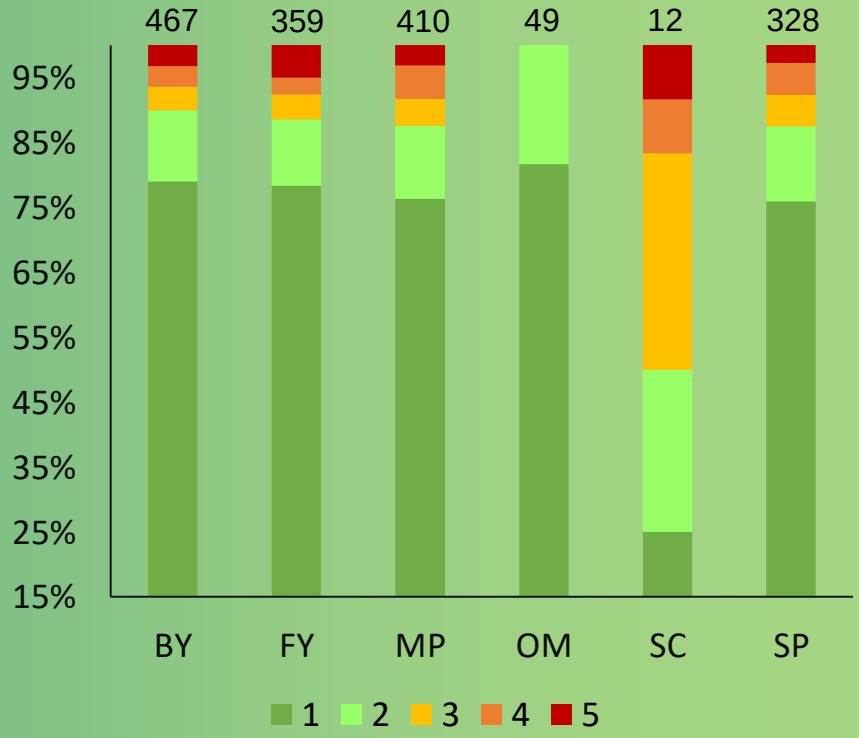
Pittsfield

Health by Site Type

Mortality

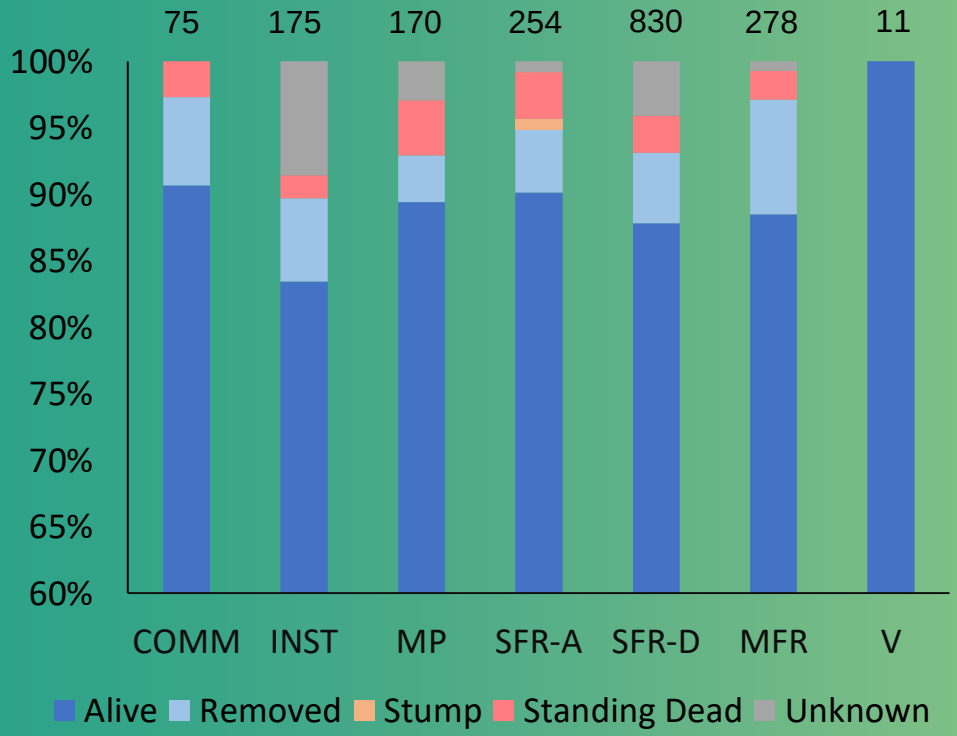


Vigor

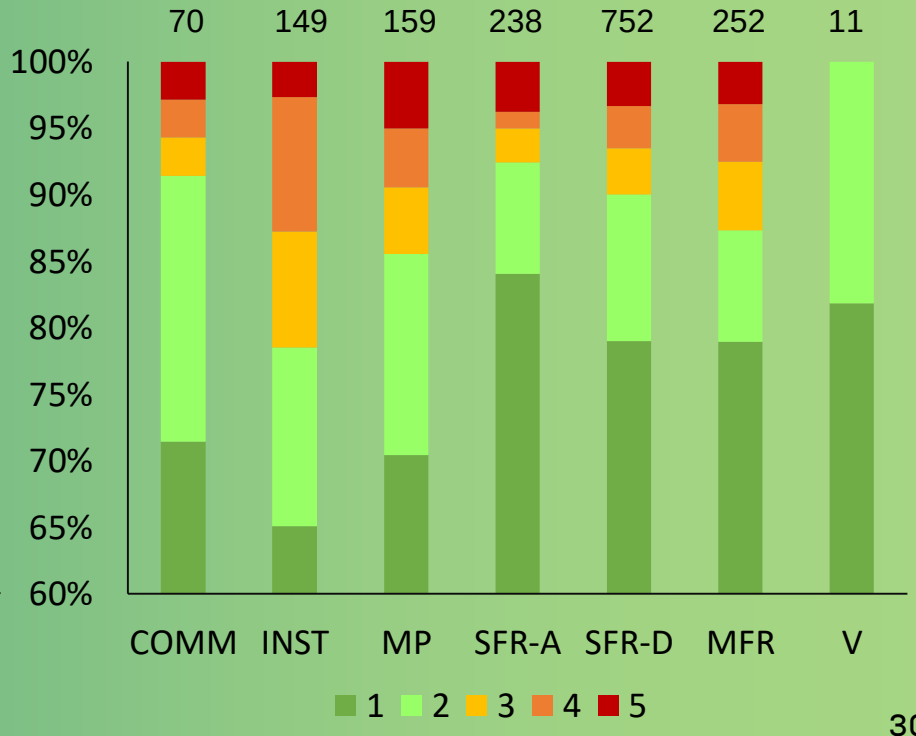


Health by Land Use

Mortality

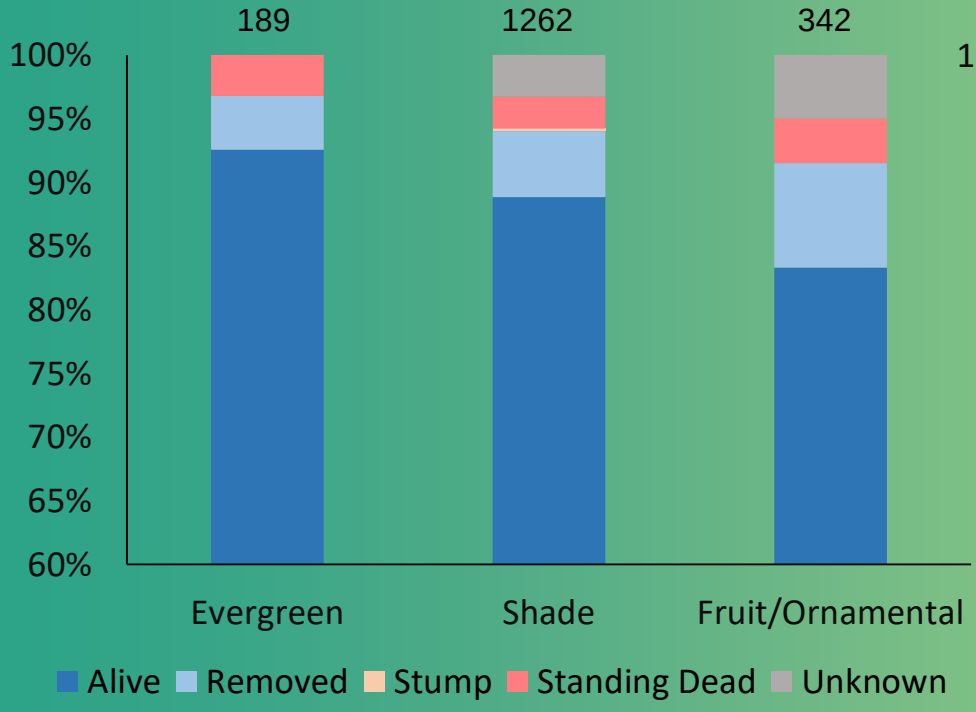


Vigor



Health by Tree Type

Mortality



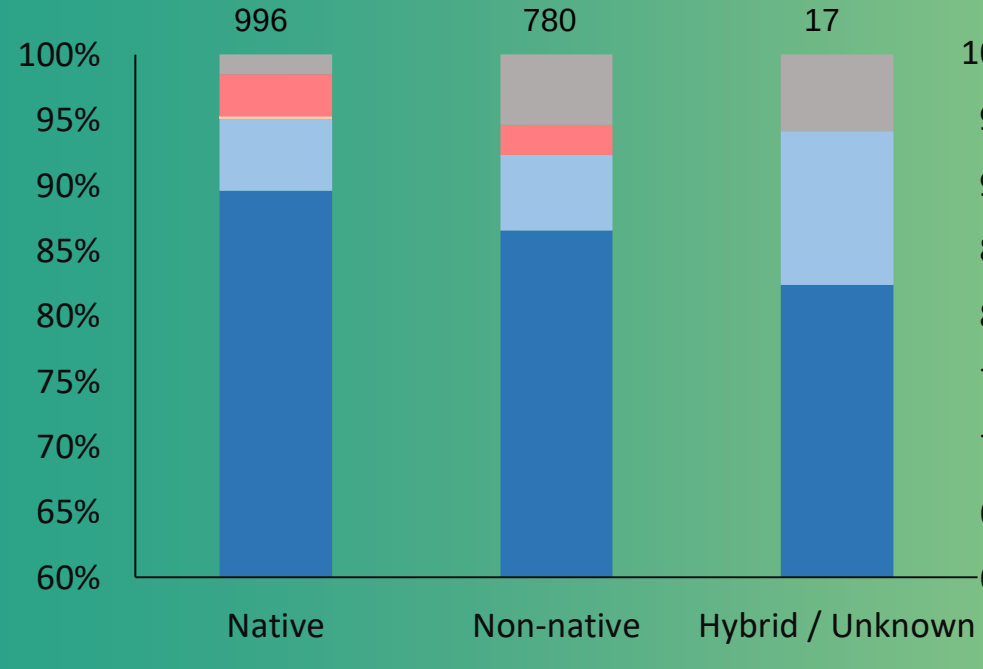
p-value: 0.0028

Vigor

p-value: 0.0000

Health by Native Status

Mortality



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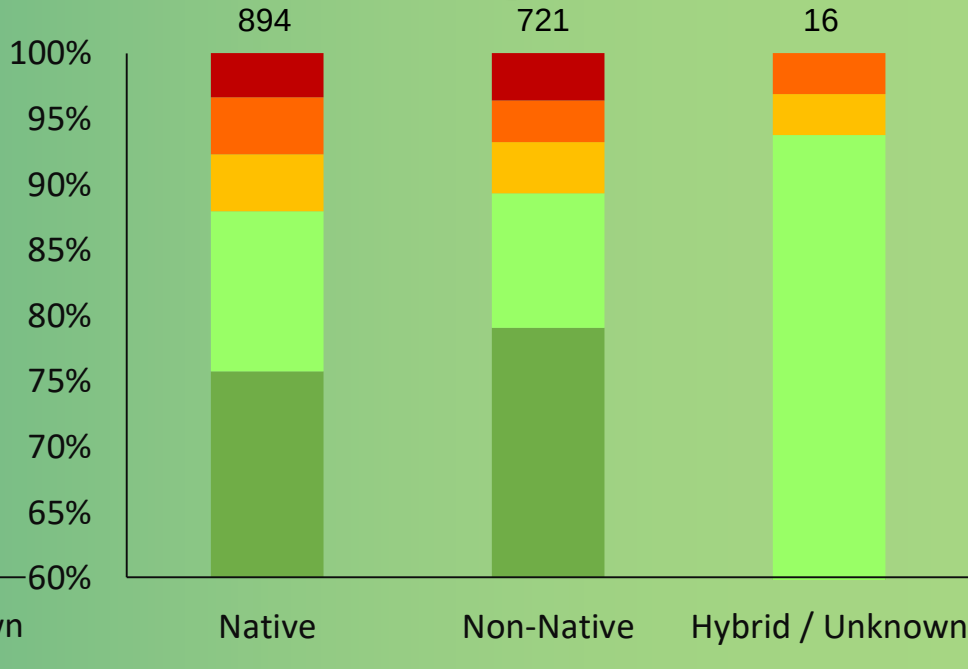
Vigor



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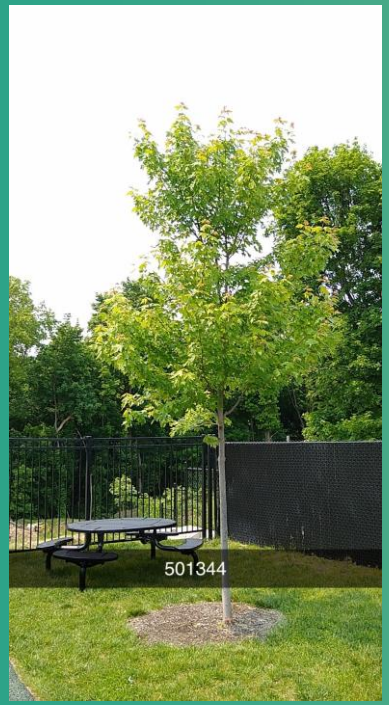
Top 10 Most Planted Genera



Red Maple

Genus	N	Survivorship	Mean Vigor
Acer	137	89.1%	1.20
Quercus	119	89.1%	1.35
Liriodendron	97	82.5%	1.45
Carpinus	92	89.1%	1.68
Liquidambar	76	76.3%	1.98
Amelanchier	70	95.7%	1.36
Ginkgo	69	84.1%	1.32
Malus	66	95.5%	1.13
Thuja	66	81.8%	1.28
Cercidiphyllum	65	87.7%	1.24

Scarlet Oak

Genera with a 100% Survival Rate

Birch
n=53

Cherry / Plum
(prunus)
n=44

Yellowwood
n=24

Witch-hazel
n=19

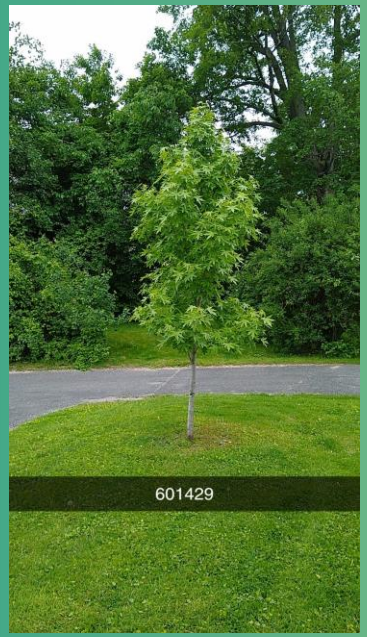
Dawn redwood
n=17

Program-Wide Trees with Lowest Survivorship

Ironwood

76.9%

n=13



Sweetgum

76.3%

n=76

Tupelo

72.9%

n=59

Bald cypress

60.0%

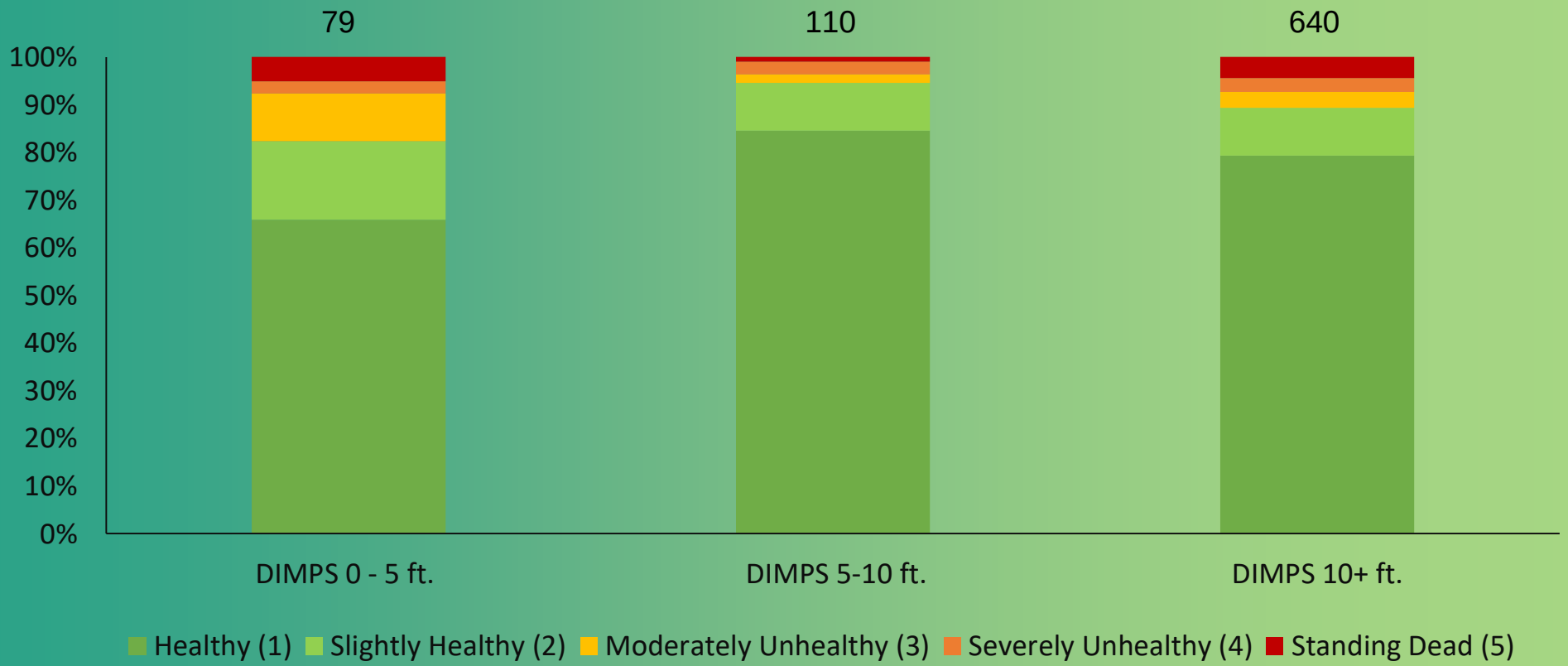
n=25

Silverbell

22.2%

n=9

Distance to Impervious Surfaces (DIMPS)
Vigor of Residential Trees



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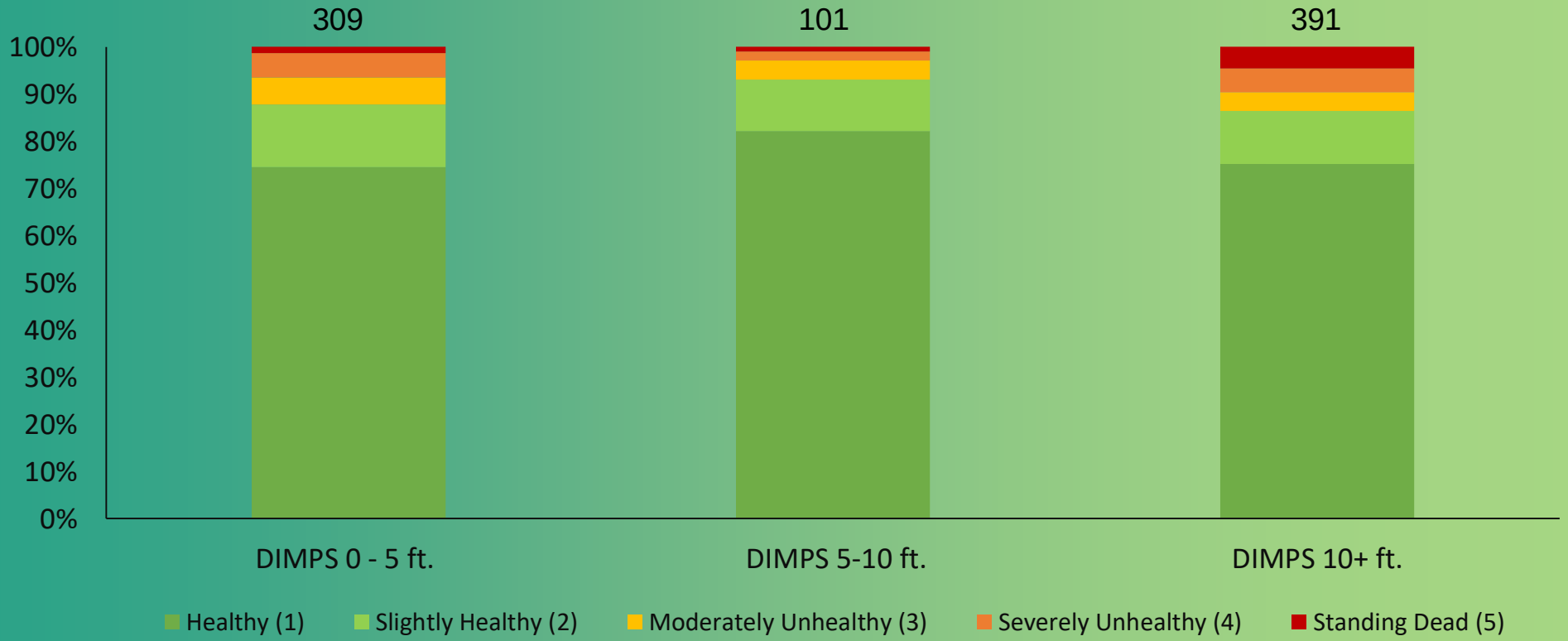
Impervious Surface
Vigor of Non-Residential Trees



p-value: 0.1192

Impervious Surface
Mortality of Maintained Areas and Street Trees

p-value: 0.0012

Tree Survey Summary

Leominster DCR tree planting team

Survivorship

- Higher in Leominster than Pittsfield
  - High number of unknowns in Pittsfield
- Genera planted in Leominster display more even distribution

Location

- Over 70% of land use residential in both cities
- Resident trees with DIMPS <5 feet have lower vigor
- Street trees have higher survivorship than other maintained trees

Characteristics

- Fruit/ornamental trees have significantly lower survivorship
- Shade trees have significantly higher vigor
- Native status not significant for mortality or vigor

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Research Questions

What are the biophysical factors and the social networks that influence tree health in the GGC program?

How does tree health in 2019 compare to previous HERO results?

UMass graduate student Joana and HERO Fellow Novak interviewing resident in Pittsfield

Interviews:

- How do actors communicate amongst each other?
- How is tree stewardship approached and implemented?
- What are the discourses associated with the program?

Data Collected

148 Property owners called

33 Scheduled property owner interviews

50 Interviews Conducted

- 36 Residents
- 5 Business
- 3 Organizations
- 5 City Officials
- 1 DCR Forester

(Right): HERO Fellows Sadie and Shannon ask a resident about their tree preferences at their home in Pittsfield.

(Left): HERO Fellows Sadie and Ben interview the Leominster community partner at a farmers market in Fitchburg.

Organizations & Agencies Interviewed

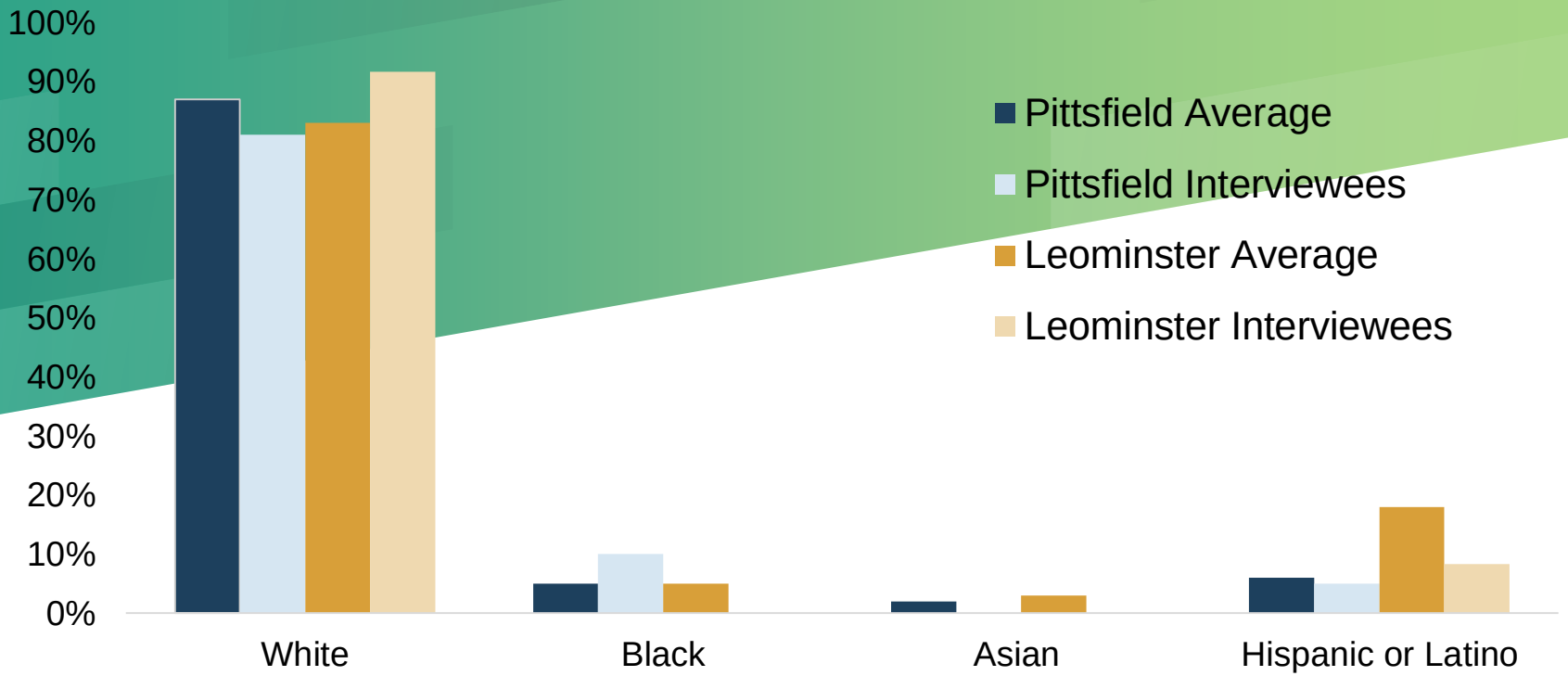
Leominster

- Growing Places
- Leominster Mayor's Office

Pittsfield

- Berkshire Environmental Action Team (BEAT)
- City Departments:
  - Community Development
  - Public Utilities
  - Conservation Comission
  - Public Services

Interviewee vs. City Racial Demographics



Interviewee Deomgraphics Compared to City: Income, Age, Education

- Income level was disproportionately represented (55% over the median income in Leominster, 80-95% in Pittsfield)
- Interview participants disproportionately represented people over 65
- Interviewees were disproportionately educated for Leominster and Pittsfield
    - Leominster interviewees matched gateway city profile
    - Pittsfield interviewees did not

Policy Arrangement Approach

Resources

- How resources are distributed led to differentiations in power
- The “how”

Actors

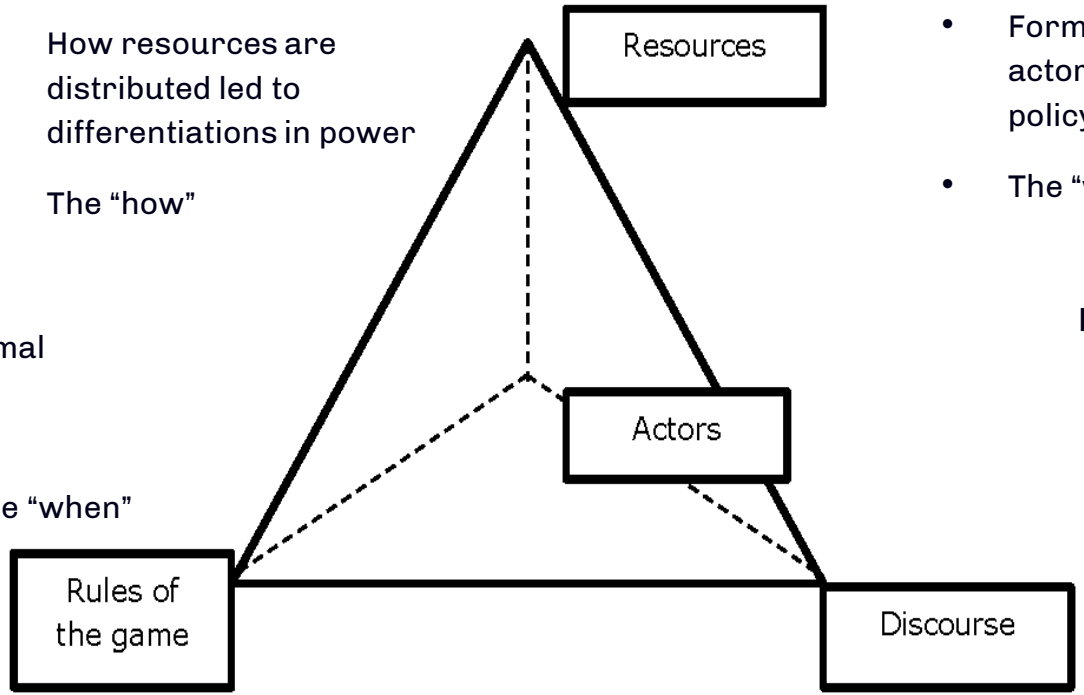
- Formal and informal actors who participate in policy decision making
- The “who”

Rules of the Game

- Formal or informal procedures of implementation
- The “what” or the “when”

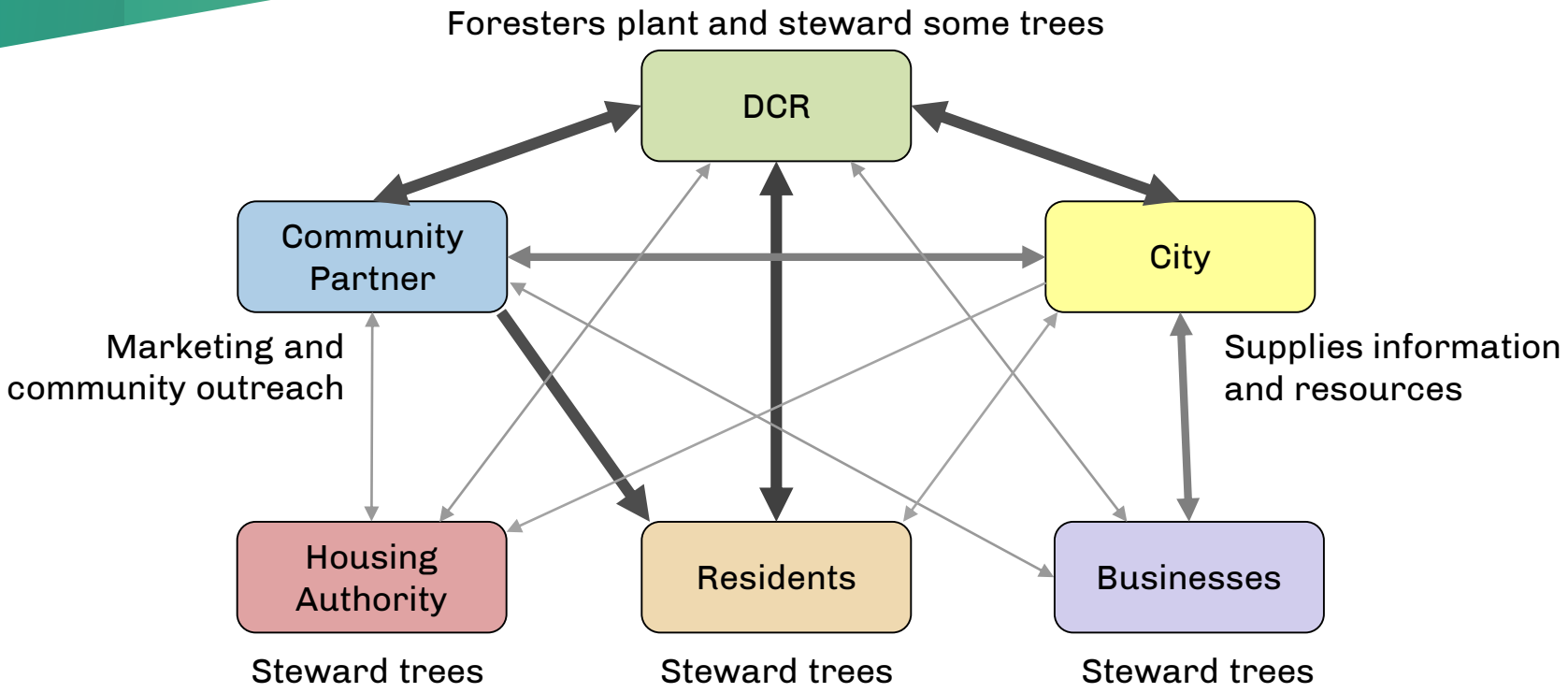
Discourses

- A shared understanding of the world / the environment
- The “why”

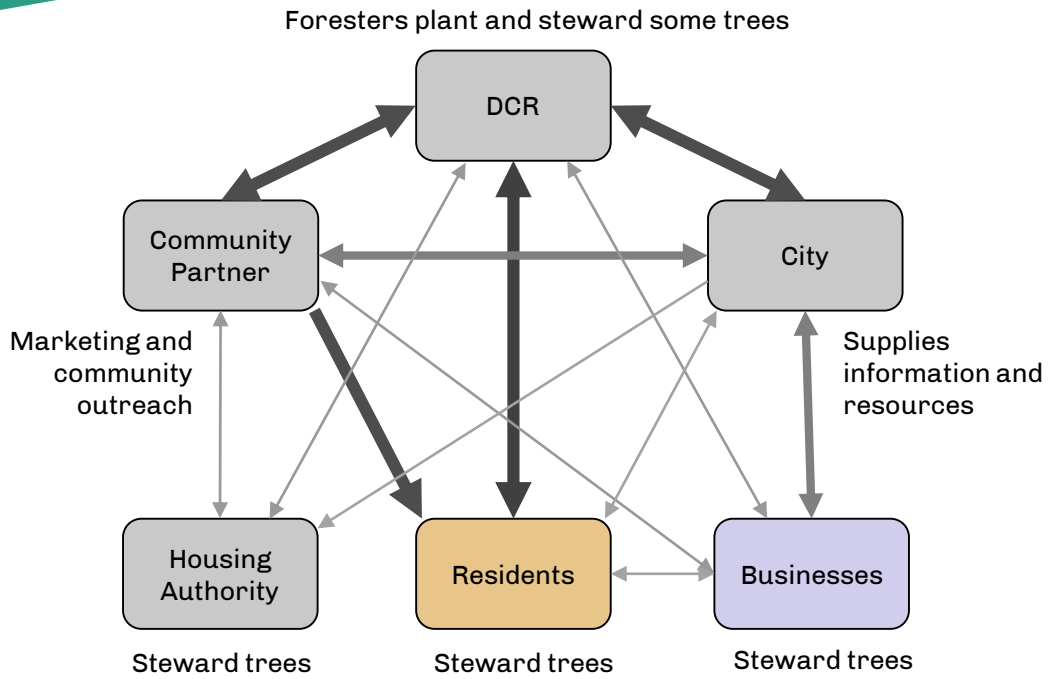


Park & Youn. 2013

Actor Roles and Communication

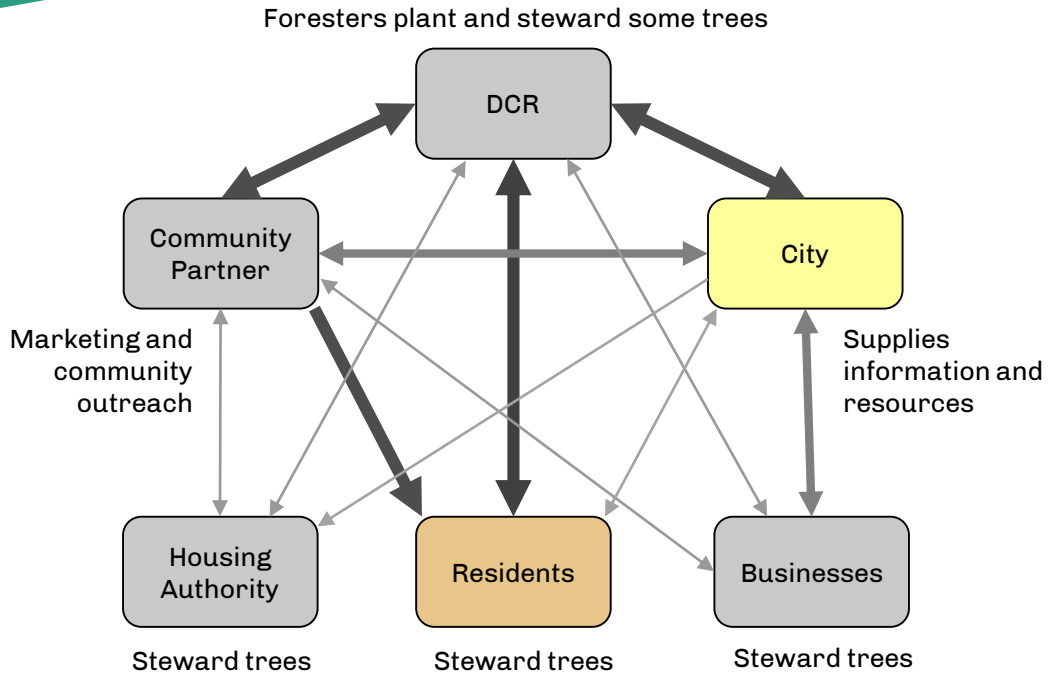


Actor Roles and Communication



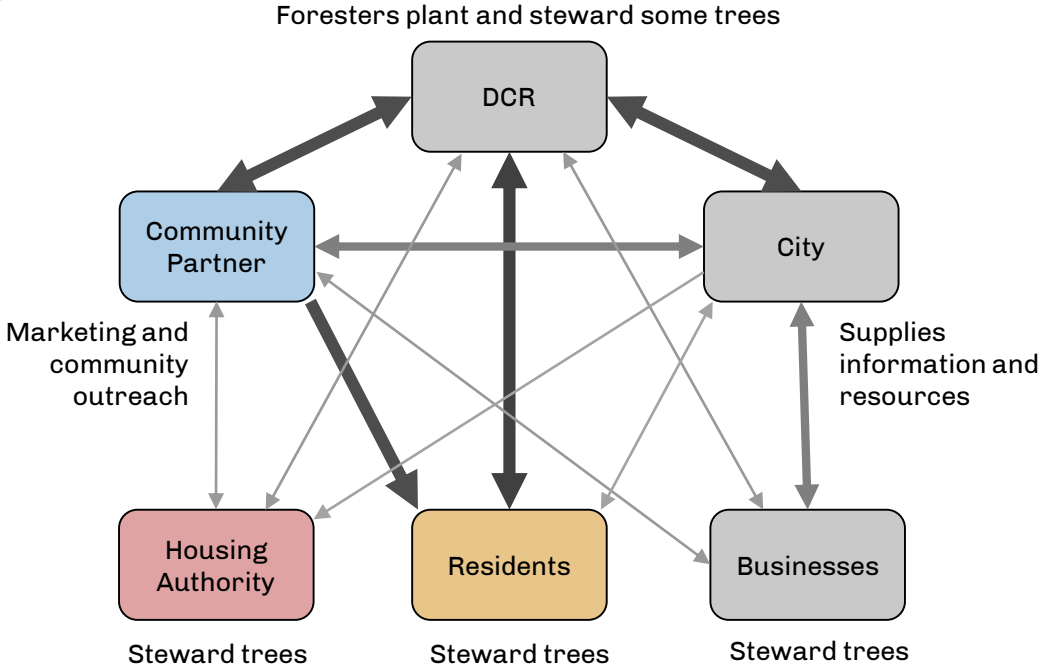
"[people] which may not **may not necessarily interact with city government**, they'll interact with **the Spanish center** and [... The Spanish American Center] **pushes that stuff, all the information**. And they're so willing to do it and they're good at it." (Leominster City)

Actor Roles and Communication



“So you know, and **the mayor is just like never stops talking about this** so everybody knows about the program because he just, he does two, **he does a radio show every week and a TV show every week on local people and it's always in his book, "Don't forget to get your free tree!"** and he's like holding it up to the screen, "free tree, call" you know "it's a 617 number but they're right in Leominster!” (Leominster City)

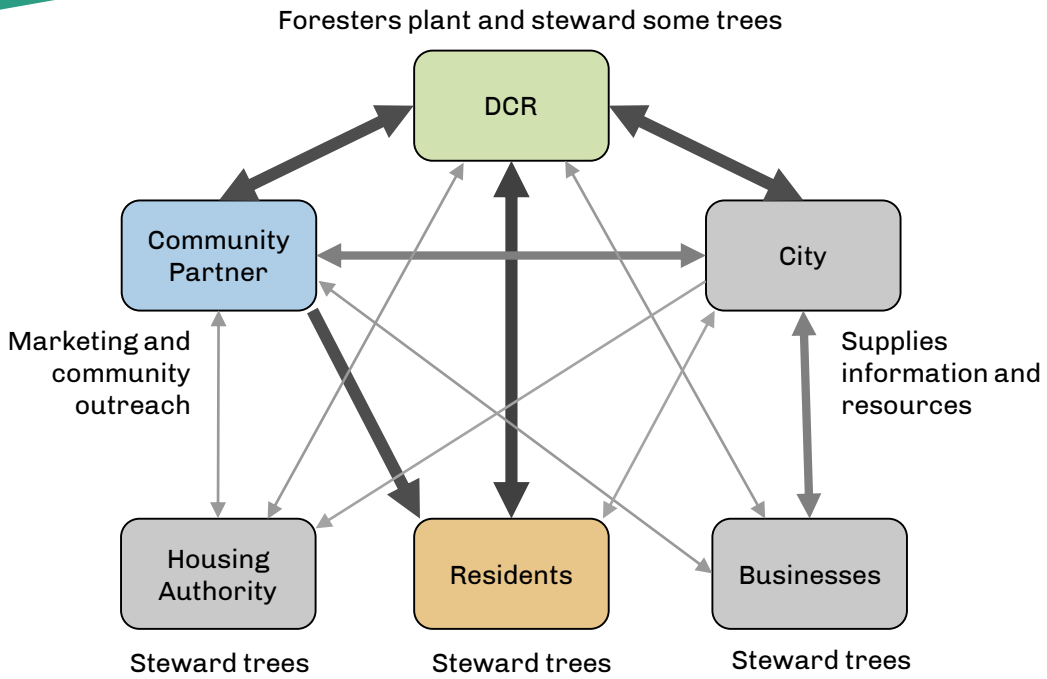
Actor Roles and Communication



"So when you're on a landlord owned property, they're not there. So when you even get the tenant, they can't give permission to plant the tree, so then **you have to reach the landlord** [...] **we want to focus on renters** like **rental property owners**." (Leominster Community Partner)

"There's a lot of other people **that are not involved, who should be involved**. Just thinking [...] there's not enough **youth programs** out here" (Resident)

Actor Roles and Communication

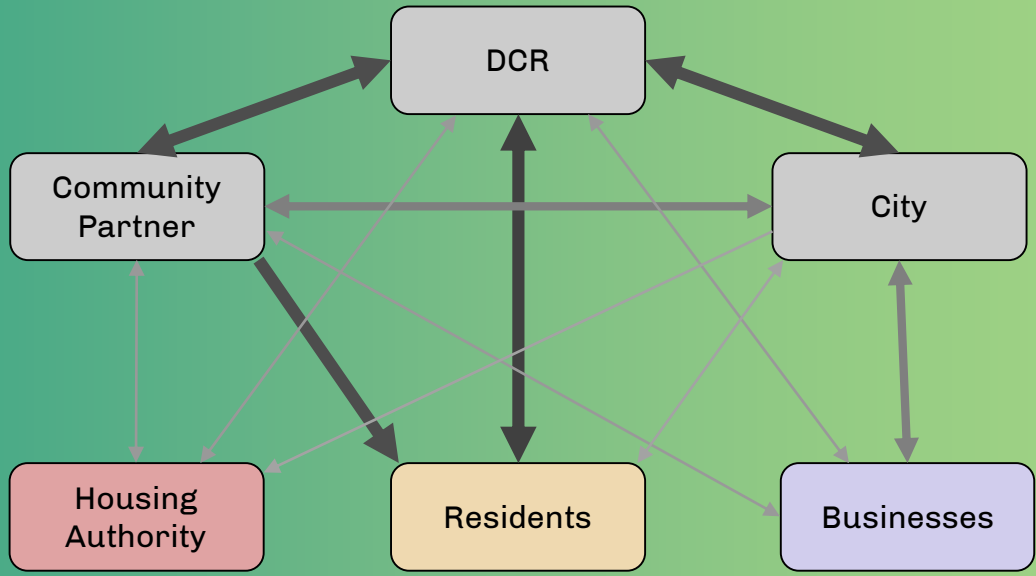


"The **DCR makes a flier** that goes out, **we'll take the flier and we'll make it a little more promotable**, and we'll make it **a little more accessible** to the community. **[...] we're able to translate things into Spanish**, and that's a huge percentage of the population in Leominster, **so it's really important that we do that for accessibility** as well." (Leominster Community Partner)

Stewardship

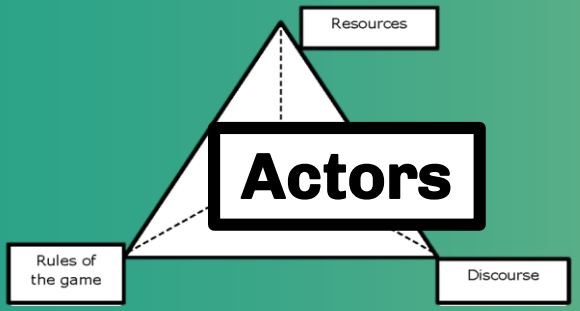
Tulip Tree

Foresters plant and steward some trees



Steward trees | Steward trees | Steward trees

Japanese Stewartia



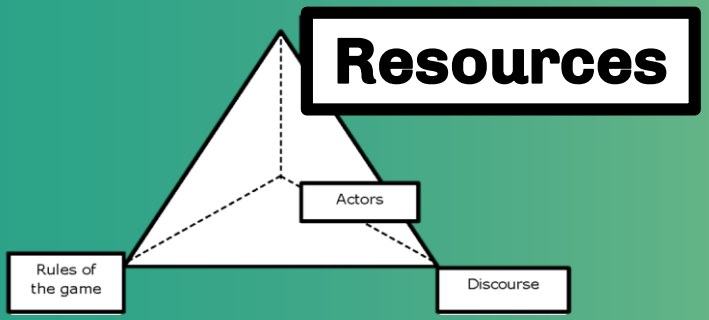
Who has **stewardship** of GGC trees?

"The woman who does the flowers **takes care of [the street trees].** She goes around and **they have people on the weekends who do it, and take this water truck and go water trees and plants**, and everything else." (Leominster City)

"Businesses are usually not gonna take time out of the day to water the trees**, so the DCR was doing it** [...] **the DCR was able to—and this is specific to Leominster—but they were able to water the trees,** because they had capacity to the first couple of years [...] So in terms of maintenance, when they're able to do that, obviously it's the most effective. **But, when they're not able to do that, it's really about then us also finding helpers in the community**." (Leominster Community Partner)

There's one retired arborist who goes around and does it on his own for free, takes care of a lot of the younger city trees [...] **without him there's nobody really to do the follow-up**. All these trees are going to need pruning. **We're doing that in the in-between seasons, we're going around and checking on the trees**. Pruning up, restaking, whatever needs to be done. **But, when we're gone that's going to disappear."** (Pittsfield Foresters)

"I think [my neighbors] don't take trees **'cause they're renters**. And **they don't really have yards**." (Resident)



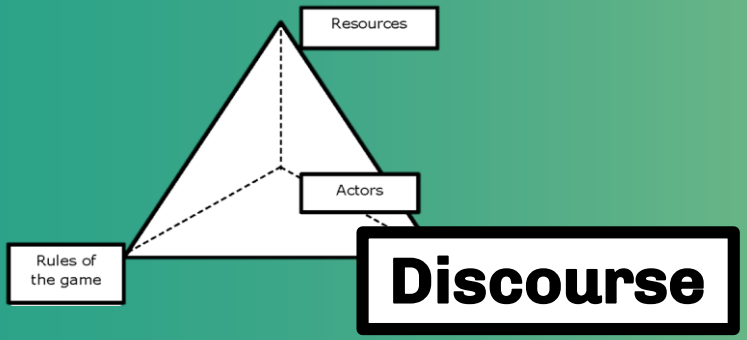
How do actors take stewardship of GGC trees?

"I don't really do anything [besides daily watering]. Because they're so young **I thought it was better to just let them grow before I do any pruning** or anything like that. Plus **I'm not that confident in the pruning** anything [...] I was gonna do probably more **research** or **call [DCR]** or find out what to do. **I know it says it in the guide** but still I don't want to just start clipping branches and I don't want to hurt the tree" (Resident)

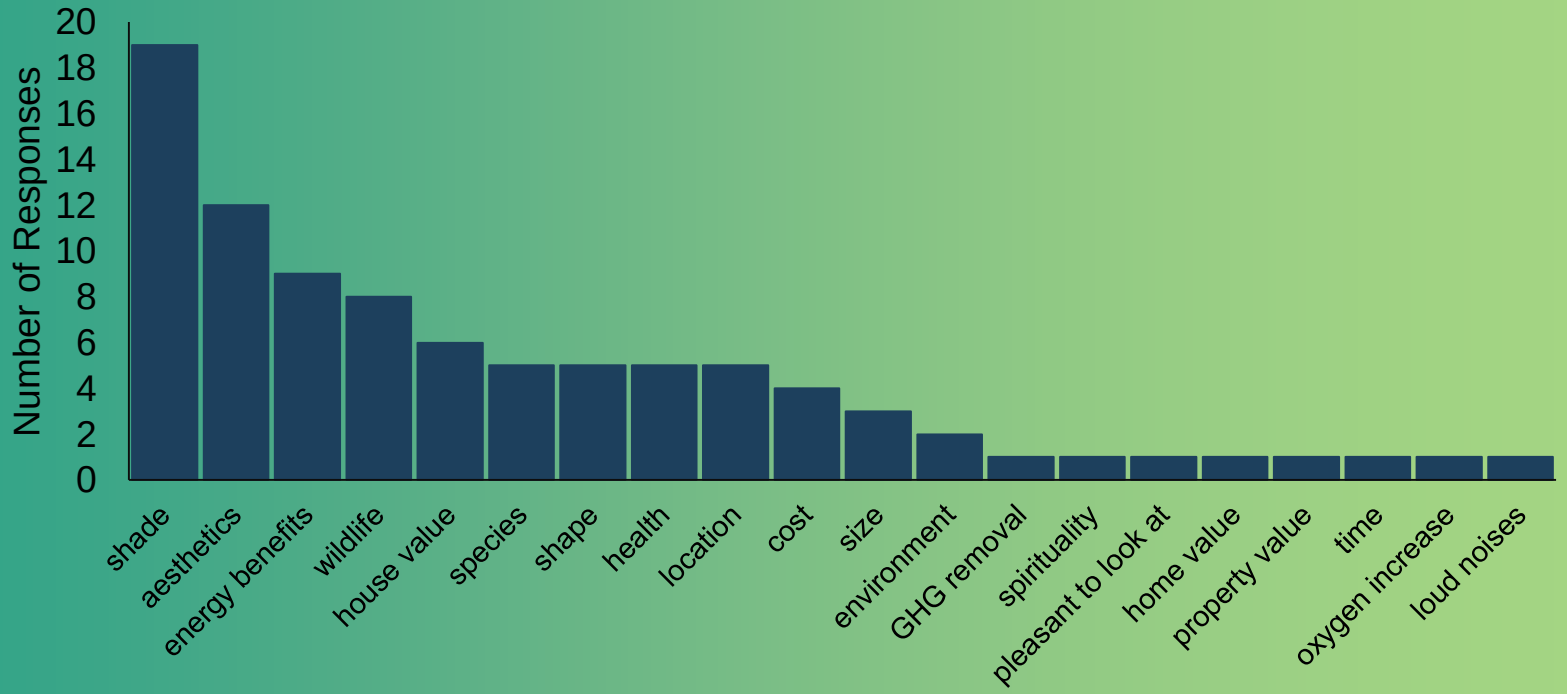
"So that's my concern is **the public safety in terms of dead trees and pruning** and take downs of pruning stuff. **We just can't keep up with it right now**." (Pittsfield City)

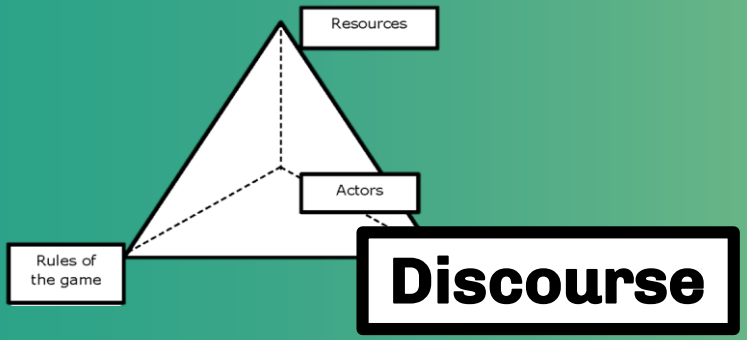
"The foresters **don't have the capacity to water it**, the people who live there are seniors and **they don't have the ability to water it.** So **we were going to try to adopt those trees out to people who are able so they take care of a tree** and then hopefully down the road we are going to get them be like this is our tree and do decorating contests stuff like that **get people to connect to a certain tree**." (Leominster Community Partner)

"We gave them [DCR Foresters] **office space**! [...] every day when they get phone calls they can just go right to the neighborhood and check it out." (Leominster City)



Why do actors take or not take **stewardship** of GGC trees**?**





Why do actors take or not take **stewardship** of GGC trees**?**

"**It's like the least I could do**. Least I could do is try to help the environment, plant more trees. [...] it's like the people that have all the money you wish they would think like you did so they could help out the planet more doesn't quite work like that but. ." (Resident)

"[I take care of my trees] because we need them**. We need them** for this [points to oxygen tank]!" (Resident)

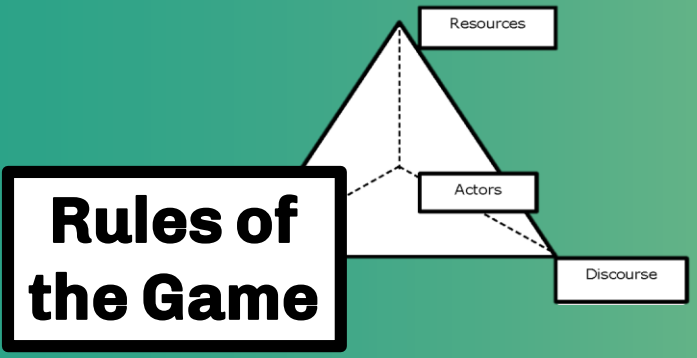
"I just feel, you know, trees man. You know, **they were here before us humans** [...] if God had that much desire to create these other things, **then they need to be respected just the same way that us human beings should** be respected." (Resident)

"I love trees for several different reasons, you know what I mean? Whether it's just to **catch some shade**, whether it's just to feel like, you know, I don't know, kind of country about things**.**" (Resident)

When the mayor was elected his philosophy [was] you never know who's coming into town. So **our town has to be clean**, [...] **look really nice**. (Leominster City)

But **it is well worth the time and money that he allowed us to spend**. The trees alone [...] **they're beautiful trees**. (Pittsfield City)

Rules of the Game



What are the informal and formal rules of **stewardship** of GGC trees**?**

"**Water them** and **fertilize them**, put **mulch around them**. **They told us to** water every week. **According to the pamphlet** they said 15 gallons per week for the first year." (Resident)

"No one takes care of the trees. [**The housing authority] gets mad when residents try to take care of the trees**." (Resident)

"People love their trees. You know **they're mad when they can't get tree**. So we kept a list because they always told them "it will expand" **so then we called those people back and said "you're in the area now" and you would have thought they won the lottery**. Free trees!" (Leominster City)

Benefits of the GGC Program

"Every single resident I have talked to for this program loves it […] **they love our foresters**. One of the women I interviewed, she was like yeah one of my trees died over the winter, I didn't even call them […] they came over and were like hey lets replace your tree, she didn't have to do anything." (Leominster Community Partner)

"They're the best thing in the world, they're **free**!" (Resident)

Again the people that **have been offered trees that could not normally afford trees**. (Pittsfield City)

Challenges of the GGC Program

"**An elder may not be able to** […] **water** the garden every day […] Businesses are usually not gonna take **time** out of the day to water the trees, so the DCR was doing it." (Leominster Community Partner)

"**Leaves increase the cleanup** as they grow. You can have branches that died and need to be taken down to prevent property damage. Definitely increases the **care of your yard**." (Resident)

"One thing lacking in this program, the **aftercare for the trees**. It would be nice to get a follow-up program to take care of these trees. Cause right now **the city has nobody to maintain the trees**." (Pittsfield Foresters)

"I think **there's never enough local awareness about these particular programs**. I think, like I said, no matter what, there's still gaps. You're still not gonna be able to reach people [...] reaching people are always difficult. (Leominster Community Partner)

General Trends Across Both Cities

- Lack of funding and infrastructure outside of the GGC program
  - The DCR is the only active group
- Maintenance after DCR leaves?
  - Strong ties with community groups in Leominster
  - Pittsfield residents and officials specifically feel very disconnected
- Communication a consistent challenge
- Huge support for the program among city and residents

Outline

Introduction

- HERO Program
- Greening the Gateway Cities

Tree Survey

- Methods
- Results

Interview Response

- Framework
- Analysis

Conclusions

- Tree Survey
- Interview Response

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What are the biophysical factors and the social networks that influence tree health in the GGC program?

Tree Survey:

- Breadth of tree genera can be associated with higher tree survivorship
- Tree vigor classes influenced by site location, mainly site type
- Distance to impervious surfaces has significant effects on tree vigor especially within 5 feet

Interviews:

- Cities and residents ask post-GGC tree maintenance questions
- Resources and rules shape perceptions about who acts and who can act
- Communication and stewardship could be enhanced with attention to: renters/landlords youth and unexpected actors

How does tree health in 2019 compare to previous HERO results?

Survivorship average is in line with survivorship results for 2017 and 2018

Location

- More trees in maintained parks than previous years, which had more residential and sidewalk trees

Native Status

- 2018, non-native trees have higher survivorship*
- 2019, native trees have higher survivorship

Tree Type

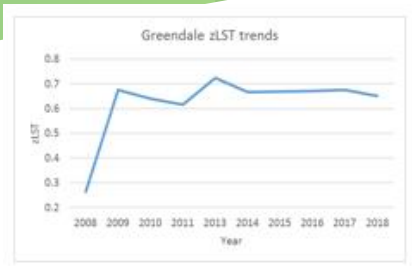
- 2018 ornamental/fruits highest survivorship*, 2019 evergreen highest survivorship*
- 2018 ornamental/fruits had better vigor, 2019 shade trees had lower vigor*

* Statistical test indicates significant findings

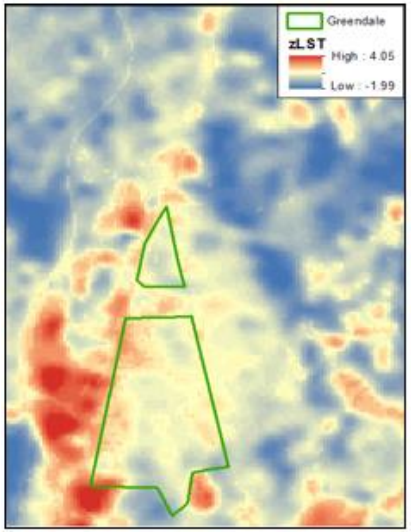
Recommendations

- Address concerns about maintenance once GGCP leaves
- Greater outreach to private rental property owners and underrepresented actors
- Have planting zone include both sides of street
- Breadth in genus distribution could foster diversity, minimize impacts of high individual genus mortality

Future Research Interests



- Historical urban canopy cover
- Residential tree survivorship in GGCP cities
- Landsat temperature time series
- Urban microclimate around GGCP trees
- City energy and canopy cover analysis



Acknowledgements

Leaders and Volunteers from BEAT and Growing Places

Resident and Stakeholder Interviewees

Residents of Leominster and Pittsfield

City of Leominster:

City of Leominster Grant Office

City of Pittsfield:

Department of Community Development
Department of Public Utilities
Pittsfield Conservation Commission
Department of Public Services

Administrative Support

Rachel Levitt
Pamela Dunkle

DCR

Mat Cahill
Larissa Parse
Carolyn Streeter
Jay Girard
Yoni Glogower

U.S. Forest Service

Lara Roman

UMass Amherst

Theodore Eisenman
Robert Ryan
Alicia Coleman
Joana Herculano

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Thank You