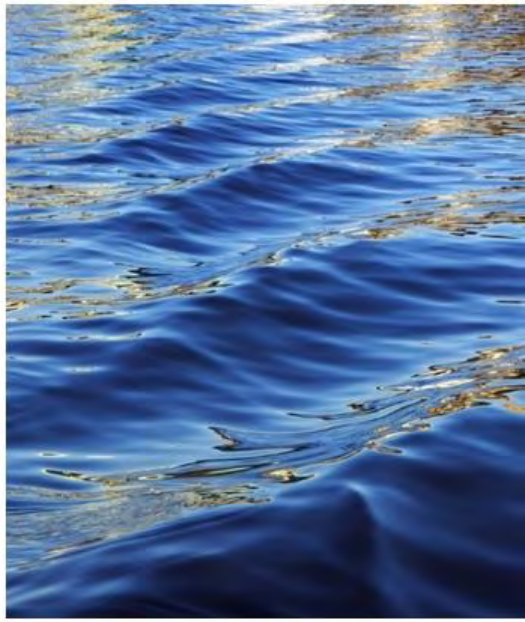
GREENING THE GATEWAY CITIES



Tree planting and retention for demand-side energy use reduction

Overview

- The Massachusetts Office of Energy and Environmental Affairs (EEA) is developing innovative strategies to reduce energy use in homes through the benefits gained from increased urban tree canopy

- This includes planting new trees and retaining existing trees to save energy

- In low-income neighborhoods in the state's Gateway Cities, the strategy is focused on planting new trees with a goal of increasing tree canopy by 10% in the target neighborhoods

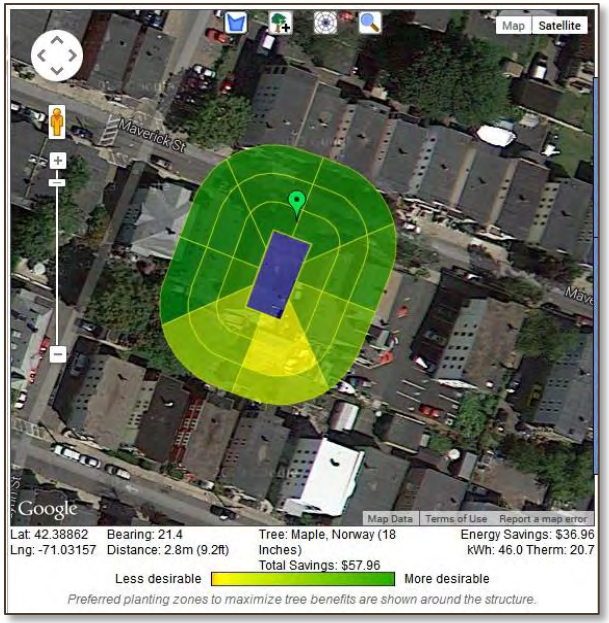
- In other neighborhoods and communities, programs to retain existing mature canopy threatened by new construction or redevelopment can have similar benefits

Overview continued

- Both programs are based on research that shows tree canopy brings greatest benefits when established over a **neighborhood area**, by lowering wind speeds and reducing summertime air temperature.

- For every 1% increase in tree canopy above a minimum 10% canopy cover, the energy benefit is **1.9% reduction in energy for cooling**, and **1.1% reduction in energy for heating**.

- This benefit is experienced by all households in a neighborhood, not just the ones with trees directly adjacent.

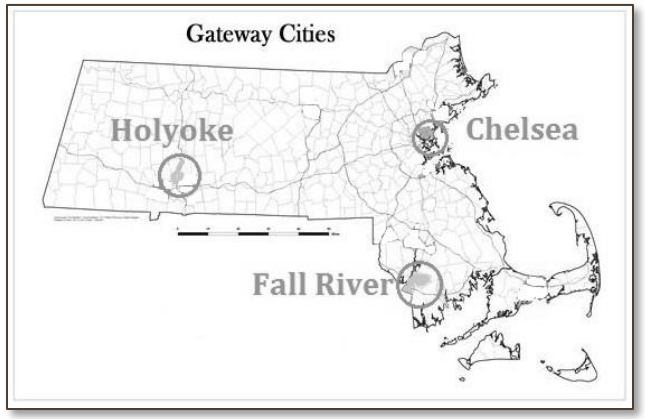


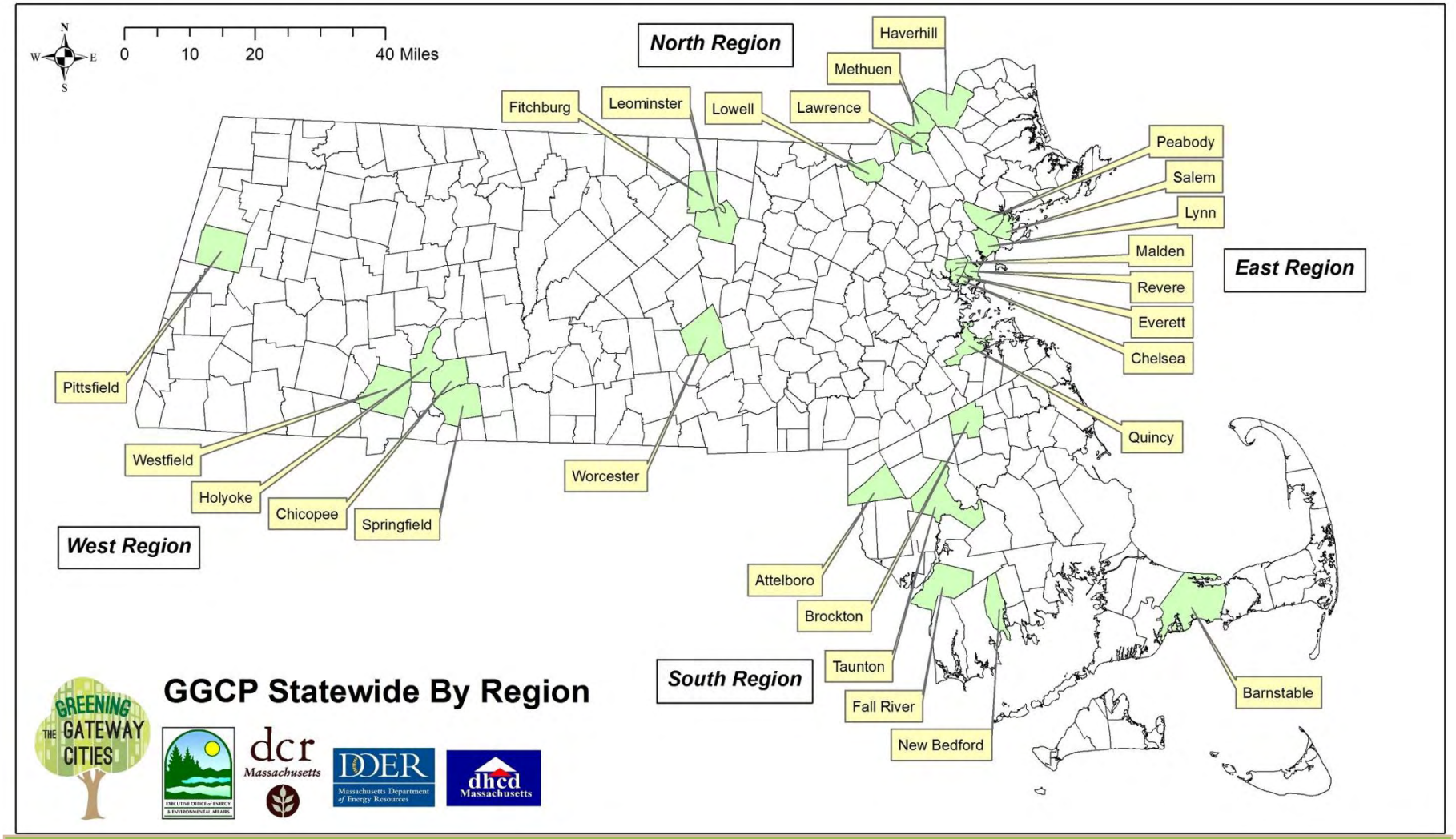
US Forest Service i-Tree Software
https://www.itreetools.org/

What are Gateway Cities?

- The General Laws of Massachusetts, Chapter 23A, Section 3A defines **Gateway Cities** as: "a municipality with a population greater than 35,000 and less than 250,000, a median household income below the commonwealth's average and a rate of educational attainment of a bachelor's degree or above that is below the commonwealth's average."
- There are currently 26 Gateway Cities in the state. Initial piloting locations are:

Chelsea: Spring 2014
Holyoke: Fall 2014
Fall River: Spring 2015





Trees outside our windows are our first contact with the urban forest and a gateway to conservation

Why Gateway Cities?

- Older, less insulated housing benefits the most from shading and reduced wind speeds.
- This program targets the parts of Gateway Cities that have lower tree canopy, older housing stock, higher wind speeds, and a larger renter population.
- Study areas are set up to track the energy savings of local residents provided by the trees over time.
- Plantings will mostly occur in Environmental Justice neighborhoods.

Mandates to Plant Trees

- Green Communities Act

  Planting trees is the best way to "Go Green!" GCA requires all cost-effective energy efficiency measures be adopted before construction of new power plants.

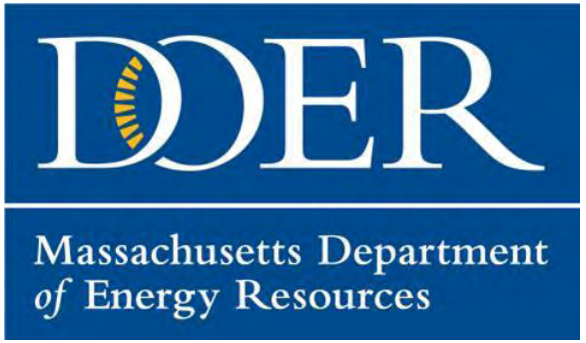
- Global Warming Solutions Act:

  The Commonwealth is committed to reducing its CO_2 emission levels by 25% by 2020 and 80% by 2050. Tree planting is a long-term demand reduction strategy.

Partners


EXECUTIVE OFFICE of ENERGY
& ENVIRONMENTAL AFFAIRS


dcr
Massachusetts


DOER
Massachusetts Department
of Energy Resources


dhcd
Massachusetts


CHELSEA
SETTLED 1624 • A TOWN 1739 • A CITY 1857
WINNISIMMET


INDUSTRIA ET COPIA
CIVIC REGIMINE DONATA 1873
HOLYOKE
CONDITA A.D. 1850


UNIVERSITY OF MASSACHUSETTS
AMHERST 1863
UMASS
AMHERST


1887
CLARK
UNIVERSITY


Chelsea Collaborative


NUESTRAS
RAICES


FALL RIVER
FOUNDED
A.D. 1803
INCORPORATED A. CITY 1854

A new program with old concepts

When you want to beat the heat, find some shade!

Technology?

If you were told there was a machine that can:

- Clean the Air
- Clean the Water
- Reduce your electric bill
- Reduce your heating bill
- Increase your property value
- Improve your health

WOULD YOU WANT ONE???

Trees… all that and then some


J&B ENTERPRISES INC.
Coca-Cola

Reasons to Plant Trees

- Tree canopy in urban areas directly shades homes
- Reduces the Urban Heat Island effect by reducing summer air temperatures as much as 4°F and surface temperatures by 30°F
- Reduces / intercepts airborne pollutants & particles
- Urban tree canopy reduces heating and cooling costs for residents and businesses
- Increases road pavement / gray infrastructure lifetime
- Reduces stormwater runoff demand on Combined Overflows (CSO)

Hearts and Minds

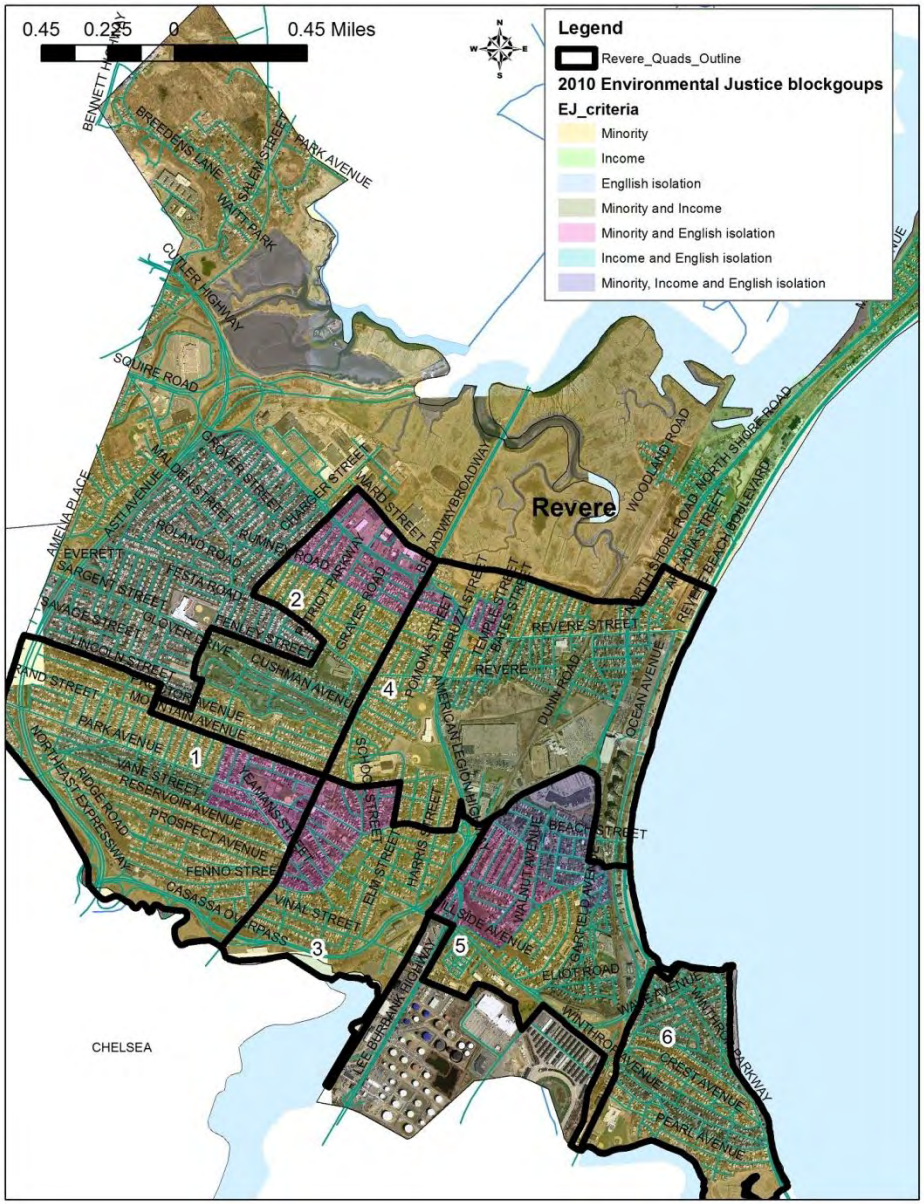
- Door to door outreach
- One-on-one site visits with DCR Urban Foresters to select trees.

Just Add Water

- Property owners sign a 2-year tree watering commitment
- DCR plants the trees for you & leaves tree care literature

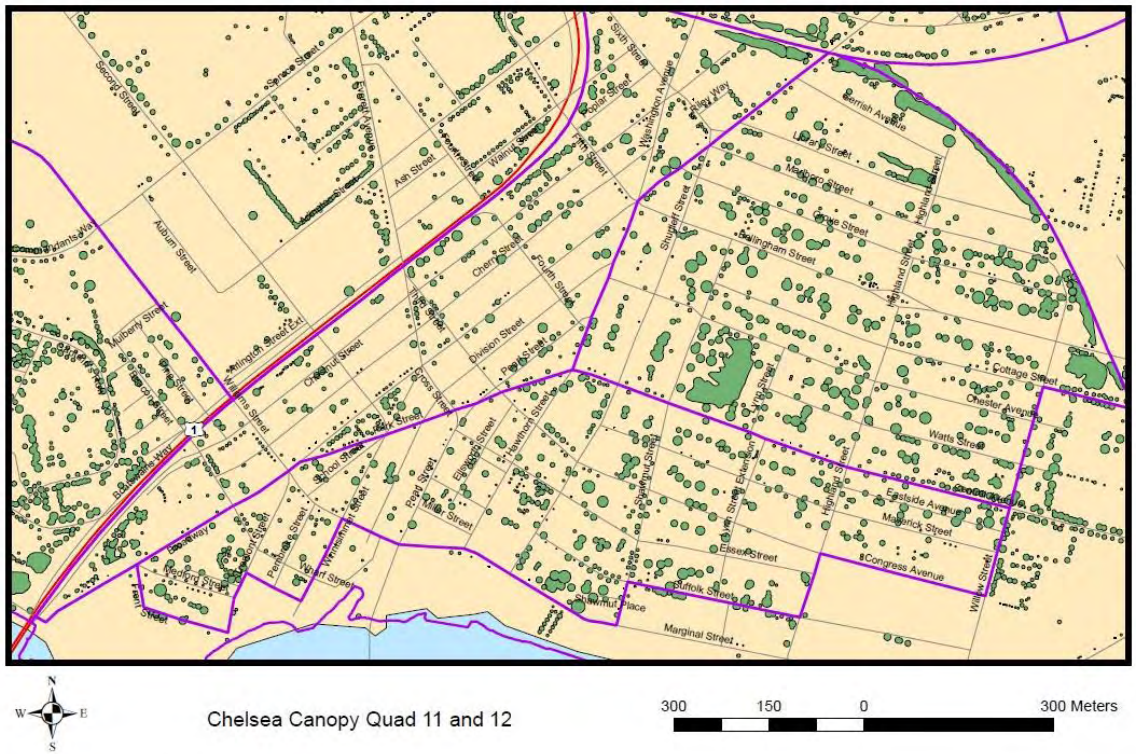
How Does it Work?

- Locate residential area with older housing stock
- Determine EJ neighborhoods and low canopy areas to target
- The two often overlap



Tree Canopy Analysis

- Requires an accurate baseline of existing tree canopy to set goals



Goals of GGC Program

- Focusing on high density urban neighborhoods, planting on average 10 trees per acre. This will increase canopy by 1% in eight years, and 10% in 30 years

Growth Projections

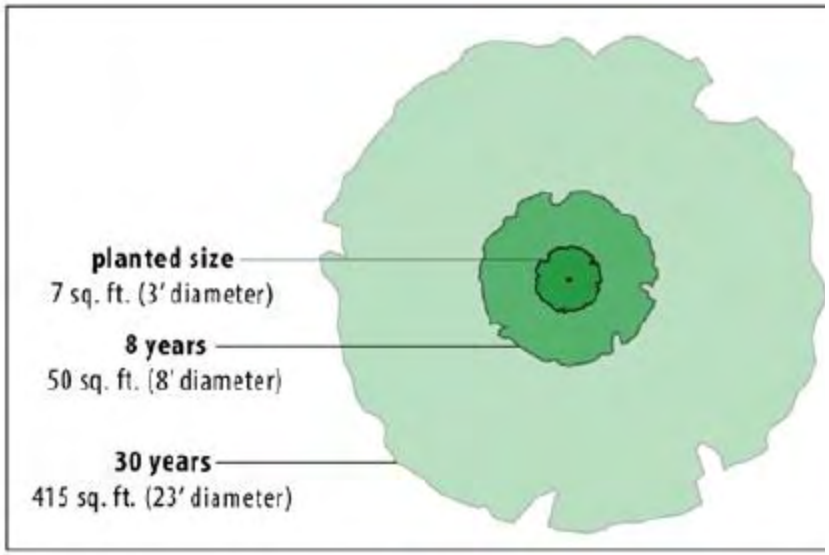


Figure 1. Average Tree Canopy Areas

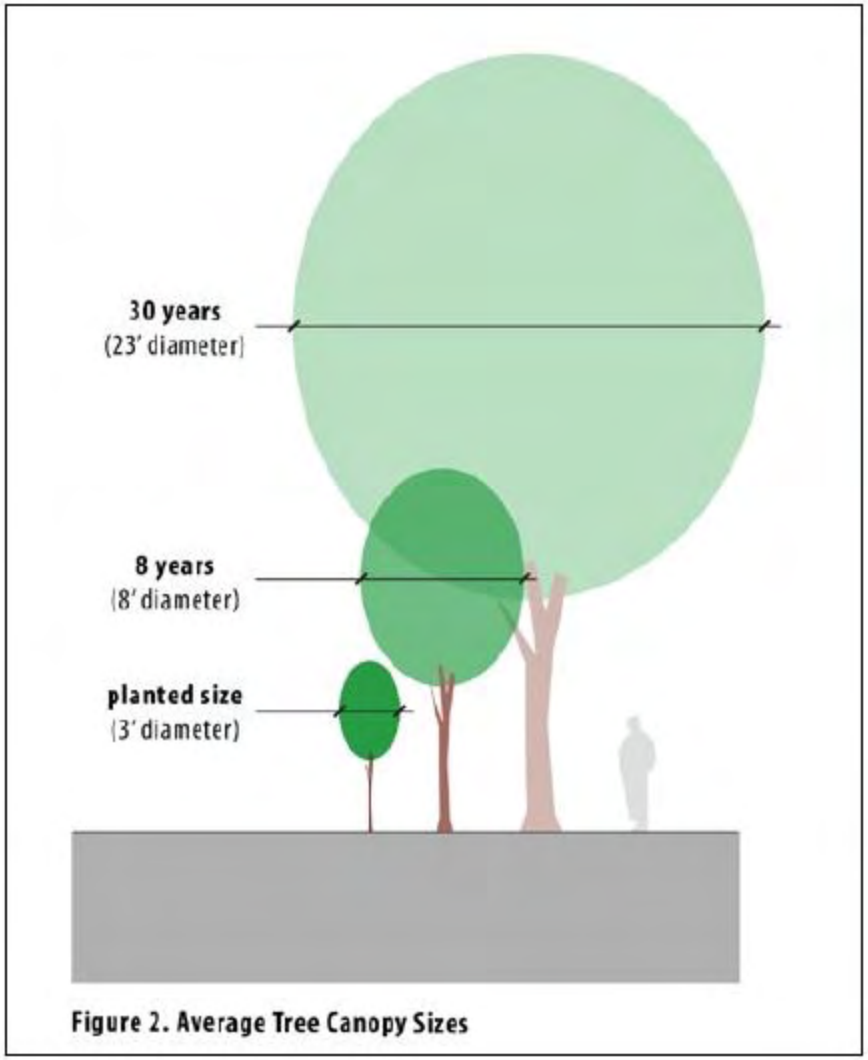


Figure 2. Average Tree Canopy Sizes

Greening the Gateway Cities

10 trees per acre= 1% in 8 years, 10% in 30 years

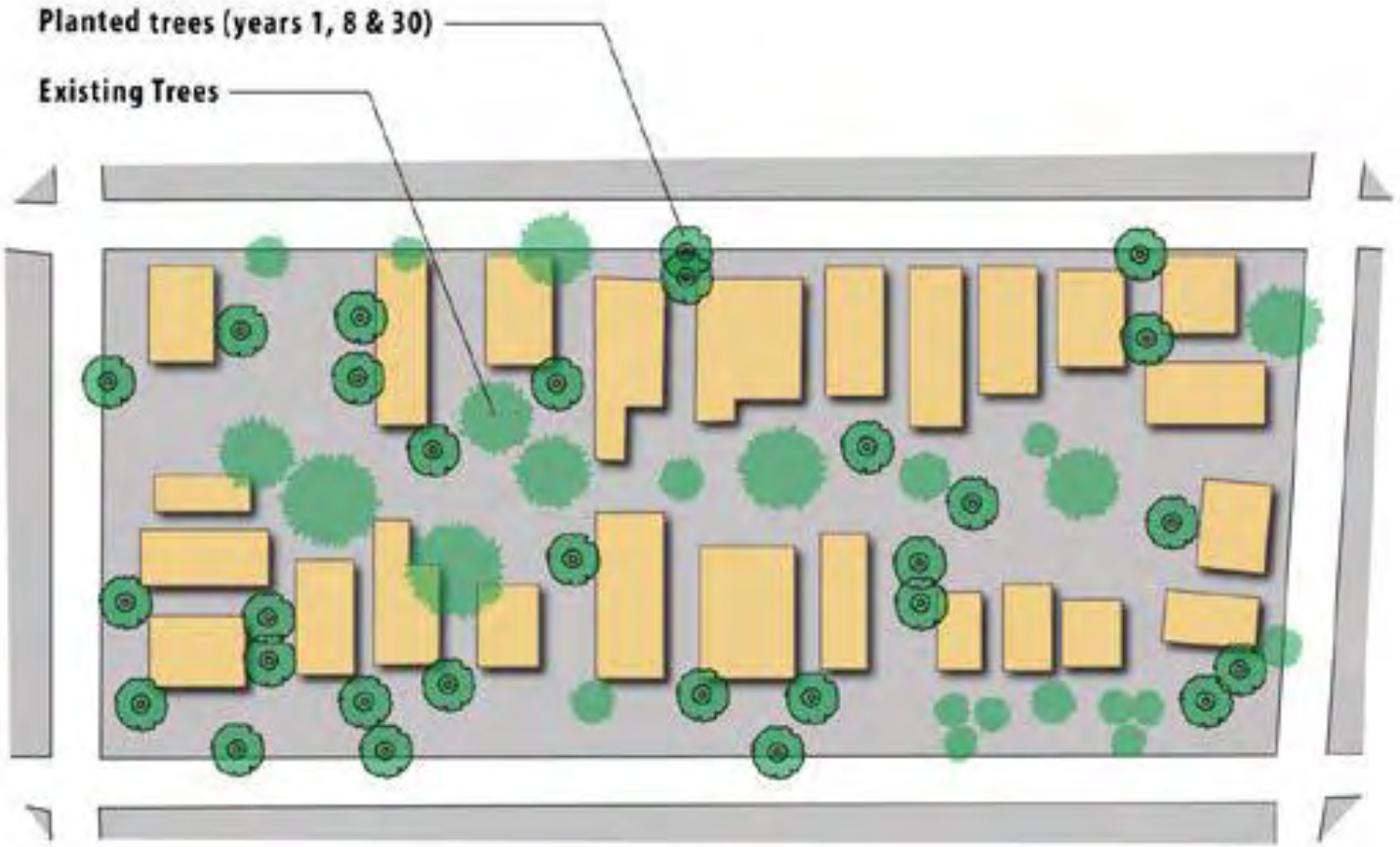
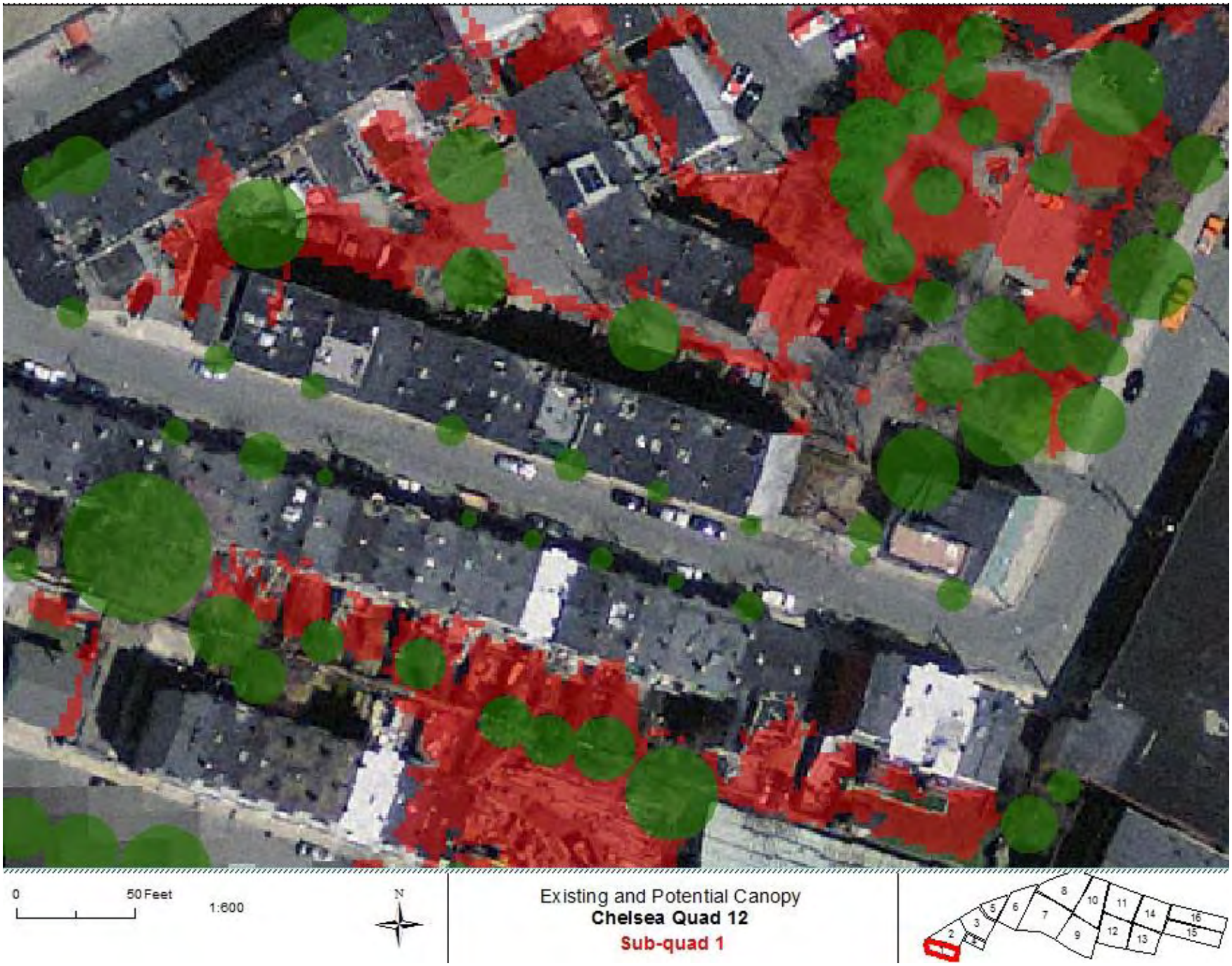
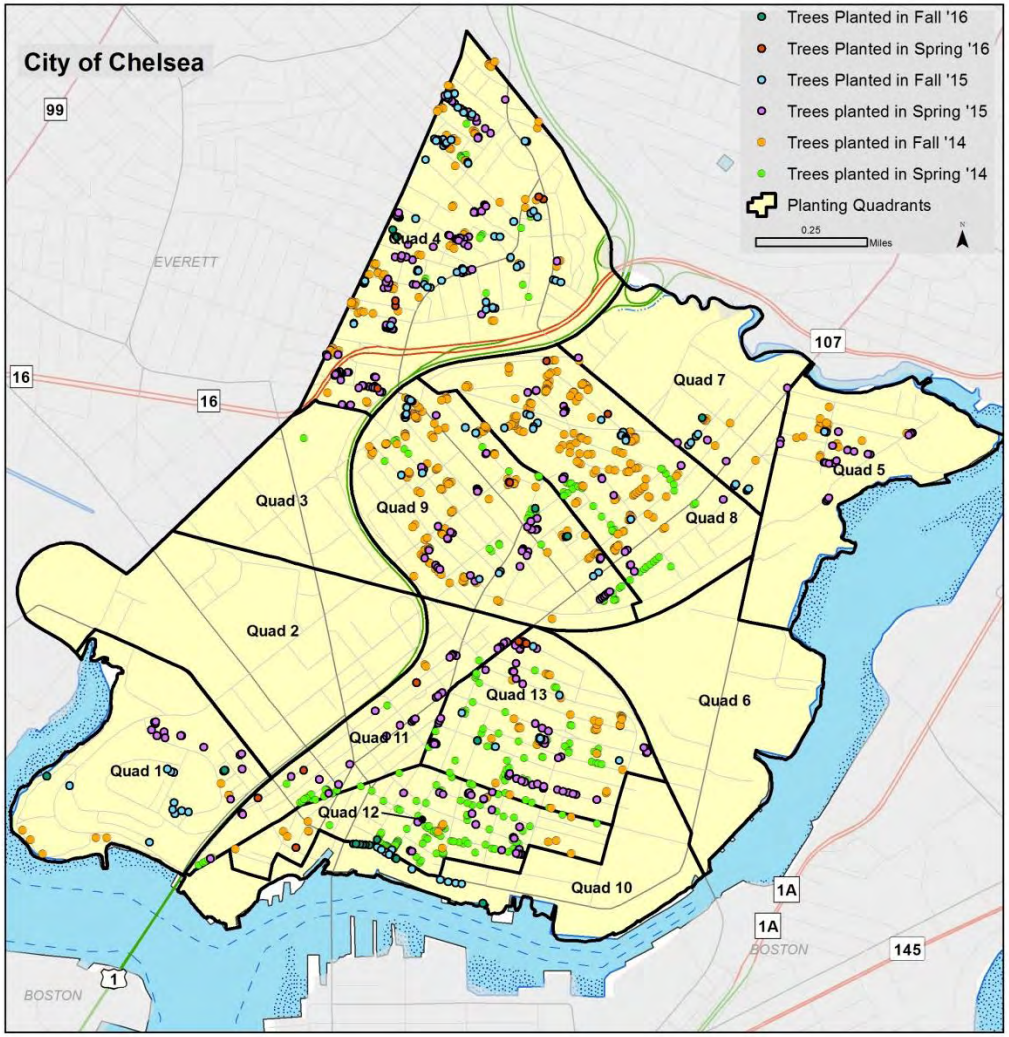


Figure 4. Tree Plantings on a Representative Block (approx. 3 acres)


0
50 Feet
1:600
N
Existing and Potential Canopy
Chelsea Quad 12
Sub-quad 1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16



Trees Planted in Chelsea by Season
1,279 Trees as of January 2017

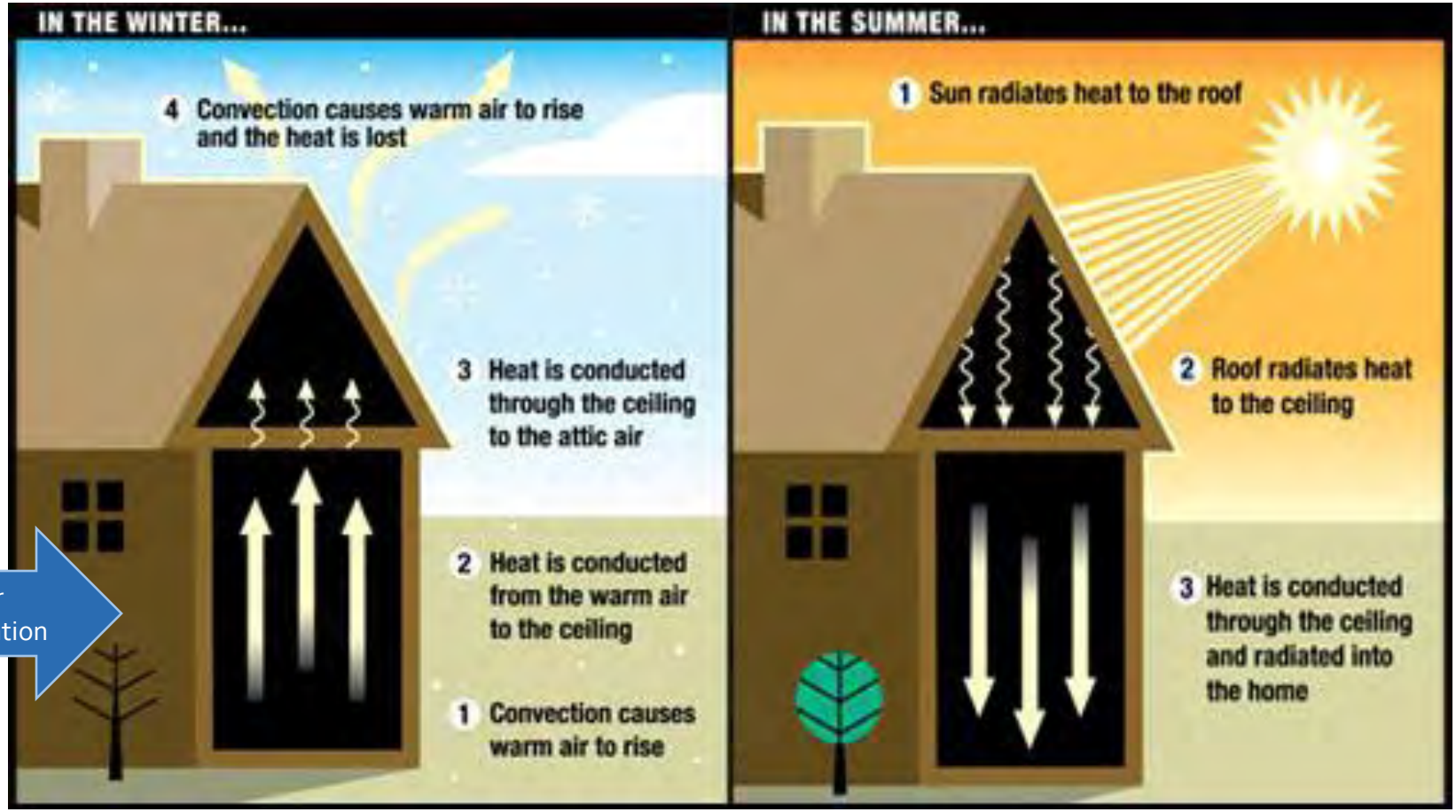
The Effects of Tree Planting

…now what happens?

Depreciation vs. Appreciation

- Green infrastructure **appreciates** in value over time
- Gray infrastructure **does not**

Reasons for heating and cooling

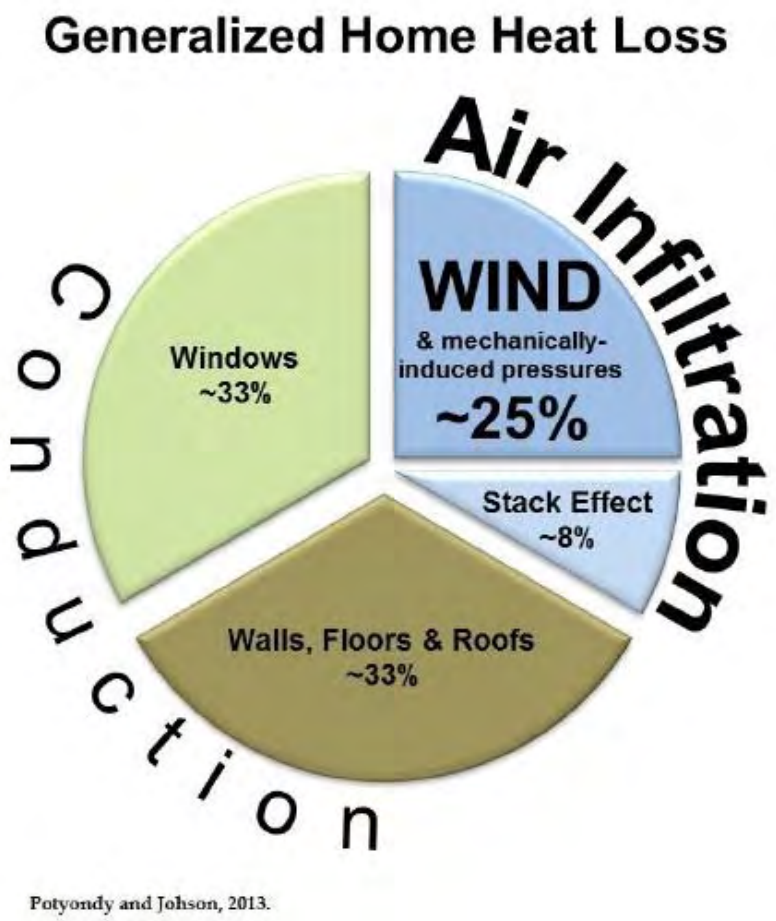


Air infiltration

Wind increases convection

Shade can decrease conduction

Wind speeds

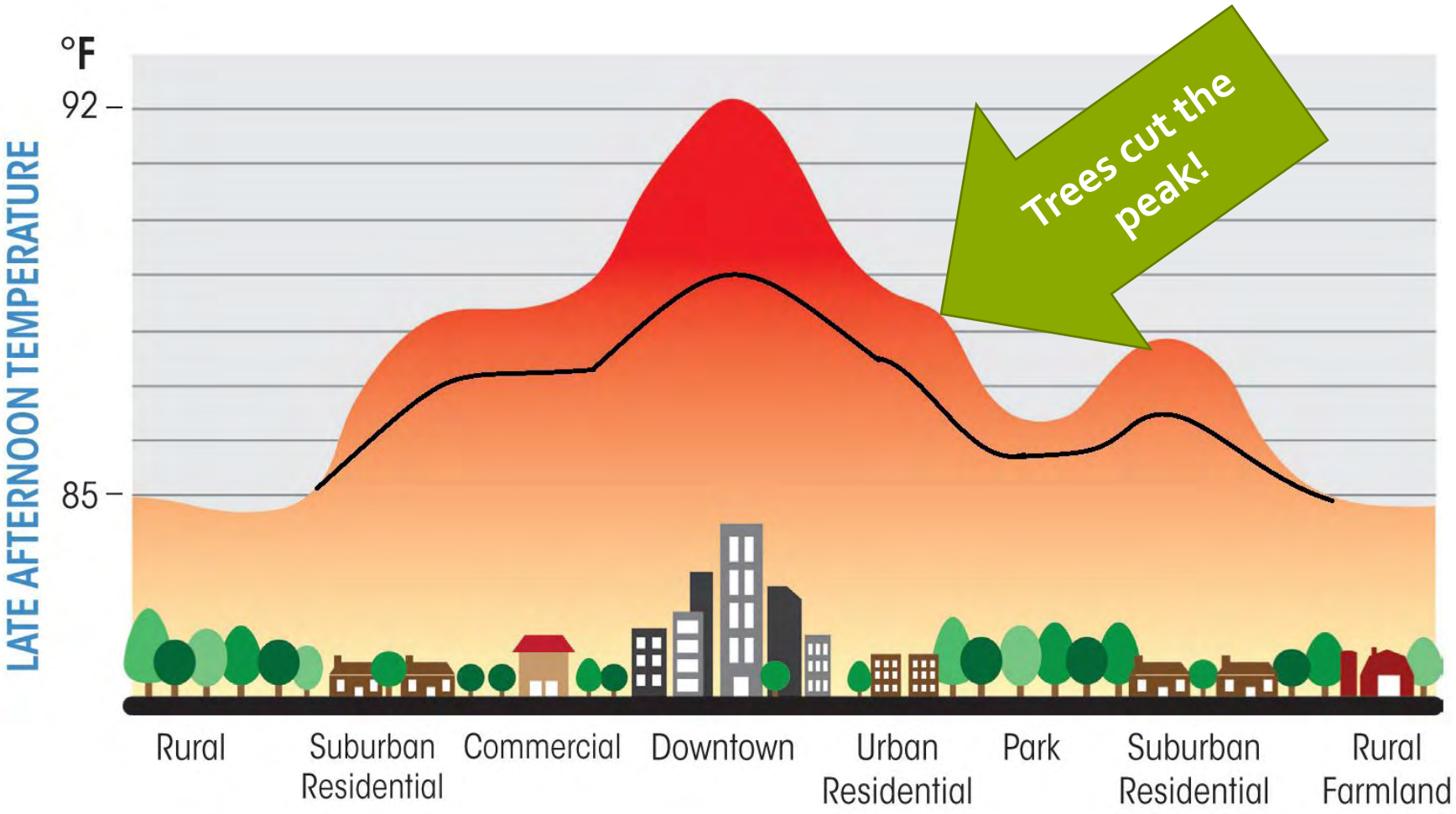

Generalized Home Heat Loss
Air Infiltration
Conduction
WIND
& mechanically-induced pressures
~25%
Windows
~33%
Stack Effect
~8%
Walls, Floors & Roofs
~33%
Potyondy and Johson, 2013.

How trees save energy

- Direct shade, reduction UHI and ambient air temps, reduction of conductive heat gain

- wind randomization

Urban Heat Island: the peak in peak load



Background

- Tree canopy brings greatest benefits when established over a **neighborhood area**, by lowering wind speeds, providing shade, and reducing summertime air temperature.

	%Canopy increase : %Energy savings
HEAT SAVINGS	1 : 1.1%
COOLING SAVINGS	1 : 1.9%

- **The whole neighborhood benefits,** not just homes with trees directly adjacent.

Sudden loss of mature canopy trees

Worcester

40% increase in electricity usage during cooling season

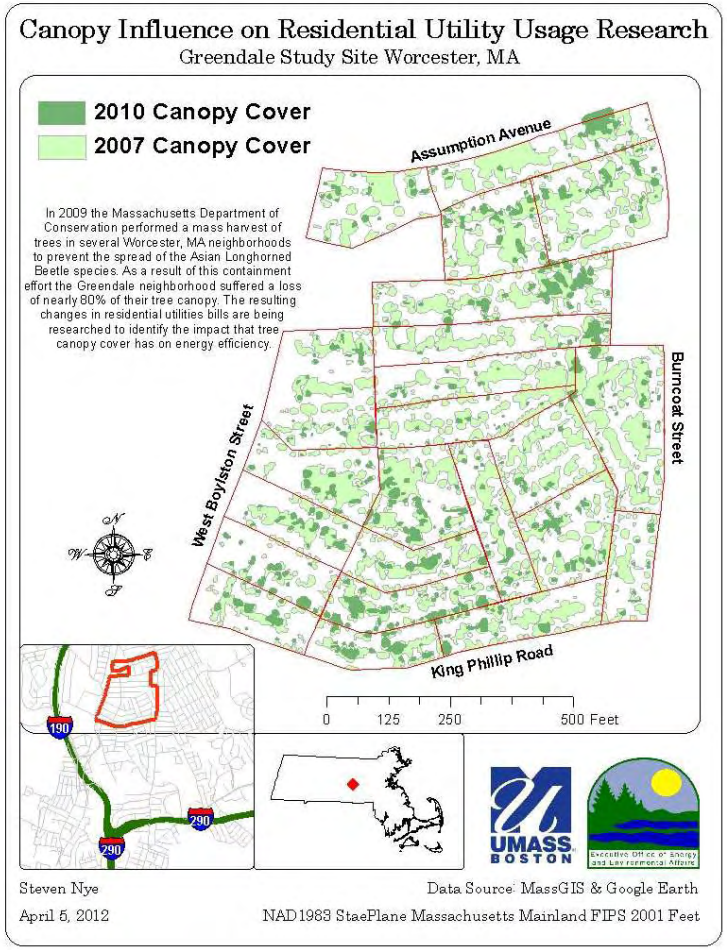
Springfield

66% increase in wind speed (causes heat loss in winter)

Sudden loss of mature canopy trees

Worcester

40% increase in electricity usage during cooling season



- Morzuch, Emma L. (2013). The Energy Benefits of Trees: Investigating Shading, Microclimate and Wind Shielding Effects in Worcester and Springfield, Massachusetts.

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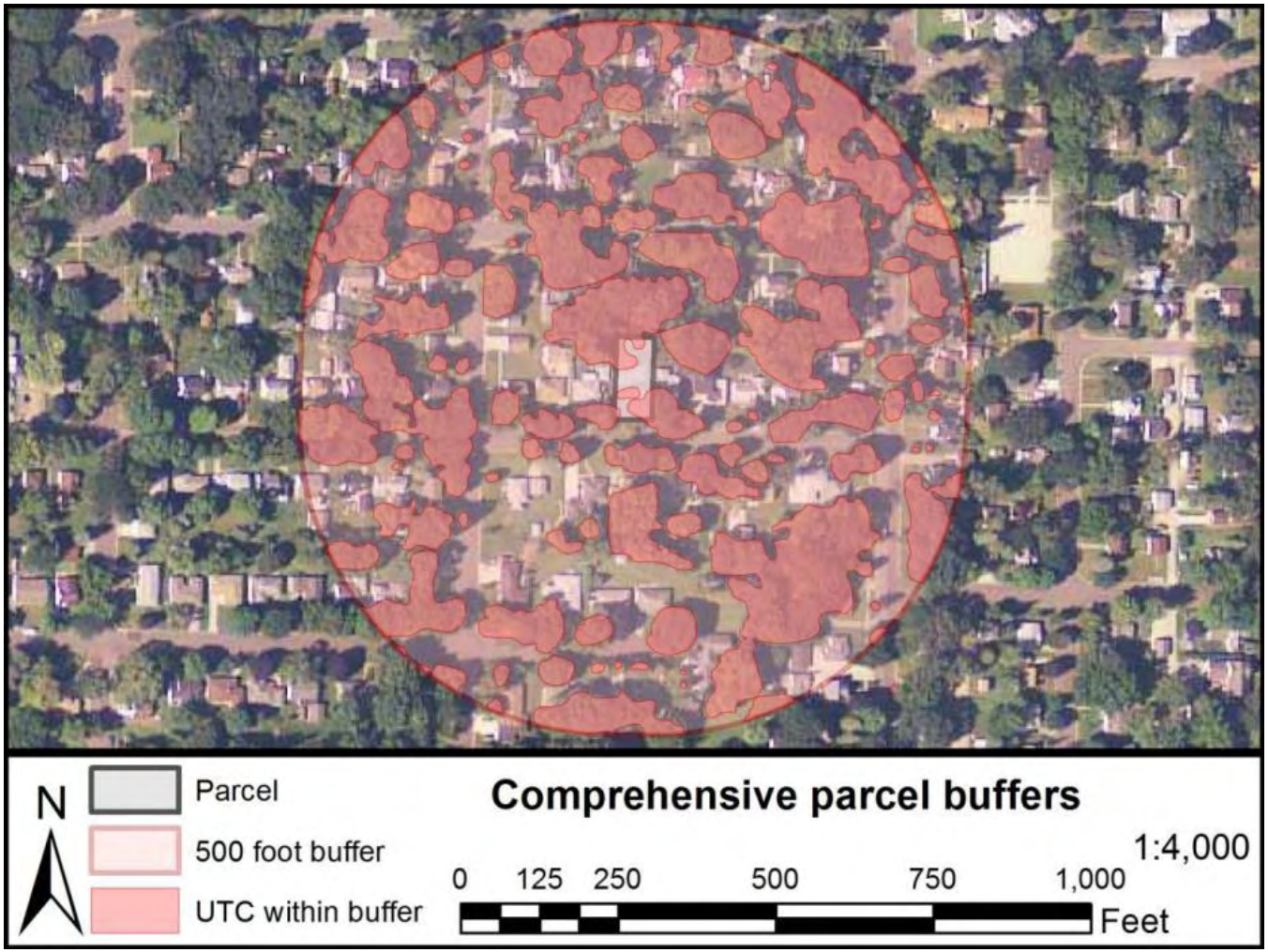
Neighborhood impacts: 500 ft parcel buffer



- Potyondy, Philip John. (2013). Influence of Urban Tree Canopy on Single-Family Residential Structure Energy Consumption at the Community Scale in Hutchinson, Minnesota.

Greendale neighborhood, Worcester, MA:

2007: 40% cover

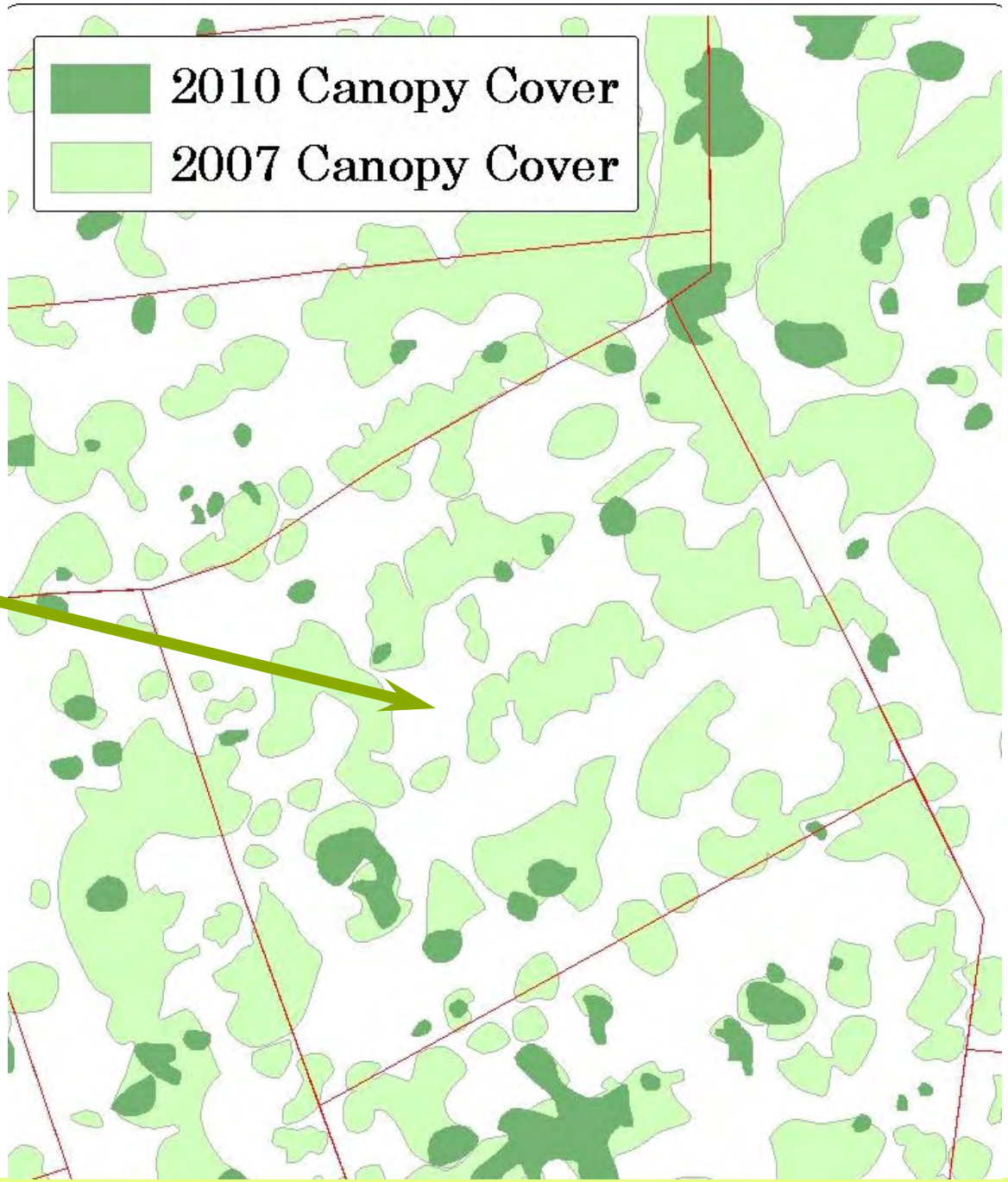
-

2010: 4 % cover

37% increase in summer electricity use

S. Nye

Block 11



2007

2010

Granville St. before tree removal

After tree removal

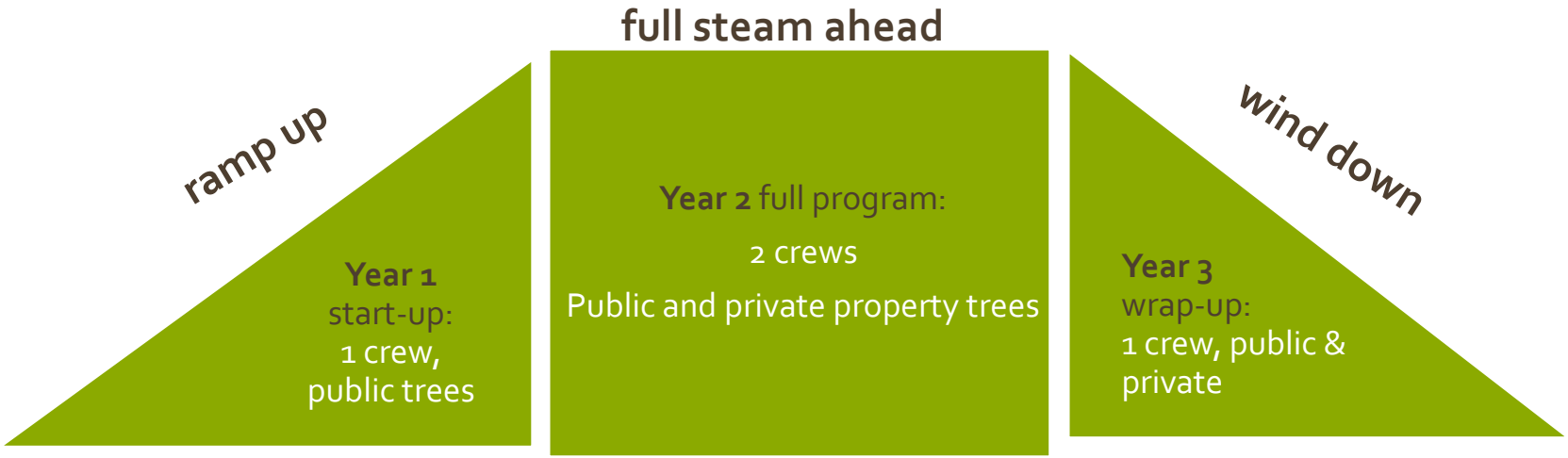
4 years after replanting

Greening the Gateway Cities: Savings

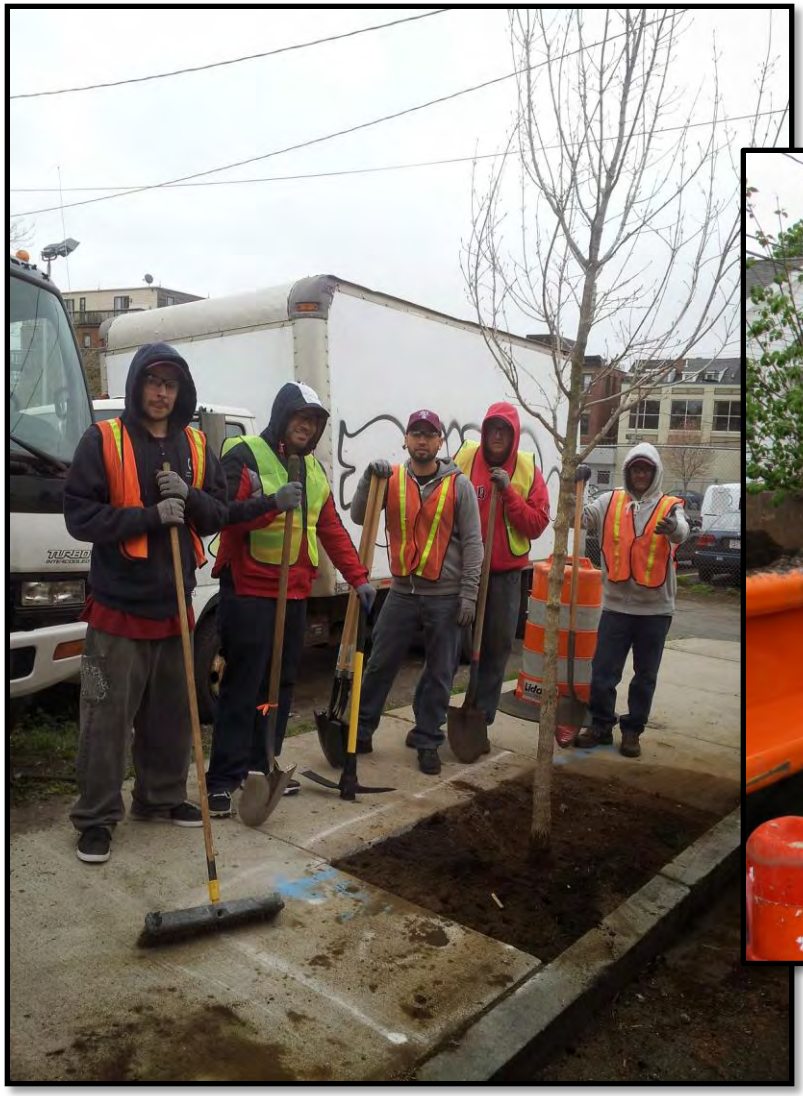
Projected Households and Energy Savings per Acre				
Lot Size	Housing type	# of lots	# of HH	Savings at 1% increase
1/6 A	2&3F	5	13	$267.75
1/8A	2&3F	7	17	$357.00
Varies	**2&3F**	**8**	**20**	**$420.00**
1/10A	2&3F	9	21	$446.25
1/12A	2&3F	10	26	$535.50

Tree planting logistics

- Overall Administration: DCR Urban Forestry
- Planting: DCR, municipal, contract crews, non-profits
- Outreach: community groups, DCR, municipal committees



Tree planting crews – Chelsea, MA

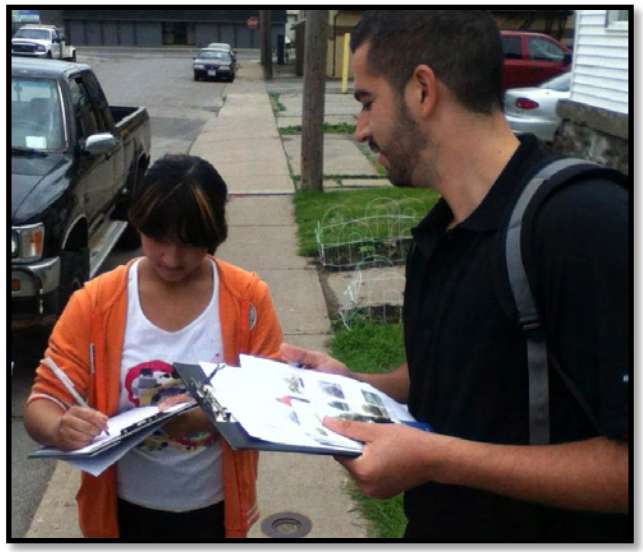


Tree planting crews – Holyoke, MA

Tree planting crews – Fall River, MA

Benefits, benefits, more benefits…

- Once trees are established, they continue to grow, and the energy benefits increase through life of the tree.
- GGC program reaches areas that have been the hardest to reach with other energy saving programs.
- GGC program works with municipal partners and community groups, and directly contacts property owners.

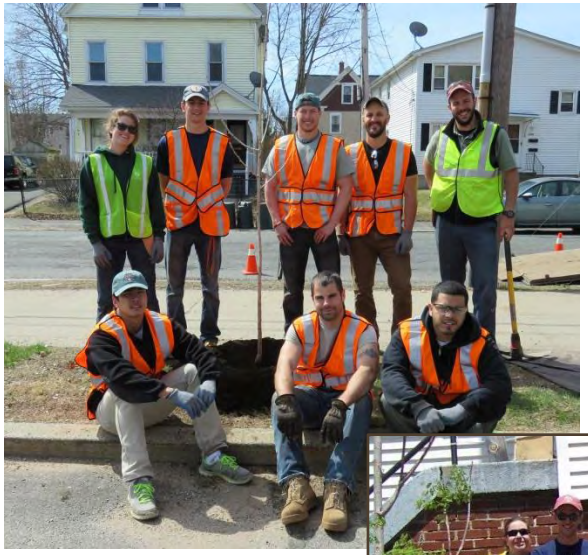


"I think it makes you smile when you come outside. They give you something to think about, worry about, and just emotionally and psychologically make you feel better. They're like a family member or friend, they make you feel proud of something."

"The trees have given the neighborhood a better look and provide a bonding piece or conversation starter for neighbors."

"I have seen a lot of trees added to the neighborhood and it makes it look nicer. It adds shading for my property and hopefully birds will be attracted to my yard now too."

"They provide color and shade. I'm a green person and it always helps to have nature around especially when you're struggling with illnesses. We have people coming in and out of the health center all the time.."



5 DCR Crews

6,301 Trees Planted

7 Cities in Fall 2016
13 Cities in Spring 2017

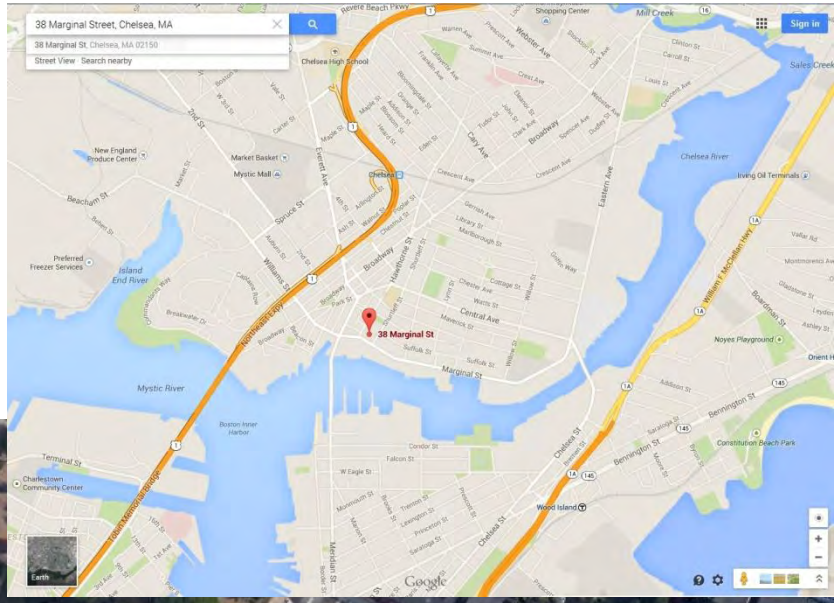
152 Seasonal Planting Jobs Created

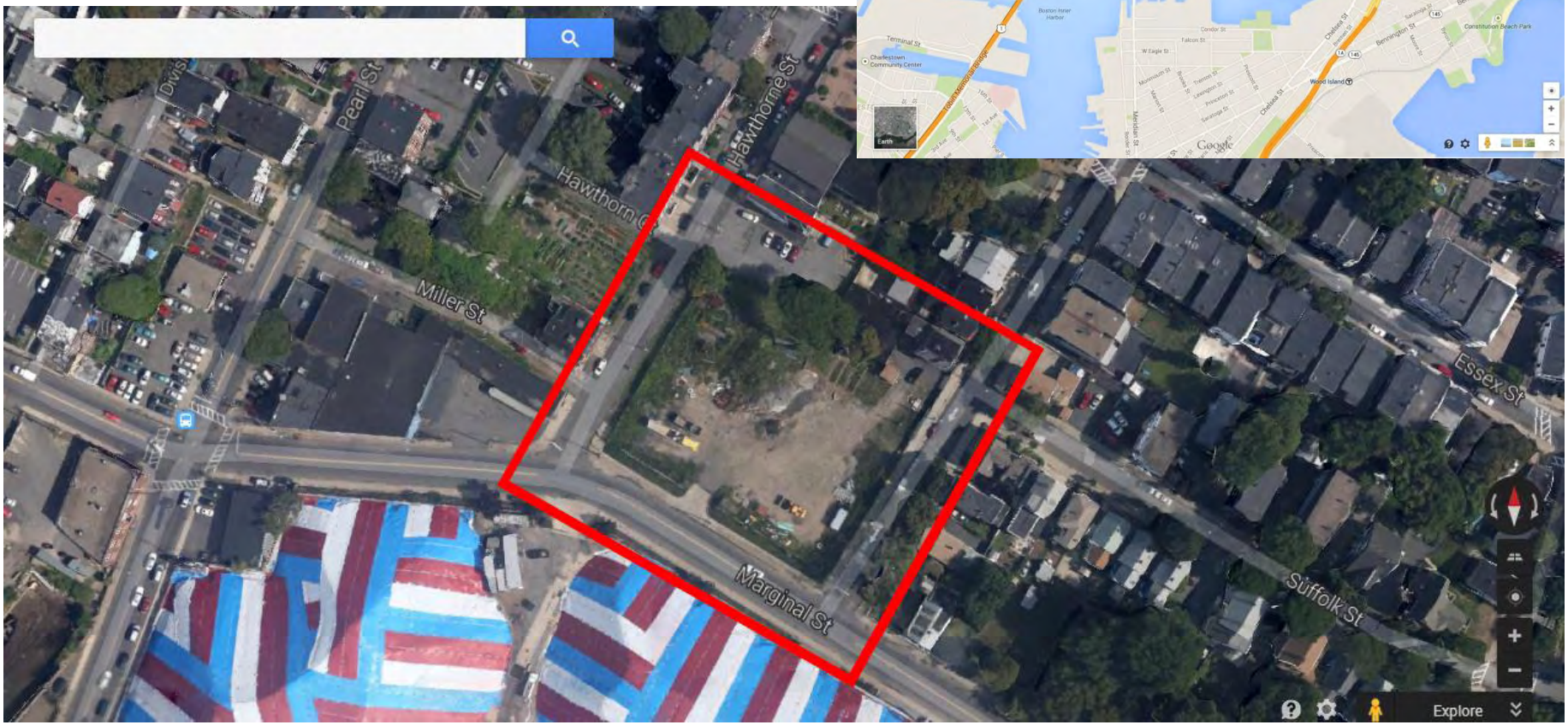
Water-By-Bike Team – Nuestras Raices

- Collaboration in Holyoke with the local grassroots organization to employ students in the Summer of 2015
- Concept from Casey Trees in Washington, DC.

Watershed Benefits

- 38 Marginal St, Chelsea





Neighborhood Level Benefits

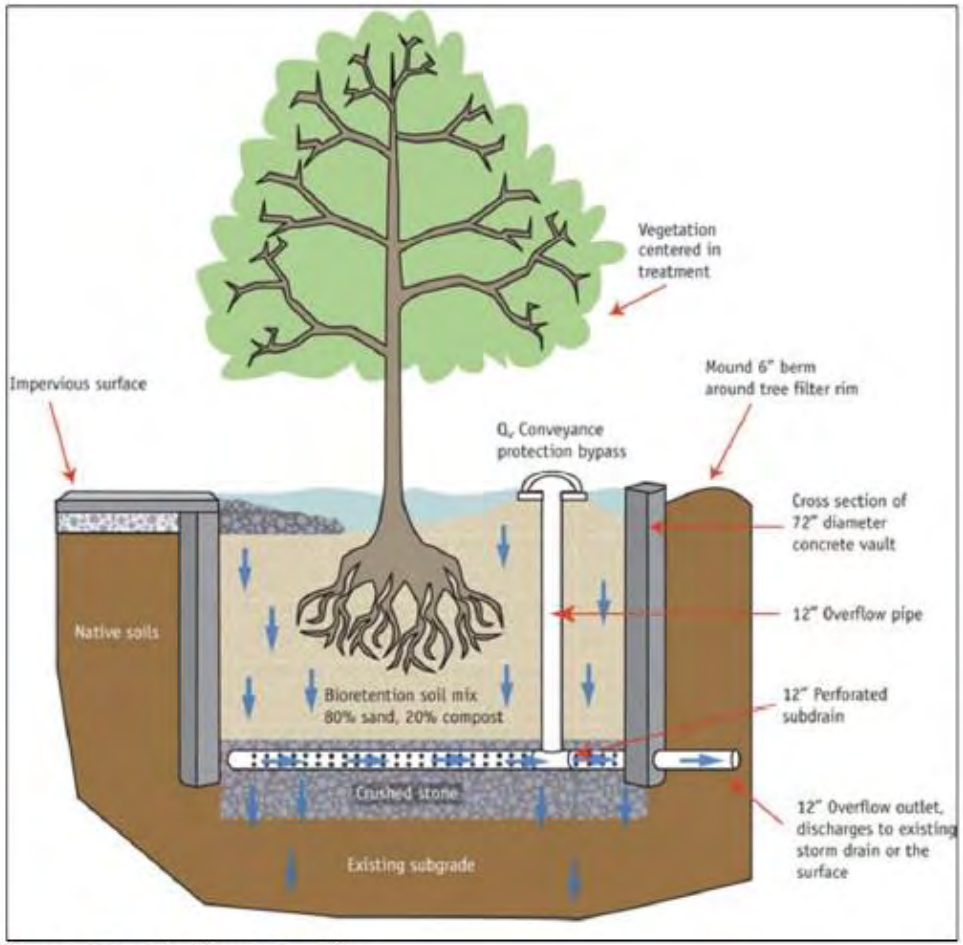
Other Water Quality Benefits

- USFS support from a Water Quality Grant to support the outreach efforts of GGC non-profit partners
- Take a tree, get a rain barrel!
- Many rain barrels per community

- Potential collaboration in Fall River to reduce property owner CSO fee through tree planting
- Stormwater tree pits in development

Stormwater Tree Pit

- Designed to help intercept and slow urban water runoff during storm events
- Accommodates grasses and smaller trees



Source: University of New Hampshire

Figure 4-1. Schematic view of typical tree filter

Source: Tetra Tech, Inc.

Figure 4-3. Recommended tree filter retrofit locations

- Fall River, MA urban drainage area
- Contours show estimated drainage and potential runoff

Source: Tetra Tech, Inc.

Figure B-6. Map of retrofit site number 2 drainage area

Coming soon to a city near you…

GREENING THE GATEWAY CITIES

DCR Urban & Community Forestry Greening the Gateway Cities Program

- For more info contact:

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Urban & Community Forestry

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