What is Up with Inventories?

Connecticut Urban Forest Council Conference 2011

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and

Dr. Dave Bloniarz, USFS

Distinguish among:

Inventories

Surveys

Samples

Assessments

Analyses

What is the purpose of this inventory / survey / sample / assessment / analysis?

Why are we conducting these studies?
What do we hope to get out of this effort?

Public Trees / Private Trees

Are we trying to:

- *Better Describe the Urban Forest*
- *Communicate Information Regarding the Urban Forest*
- *Influence Policy*
- *Increase Public Involvement*
- *Improve Management Practices*
- *Gain a Better Understanding of How the Urban Forest Functions*

Trees are Good

Numbers in the Urban Forest

Making the Case for Trees

Collecting the Numbers

- Inventories
- iTree Tools
- Urban Tree Canopy Assessments

Why Inventory?

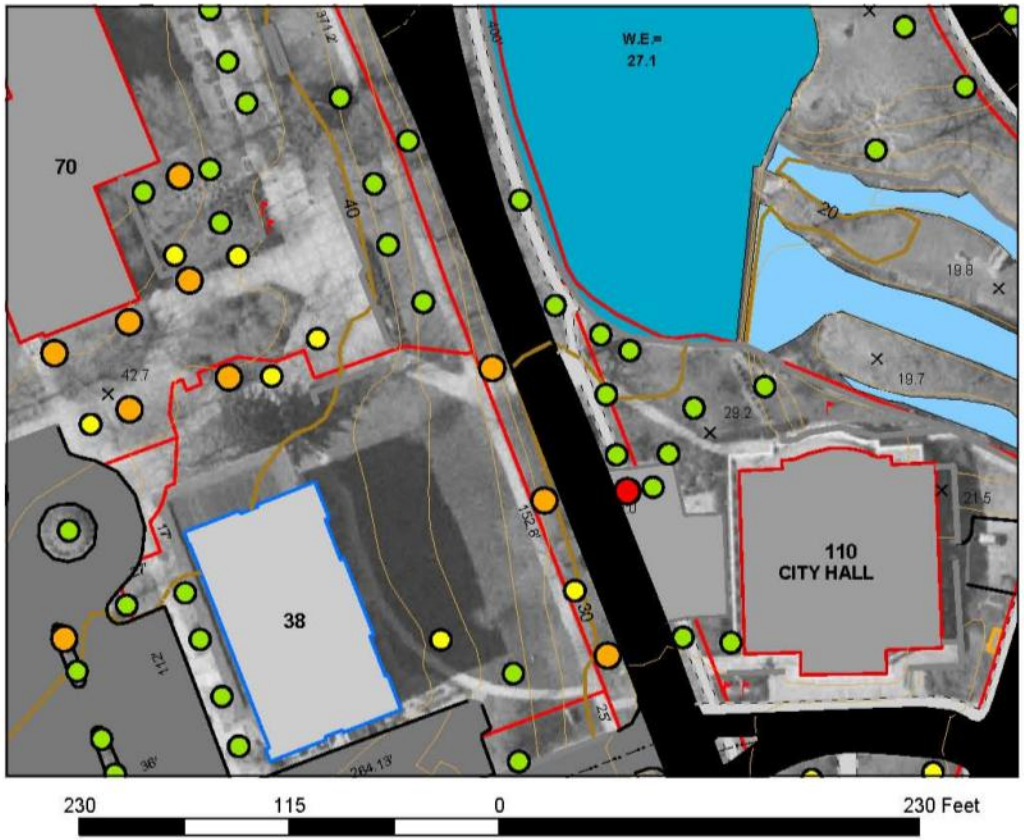
- ***You can't manage it if you don't know you have it***
- ***It is an effective way to describe the importance of the urban forest resource***
- ***It is always worthwhile to look closely at trees***
- ***You are establishing a baseline by which you can measure the progress of your program***
- ***If you don't know you have it, it's too easy to lose it***

High Hopes for Street Tree Inventories Circa the Year 2000

- ***100% Street Tree Inventories as a management tool – great for planning, record-keeping, forecasting, etc.***
- ***Street Tree Inventories as a communications tool – what do we have, what it going on with it, why it is important and what it will cost to manage***
- ***Inventories as opportunities for education and outreach***

TREEID	MAP	TMPNUMBER	CODE	DBH	CONDITION	LOCATION	COMMENTS
107	F07		ZS	10	Good	Lawn	
108	F07		QP	12	Good	Lawn	
109	F07		ZS	10	Good	>3'	
110	F07		ZS	10	Good	>3'	
111	F07		ZS	9	Good	>3'	
106	F07		QP	25	Good	Lawn	DEAD BRANCH NEAR SIDEWALK
105	F07		AP	27	Good	>3'	
118	F07		QP	29	Good	Lawn	
76	F07		APA	8	Poor	Lawn	2 TRUNKS/ 2 CAVITIES
77	F07		CP	6	Good	Lawn	4 TRUNKS
78	F07		QP	28	Fair	Lawn	CLEAN 8 BRANCHES HIGH UP
79	F07		PF	12	Good	Lawn	
80	F07		PC	11	Fair	>3'	
81	F07		PC	10	Poor	>3'	LARGE CAVITY/ WALL SIDE
88	F07		AM	21	Poor	Lawn	DEAD MAIN LEADER/ SPLIT BRANCH/BLDG.
87	F07		AM	21	Poor	Lawn	HUGE CAVITY/ MAIN TRUNK/ EXPOSED RTS.
86	F07		AM	21	Fair	>3'	1 SMALL BRANCH OVERHEAD
85	F07		AM	18	Poor	>3'	CONSTRUCTION CAUSED CAVITY AT BASE
82	F07		SR	30	Poor	Lawn	LARGE CAVITY IN TRUNK
83	F07		PC	11	Fair	>3'	4 TRUNKS
84	F07		PC	12	Fair	>3'	
112	F07		PA	28	Good	Lawn	ROOT DAMAGE/ MOWER
115	F07		AM	34	Good	>3'	WATCH TRUNK/ SPLIT
113	F07		AP	17	Good	Lawn	
114	F07		AP	15	Good	Lawn	SCAR 15 FEET UP

Milford Tree Inventory



Legend

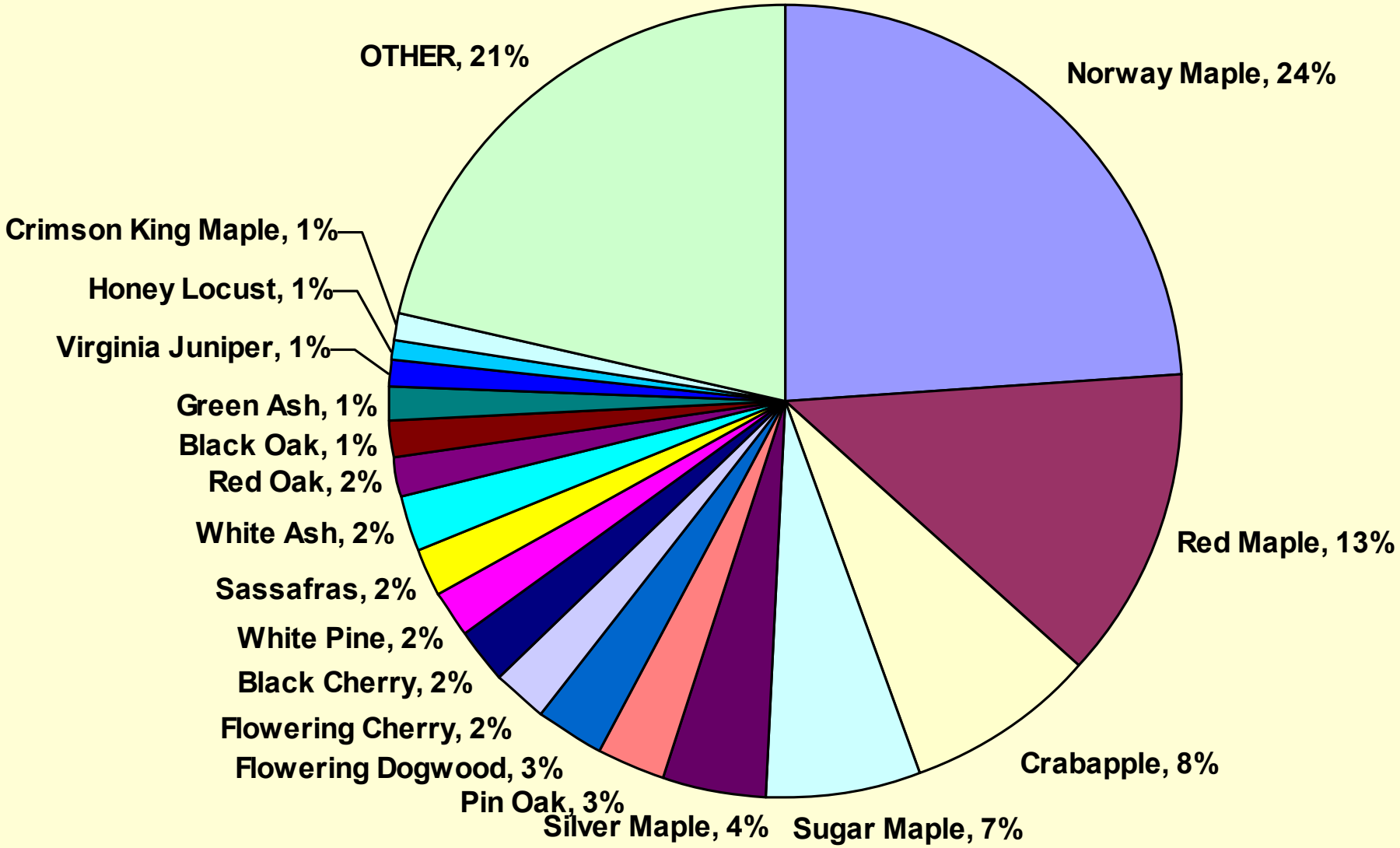
Tree Inventory (as of 2002)

TreeInventory.Condition

- No Condition
- Consult
- Dead
- Fair
- Good
- Poor

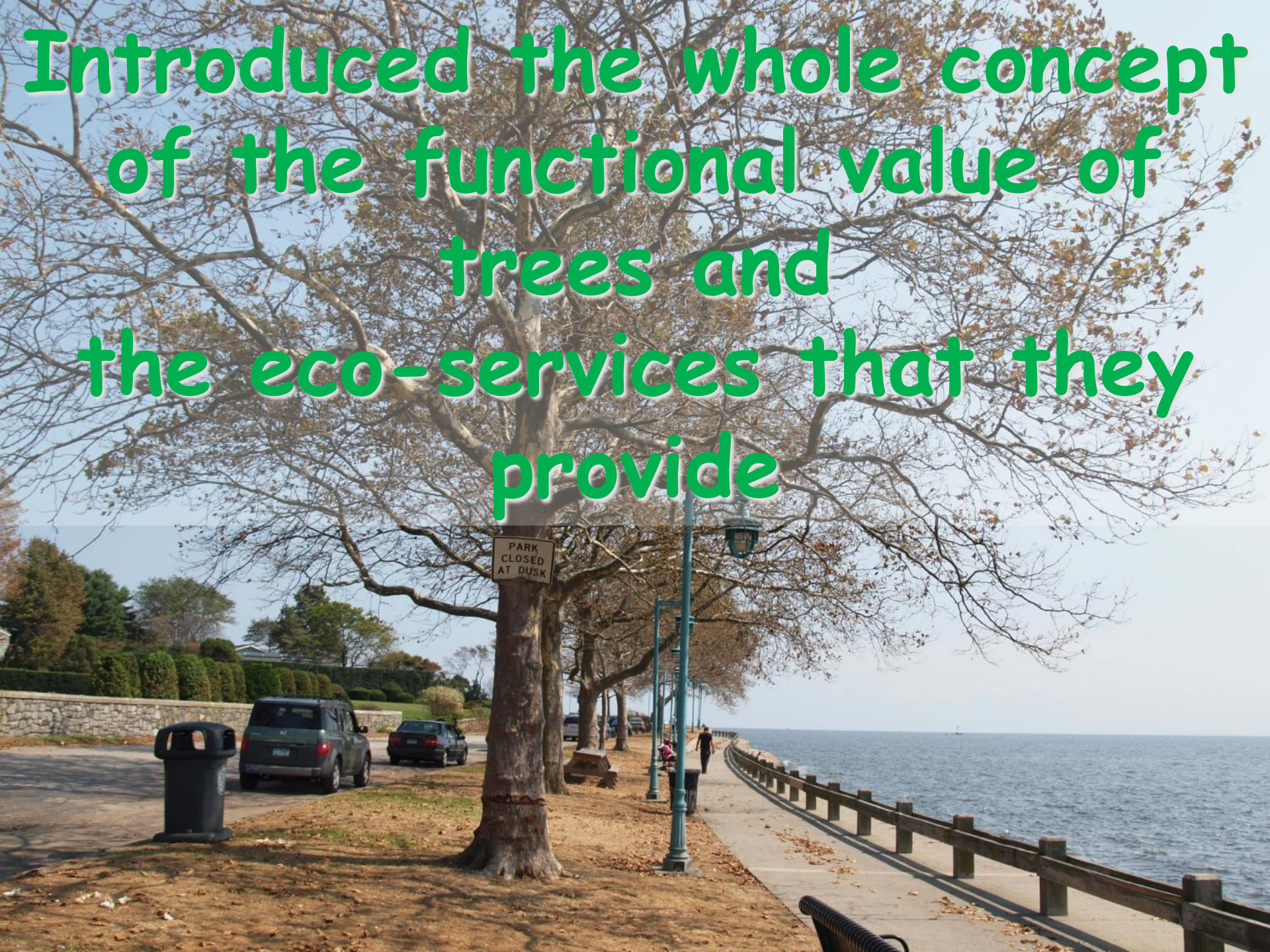
N
W E
S

Milford Street Trees - Species Distribution



That's great, but…..
…what progress are we making?

i-Tree Tools:
UFORE
(now i-Tree Eco)
and
STRATUM
(now i-Tree Streets)



Introduced the whole concept of the functional value of trees and the eco-services that they provide

UFORE:

Urban Forest Effects Model

(iTree-Eco)

UFORE assesses the:

Structure of the urban forest – what kinds of trees, of what size, condition, where these trees are located, etc.

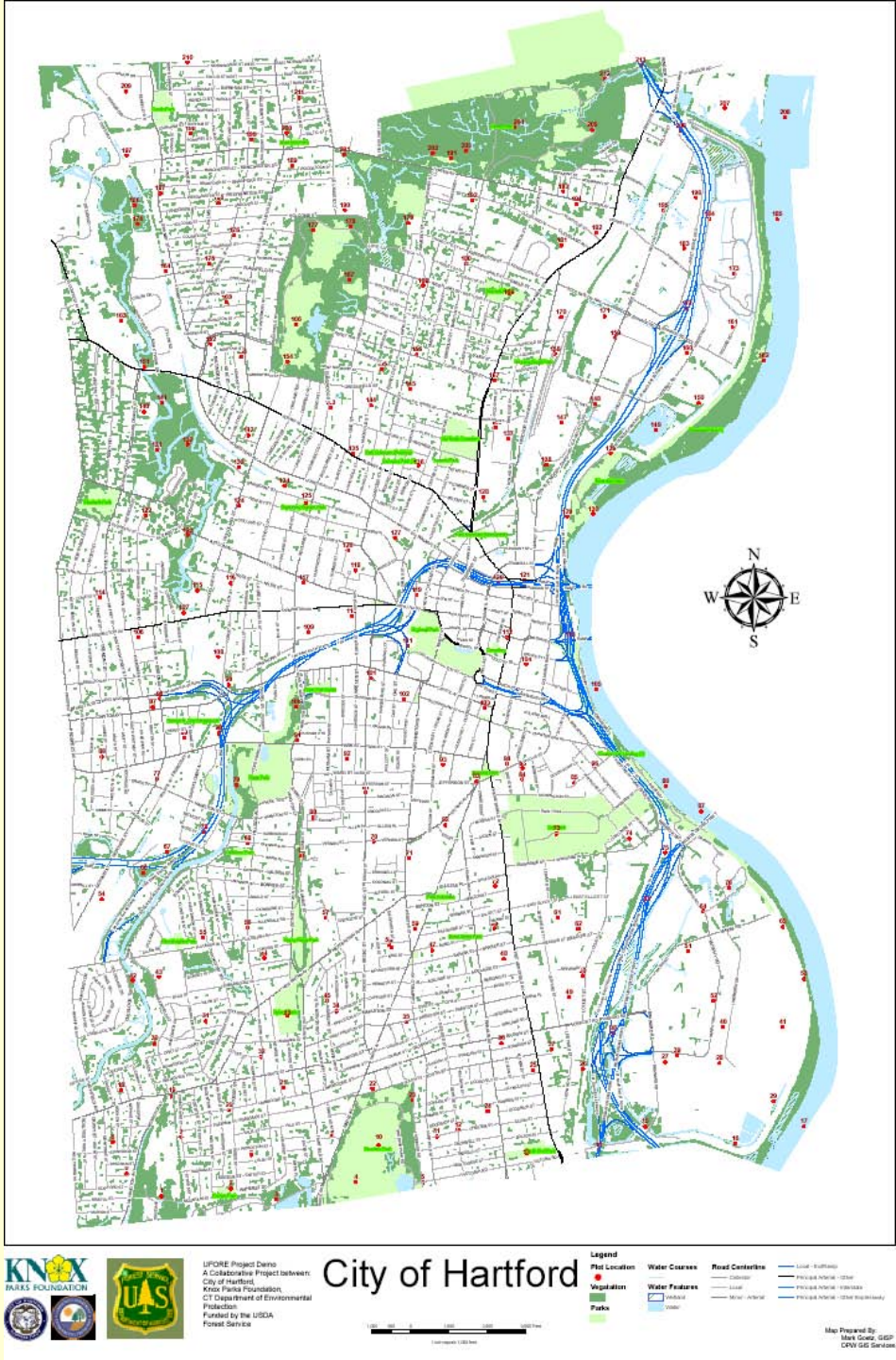
Function of the urban forest – what types of services do trees provide – such as air quality effects, energy reduction, etc.

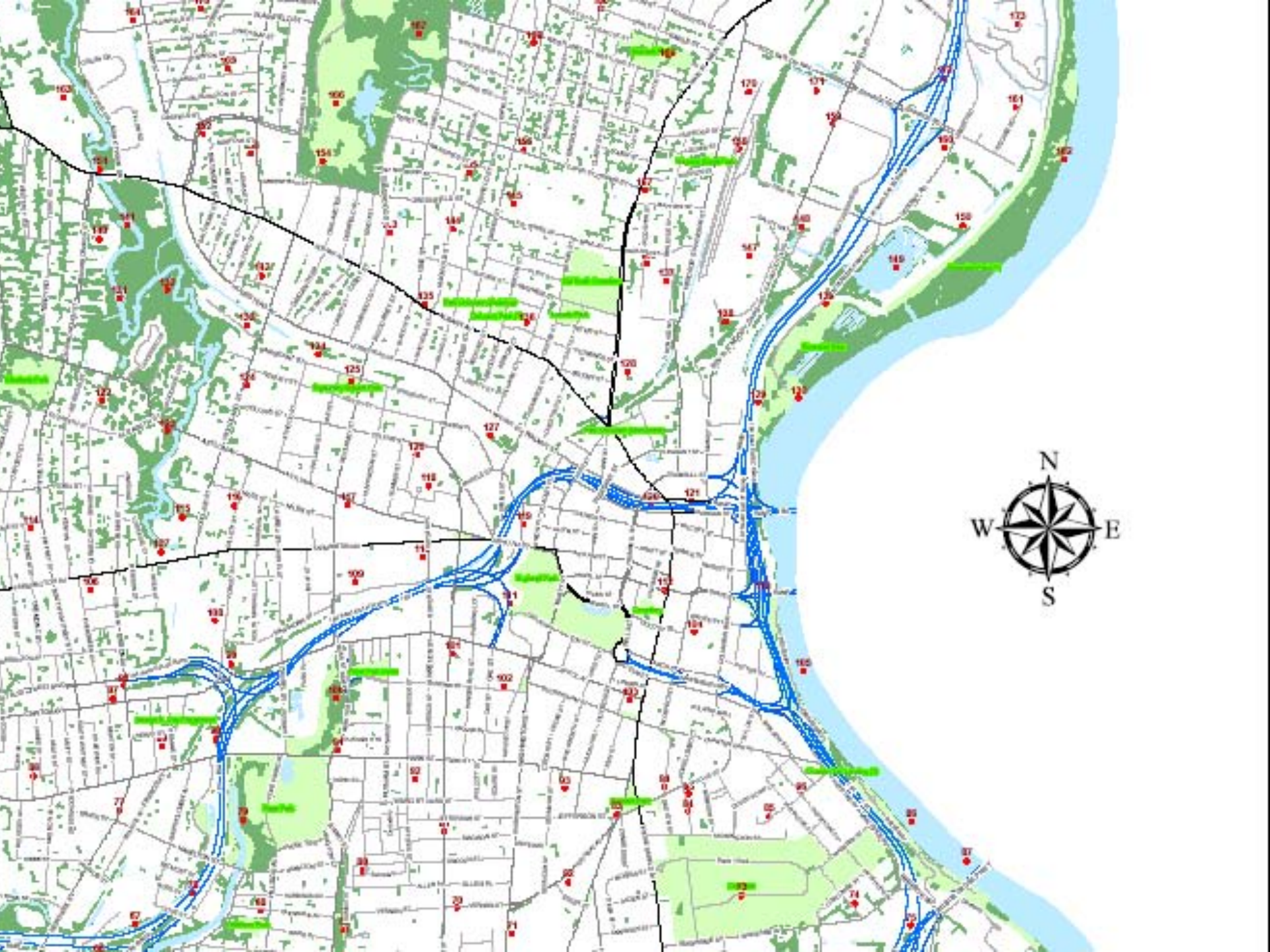
UFORE also assesses:

Structural value of the urban forest – essentially, what would it cost to replace this forest?

Functional value of the urban forest – what would society be willing to pay for the service provided by trees (e.g. – air pollution removal or value of energy saved).

Randomized Grid - 213 points total




N
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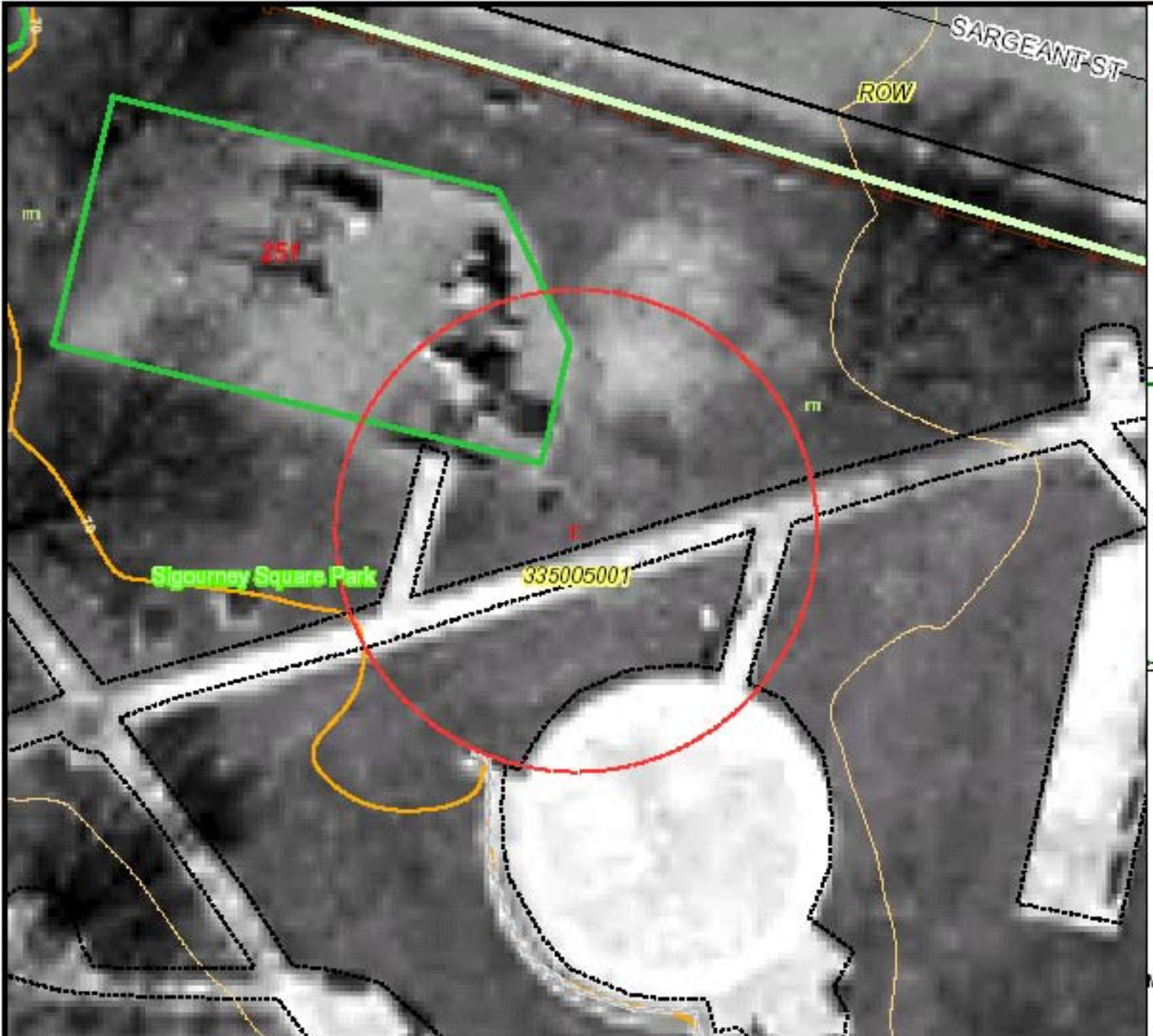


KNOX PARKS FOUNDATION

UPORE Project Demo
A Collaborative Project between:
City of Hartford,
Knox Parks Foundation
and
CT Department of Environmental Protection

General Location Map

20 10 0 Feet

1 inch equals 20 feet

Site #

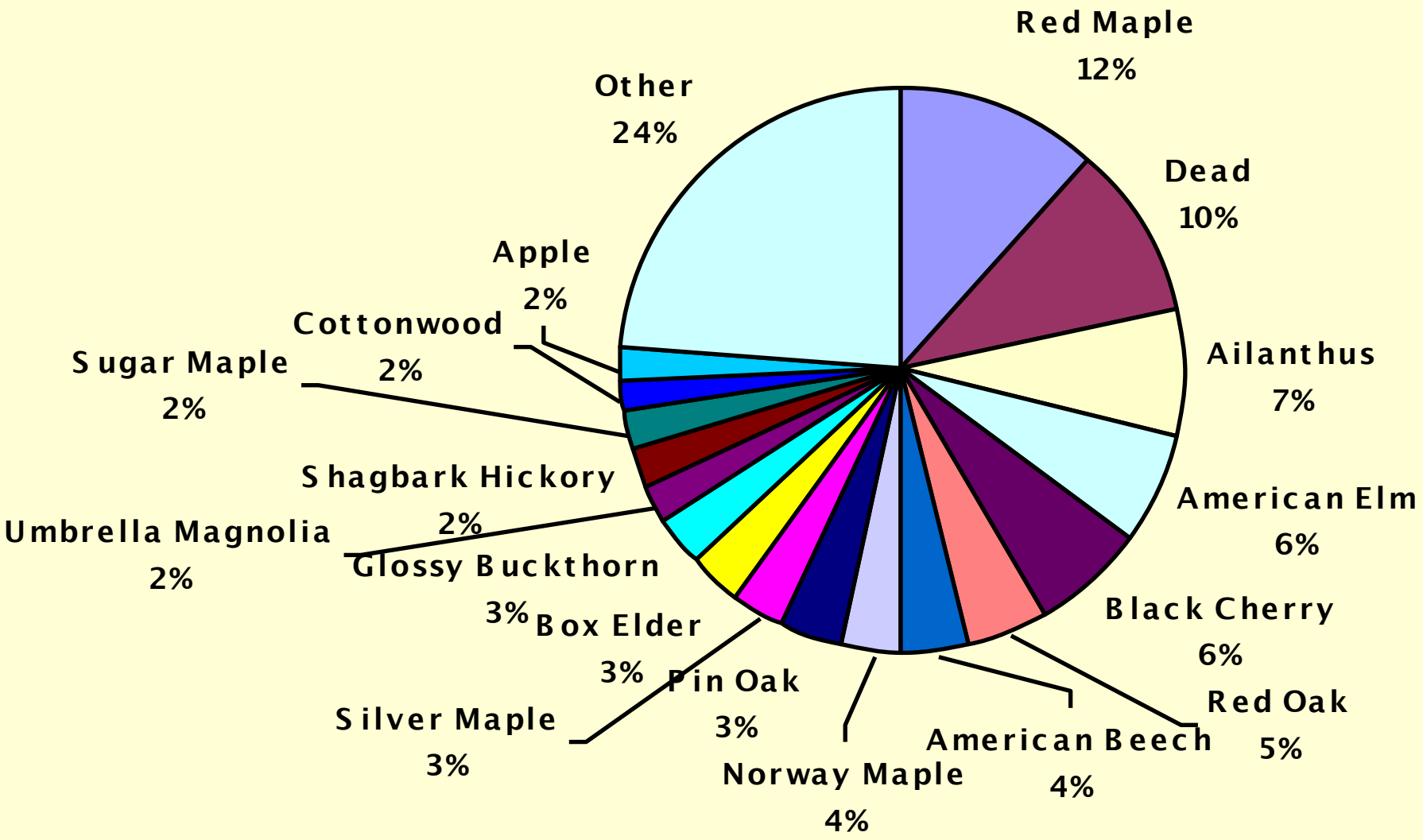
125

Map Prepared By:
Mark Goetz, GISP
DPW GIS Services

General Numbers on Hartford's Trees

Total Number of Trees:	567,992
Number of Trees >4" dbh:	267,840
Number of Trees >10 " dbh:	140,544
Number of Trees >20" dbh:	55,296

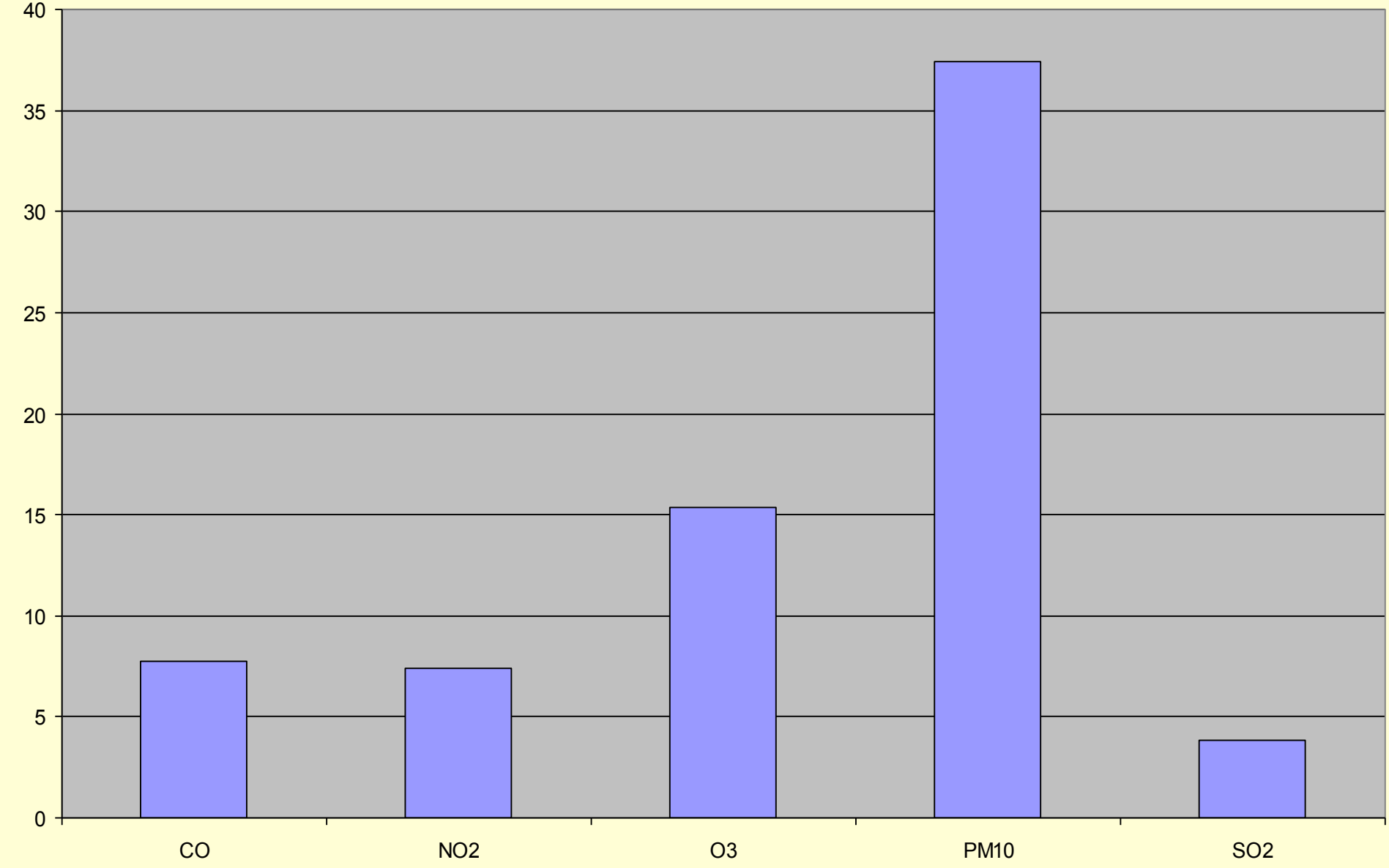
Hartford – All Trees – Species Distribution



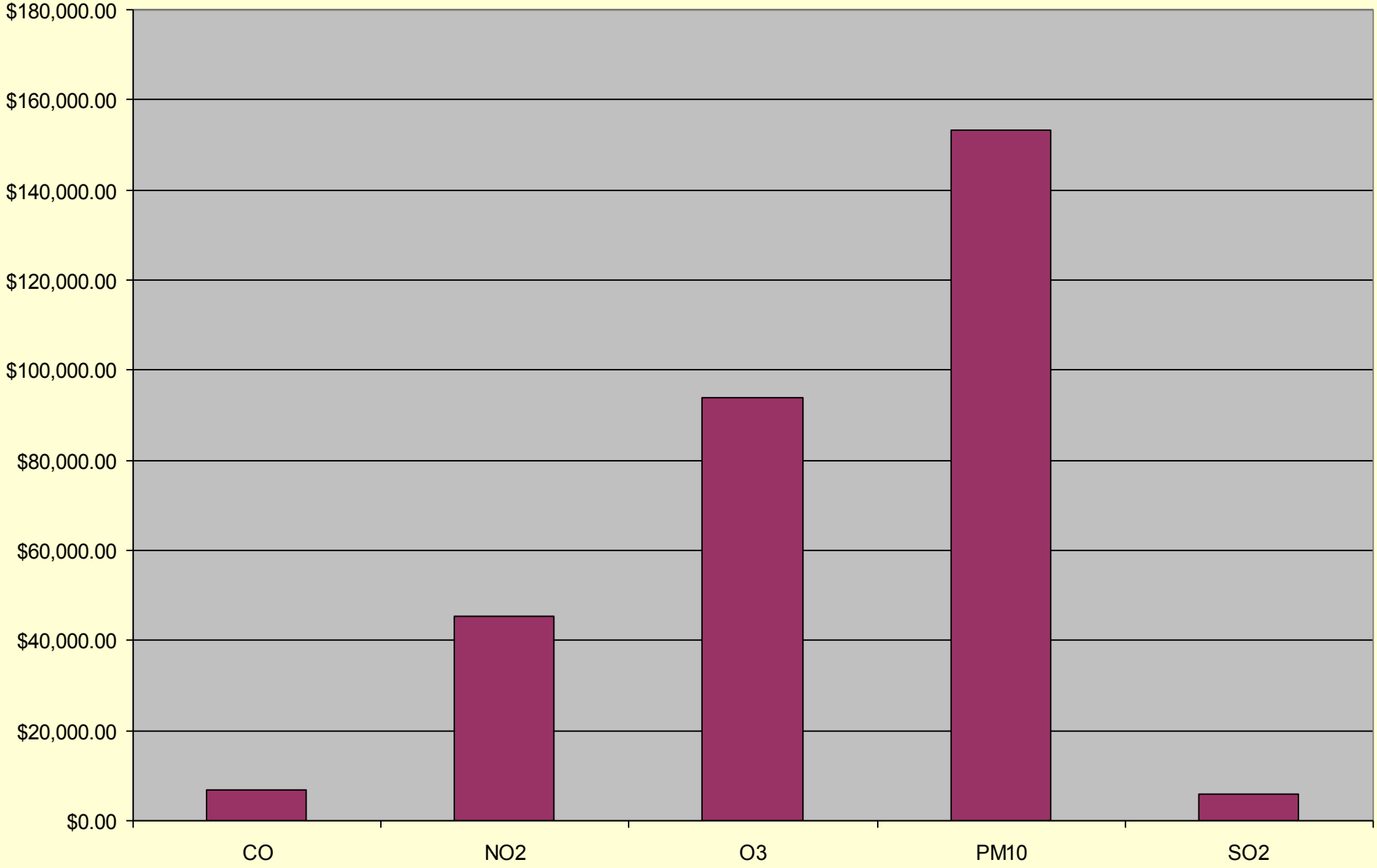
Replacement Value of Hartford's Trees = $589,177,284

Functional Value of Hartford's Trees in air quality alone = $304,884/year

Hartford Data - Pollutants Removed Annually - Tons



Hartford Data - Pollutants Removed Annually - Value in Dollars



Hartford's Urban Forest - a Summary

Number of Trees: 568,000

Number of Larger Trees (over 20" in diameter): 55,000

Most Common Trees: red maple, tree of heaven, black cherry, American elm and red oak

Tree Canopy Cover: 26%

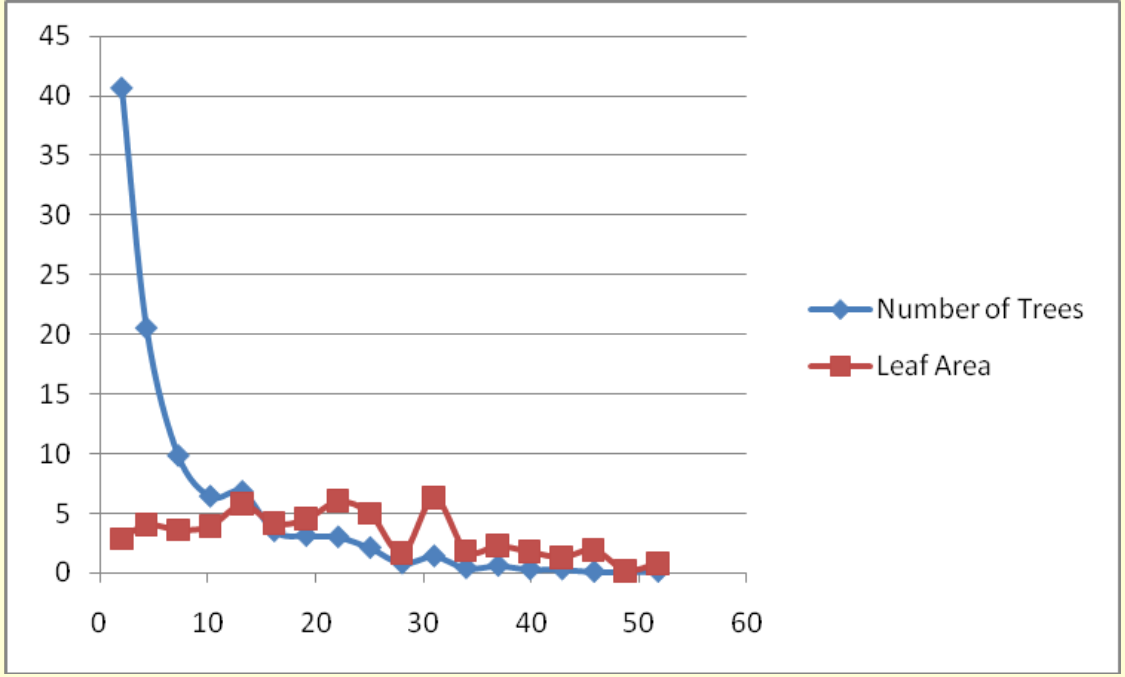
Amount of Carbon Removed by Hartford's Trees Annually: 2,440 tons

Amount of Major Air Pollutants Removed Annually: 73 tons

Oil Saved due to Energy Reduction by These Trees: 2,400 barrels a year

Replacement Cost for These Trees:

$590 million dollars



Comparison of percentages by dbh class

•20% of Hartford's trees are 12 inches in diameter or greater

•5% of Hartford's trees are 24 inches in diameter or greater

•2% of Hartford's trees are 36 inches in diameter or greater

However:

•75% of the leaf area of Hartford's trees are in trees 12 inches in diameter or greater

•40% of the leaf area of Hartford's trees are in trees 24 inches in diameter or greater

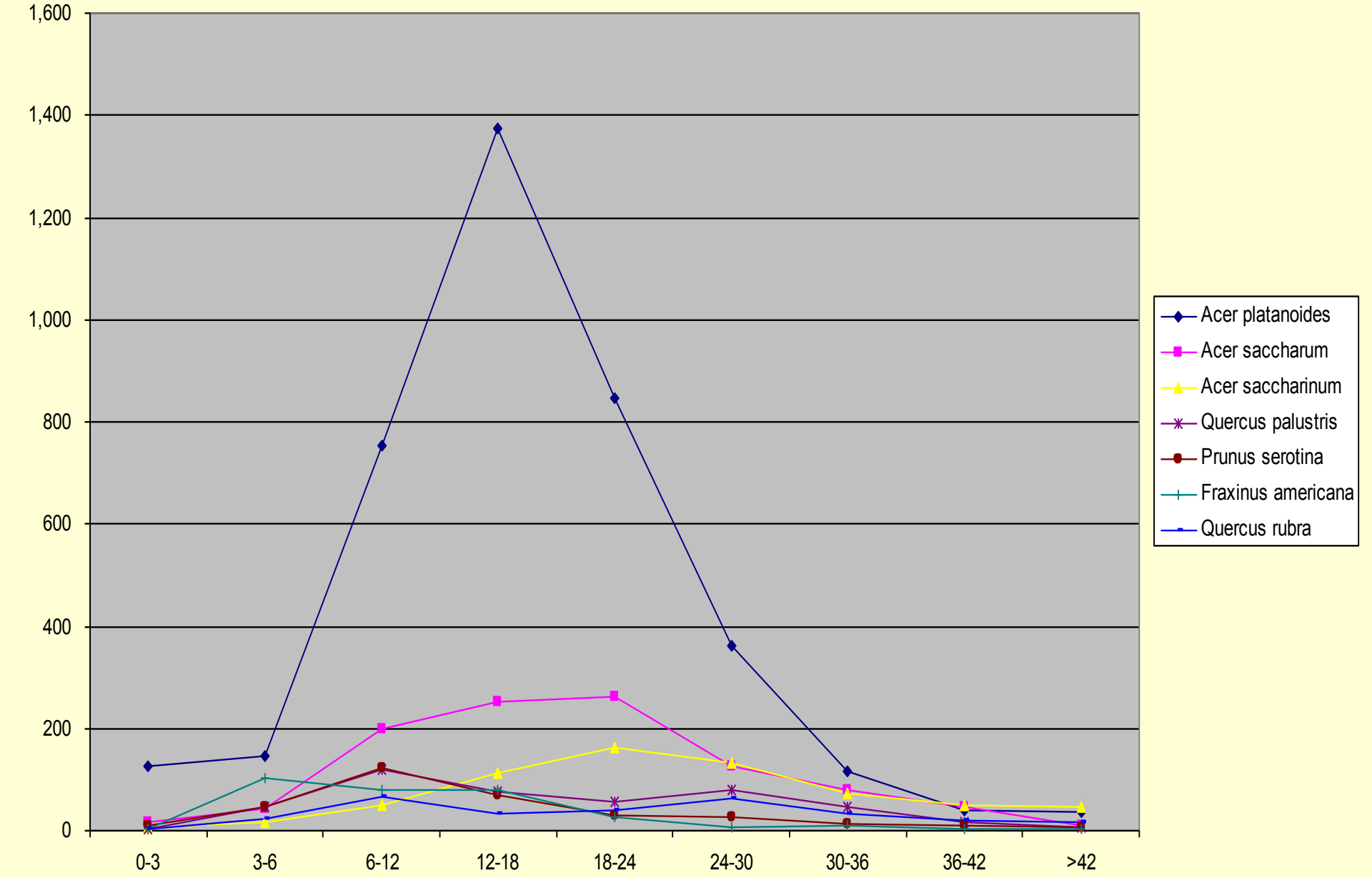
•14% of the leaf area of Hartford's trees are in trees 36 inches in diameter or greater

Leaf area is the main determinant of the capability of an individual trees to deliver such benefits as air pollution reduction, stormwater reduction and so on.

STRATUM: Street Tree Analysis Tool for Urban forest Managers

(iTree-Streets)

dbh distribution of Milford's most common street trees



Total Annual Benefits, Net Benefits, and Costs for Public Trees

Benefits	Total ($)	Standard Error Total	$/tree	Standard Error Per Tree	$/capita	Standard Error Per Capita
Energy	918,979	(N/A)	57.90	(N/A)	18.38	(N/A)
CO2	22,820	(N/A)	1.44	(N/A)	0.46	(N/A)
Air Quality	166,089	(N/A)	10.46	(N/A)	3.32	(N/A)
Stormwater	219,991	(N/A)	13.86	(N/A)	4.40	(N/A)
Aesthetic/Other	762,869	(N/A)	48.07	(N/A)	15.26	(N/A)
Total Benefits	2,090,748	(N/A)	131.73	(N/A)	41.81	(N/A)
Cost						
Planting	20,000		1.26		0.40	
Contract Pruning	40,000		2.52		0.80	
Pest Management	1,000		0.06		0.02	
Irrigation	5,000		0.32		0.10	
Removal	50,000		3.15		1.00	
Administration	100,000		6.30		2.00	
Inspection/Service	3,000		0.19		0.06	
Infrastructure Repairs	50,000		3.15		1.00	
Litter Clean-up	20,000		1.26		0.40	
Liability/Claims	6,000		0.38		0.12	
Other Costs	5,000		0.32		0.10	
Total Costs	300,000		18.90		6.00	
Net Benefits	1,790,748	(N/A)	112.83	(N/A)	35.81	(N/A)
Benefit-cost ratio	6.9691601	(N/A)				

Replacement Value of Milford's 15,871 Street Trees =

$95,628,653

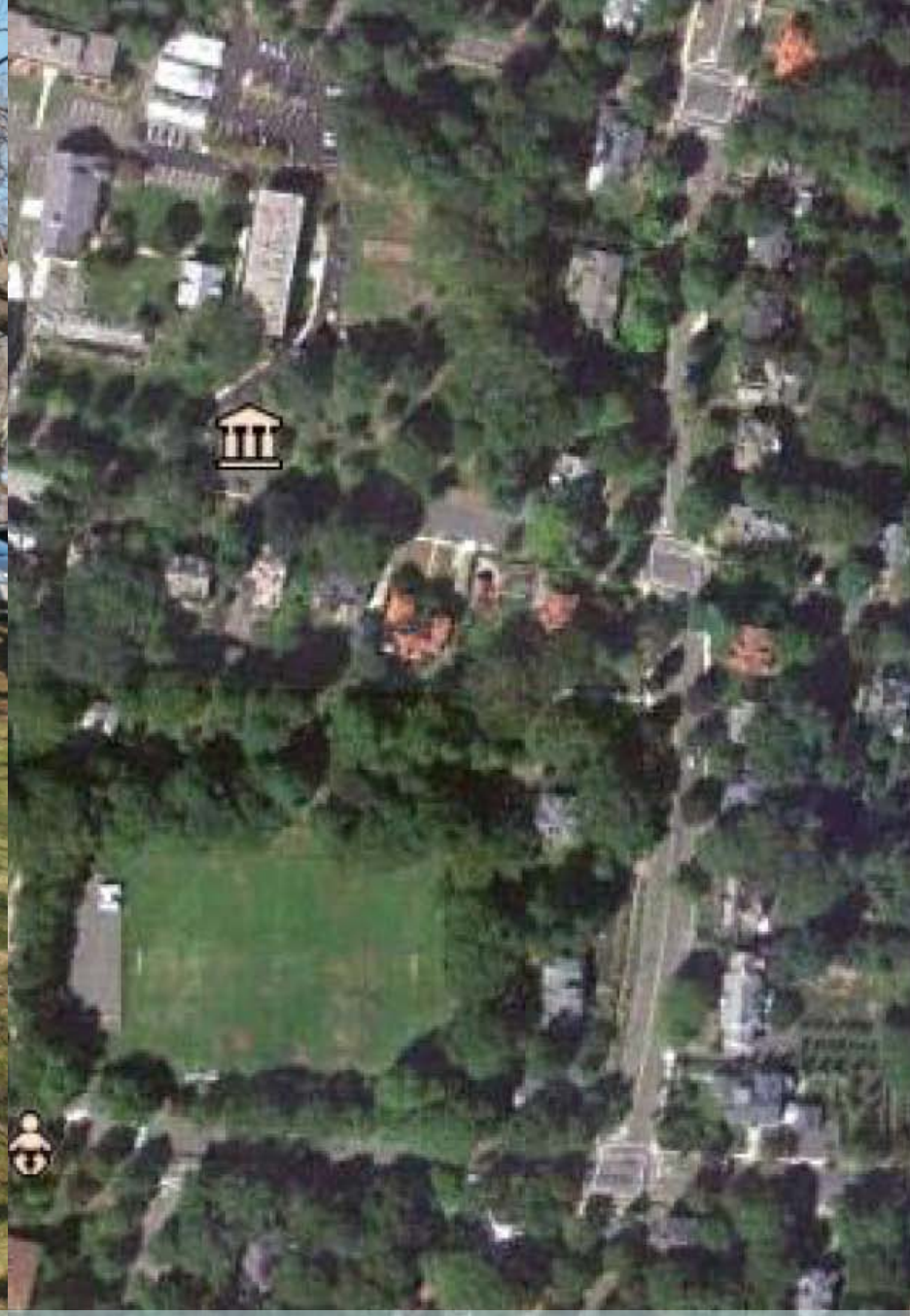
Functional Value of Milford's Street Trees in Air Quality alone =

$166,089/year

Trees are Good

UTC:

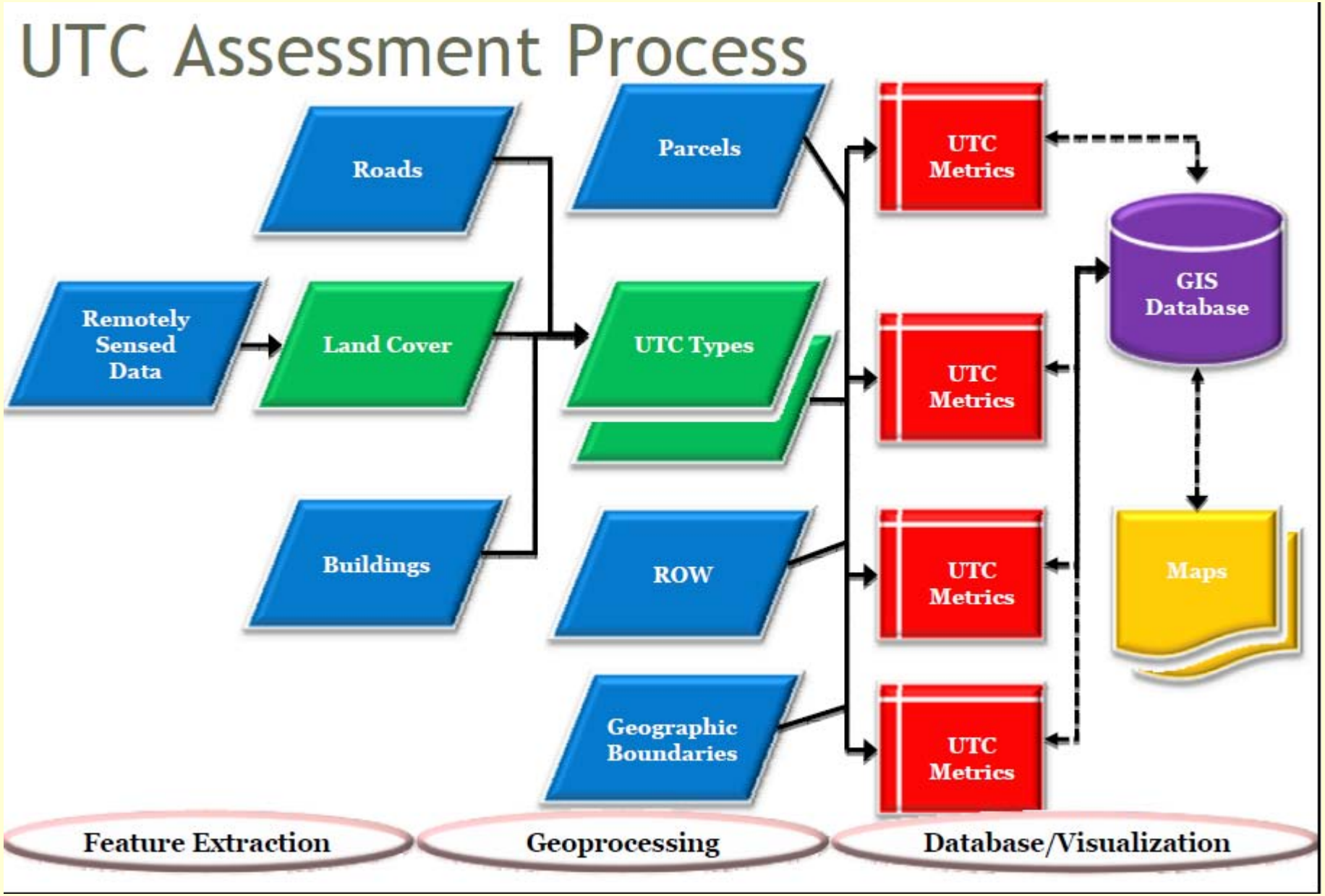
Urban Tree Cover Assessment



i-Tree Tools

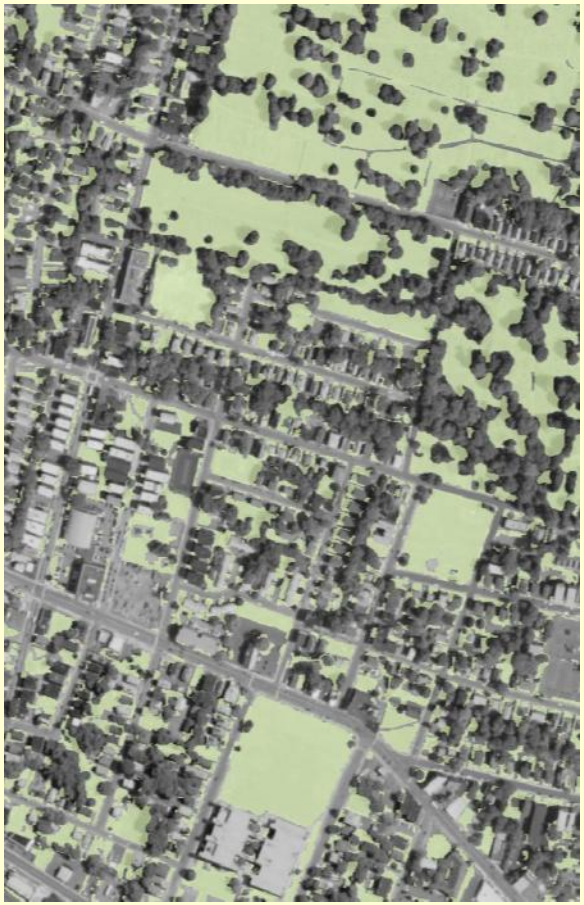
UTC Assessment

UTC Assessment Process

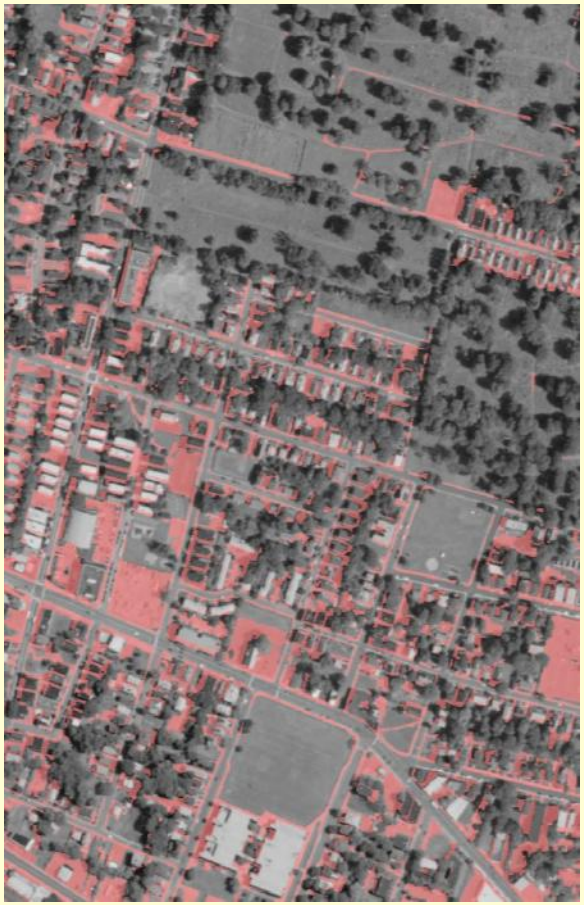


Tree Canopy Assessment Classes

Existing TC



Vegetation

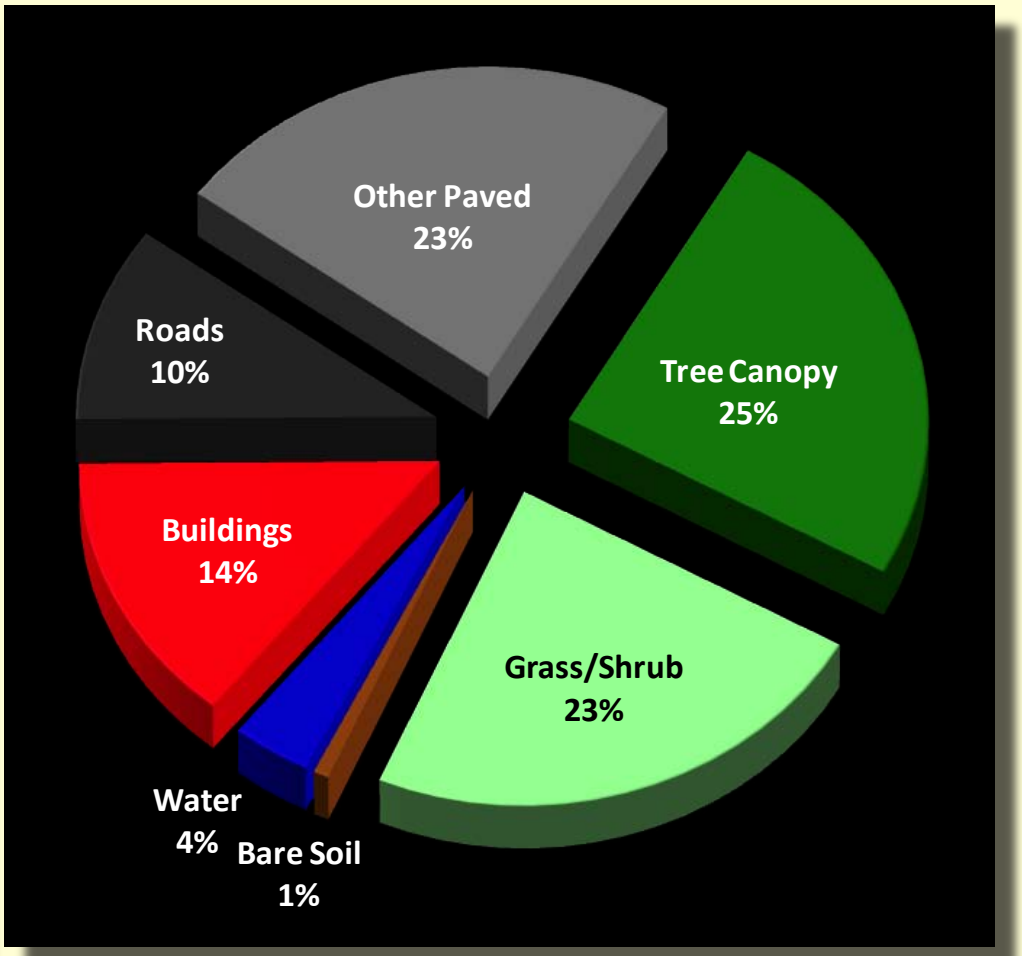


Impervious

Possible TC

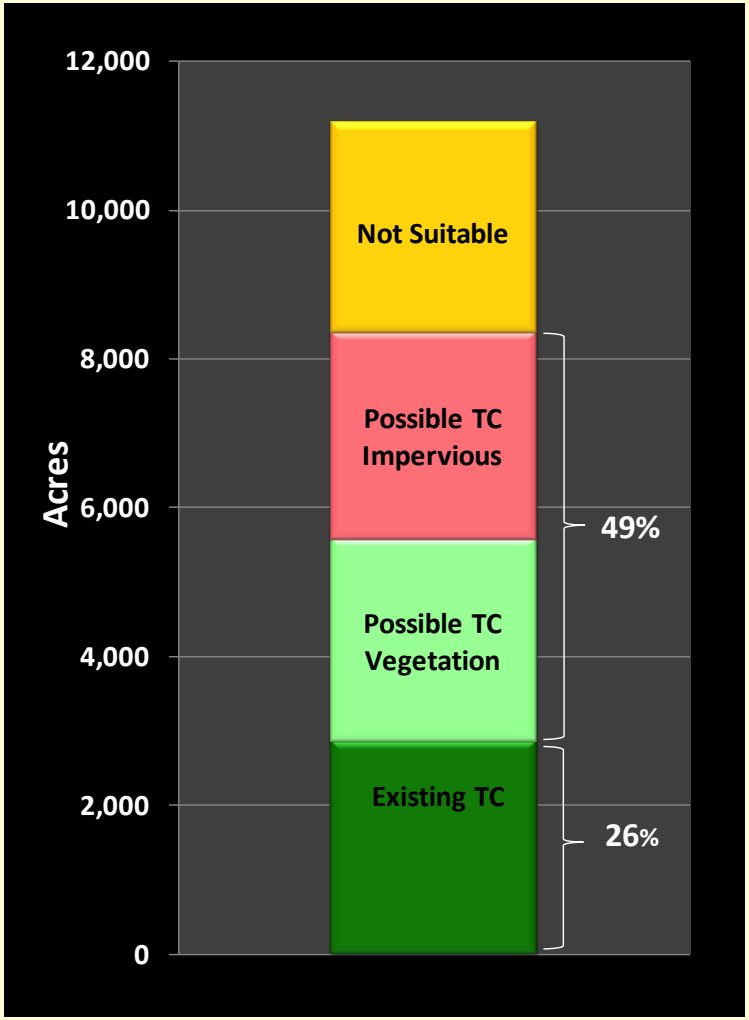
Hartford, CT

Land Cover Metrics



Hartford, CT

City TC Metrics



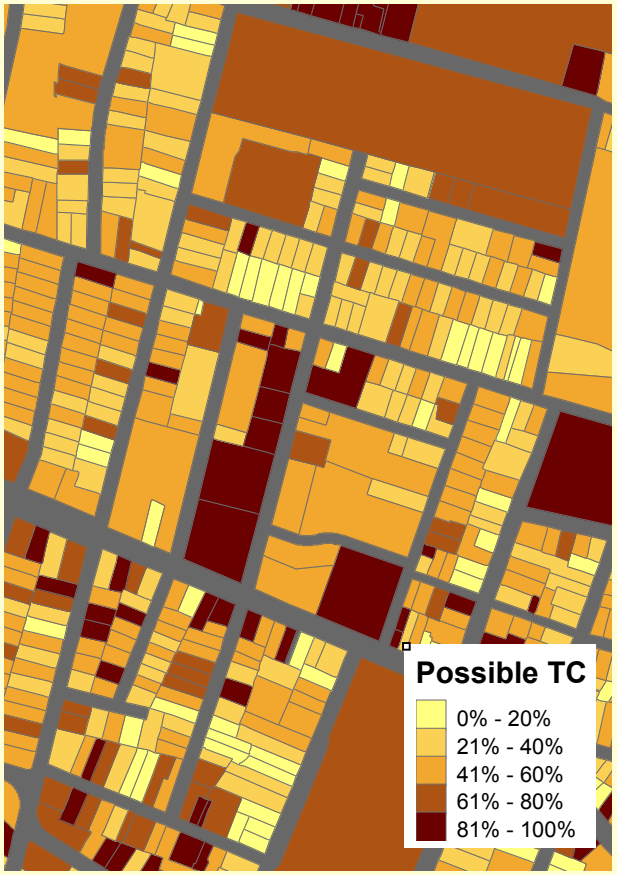
- **11167** acres of land (excludes water)
- **2870** acres of Existing TC
- **2711** acres of Possible TC that is grass/shrub
- **2778** acres of Possible TC that is impervious
- **2809** acres are not suitable for tree canopy (building, water, and transportation)

Hartford, CT

Parcel Level Data

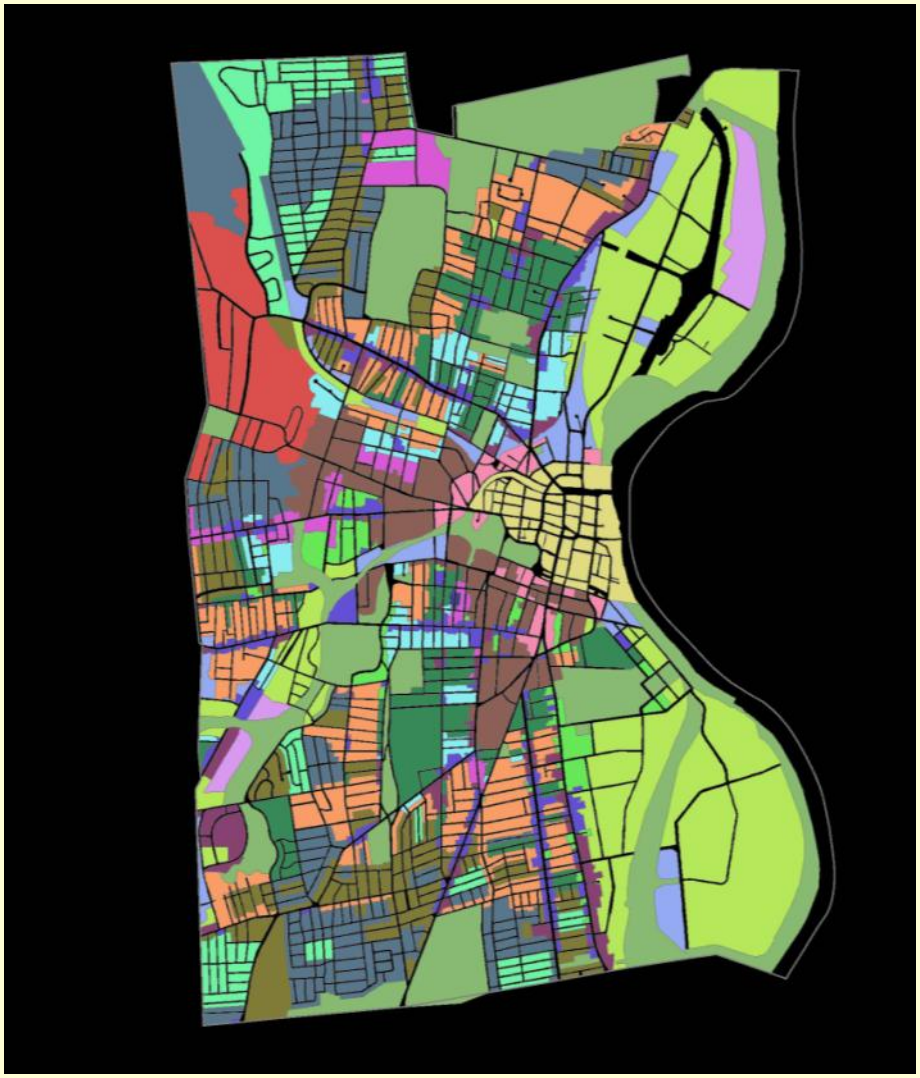
Parcels

Existing TC



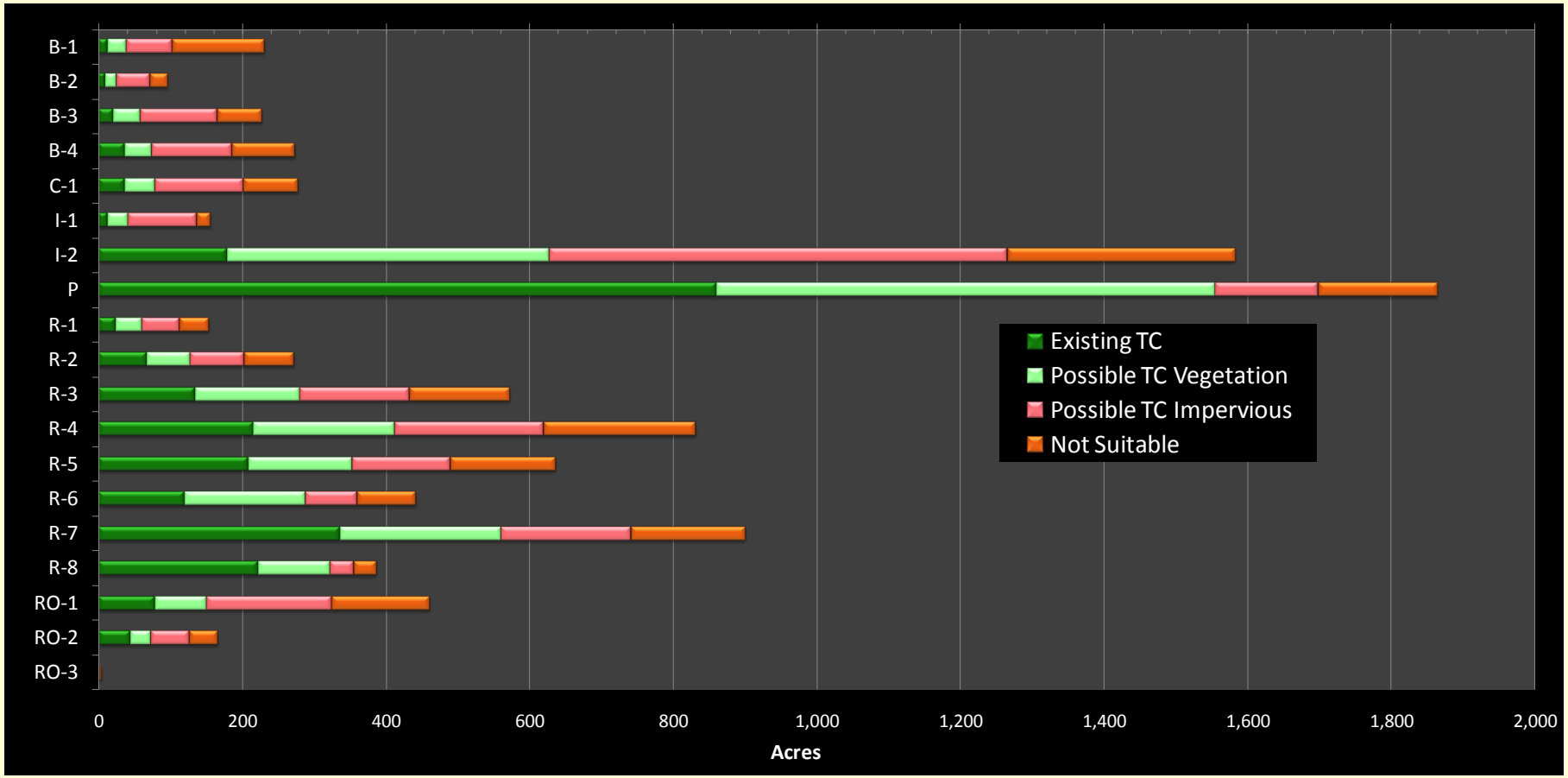
Possible TC

Zoning Analysis

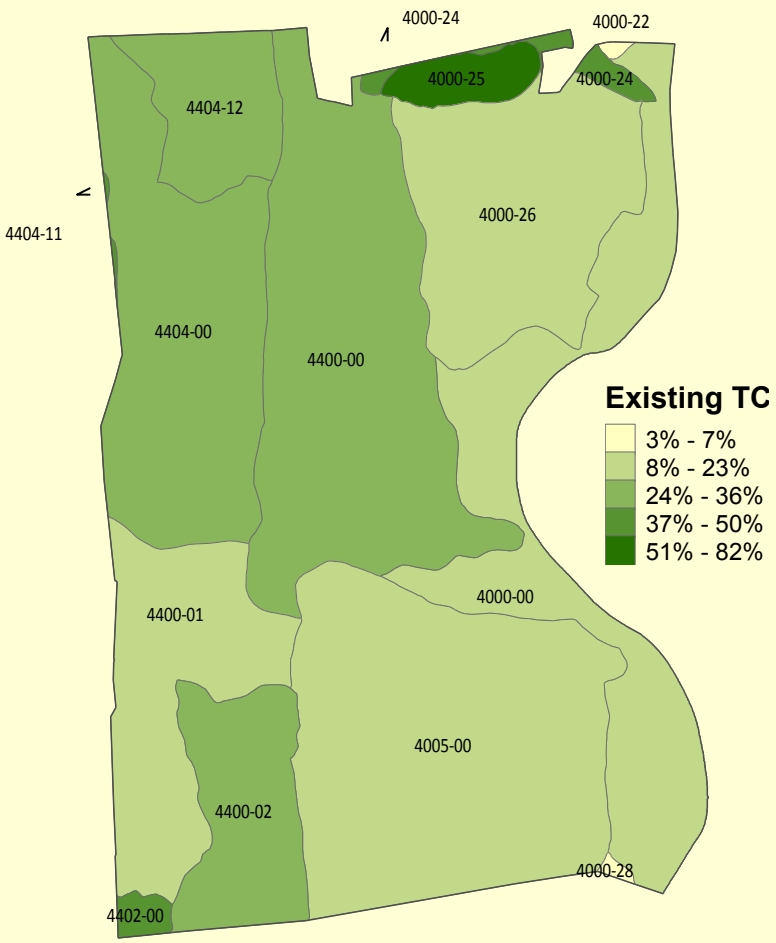


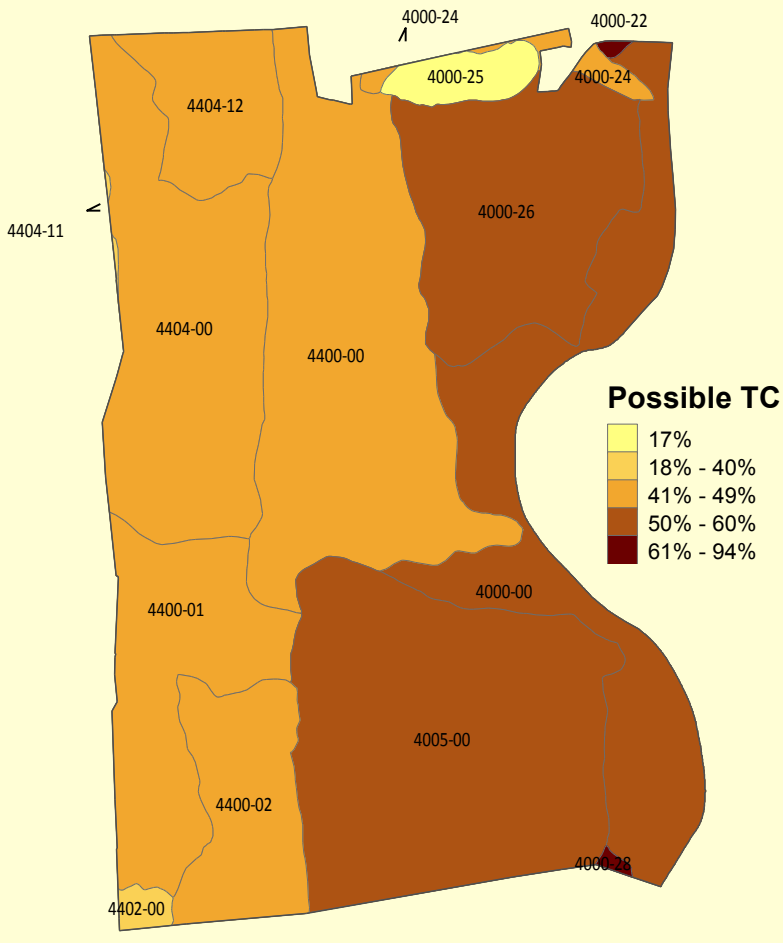
B-1
B-2
B-3
B-4
C-1
I-1
I-2
P
R-1
R-2
R-3
R-4
R-5
R-6
R-7
R-8
RO-1
RO-2
RO-3

Zoning TC Metrics

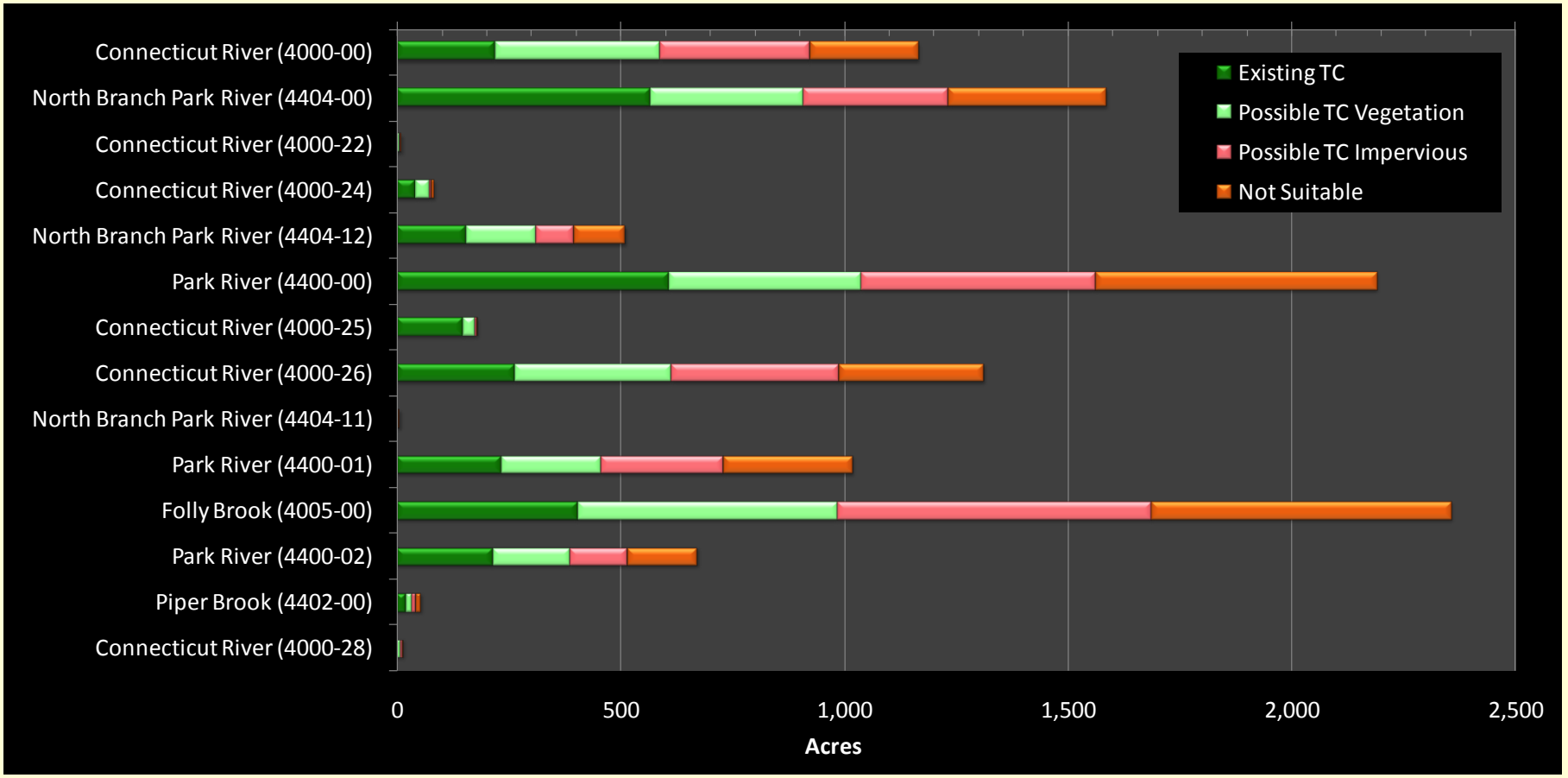


Watershed Analysis

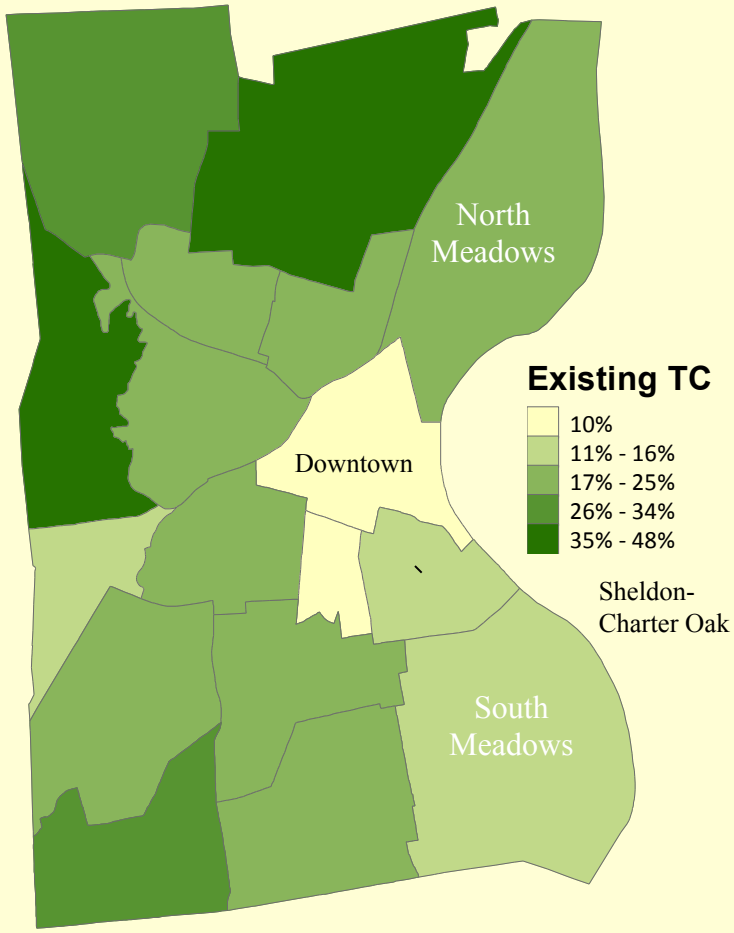


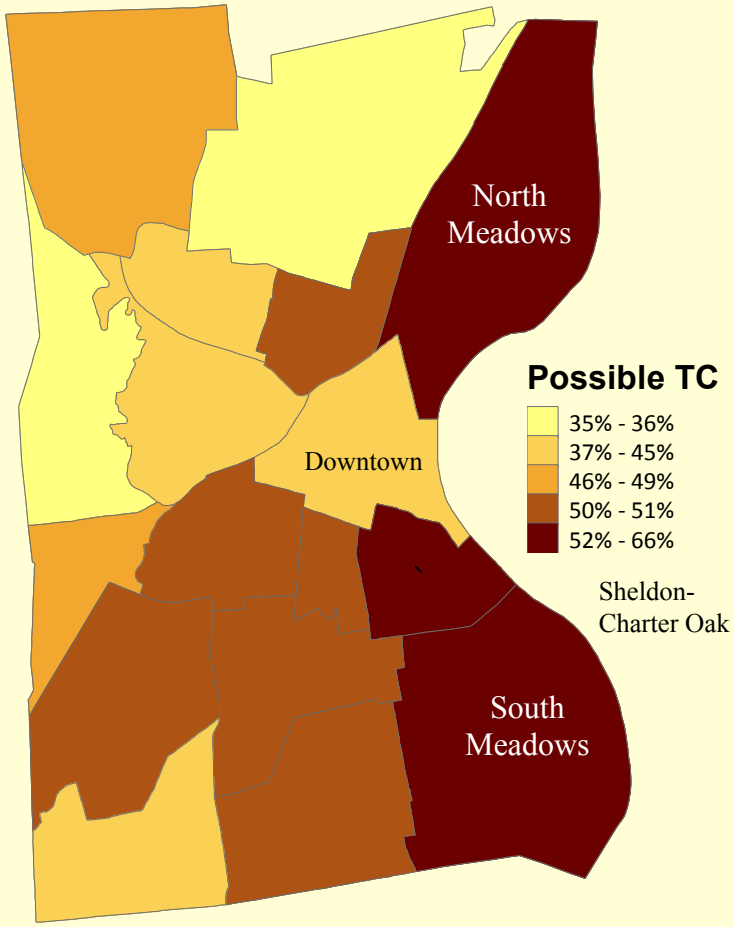


Watershed TC Metrics

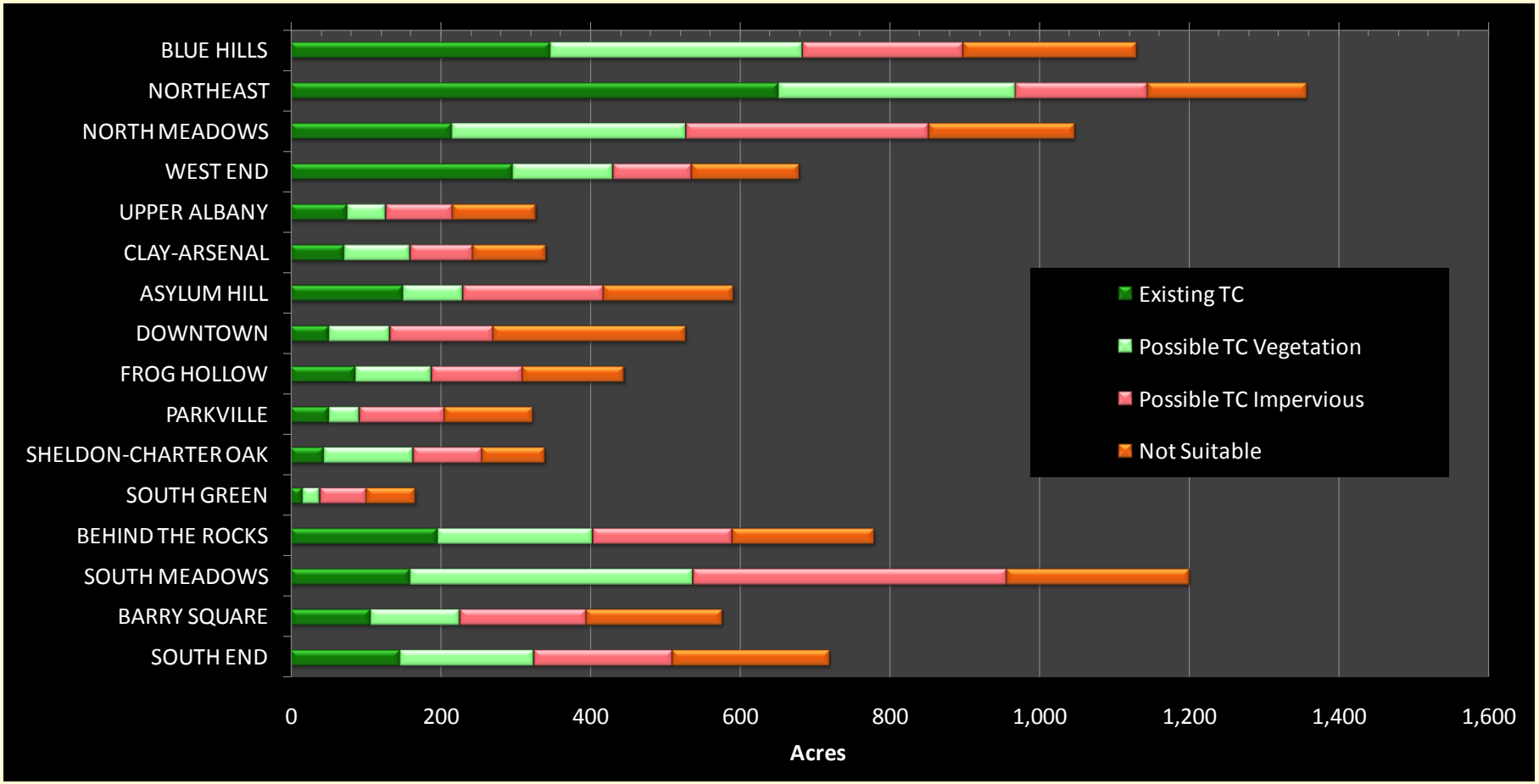


Neighborhood Analysis





Neighborhood TC Metrics



Two Connecticut UTC Reports Completed:

available on the DEEP Website – www.ct.gov/deep/forestry

A Report on the City of New Haven's Existing and Possible Urban Tree Canopy

Why is Tree Canopy Important?

Urban tree canopy (UTC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. Urban tree canopy provides many benefits to communities, including improving water quality, saving energy, lowering city temperatures, reducing air pollution, enhancing property values, providing wildlife habitat, facilitating social and educational opportunities, and providing aesthetic benefits. Establishing a UTC goal is crucial for those communities seeking to improve their green infrastructure. A UTC assessment that estimates the amount of tree canopy currently present (Existing UTC), along with the amount of tree canopy that could theoretically be established (Possible UTC), is the first step in the UTC goal-setting process.

How Much Tree Canopy Does New Haven Have?

An analysis of New Haven's urban tree canopy based on land cover derived from high-resolution aerial imagery (Figure 1) found that more than 4,468 acres of the city were covered by tree canopy (termed Existing UTC) representing 38% of all land in the city. An additional 41% (4,824 acres) of the city could theoretically be improved (Possible UTC) to support tree canopy (Figure 2). In the Possible UTC category, 21% (2,480 acres) of the city were Impervious Possible UTC and another 20% were Vegetated Possible UTC (2,344 acres). Vegetated Possible UTC, or grass and shrubs, is more conducive to establishing new tree canopy, but establishing tree canopy on Impervious Possible UTC will have a greater impact on water quality.

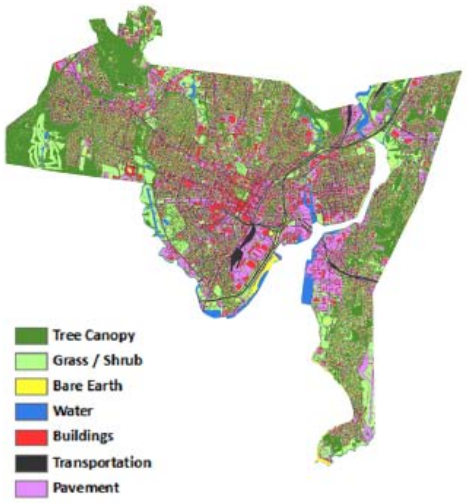


Figure 1: Land cover derived from high-resolution aerial imagery for the City of New Haven.

Project Background

The analysis of New Haven's urban tree canopy (UTC) was carried out in collaboration with the City of New Haven, the Urban Resources Initiative at the Yale School of Forestry & Environmental Studies, The University of Connecticut's Center for Land Use Education & Research, and the State of Connecticut Department of Environmental Protection. The analysis was performed by the Spatial Analysis Laboratory (SAL) of the University of Vermont's Rubenstein School of the Environment and Natural Resources, in consultation with the USDA Forest Service's Northern Research Station.

The goal of the project was to apply the USDA Forest Service's UTC assessment protocols to the City of New Haven. This analysis was conducted based on year 2008 data.

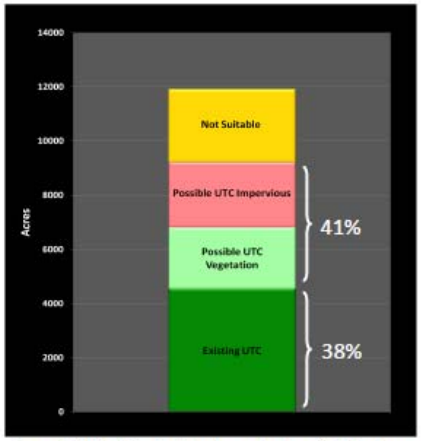


Figure 2: UTC metrics for New Haven based on % of land area covered by each UTC type.

Key Terms

UTC: Urban tree canopy (UTC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above.
Land Cover: Physical features on the earth mapped from aerial or satellite imagery, such as trees, grass, water, and impervious surfaces.
Existing UTC: The amount of urban tree canopy present when viewed from above using aerial or satellite imagery.
Impervious Possible UTC: Asphalt or concrete surfaces, excluding roads and buildings, that are theoretically available for the establishment of tree canopy.
Vegetated Possible UTC: Grass or shrub area that is theoretically available for the establishment of tree canopy.

A Report on the City of Hartford, Connecticut's Existing and Possible Tree Canopy

Why is Tree Canopy Important?

Tree canopy (TC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. Tree canopy provides many benefits to communities, improving water quality, saving energy, lowering city temperatures, reducing air pollution, enhancing property values, providing wildlife habitat, facilitating social and educational opportunities, and providing aesthetic benefits. Establishing a TC goal is crucial for communities seeking to improve their green infrastructure. A TC assessment is the first step in this goal-setting process, providing estimates for the amount of tree canopy currently present in a municipality as well as the amount of tree canopy that could theoretically be established.

How Much Tree Canopy Does Hartford Have?

An analysis of Hartford's tree canopy based on land cover derived from high-resolution aerial imagery (Figure 1) found that more than 2,870 acres of the city were covered by tree canopy (termed Existing TC), representing 26% of all land in the city. An additional 49% (5,488 acres) of the city could theoretically be modified (Possible TC) to accommodate tree canopy (Figure 2). In the Possible TC category, 25% (2,778 acres) of the city was classified as Impervious Possible TC and another 24% was Vegetated Possible TC (2,711 acres). Vegetated Possible TC, or grass and shrubs, is more conducive to establishing new tree canopy, but establishing tree canopy on Impervious Possible TC will have a greater impact on water quality.

Figure 1: Land cover derived from high-resolution aerial imagery for the City of Hartford.

Project Background

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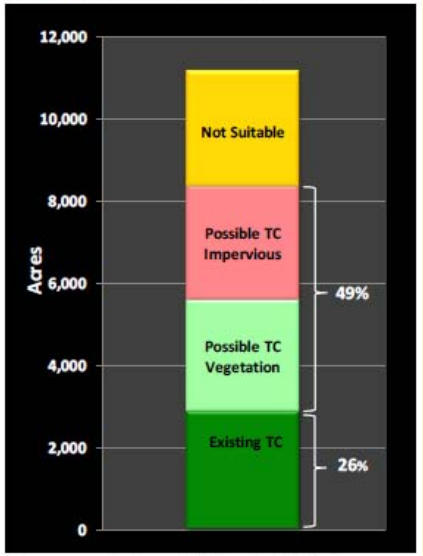

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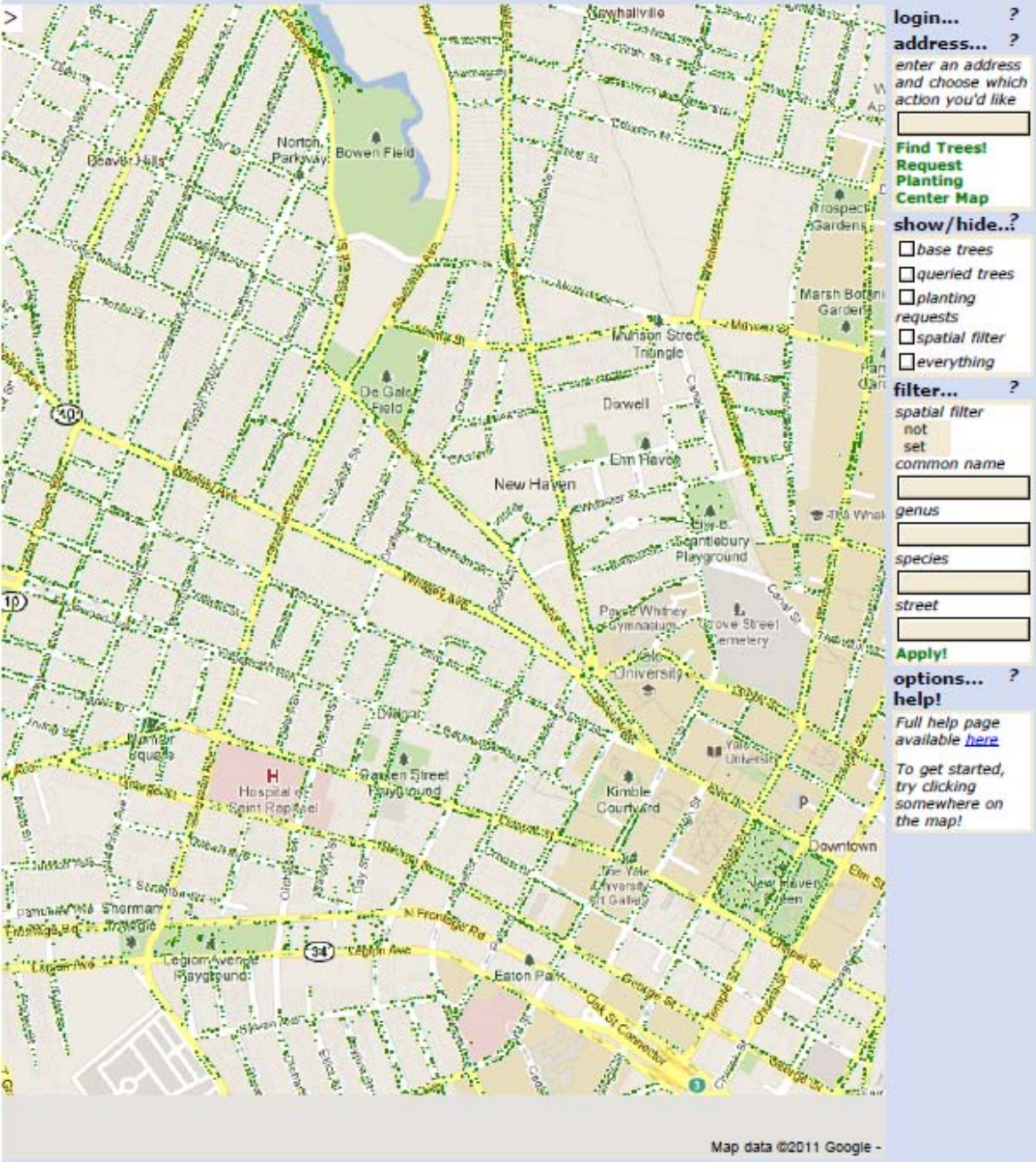
Key Terms

TC: Tree canopy (TC) is the layer of leaves, branches, and stems of trees that cover the ground when viewed from above.
Land Cover: Physical features on the earth mapped from aerial or satellite imagery, such as trees, grass, water, and impervious surfaces.
Existing TC: The amount of urban tree canopy present when viewed from above using aerial or satellite imagery.
Impervious Possible TC: Asphalt or concrete surfaces, excluding roads and buildings, that are theoretically available for the establishment of tree canopy.
Vegetated Possible TC: Grass or shrub area that is theoretically available for the establishment of tree canopy.



login... ?

address... ?

enter an address and choose which action you'd like

Find Trees!
Request Planting
Center Map

show/hide... ?

- ☐ *base trees*
- ☐ *queried trees*
- ☐ *planting requests*
- ☐ *spatial filter*
- ☐ *everything*

filter... ?

spatial filter not set

common name

genus

species

street

Apply!

options... ?

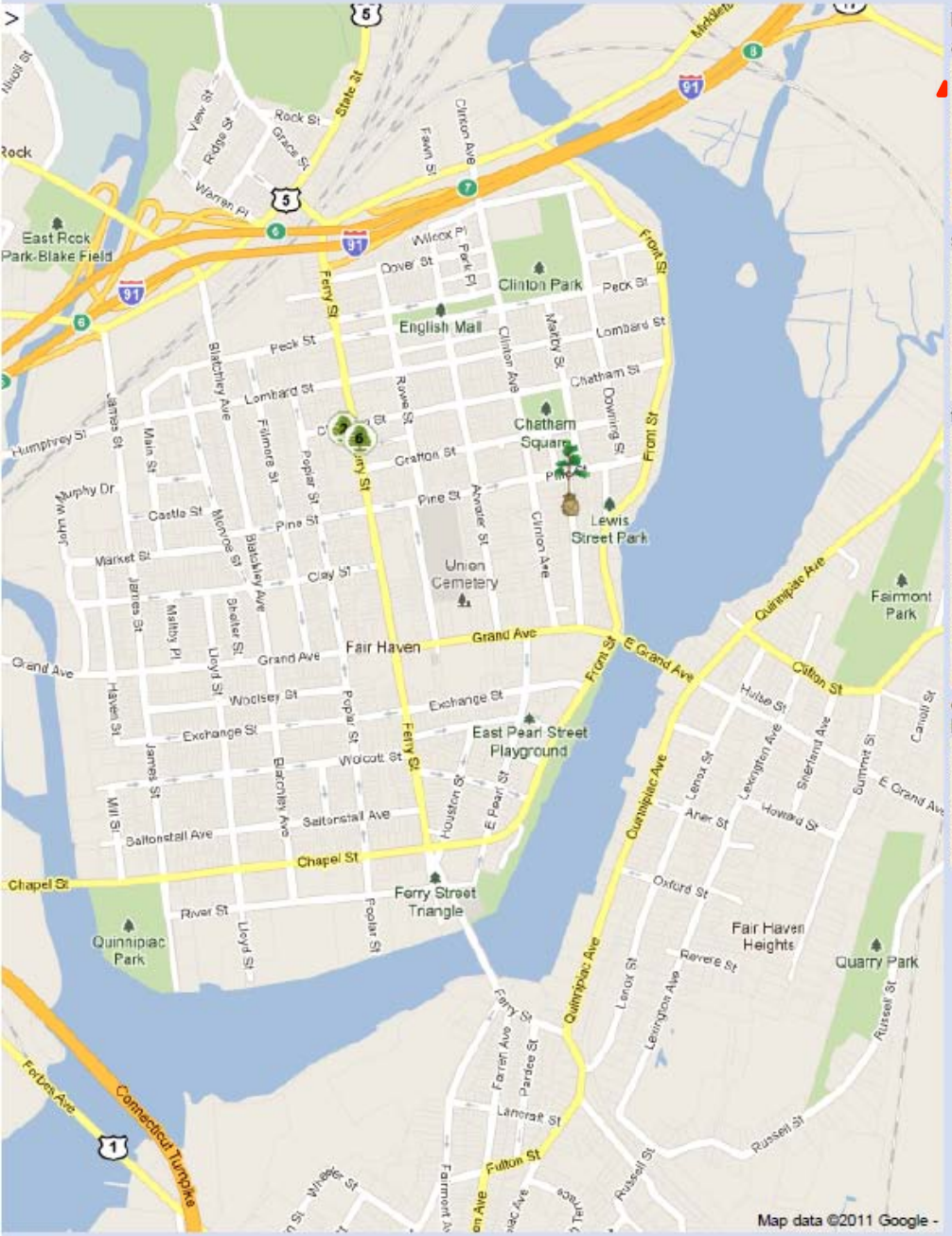
help!

Full help page available here

To get started, try clicking somewhere on the map!

New Haven Interactive Street Tree Map

http://environment.yale.edu/uri/maps/street-tree-inventory-map/



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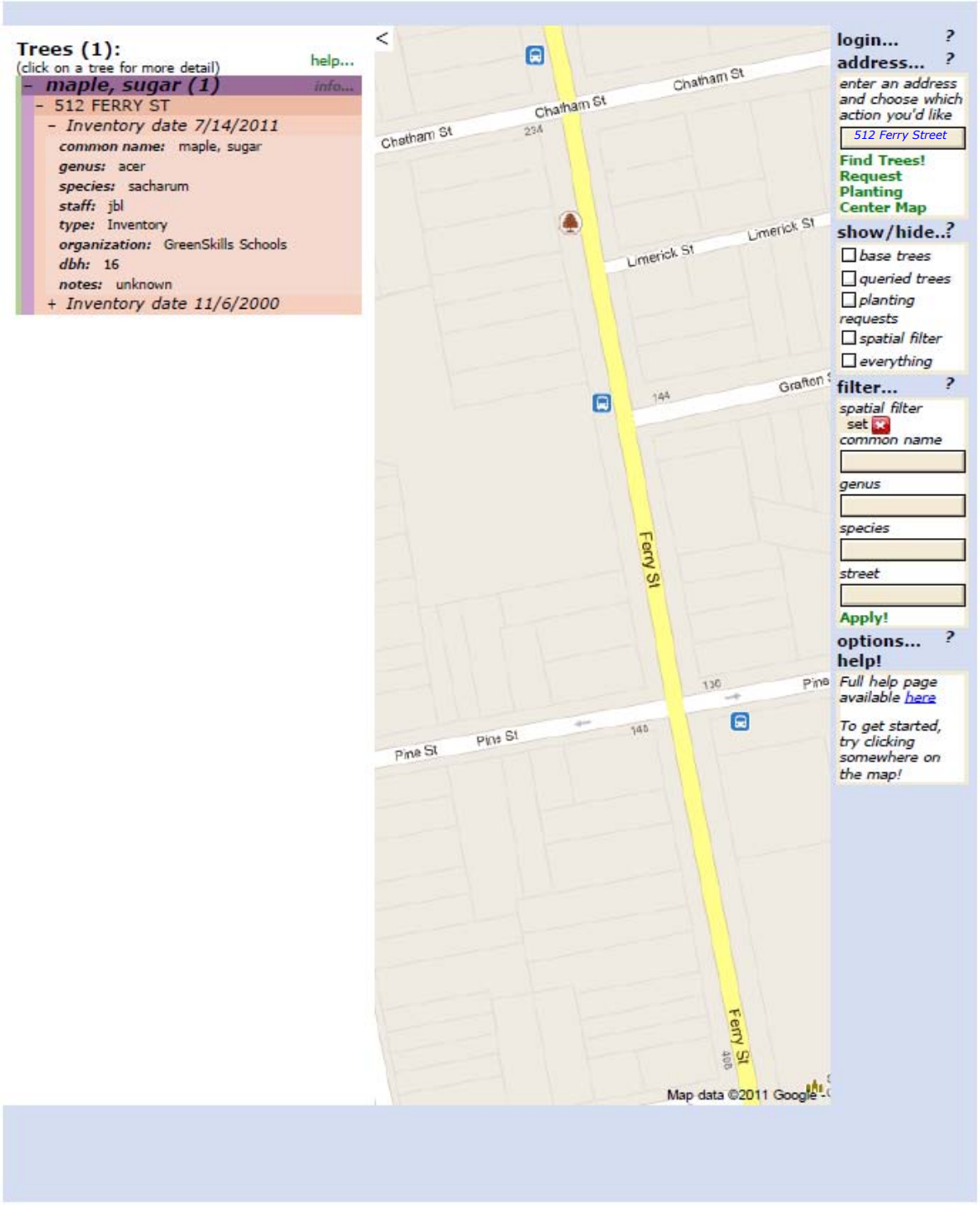


http://environment.yale.edu/uri/maps/street-tree-inventory-map/

i-Tree Design *Beta*

512 Ferry St, New Haven, CT 06513, USA

Home

Get started with these easy steps:

Enter your tree's species:

Maple, Sugar

Note: If you're looking for a Willow Oak, it's listed as "Oak, Willow". If your tree isn't listed, use the general "Other" listings.

Enter how wide (diameter) your tree is at 4.5 feet above the ground: [ ] inches.

Note: This measurement is what foresters call "diameter at breast height".

Enter what type of condition best describes your tree: Excellent

Check here if you would like to evaluate energy effects: ☐

Calculate Benefits

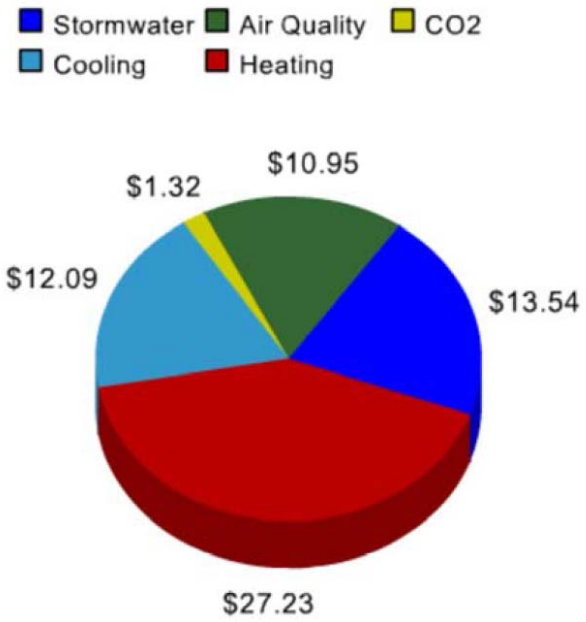
Bearing:58.3,Distance:8.5m (27.7ft)

Vertices:11; Area:165.3 m^2 (1779.1 ft^2)

pre-1950

i-Tree Design *Beta* 512 Ferry St, New Haven, CT 06513, USA

Overall Benefit | Storm Water | Energy | Air Quality | CO2



Breakdown of your tree's benefits

Click on one of the tabs above for more detail

This 16 inch Sugar maple provides overall benefits of: $65 every year.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations to better understand the environmental and economic value associated with trees and their placement.

Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

If this tree is cared for and grows to 21 inches, it will provide $75 in annual benefits.

Thank You