



Thank You for the Invitation...



2011 Certified Tree Steward Program



*David Bloniarz
USDA Forest Service
Northern Research Station
Amherst, Massachusetts*

i-Tree Overview

Tools for Tree Inventory & Assessment



*David Bloniarz
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Amherst, Massachusetts*

i-Tree Overview

Tools for Tree Inventory & Assessment



www.unri.org/research-documents

Overview of Today's Presentation:



Urban Forests



i-Tree Software

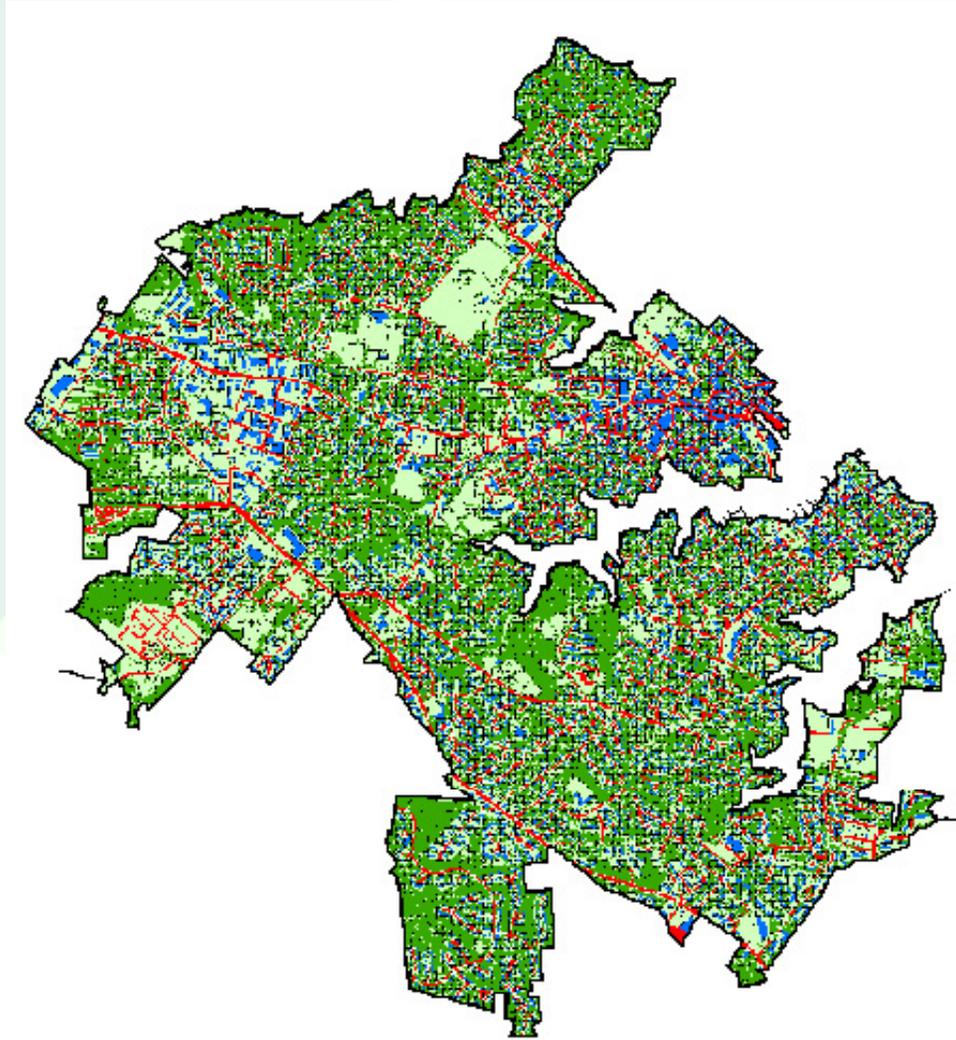


Using the Tools

Urban Forests & Tree Canopy



Urban Forests & Tree Canopy



Annapolis, MD

Urban Forests & Tree Canopy



Brooklyn, NY

What is i-Tree?



 A suite of tools to assess urban vegetation and their ecosystem services and values



Public-Private Partnership



 **USDA Forest Service**



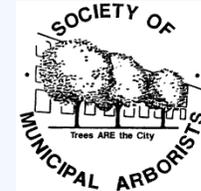
 **Davey Tree Expert Co.**



 **National Arbor Day Foundation**



 **Society of Municipal Arborists**



 **International Society of Arboriculture**



 **Casey Trees**



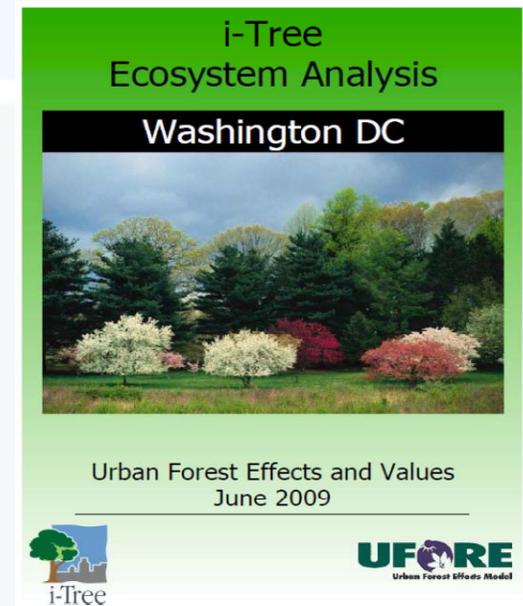
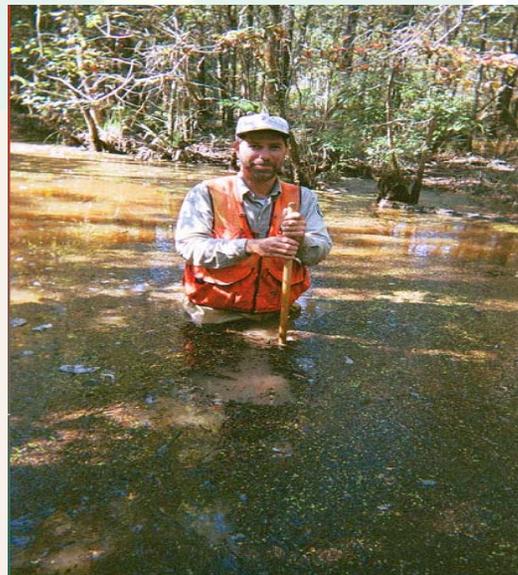
Goals

- Simple and low-cost tools and methods to aid in urban forest planning and management
- Complete process – start to finish



Croyden Road

13



Assessing Tree Populations



i-Tree assesses:

- 🌳 Structure
- 🌳 Function
 - Energy use
 - Air pollution
 - Carbon
 - VOC emissions
- 🌳 Value
- 🌳 Management needs
 - Pest risk
 - Tree health
 - Exotic/invasive spp.

I. Tree Characteristics of the Urban Forest

The urban forest of Washington DC has an estimated 2,043,000 trees with a tree cover of 29.6 percent. Trees that have diameters less than 6-inches constitute 56.7 percent of the population. The three most common species are American beech (14.60 percent), Red maple (6.43 percent), and Boxelder (6.17 percent).

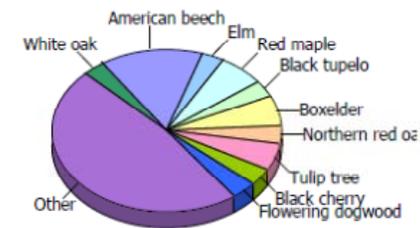


Figure 1. Tree species composition in Washington DC

Among the land use categories, the highest tree densities occur in Forest followed by Ag./Water/Wetlands and Developed, open. The overall tree density in Washington DC is 128 trees / hectare (see Appendix III for comparable values from other cities).

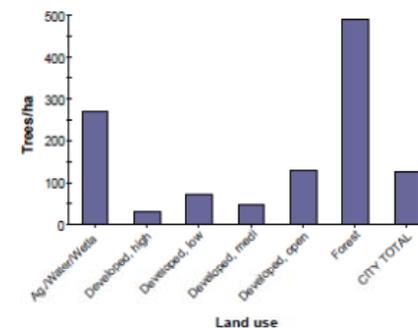


Figure 2. Number of trees/ha in Washington DC by land use

The Foundation: Local Data

Local Sample or Inventory

Local information:

 Weather

 Pollution

 Environmental variables

Hourly simulations



Benefit-Based Approach



Conserving Energy



Image courtesy of the Center for Urban Forest Research

Conserving Energy



- **Save up to 30% of annual air conditioning costs**

- **Save 10-25% of winter heating costs**

Improving Air Quality

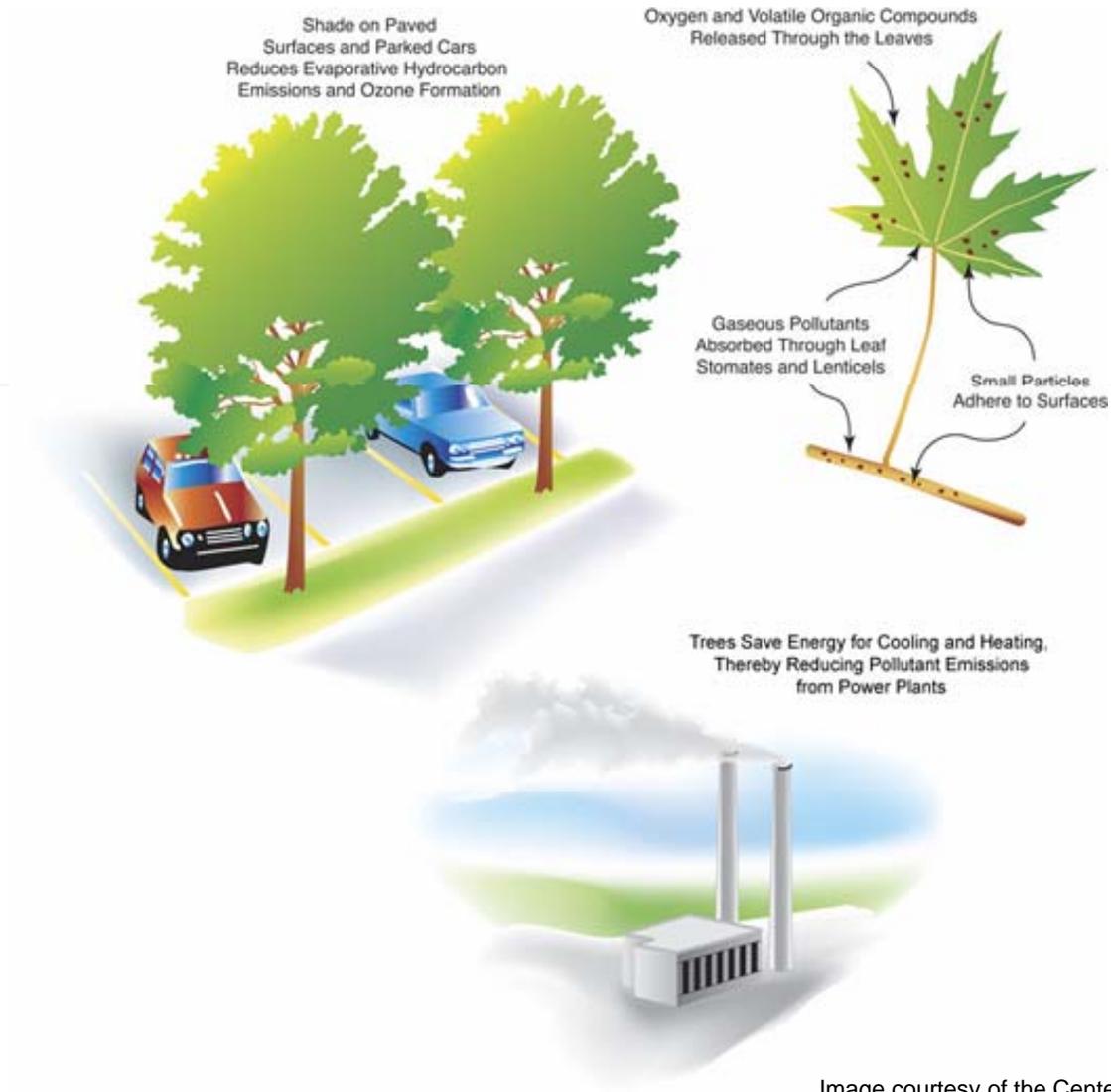


Image courtesy of the Center for Urban Forest Research

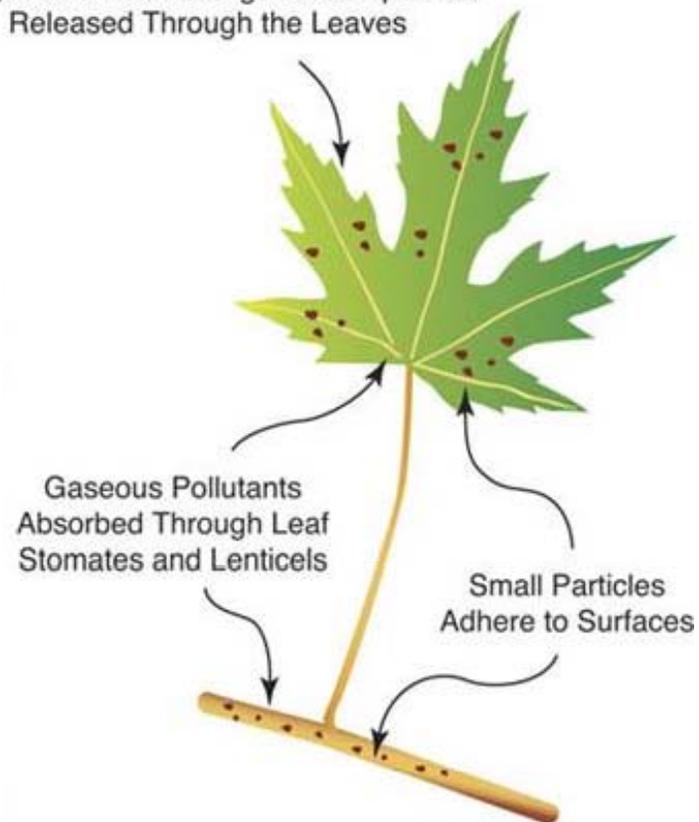
Improving Air Quality



Oak at 20 years (lbs):

- 🌳 NO₂ = 0.98
- 🌳 SO₂ = 2.72
- 🌳 PM₁₀ = 0.52
- 🌳 Ozone = 0.84
- 🌳 VOCs = 0.21

Oxygen and Volatile Organic Compounds
Released Through the Leaves



Reducing Atmospheric Carbon Dioxide



Trees Save Energy for Cooling,
Thereby Reducing CO₂ Emissions
from Power Plants



Trees Sequester
CO₂ in Trunk,
Branches, Leaves,
and Roots as
They Grow

Mulch

CO₂ is Released
Via Decomposition
of Dead Wood
and Mulch

CO₂ is Released
Via Tree Care
Activities

Reducing Atmospheric Carbon Dioxide



100 trees remove five tons of CO₂/year



100 trees remove about 1000 lbs of pollutants per year, including:

400 lbs of ozone

300 lbs of particulates

Reducing Stormwater Runoff

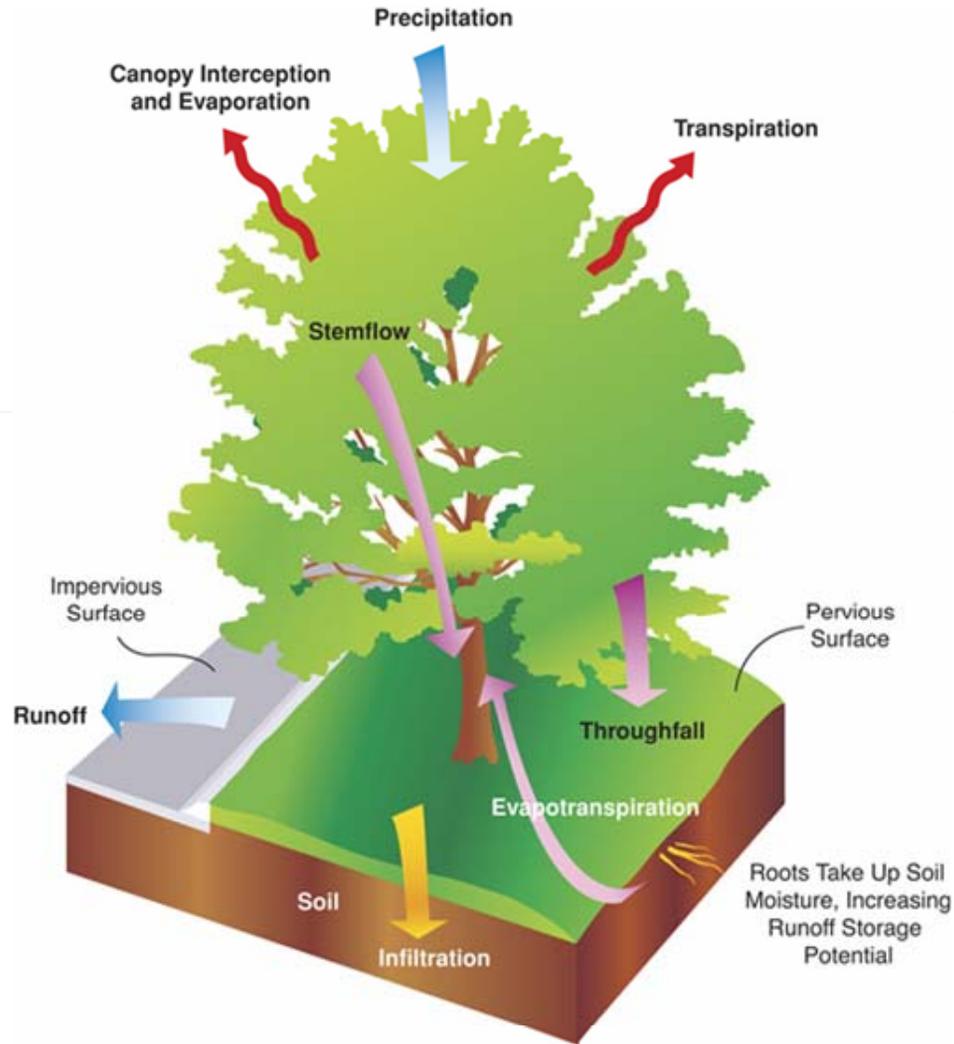
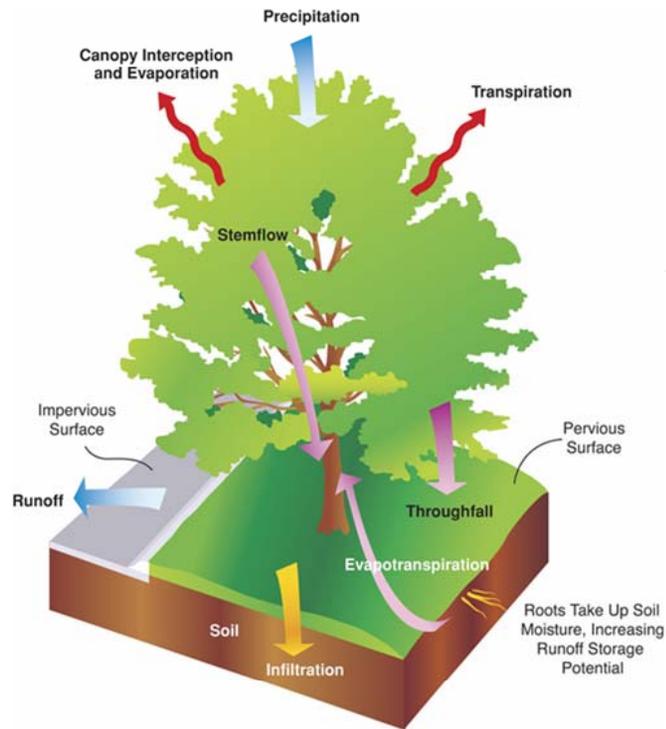


Image courtesy of the Center for Urban Forest Research

Reducing Stormwater Runoff



**100 mature trees intercept
100,000 gallons of rainwater
per year...**

- Less \$ for stormwater control
- Cleaner water

Aesthetic and Other Benefits



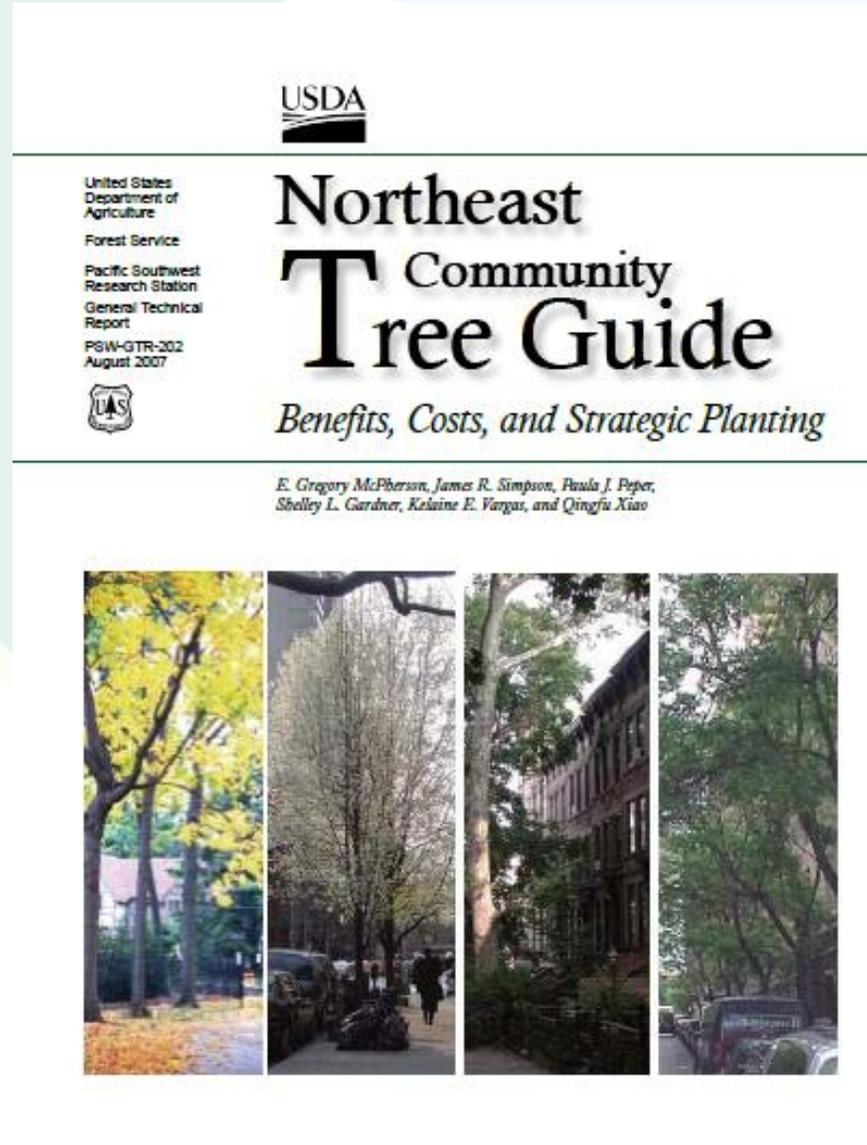
Others Things Trees Do....



Reduce human stress
Safer neighborhoods
Less domestic violence

Speed medical recovery times
Improve business
Increase property value

Quantifying the Benefits of Trees



Credit: Urban Advantage

i-Tree is...



Development, Dissemination, Support, & Refinement

Credible, USDA

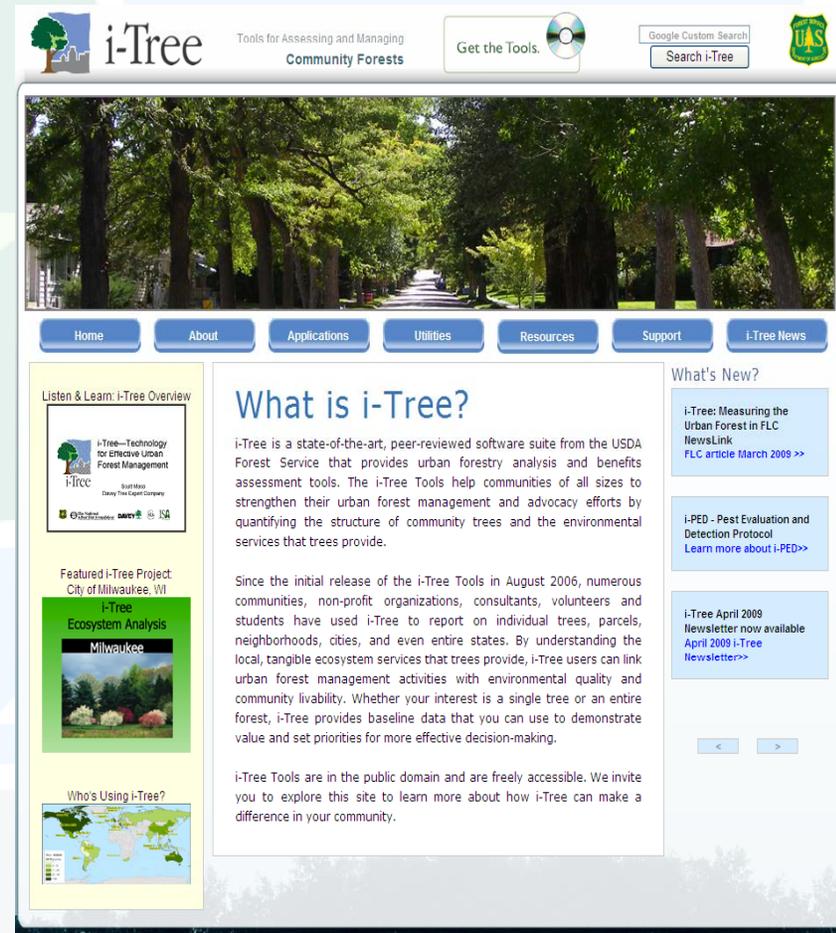
**FS peer-reviewed
tools**

Public Domain Software

Accessible

Technical Support

*“Putting USFS Urban Forest
science into the hands of users”*



The screenshot shows the i-Tree website homepage. At the top, there is a navigation bar with the i-Tree logo, the tagline "Tools for Assessing and Managing Community Forests", a "Get the Tools" button with a CD icon, a Google Custom Search box, and the USDA logo. Below the navigation bar is a large banner image of a tree-lined street. Underneath the banner is a horizontal menu with buttons for Home, About, Applications, Utilities, Resources, Support, and i-Tree News. The main content area is divided into three columns. The left column features a "Listen & Learn: i-Tree Overview" section with a small i-Tree logo and text, a "Featured i-Tree Project" section for the City of Milwaukee, WI, titled "i-Tree Ecosystem Analysis" with a thumbnail image, and a "Who's Using i-Tree?" section with a world map. The middle column has a "What is i-Tree?" section with a heading and a paragraph explaining the software suite. The right column has a "What's New?" section with three news items: "i-Tree: Measuring the Urban Forest in FLC NewsLink FLC article March 2009 >>>", "i-PED - Pest Evaluation and Detection Protocol Learn more about i-PED>>>", and "i-Tree April 2009 Newsletter now available April 2009 i-Tree Newsletter>>>".

What's Included?



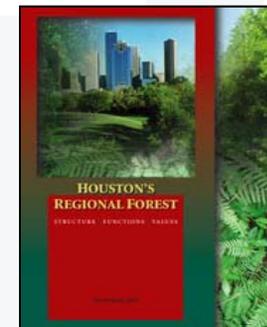
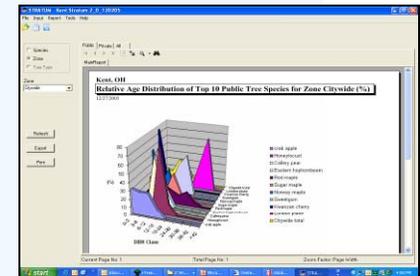
Two urban forest assessment tools:

- Assessing street tree populations
- Assessing urban ecosystems



Urban forest management utilities:

- Species Selection
- Benefit Mapping
- Stream flow & water quality (coming soon!)



Assessing Street Tree Populations



i-Tree Streets:

- 🌳 Structure
- 🌳 Function
 - Energy
 - Air pollution
 - Stormwater
 - Carbon
 - Property Value
- 🌳 Value
- 🌳 Management needs



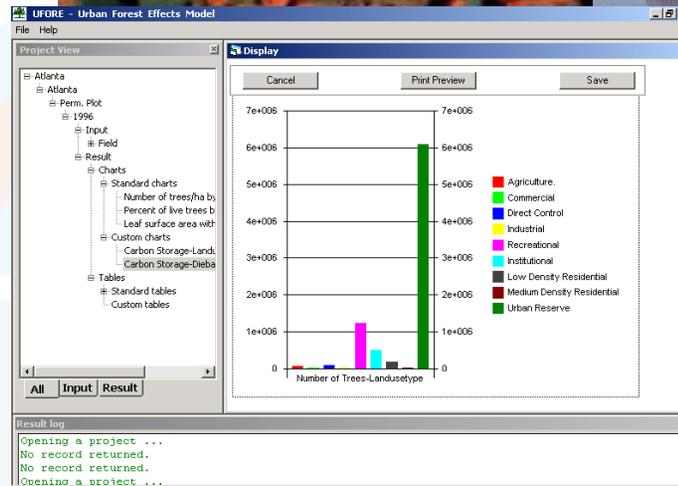
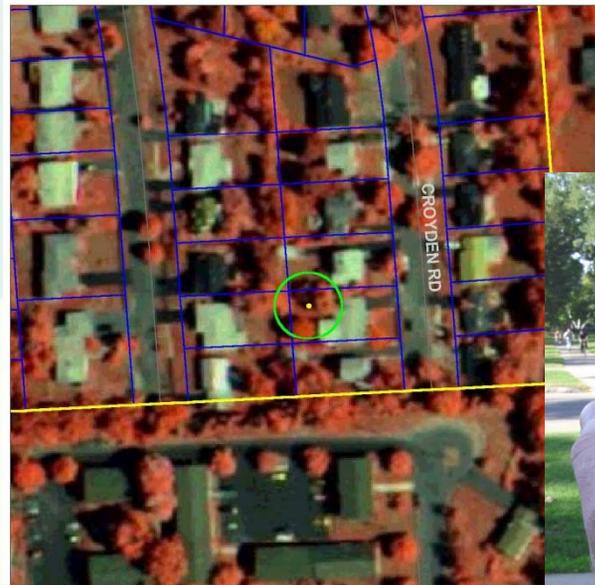
	Total (\$)	\$/capita	\$/tree
Benefit	501,064	11.31	93.64
Cost	94,000	2.12	17.57
Net Benefits	407,064	9.19	76.07
Benefit-Cost Ratio	5.33	5.33	5.33

Assessing Urban Ecosystems



i-Tree Eco:

- Structure
- Function
 - Energy
 - Air pollution
 - Carbon
- Value
- Management
 - Health
 - Pest impacts



April 18, 2007

Maybe Only God Can Make a Tree, but Only People Can Put a Price on It

- Climate change
 - Storm water mgt.
 - Pollution mitigation
 - Energy conservation
 - Carbon strategies
 - Public health issues
- 
- Economic development
 - Green job creation

Using technology to tell a story?



Credit: Waldo Nilo

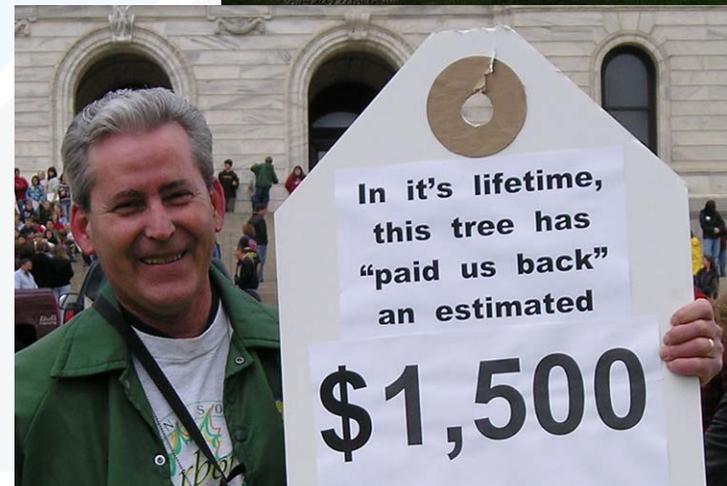


i-Tree: Demonstrating That Trees Pay Us Back!



Street Tree Benefits in Minneapolis:

- 🌳 \$6.8 million in energy savings
- 🌳 \$9.1 million in reduced storm water runoff
- 🌳 \$7.1 million increase in property value
- 🌳 \$1 million improvements to air quality



Monday, November 2nd, 2009



Re-Elect Jo
McE
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YOU ARE HERE: [HOME](#) / [CITY HALL](#) / PARK LANE TREES GET REPORT CARDS; SOME QUESTION PROGRAM

Park Lane trees get report cards; some question program

3

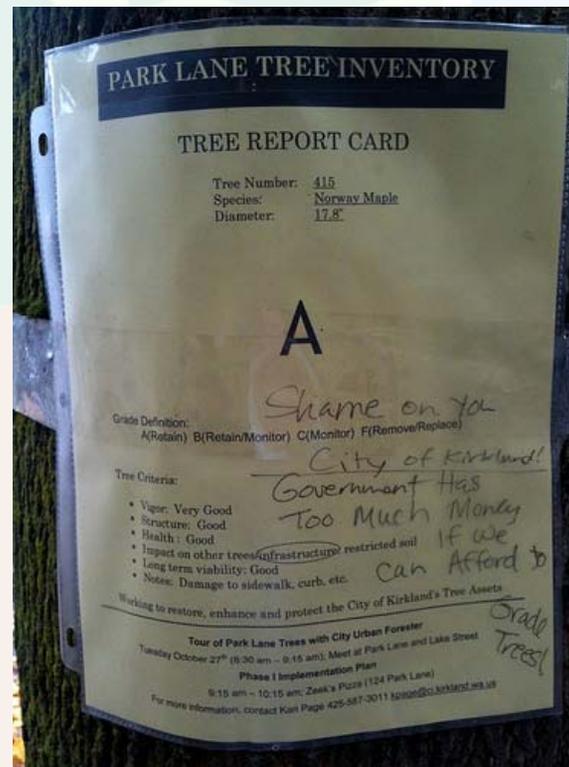


The City of Kirkland has given each tree along Park Lane a report card and some of them are not doing so well. The report cards state that the city is "working to restore, enhance

How do we communicate the value of community trees?



🌳 ***“Shame on you City of Kirkland! Government has too much money if we can afford to grade trees!”***



*City of Pittsburgh, Pennsylvania
Municipal Forest Resource Analysis*

April, 2008



**\$2.94 in
benefits for
every \$1 spent**

*Benefit Summary for
Pittsburgh's Street Trees*

+ Benefits	Total (\$)
 Energy	\$1,205,133
 CO2	\$35,424
 Air Quality	\$252,935
 Stormwater	\$334,601
 Aesthetic/Other	\$572,882
<hr/>	
 Total Benefits	\$2,400,975

Using i-Tree Data to Inform

Knowing why you are implementing i-Tree and specifically what you want out of it.

- 🌳 Credibility
- 🌳 Quantification using sound science

“Trees are a favorite tool because every tree intercepts about 1,400 gallons of rainfall”

--Danielle Crumrine

PITTSBURGH TRIBUNE-REVIEW™

[Larger text](#) [Smaller text](#)

SHARE    

A coalition in East Liberty is tackling stormwater issues

By Mike Cronin
TRIBUNE-REVIEW
Tuesday, July 22, 2008

 Buzz up!
Buzz up!

Not many things are less sexy than raw sewage flowing into Western Pennsylvania waterways. But few are more important, said Nate Wildfire, a policy coordinator for East Liberty Development Inc.

"People don't understand that the water you flush down the toilet and the water that goes into stormwater drains go to the same place," Wildfire said.

Multimedia

PDF: East Liberty
Porous streets
[View PDF Now](#)

Photo Gallery



Chestertown, MD: Linking technology with policy



Energy	\$31,280
Carbon	\$7,760
Air quality	\$8,287
Stormwater	\$83,413
Property	\$103,020
Total annual benefits	\$223,750



Chestertown i-Tree Streets Project Details



- 🌳 Project expenses **\$2,000 approx.**
- 🌳 Funding assistance **Chesapeake Bay Trust grant**
- 🌳 Key Partner **Washington College- CES**
- 🌳 Project manager **Local resident (retired forester)**
- 🌳 Inventory type **15% random sample**
- 🌳 Data collection **40 students & trained vols.**
- 🌳 Data collection **3 - Days**
- 🌳 Total project time **Approx. 3 months**

Milwaukee i-Tree Eco Assessment Emerald Ash Borer (EAB)



EAB Structural Impacts:

17.4% Canopy Loss

\$221 Million structural damage (citywide)

EAB Functional Impacts:

- 🌳 \$243,785 less pollutant removal**
- 🌳 \$138,000 less energy savings (cooling costs)**
- 🌳 \$2.6 million reduction in storm water benefits (1996 study)**



Milwaukee Ecosystem Assessment



Oakville, Ontario i-Tree Eco Study

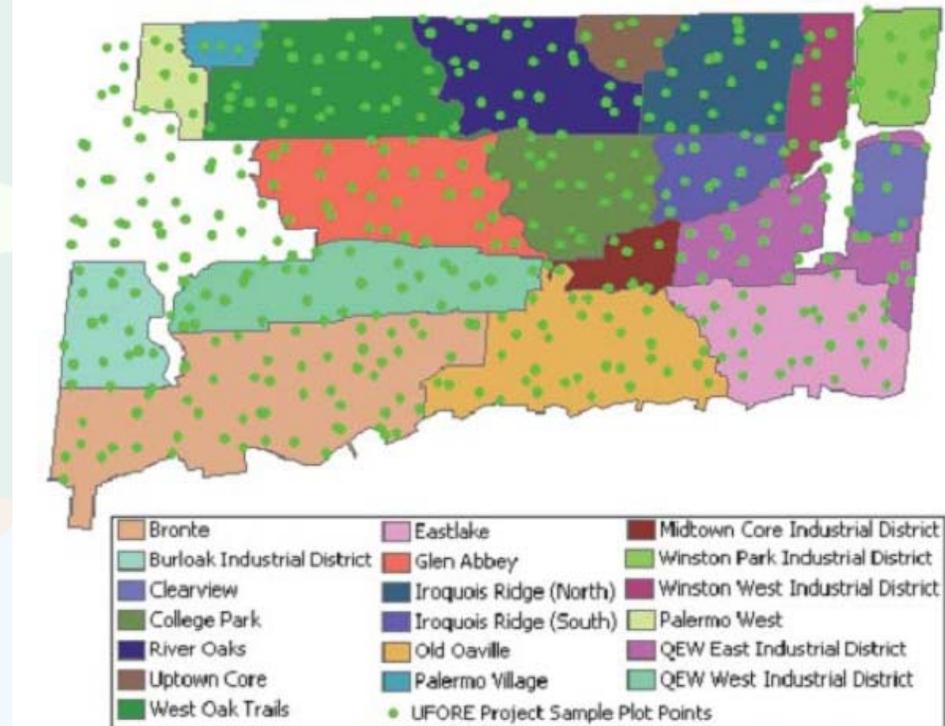


UFORE Plot Atlas

Plot: 11
 Address: STEVENSON RD
 Land Use: Residential

Parks and Open Spaces, Forestry Section
 P.O. Box 310, 1125 Trafalgar Road
 Oakville, Ontario L6L 4M1
 905-849-6001

- UFORE Plots
- Address Points
- UFORE Plot Buffers



Oakville, Ontario i-Tree Eco Study

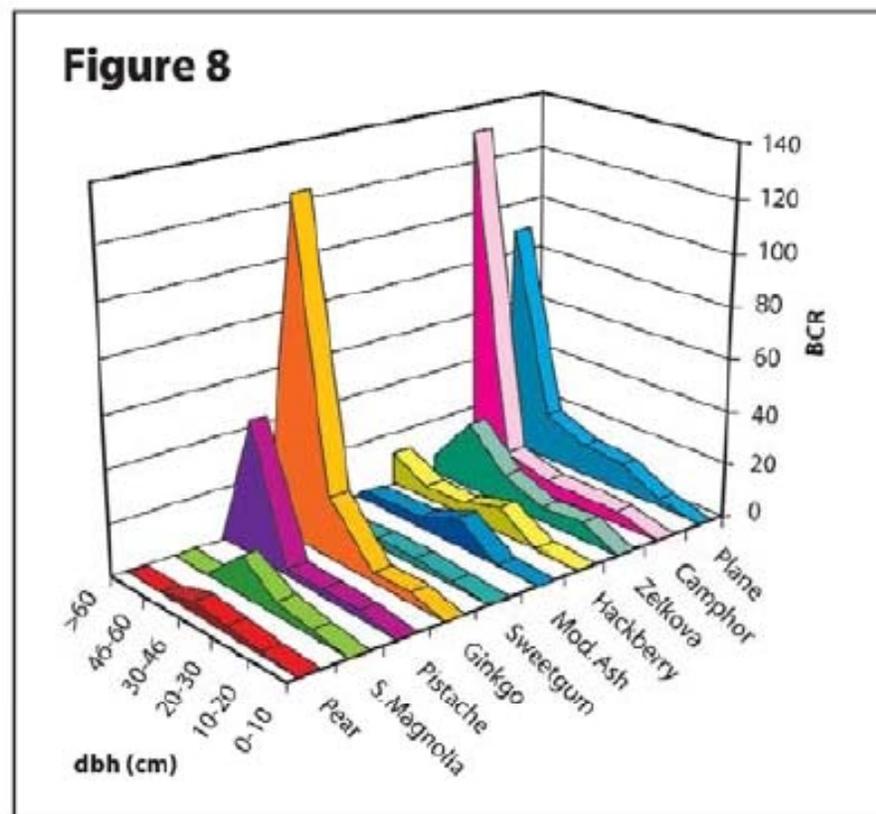
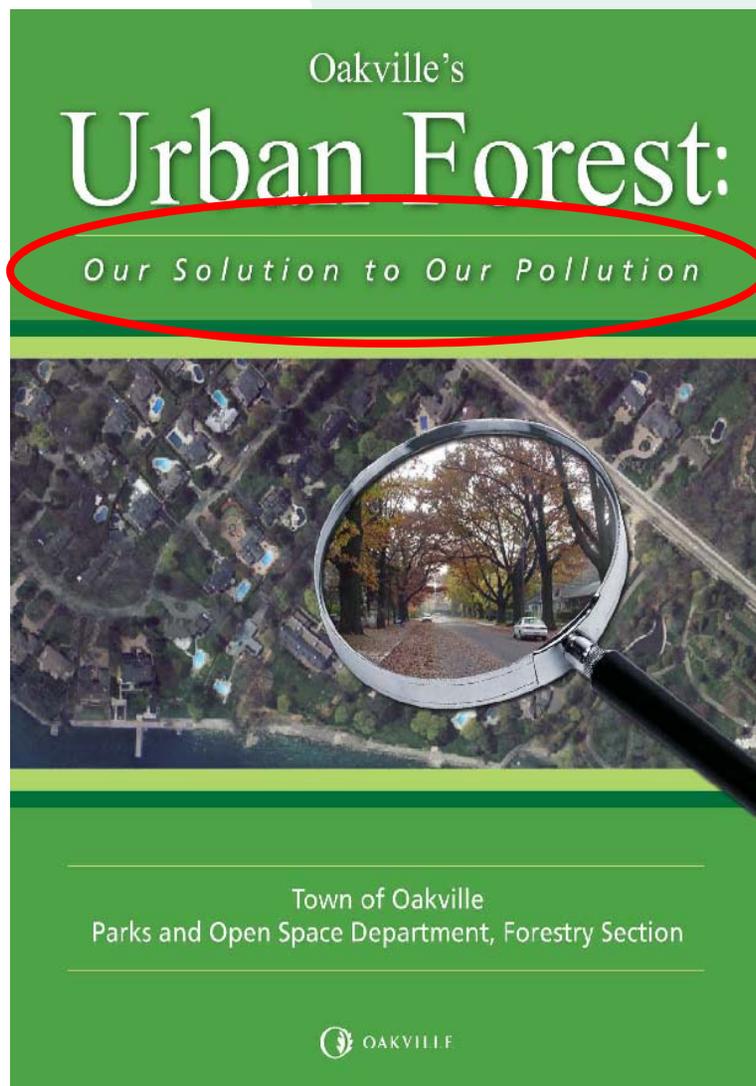
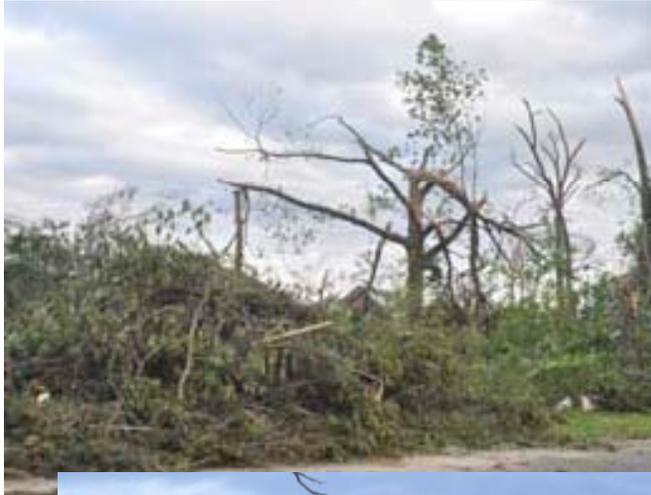


Figure 8. Distribution of benefit-cost ratios (BCR) among species by dbh class (McPherson 2003)

Springfield Massachusetts June 1, 2011 Tornado



Springfield Massachusetts June 1, 2011 Tornado





INFORMATIONAL BRIEF

3.0

June 23, 2011

Kipling Street
East Forest Park
Springfield, MA



i-Tree Streets Analysis of Springfield Tornado Impact Zone



Tornado Damage Quick Facts Impacts on Springfield's Street Trees

On June 1, 2011 a series of three tornadoes ripped through Western Massachusetts, and included the second strongest tornado ever recorded in Massachusetts, with wind speeds estimated at 136 to 165 mph, according to the National Weather Service. The most severe tornado was the EF-3, on the Enhanced Fujita Damage Classification Scale, that carved a half-mile-wide path for 39 miles from Westfield to Charlton, killing three people and injuring 100. In Springfield, the tornadoes impacted city's South End, Six Corners, East Forest Park and Sixteen Acres neighborhoods.

In the neighborhoods of Springfield affected by the storms, damage to the street trees was extensive, destroying or severely many of the public trees growing in these areas. A team of US Forest Service and City of Springfield personnel conducted a preliminary review of the streets in these neighborhoods, and an initial summary of the storm impacts was developed.

A preliminary review of the storm damage to Springfield public street trees follows here:

- 87 miles of the 540 total miles of city streets were impacted by the storms;
- 16.1 % of Springfield's streets showed some damage to the public trees growing on them;
- Approximately 1,340 of the 3,830 streets trees, growing in the impacted areas, were destroyed or severely damaged, necessitating removal;
- Immediate impacts include the reduction of rainwater interception by 2,444,252 gallons;
- Reduced storage of 7,220,361 pounds of carbon;
- Approximately 331,232 pounds of sequestered CO² has been lost.



i-TreeTM

Streets

For more information please contact:



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Alexander R. Sherman
City of Springfield
Assistant City Forester
arsherman@eco.umass.edu

Annual Loss in Benefits of Springfield's Street Trees



Annual Benefits of Impact Zone Street Trees			
Benefit	Quantity	Impact Zone Value	Loss Value
Energy Saved			
Electricity (MWh)	360.6	\$18,393	\$4,598
Natural Gas (therms)	129,018.6	\$85,439	\$29,903
Total (\$)		\$103,832	\$34,501
Carbon Dioxide			
CO ₂ Sequestered (lbs)	946,377	\$3,123	\$1,093
CO ₂ Released (lbs)	-244,714	-\$808	-\$283
CO ₂ Avoided (lbs)	1,086,259	\$3,585	\$1,255
Total (lbs, \$)	1,787,922	\$5,900	\$2,065
Air Quality			
Avoided pollutants* (lbs)	4954	\$21,451	\$7,508
Deposited pollutants** (lbs)	4264	\$22,958	\$8,035
BVOC emitted (lbs, \$)	-1,140	-\$2,634	-\$922
Total (lbs, \$)	8,078	\$41,775	\$14,621
Storm Water			
Rainfall intercepted (gal)	6,983,576	\$55,872	\$19,555
Aesthetic/Other			
Added Property Value		\$140,569	\$49,199
TOTAL VALUE		\$347,948	\$121,782

*NO 2 , SO 2 , VOC, PM10 **O 3 , NO 2 , PM10, SO 2



INFORMATIONAL BRIEF

July 7, 2011

Arcadia
Boulevard
Springfield, MA



i-Tree Canopy Analysis of Springfield Tornado Zone



Tornado Damage Quick Facts Impacts on Springfield's Urban Forest



On June 1, 2011 a series of three tornadoes ripped through Western Massachusetts, and included the second strongest tornado ever recorded in Massachusetts, with wind speeds estimated at 136 to 165 mph, according to the National Weather Service. The most severe tornado was the EF-3, on the Enhanced Fujita Damage Classification Scale, that carved a half-mile-wide path for 39 miles from Westfield to Charlton, killing three people and injuring 200. In Springfield, the tornadoes impacted city's South End, Six Corners, East Forest Park and Sixteen Acres neighborhoods.

In the neighborhoods of Springfield affected by the storms, damage to the urban forest canopy was extensive, destroying or severely many of the trees growing in these areas. A team of US Forest Service and City of Springfield personnel conducted a preliminary review of the streets in the impacted neighborhoods, and utilized i-Tree modeling software to analyze the impacts of the storms on the urban forest, and an initial summary of the damage n was developed.

A preliminary review of the storm damage to Springfield's urban tree canopy follows here:

- Based on initial estimates, over 13,000 trees were destroyed or severely damaged;
- Immediate impacts include the reduction of rainwater interception by over 7.5 million gallons per year;
- Reduced storage of over 30 million pounds of carbon annually;
- Approximately 1.4 million pounds of sequestered CO² has been lost.



i-Tree™

Canopy



For more information please contact:
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City of Springfield
Assistant City Forester
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i-Tree Canopy Analysis of Springfield Tornado Zone

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- Immediate impacts include the reduction of rainwater interception by over 7.5 million gallons per year;
- Reduced storage of over 30 million pounds of carbon annually;
- Approximately 1.4 million pounds of sequestered CO₂ has been lost.



SPRINGFIELD TORNADO IMPACTS ON TREE CANOPY, TEMPERATURE & HUMIDITY



Fall 2011
USDA Forest Service
Northern Research Station



TREE CANOPY LOSS IN THE TORNADO IMPACT ZONE WAS EXTENSIVE, WITH MANY LARGE SHADE TREES DESTROYED.

The June 2011 Massachusetts tornado profoundly altered the landscape over a wide geographic area.

On June 1, 2011 a series of tornadoes ripped through Western Massachusetts, and included the second strongest tornado ever recorded in Massachusetts, with wind speeds estimated at 138 to 165 mph,

according to the National Weather Service. The most severe tornado was the EF-3, on the Enhanced Fujita Damage Classification Scale, that carved a half-mile-wide path for 89 miles from Westfield to Chariton, killing

three people and injuring 200. In Springfield, the tornado impacted city's South End, Upper Hill, Metro Center, Six Corners, East Forest Park and Sixteen Acres neighborhoods.



CANOPY LOSS



TREE FAILURE



STRUCTURE DAMAGE

Micro-climate Changes in Springfield's Tornado Zone





i-Tree Design



i-Tree

Tools for Assessing and Managing
Community Forests

[Get the Tools.](#)

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i-Tree Benefit Calculator

1500 N Mantua St, Kent, OH 44240, USA

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[Calculate another tree](#)

Overall Benefit

Storm Water

Energy

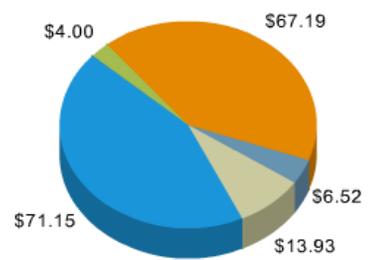
Air Quality

CO2

About Model

■ Stormwater
■ Cooling
■ Heating

■ Air Quality
■ CO2



Breakdown of your tree's benefits

Click on one of the tabs above for more detail

This 21 inch Northern pin oak provides overall benefits of: **\$163 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—a general accounting of the benefits produced by urban street-side plantings.

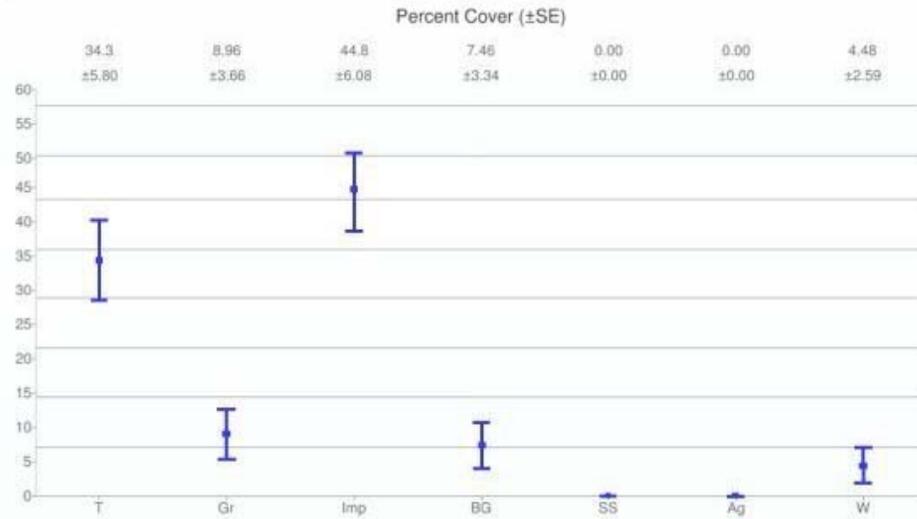
Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

If this tree is cared for and grows to 26 inches, it will provide **\$195 in annual benefits.**



Northern pin oak
Quercus ellipsoidalis

i-Tree Canopy Cover Report



Cover Class	Description	Abbr.	% Cover
Tree	tree, non-shrub	T	34.3 \pm 5.80
Grass	herbaceous ground cover	Gr	8.96 \pm 3.66
Impervious	artificial surfaces	Imp	44.8 \pm 6.08
Bare Ground	soil or barren	BG	7.46 \pm 3.34
Shrub/Scrub	non tree woody land cover	SS	0.00 \pm 0.00
Agriculture	crops, pasture, hay	Ag	0.00 \pm 0.00
Water	lakes, streams	W	4.48 \pm 2.59
Other	other land cover	O	0.00 \pm 0.00

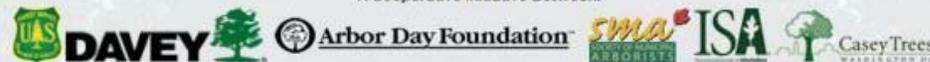
About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffrey T. Walton and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company).

Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

A Cooperative Initiative Between:



i-Tree Overview

**Urban Forestry and Water Resource Protection:
Assessing the Value of Urban Trees**



dbloniarez@fs.fed.us



www.unri.org/research-documents