



# i-Tree v4.0 update

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Tools & strategies for creating value  
in urban forestry

*Al Zelaya*  
*The Davey Tree Expert Company*



i-Tree is a  
Cooperative  
Initiative



**DAVEY**

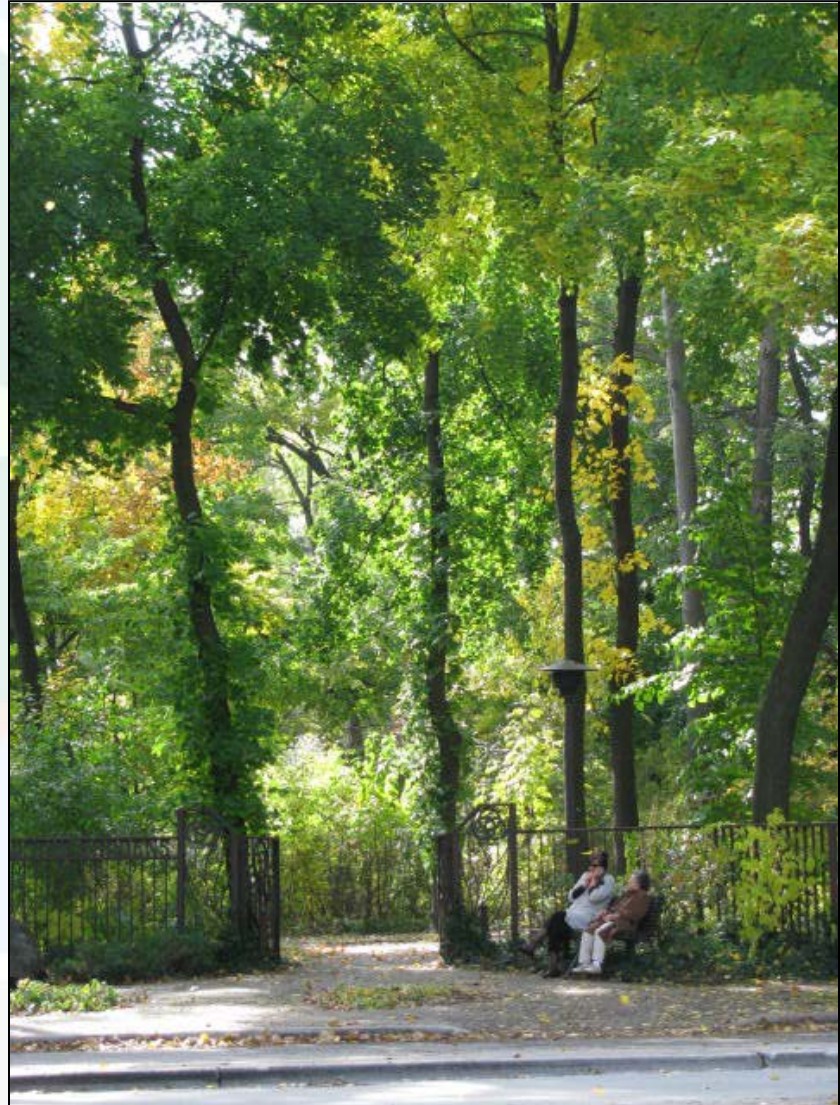




# Focus for Today...

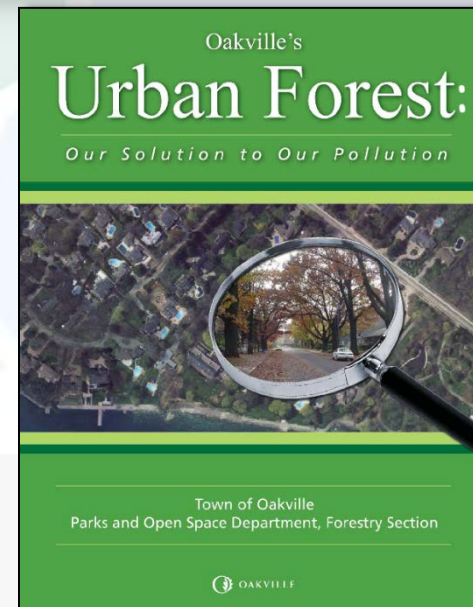
- 🌳 Focus on creating value
- 🌳 New i-Tree Tools & updates
- 🌳 i-Tree single day strategies

[www.itreetools.org](http://www.itreetools.org)



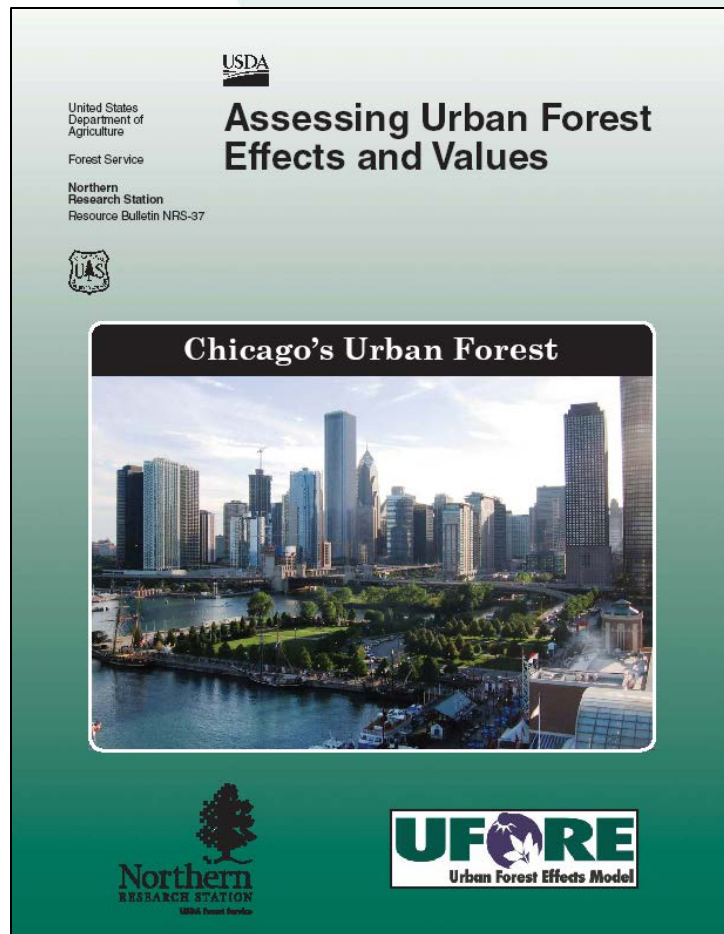


# i-Tree: Demonstrating Tree Value





# i-Tree: Integration of Tree Value...





# Values change...



## Rodent Control, Forestry Services Cut Due to City Budget

Updated: Tuesday, 29 Mar 2011, 9:27 AM CDT  
Published : Tuesday, 29 Mar 2011, 7:37 AM CDT

FOX Chicago News

Chicago - Chicago officials are considering shifting rat patrol crews to garbage pickup duty, and some city workers say that's going to lead to a real pest problem.

The Laborers Union said they're down about 100 jobs in the Streets and Sanitation Department. It predicts the city will cut rat control in half and said that's going to cause problems in the neighborhoods.

There are 12 citywide crews right now.

The city often says keeping a lid on garbage will help control the rats' food supply, but without crews to bait for rats the Laborers Union says Chicago will experience a rat population explosion.

The Bureau of Forestry is also taking a big hit. Two years ago forestry had 50 citywide crews, now it has 16.

Streets and Sanitation Spokesman Matt Smith said the cuts are temporary and only to keep up with garbage



## Lincoln city forester told to lobby for his job on his own time



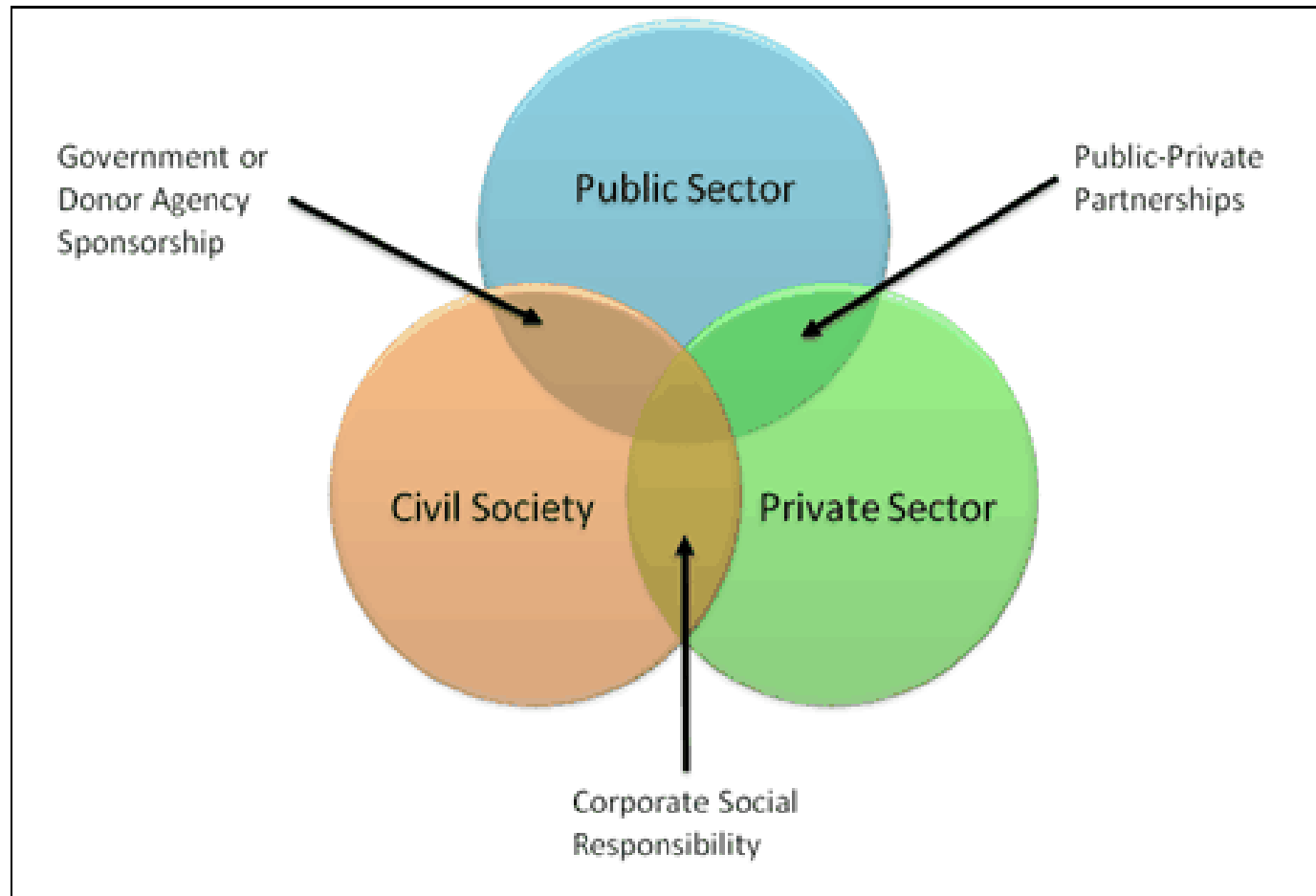
Lincoln's city forester, whose job is on the chopping block, has been told he can't talk to the press about the proposed budget cut while on the clock.

City Forester Steve Schwab -- who has held the position for more than 20 years -- was recently chastised for sending an e-mail to forestry advocates asking them to write letters to city officials opposing the mayor's proposal to cut his job. Schwab sent the e-mail from work at 9 a.m. on a Friday.

Last week, Parks Director Lynn Johnson said in an e-mail to Schwab that he's free to comment on the mayor's budget and Johnson's proposed reorganization of the forestry division on his own time, but not on the city's time.




# Can i-Tree help me create value?



*Partnerships in Development – NGO Ecosystem*



# i-Tree... *"Putting USFS Urban Forest science into the hands of users"*

 Credible, USDA  
FS peer-reviewed  
tools

 Public Domain  
Software

 Accessible

 Continuously  
improved

[www.itreetools.org](http://www.itreetools.org)

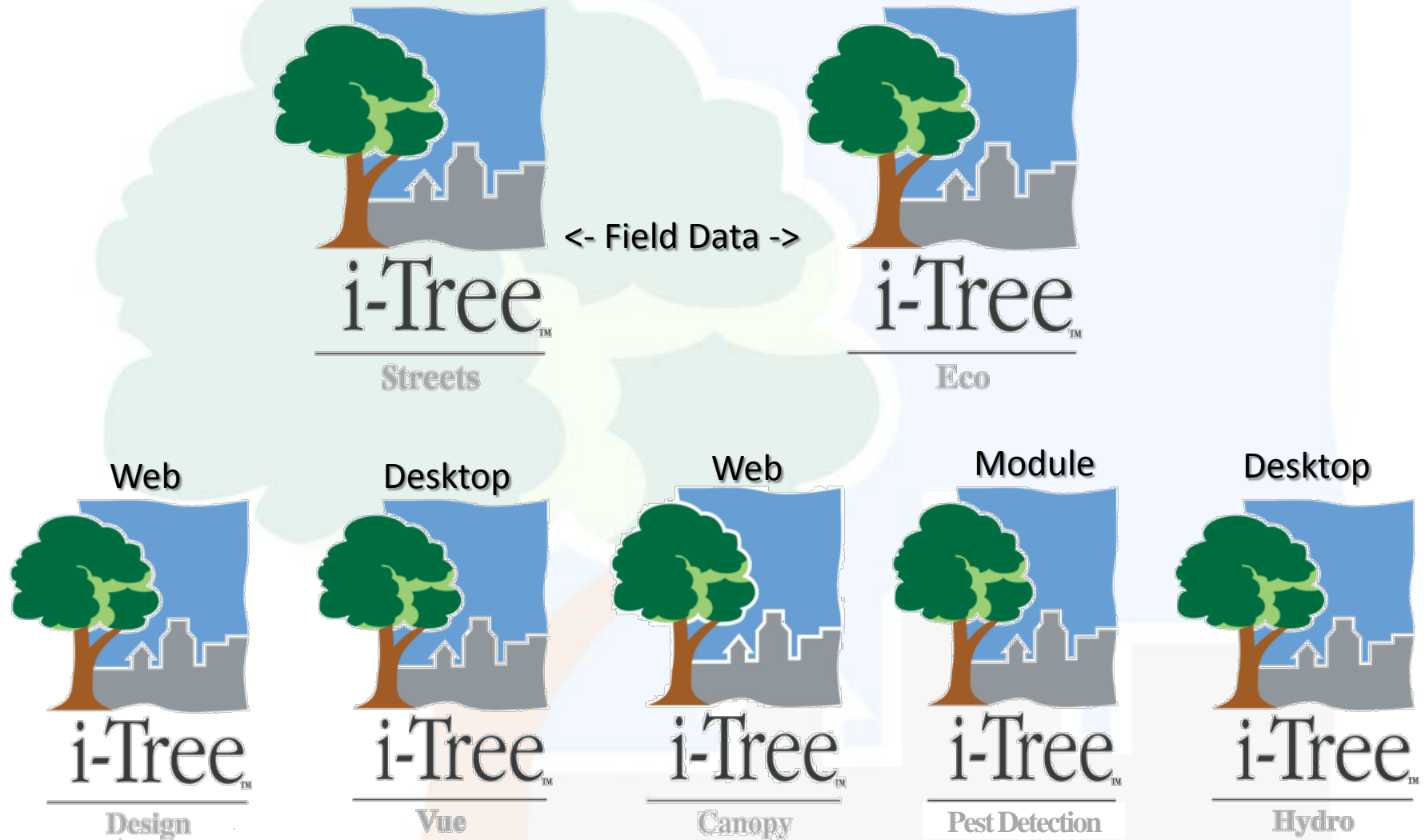


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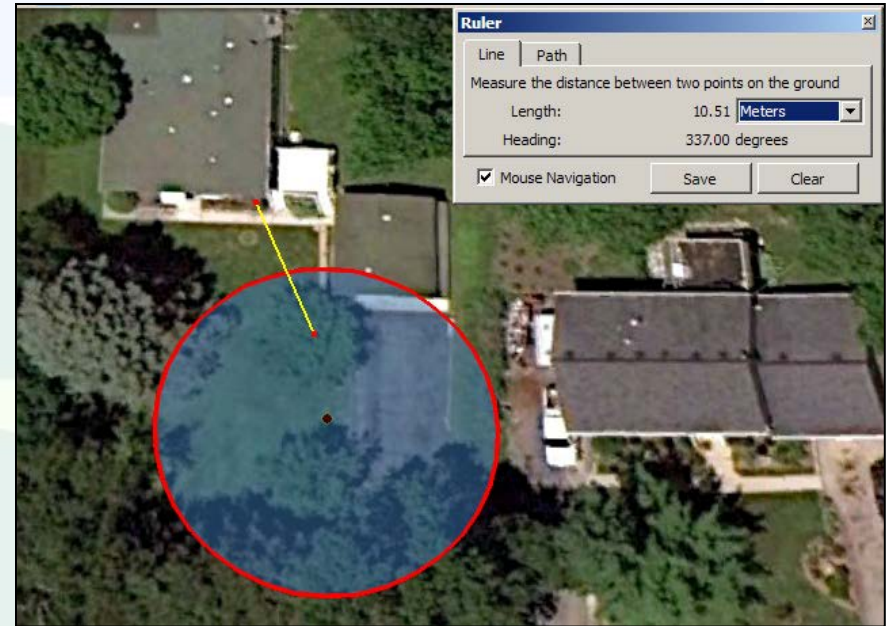
# v4: New Tools & Enhancements





# i-Tree Eco Updates

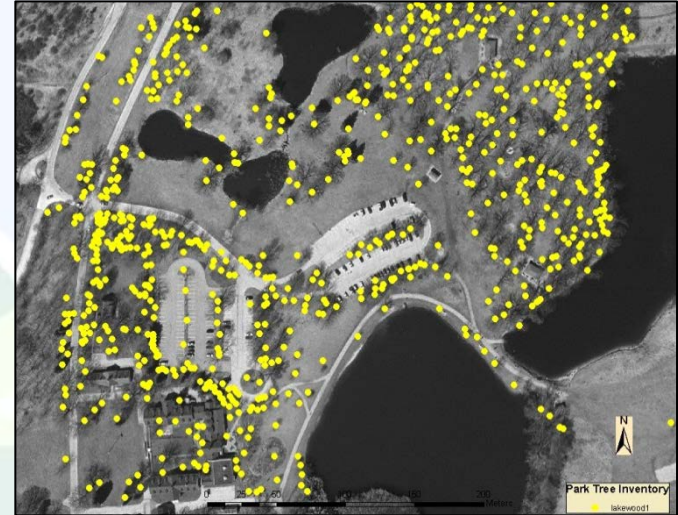
- 🌳 Automated processing
- 🌳 Import functionality for full inventory
- 🌳 Enhanced Pollution modeling
- 🌳 Pest detection integration (first phase)
- 🌳 Australian Eco version





# Consider Eco Inventory Option...

- 🌳 Structural analysis
- 🌳 Carbon sequestration & storage
- 🌳 Structural tree value
- 🌳 Annual pollution removal & value





# i-Tree Streets with Pest Detection module

- 🌳 Establish an accepted protocol to detect potentially harmful urban pests & diseases
- 🌳 Create a portable system & supporting resources
- 🌳 Enable data sharing

## IPED Field Guide Pest Evaluation and Detection



Defoliation, ALB Chewing of the Midrib Only—Does not need to meet 10% defoliation threshold



Discolored Foliage, Mottling, Spots, or Blotches—Bacterial leaf spot symptoms meet 10% Defoliation threshold



Discolored Foliage, Marginal Scorching—Oak wilt



Discolored Foliage, Marginal Scorching—Dogwood anthracnose

23



# i-Tree Pest Detection



WM\_iTree\_az

File Zoom Tools Help

Pest 2:35

### Pest Detection

**Tree Stress**

☐ Yes ☒ No

**Foliage / Twigs**

☐ Yes ☒ No

**Branches / Bole**

☐ Yes ☒ No

**Primary Pest**

Sci. Name

Omn. Name

Location GPS Species Mgt **Pest**

Cancel Save





# Tree Stress



*Epicormic branching on ash*

WM\_iTree\_az

File Zoom Tools Help

 Pest - Tree Stress  2:36

Dieback

Epicormic Sprouts

Wilted Foliage

Environment Stress

Human Stress

Notes

Cancel Save






# Foliage & Twigs



WM\_iTree\_az

File Zoom Tools Help

 Pest - Foliage & Tw   2:38

Defoliation


Discolored Foliage

Abnormal Foliage

Insect Signs

% Foliage Affected

Notes





# Branches and Bole



WM\_iTree\_az

File Zoom Tools Help

Pest - Branches & I 2:40

Insect Signs

Insect Presence

Disease Signs

Problem Location

Loose Bark

Notes

Cancel OK

Cancel Save



# Streets Pest Reporting

## Detroit

### Total Annual Benefits of Public Trees by Species (\$)

10/23/201

Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
maple, silver	511,061	11,720	99,820	158,830	234,649	1,016,080	(±0)	22.5
maple, Norway	269,932	7,991	48,741	53,621	249,345	629,631	(±0)	13.9
honeylocust, thornless	320,542	6,031	58,130	71,216	215,099	671,018	(±0)	14.8
sycamore, American	167,113	3,961	29,059	43,464	113,301	356,897	(±0)	7.9
maple, sugar	77,913	1,801	13,121	19,325	67,412	179,573	(±0)	4.0
linden, littleleaf	62,203	1,117	10,373	12,367	32,839	118,899	(±0)	2.6
maple, red	49,236	930	8,381	11,630	47,775	117,951	(±0)	2.6
elm, Siberian	107,570	3,213	23,041	32,463	105,159	271,446	(±0)	6.0
basswood, American	57,172	1,297	10,107	14,817	60,827	144,219	(±0)	3.2
ash, green	56,251	1,172	10,266	12,214	39,541	119,445	(±0)	2.6
planetree, London	62,953	1,435	10,742	15,384	44,310	134,825	(±0)	3.0
hackberry, northern	47,037	932	9,708	14,943	41,897	114,517	(±0)	2.5
apple	10,691	189	1,756	1,797	6,647	21,081	(±0)	0.5
elm, american	48,482	1,530	10,667	15,383	50,936	126,998	(±0)	2.8
oak, northern red	34,639	933	6,391	9,370	21,172	72,505	(±0)	1.6
OTHER STREET TREE	174,532	4,354	32,935	46,733	170,306	428,860	(±0)	9.5
Citywide Total	2,057,326	48,606	383,240	533,557	1,501,215	4,523,943	(±0)	100.0



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# Streets Pest Reporting

Detroit

Page 1 of 1

## Pest sign & Symptom Details Summary of Public Trees for maple, silver

10/4/2011

Species	Sign/Symptom Type/Location	Sign/Symptom	Tree Count	Population Estimate	Standard Error	% of Species	% of Public Trees	% of Pest Affected Trees
maple, silver	Tree Stress	Dieback	1,511	N/A	(N/A)	29.86	5.68	9.10
		Epicormic Sprouts	973	N/A	(N/A)	19.23	3.66	5.86
		Wilted Foliage	13	N/A	(N/A)	0.26	0.05	0.08
		Environmental Stress	699	N/A	(N/A)	13.81	2.63	4.21
		Human-caused Stress	2,154	N/A	(N/A)	42.57	8.10	12.97
		Notes Present	0	N/A	(N/A)	0.00	0.00	0.00
		Trees Affected	3,268	N/A	(N/A)	64.58	12.28	19.68
	Foliage/Twigs	Defoliation	10	N/A	(N/A)	0.20	0.04	0.06
		Discolored Foliage	856	N/A	(N/A)	16.92	3.22	5.15
		Abnormal Foliage	85	N/A	(N/A)	1.68	0.32	0.51
		Insect Signs	4	N/A	(N/A)	0.08	0.02	0.02
		%Foliage Affected	921	N/A	(N/A)	18.20	3.46	5.55
		Notes Present	1	N/A	(N/A)	0.02	0.00	0.01
		Trees Affected	921	N/A	(N/A)	18.20	3.46	5.55
	Branches/Bole	Insect Signs	177	N/A	(N/A)	3.50	0.67	1.07
		Insect Presence	93	N/A	(N/A)	1.84	0.35	0.56



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# Urban Forest Health Information Center (UFORHIC)



Data Entry Reports Maps Dictionaries Admin My Account

## UFORHIC Map

Entity Data Individual Data

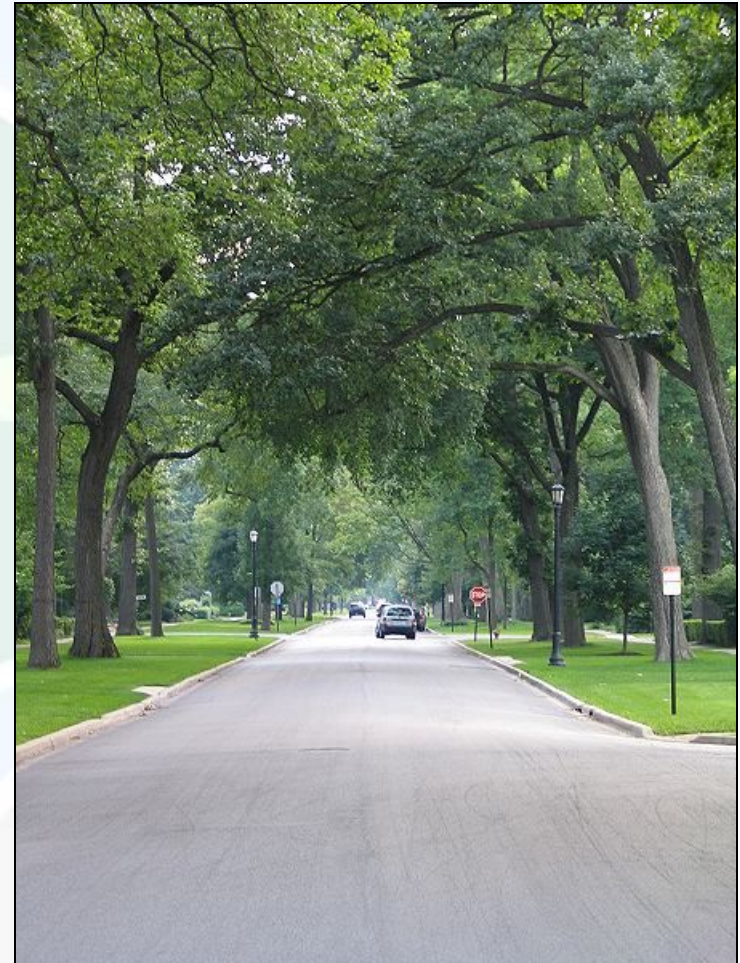
### Search Criteria





# Consider modeling trees at risk...

- 🌳 3500 ash street trees
- 🌳 10.5 % of public trees
- 🌳 \$3.18 million structural value
- 🌳 4.9 million gal/yr. of rainfall intercepted worth \$135,000/yr.
- 🌳 \$122,000/yr. energy savings
- 🌳 \$20,350/yr. in air quality improvement
- 🌳 \$113,000 annual CO2 value





## Oshkosh original 150 trees at 0-3 DBH

### Total Annual Benefits of Public Trees by Species (\$)

2/9/2010

Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Sugar maple	25	5	3	7	12	52 (±0)		9.2
Northern hackberry	28	2	4	12	92	138 (±0)		24.3
Honeylocust	42	4	5	13	10	74 (±0)		12.9
Kentucky coffeetree	16	1	2	12	132	163 (±0)		28.6
Apple	22	3	3	5	1	33 (±0)		5.8
Swamp white oak	28	2	3	8	68	110 (±0)		19.3
OTHER STREET	0	0	0	0	0	0 (±0)		0.0
Citywide Total	161	17	20	58	315	571 (±0)		100.0

## Oshkosh Original Planting now at 12-18DBH

### Total Annual Benefits of Public Trees by Species (\$)

2/9/2010

Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Sugar maple	1,103	130	177	926	989	3,324 (±0)		15.5
Northern hackberry	1,327	120	217	966	989	3,619 (±0)		16.9
Honeylocust	1,344	173	223	1,055	2,568	5,362 (±0)		25.1
Kentucky coffeetree	1,106	153	186	993	1,146	3,584 (±0)		16.8
Apple	953	105	164	452	387	2,061 (±0)		9.6
Swamp white oak	1,169	143	198	955	979	3,444 (±0)		16.1
OTHER STREET	0	0	0	0	0	0 (±0)		0.0
Citywide Total	7,003	824	1,163	5,347	7,058	21,395 (±0)		100.0



# i-Tree Design

- 🌳 Parcel level analysis of individual trees
- 🌳 General public use
- 🌳 Web accessible





Overall Benefit

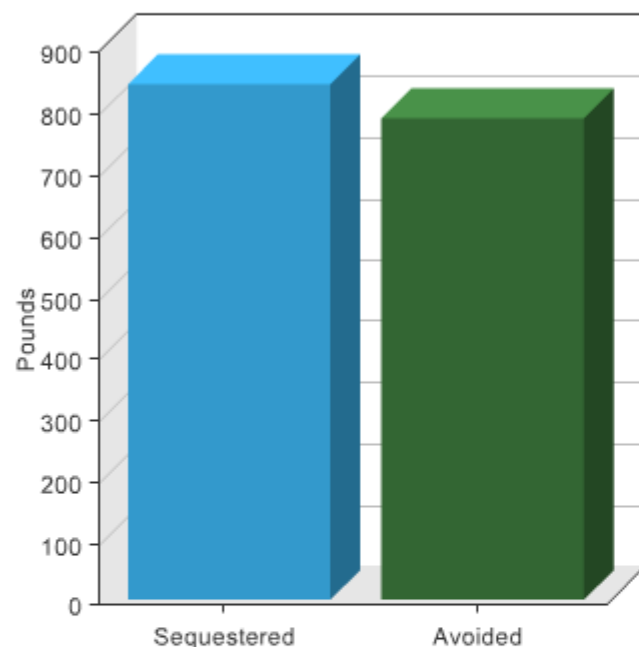
Storm Water

Energy

Air Quality

CO2

About Model



**This year your 36 inch American elm tree will reduce atmospheric carbon dioxide by 1,631 pounds.**

How significant is this number? Most car owners of an "average" car (mid-sized sedan) drive 12,000 miles generating about 11,000 pounds of CO<sub>2</sub> every year. A flight from New York to Los Angeles adds 1,400 pounds of CO<sub>2</sub> per passenger.

Trees can have an impact by reducing atmospheric carbon in two primary ways (see figure at left):

- They sequester ("lock up") CO<sub>2</sub> in their roots, trunks, stems and leaves while they grow, and in wood products after they are harvested.
- Trees near buildings can reduce heating and air conditioning demands, thereby reducing emissions associated with power production.

Combating climate change will take a worldwide, multifaceted approach, but by planting a tree in a strategic location, driving fewer miles, or replacing business trips with conference calls, it's easy to see how we can each reduce our individual carbon "footprints."

For more information see the USDA Forest Service's [Community Tree Guide](#) series.



## Step 2: Map Your House

Step 1.2

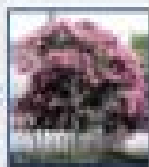
### 1. Draw Outline of House

Use the tree tool to outline your house. Once outlined, end by clicking the tree tool icon. Or Double Click.

[Watch Video Tutorial](#)

### 2. Pick Your Tree

Choose one of these pre-selected trees great for your step to help save energy.



Crape Myrtle, Common

### 3. Place Your Tree

Once you have selected your tree graphic, click on the map where you want to plant.

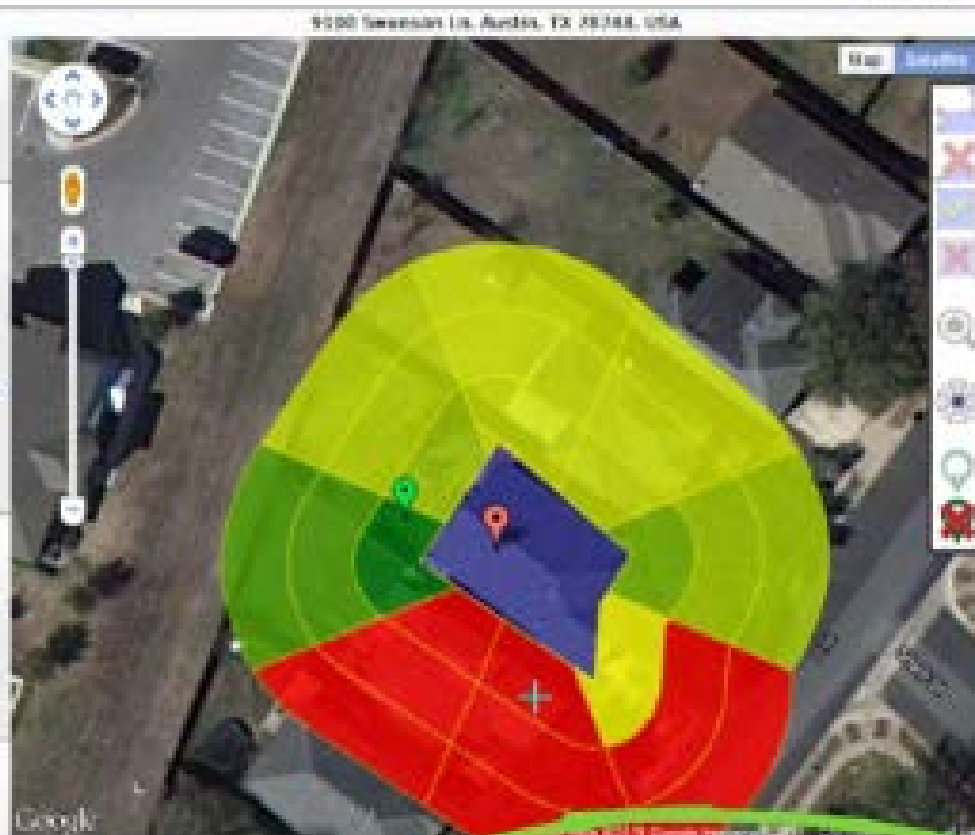
Please follow the preferred planting zone scale to help save the most energy and money.



### 4. See Your Savings

Estimated savings based on research

[Estimate My Savings >](#)



Lat: 30.1713066  
Long: -97.7062903

Elevation: 177.1  
Distance: 4.1 mi (10 km)

Tree: Crape Myrtle, Common  
Community Savings: \$17

Energy Savings: 6-2.18  
kBtu/yr - 71kBtu/yr - 4.1



# i-Tree Canopy

## Main Screen

- Web App
- No Login
- Required

1. Load shapefile
2. Configure survey
3. Assess points

Firefox

ARMH Basic ... Samples for ... GettingStart... Photo Gallery Ecuador 201... Thank You 3055 Woodc... Multi-Resolu... i-Tree Ca...

http://www.itreetools.org/canopy/survey.php

i-Tree Tools for Assessing and Managing Community Forests

Get the Tools.

Google Custom Search

Username Password

Forgot Username or Password?

Search Login Register

Home About Applications Utilities Resources Support News

Technical Notes Report Export Start Over Exit ?

Map Satellite Hybrid Terrain

i-Tree Canopy

Percent Cover (±SE)

0.00 80.0 20.0

±0.00 ±40.0 ±20.0

100 80 60 40 20 0

NT W

Id	Cover Class	Latitude	Longitude
1	Water	41.797858741309	-72.64722820779
2	Non-Tree	41.789652187085	-72.70758794779
3	Non-Tree	41.72977938796	-72.68885971042
4	Non-Tree	41.74477714313	-72.69408831927
5	Non-Tree	41.77068147283	-72.70286798009
6	Tree	41.74429952193	-72.6804620972

Page 1 of 1 View 1 - 6 of 6

Remember, the more points you survey, the lower your Standard Error, and the more precise your sampling will be. More points surveyed provide for a better estimation of Land Cover across your study area.

Save Your Data

Save Data Save Early. Save Often. Don't lose your project data!



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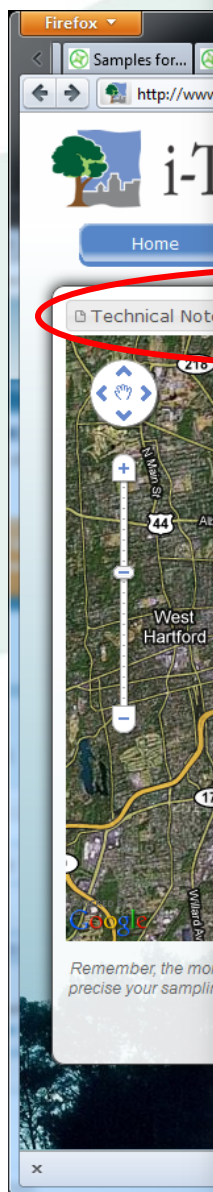
# i-Tree Canopy

Output

Report

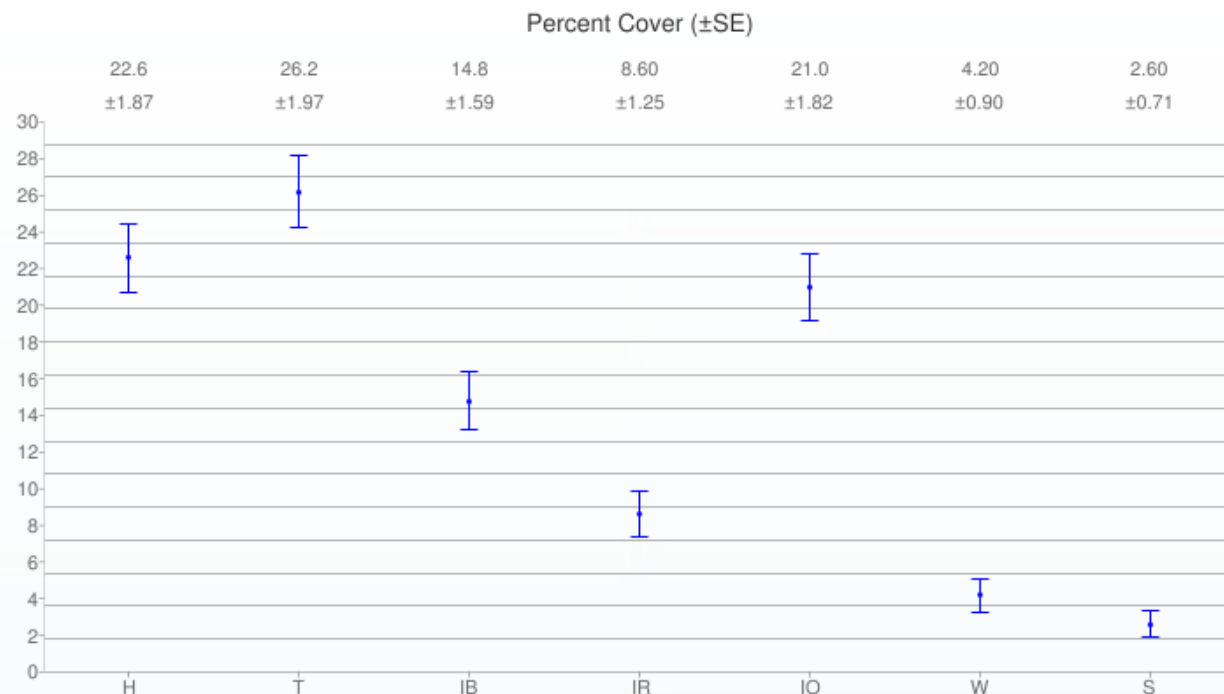
Export

Save  
Project



## i-Tree Canopy

### Cover Report



Cover Class	Description	Abbr.	% Cover
Grass/Herbaceous		H	22.6 $\pm$ 1.87
Tree/Shrub		T	26.2 $\pm$ 1.97
Impervious Buildings		IB	14.8 $\pm$ 1.59
Impervious Road		IR	8.60 $\pm$ 1.25
Impervious Other		IO	21.0 $\pm$ 1.82
Water		W	4.20 $\pm$ 0.90
Soil/Bare Ground		S	2.60 $\pm$ 0.71

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery 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

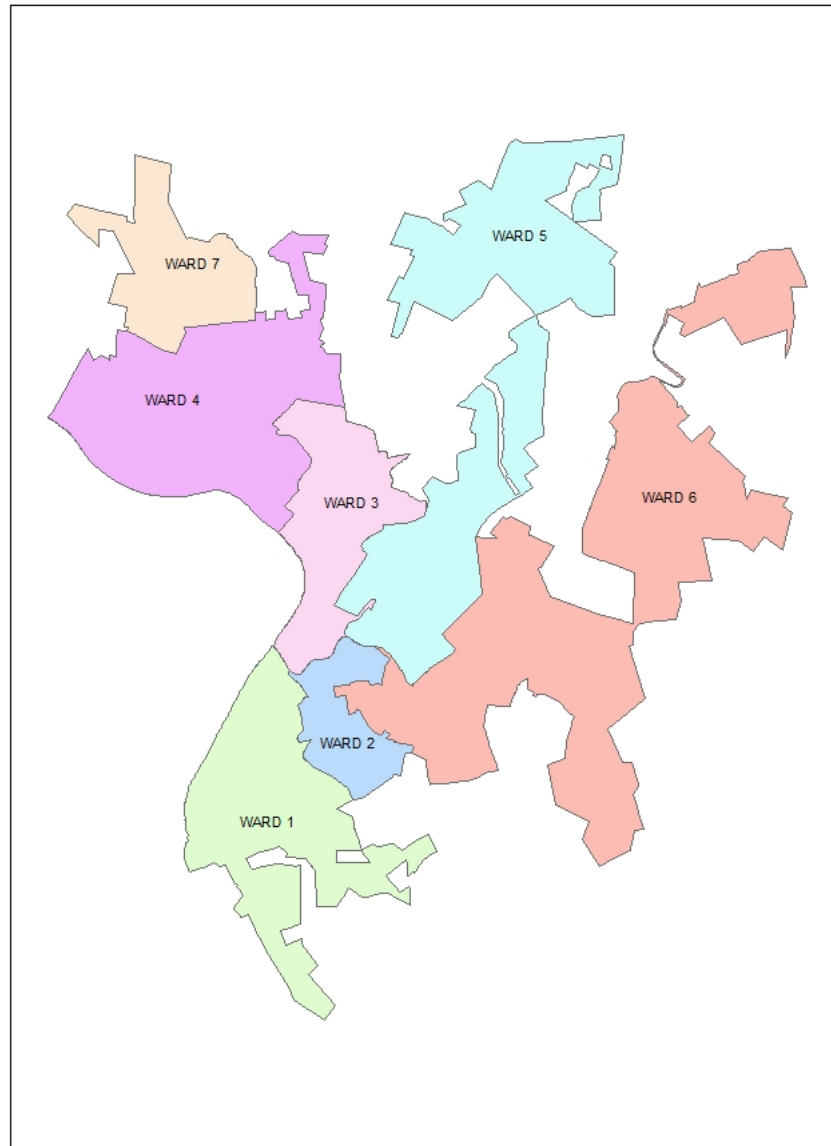


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# i-Tree Canopy Applications



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## Tools for Assessing and Managing Community Forests

Get the Tools.



Google Custom Search

Search

Username

 Password

Login

[Forgot Username or Password?](#)

Register

[Home](#)

## About

## Applications

## Utilities

## Resources

## Support

News

Technical Notes

 Report


Export




↶ Start Over

⏻ Exit

?

Percent Cover ( $\pm$ SE)

Id	Cover Class	Latitude	Longitude
1	Tree	30.46706893603	-90.1093322948
2	Tree	30.47262870542	-90.1301044666
3	Non-Tree	30.50295319422	-90.1080259051
4		30.46337772159	-90.1094360796
5	Tree 	30.45680304527	-90.1113769495

Page 1 of 1

View 1 - 5 of 5



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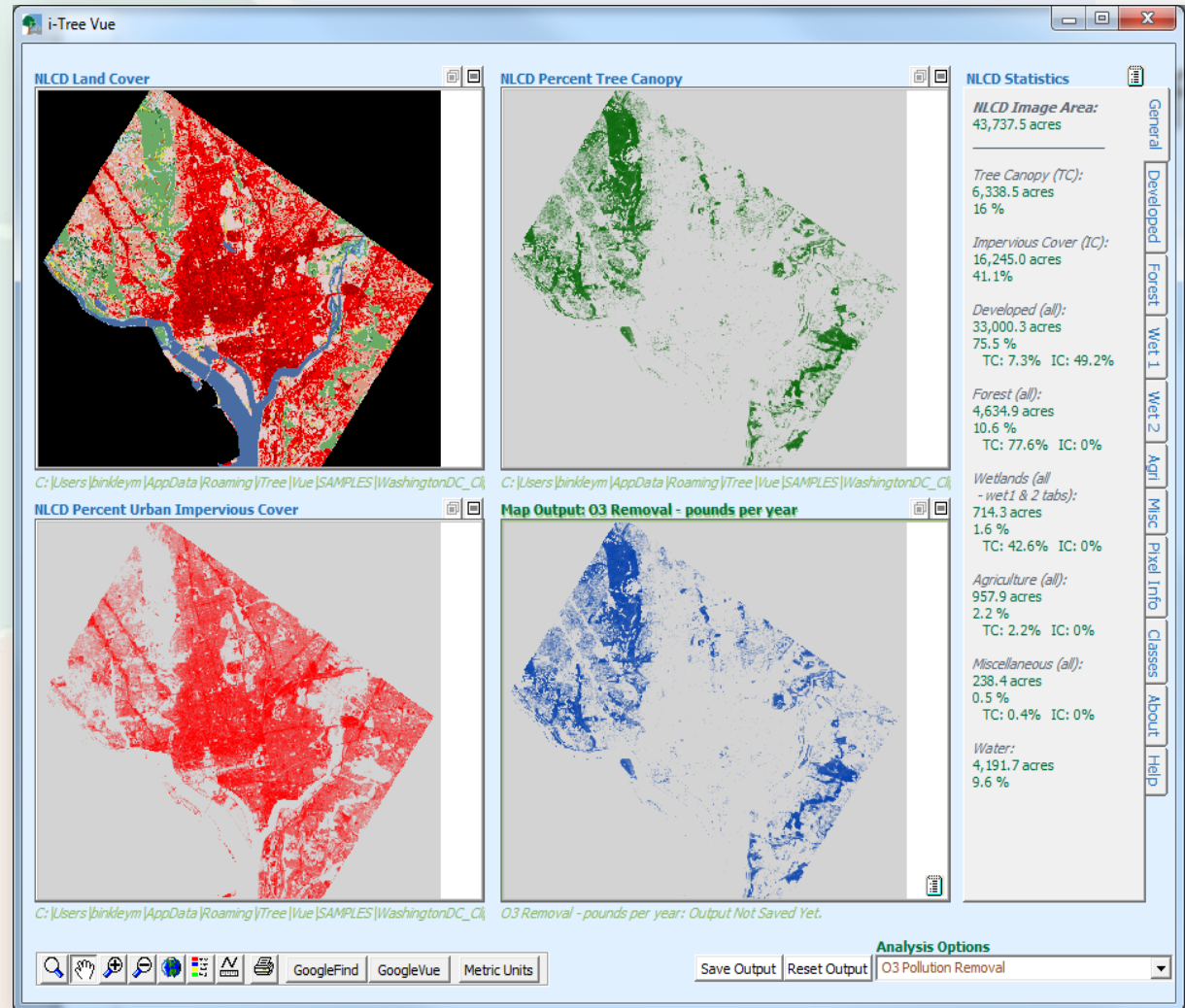
**DAVEY** **Arbor Day Foundation™**



# i-Tree Vue

- NASA Landsat
- + MRLC NLCD
- + USFS Research
- + i-Tree Development

## Urban Forest Benefit Estimates

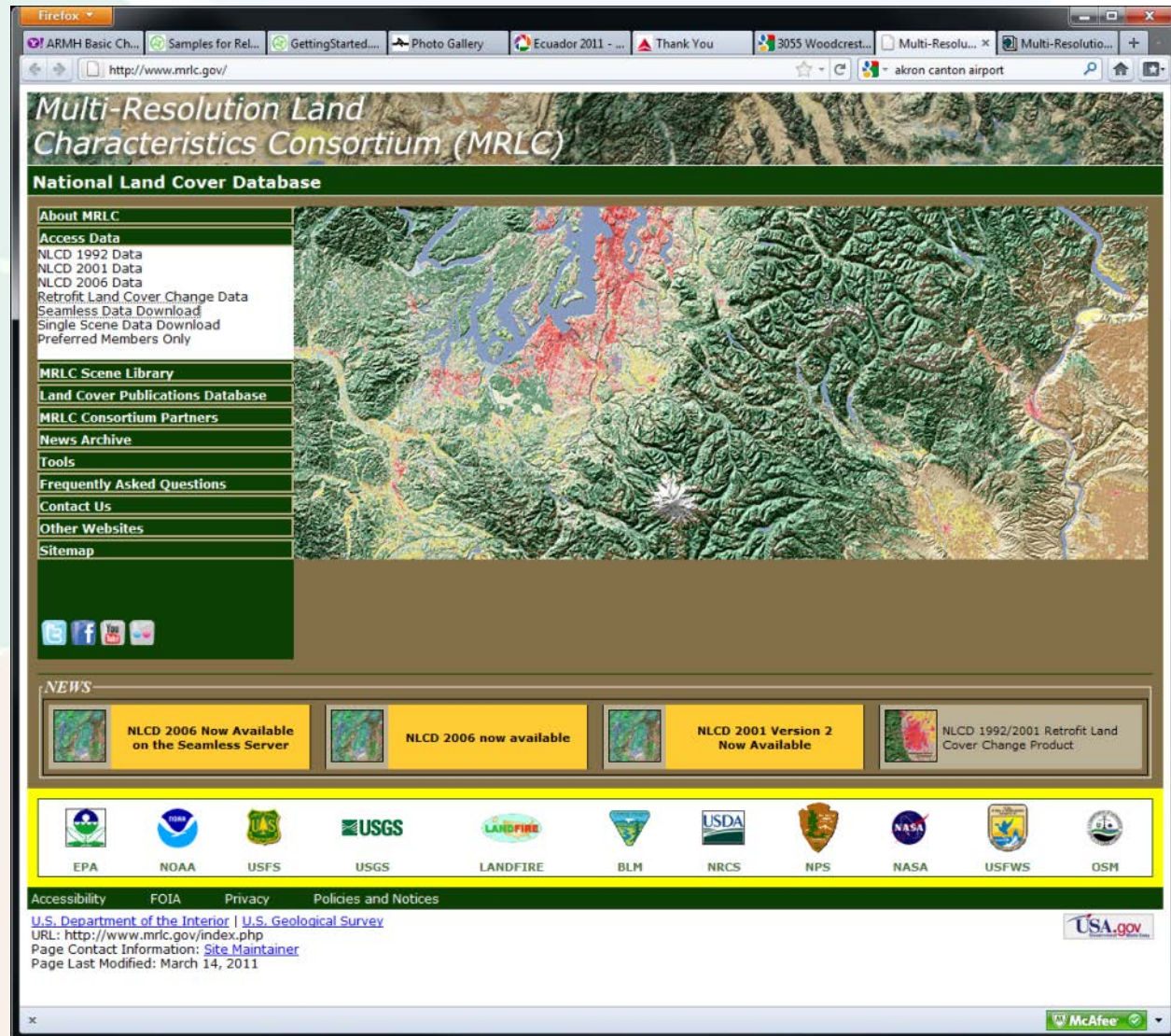




# i-Tree Vue: Obtaining Data

Free!  
Nationwide!  
Easy to Download!

[www.mrlc.gov](http://www.mrlc.gov)

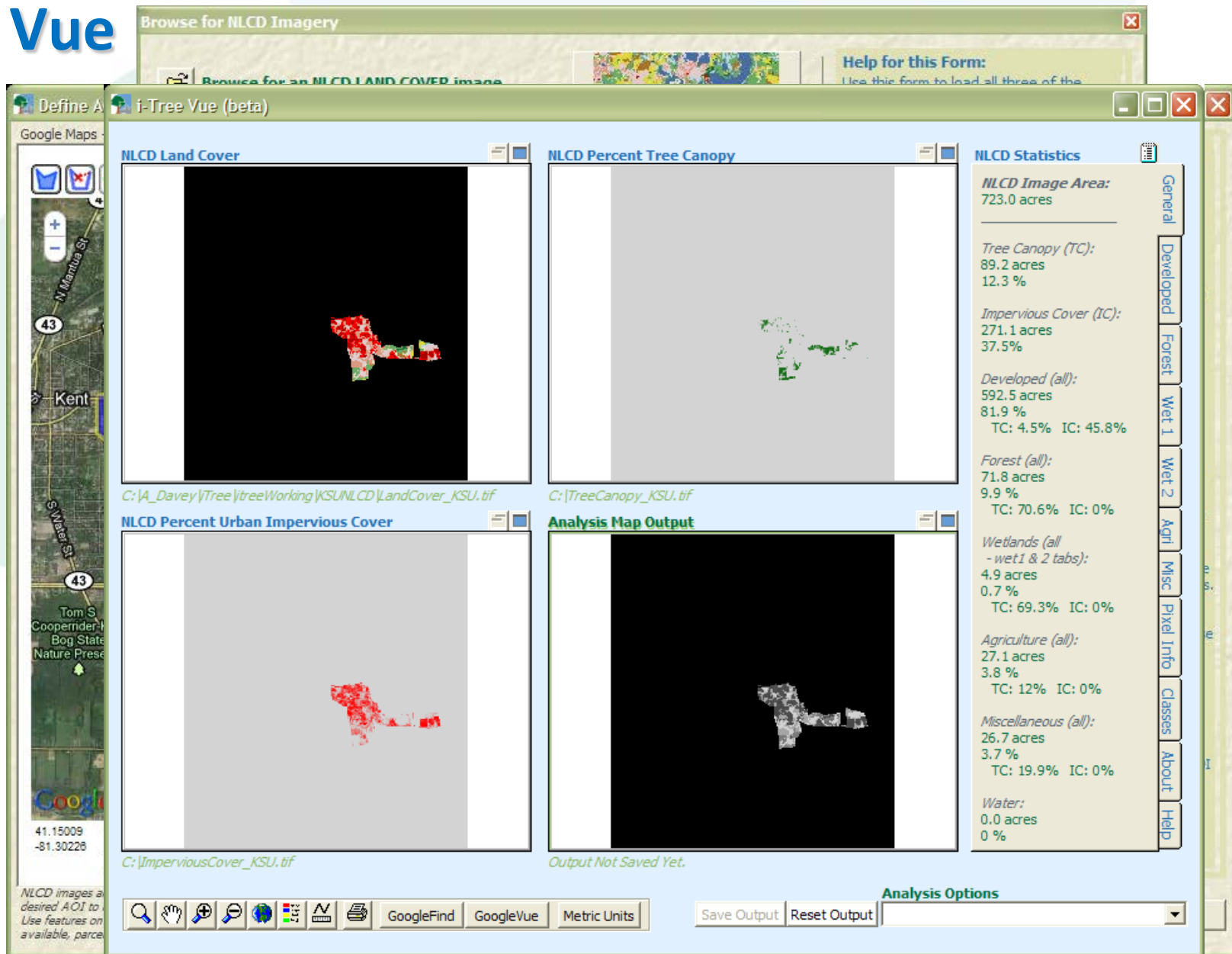




# i-Tree Vue

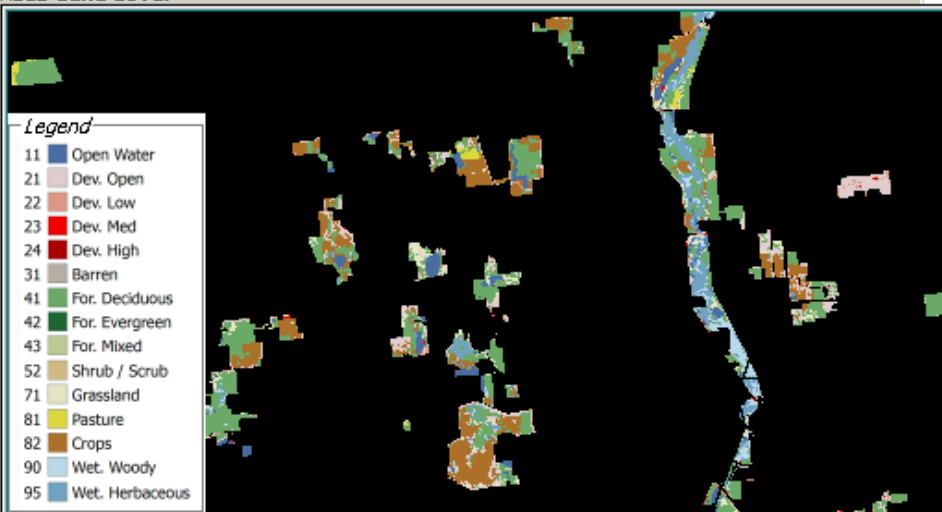
Startup:

Load  
&  
Clip  
Imagery



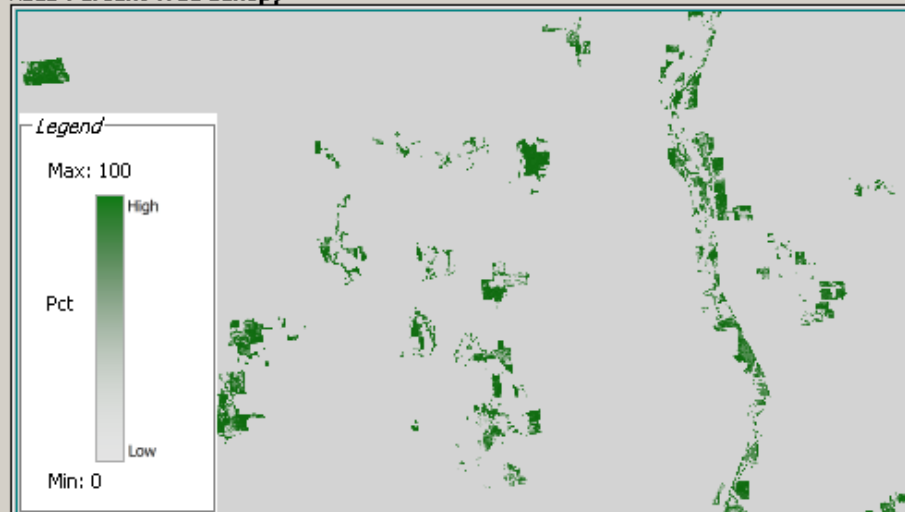


## NLCD Land Cover



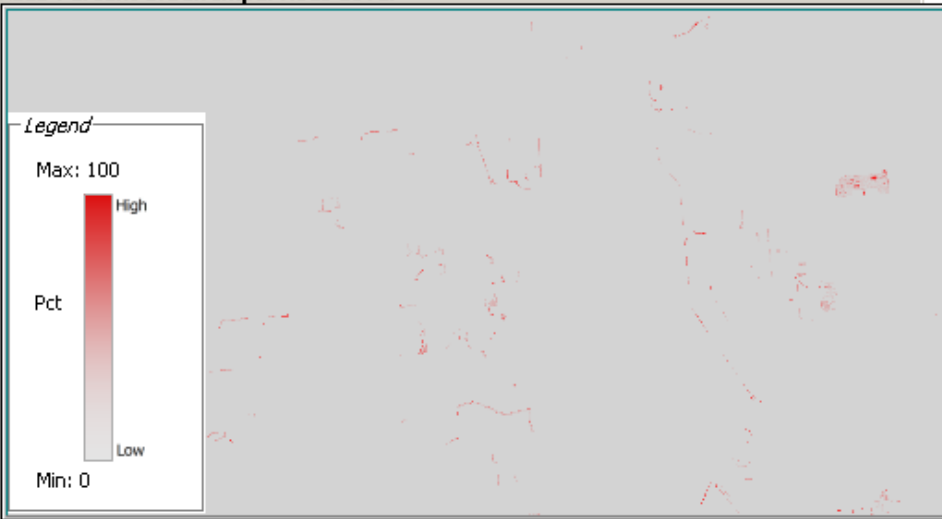
C:\Documents and Settings\zelayaa\Desktop\LCFPD\_Vue\_extracts\LCFPD\_landcover.tif

## NLCD Percent Tree Canopy



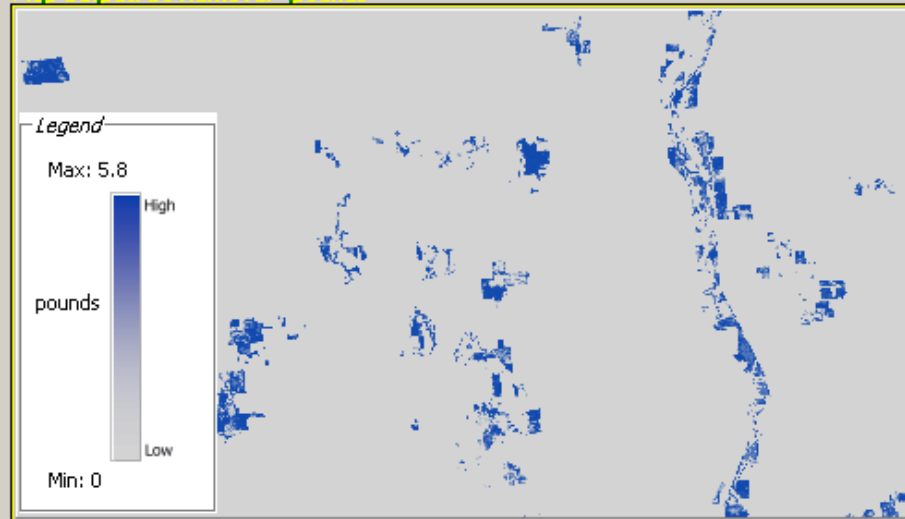
C:\Documents and Settings\zelayaa\Desktop\LCFPD\_Vue\_extracts\LCFPD\_canopy.tif

## NLCD Percent Urban Impervious Cover



C:\Documents and Settings\zelayaa\Desktop\LCFPD\_Vue\_extracts\LCFPD\_imperv.tif

## Map Output: O3 Removal - pounds



O3 Removal: Output Not Saved Yet.

## Zoom %

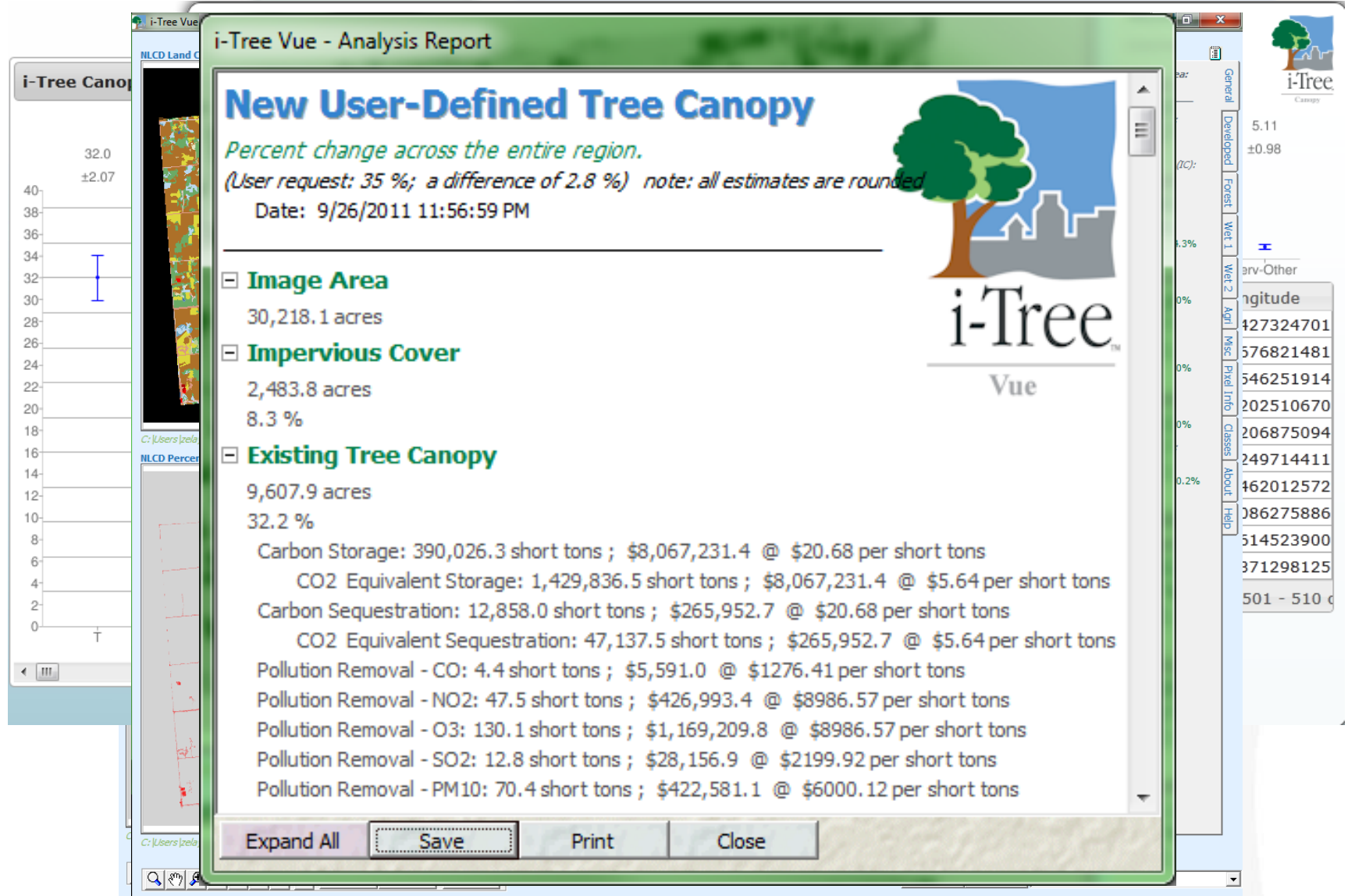
50 Full Extent Scroll Bars Off Legends Off

☐ Metric Units

Save Output Reset Output



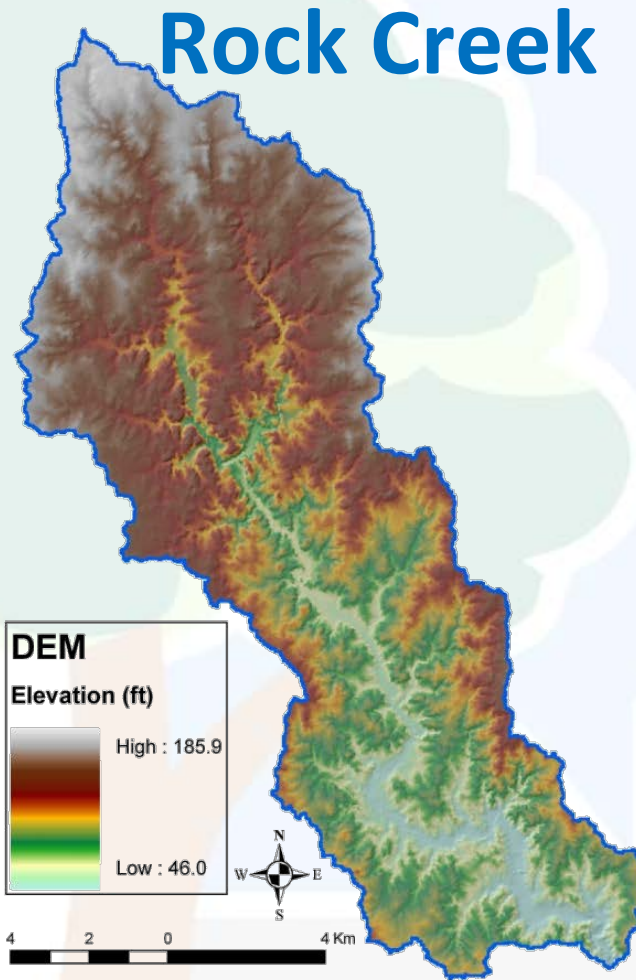
# i-Tree Vue



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Initiative







Watershed Area (m2)	161,653,500
Percent Impervious cover	15.8
Percent Tree Cover	27
Percent of Tree Cover over Impervious Area	10
Percent Water Cover	0.3
Average Tree Leaf Area Index (LAI)	3.5
Percent Shrub Cover	7.8
Percent Grass Cover	33.8
Percent Evergreen Trees	4.2
Percent Evergreen Shrubs	21
Shrub LAI	3.9
Leaf on Day	80
Leaf off Day	294



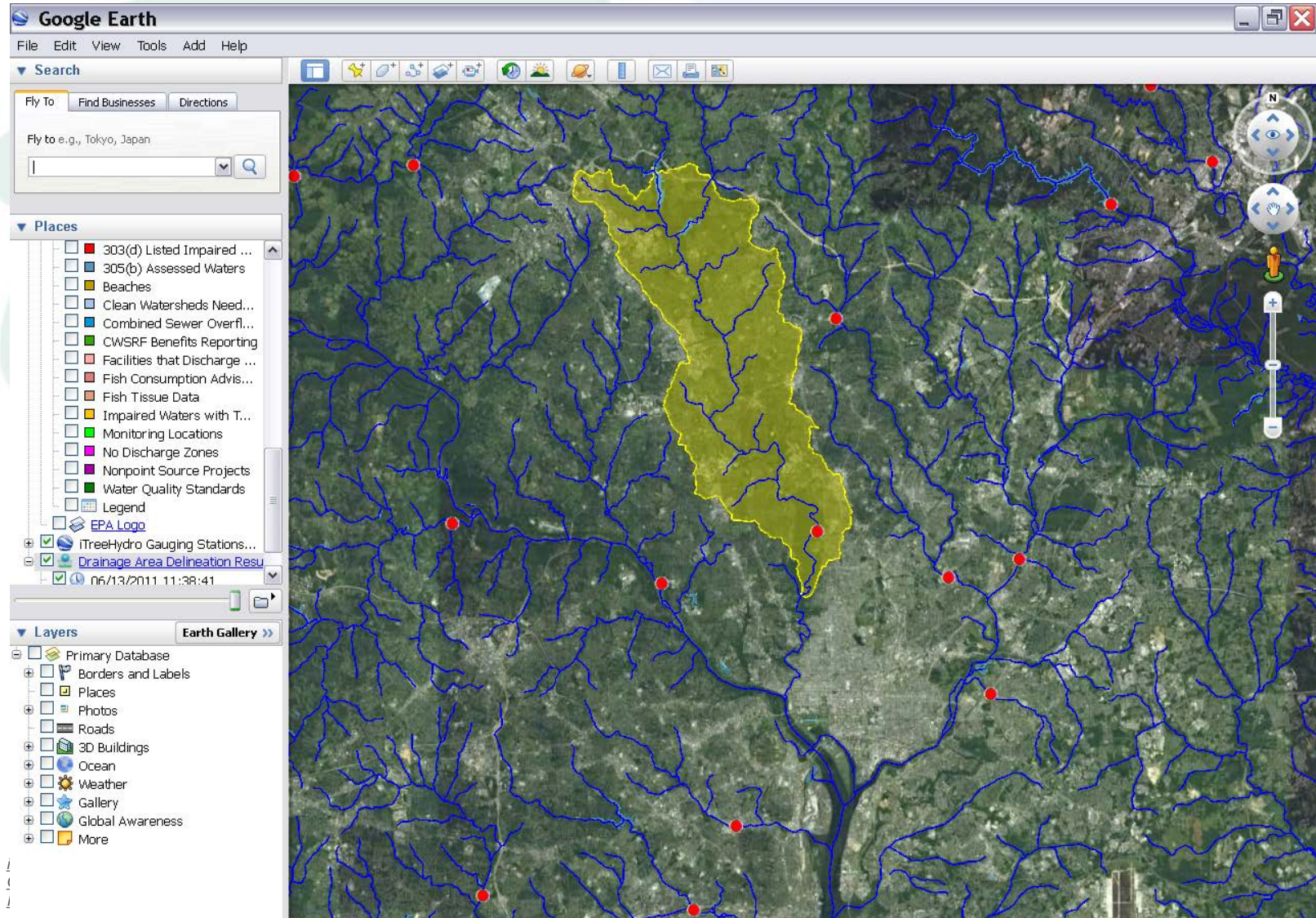
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# Determine watershed

🌳 EPA Waters and gauging station data





# Obtain Digital Elevation Model

The screenshot displays a web browser window at [seamless.usgs.gov/website/seamless/viewer.htm](http://seamless.usgs.gov/website/seamless/viewer.htm). The browser's address bar shows the URL, and the page title is "The National Map Seamless Server". The main content area shows a grayscale Digital Elevation Model (DEM) with blue stream lines. A green rectangular box is drawn on the map, indicating the area to be downloaded. The left sidebar contains various tools and links, including "Zoom", "Query", "Tools", "Downloads", and "Documents".

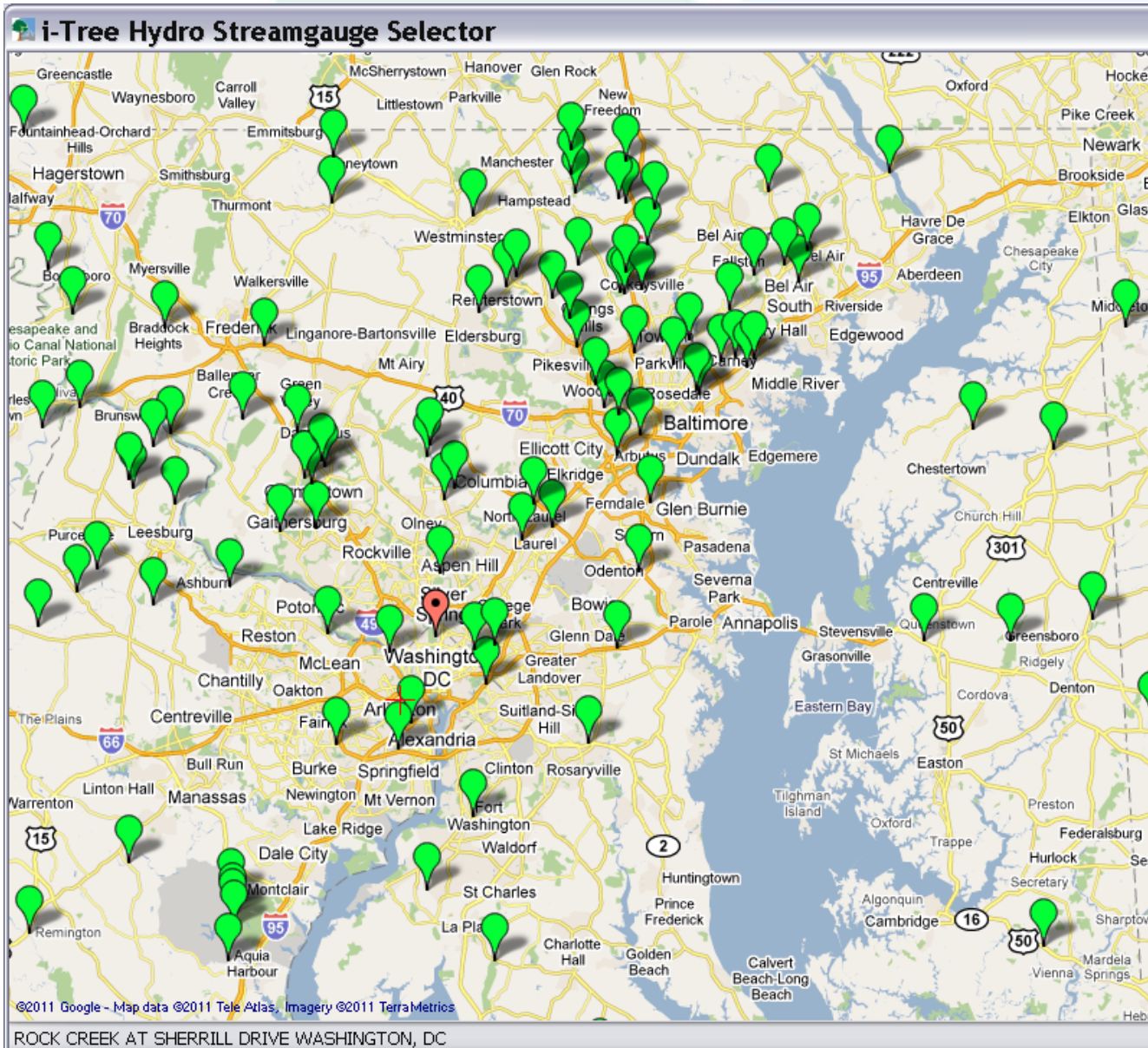
Overlaid on the browser window is an ArcMap application window titled "Untitled - ArcMap - ArcInfo". The ArcMap window shows the same DEM map. The "Layers" panel on the left lists the loaded layer as "ned\_77764315" with a value range from 167,455 (Low) to 422,531 (High). The "Spatial Analyst Tools" panel on the right lists various tools, including "Basin", "Fill", "Flow Accumulation", "Flow Direction", "Flow Length", "Sink", "Snap Pour Point", "Stream Link", "Stream Order", "Stream to Feature", and "Watershed". The "Display" and "Source" buttons are visible at the bottom of the Layers panel. The ArcMap window also shows a status bar at the bottom indicating coordinates: "-81.616 41.756 Decimal Degrees".

Click and drag to select area to download



# Extract Stream Data

**i-Tree Hydro Streamgauge Selector**



Map Type: Normal

Go To Location:

Go

Zoom Level: 9

ID: 01648000

Details:

EEK AT SHERRILL DRIVE WASHINGTON, DC

ROCK CREEK AT SHERRILL DRIVE WASHINGTON, DC

ROGNEL HGTS STORM SEWER OUTFALL AT I

S BRANCH CHOPAWAMSIK CREEK NR GARRI

S F CATOCTIN CREEK AT RT 698 NEAR WATE

S F QUANTICO CREEK NEAR INDEPENDENT H

S F SHENANDOAH RIVER AT FRONT ROYAL, V

S F SHENANDOAH RIVER NEAR LURAY, VA

SALLIE HARRIS CREEK NEAR CARMICHAEL, M

Select: Left Click Marker  
Zoom: Mouse Wheel  
Pan: Right Click & Drag

OK Cancel


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ROCK CREEK AT SHERRILL DRIVE WASHINGTON, DC



# Extract Weather Data

**i-Tree Hydro Weather Station Selector**



The map displays the Northeast United States, including Pennsylvania, Maryland, Delaware, New Jersey, New York, Virginia, and West Virginia. Numerous green pins are placed across the region, indicating the locations of weather stations. Major cities and towns labeled include Pittsburgh, Harrisburg, Philadelphia, New York, Baltimore, Washington DC, and Richmond. Major highways such as I-76, I-95, I-80, and I-495 are shown. The map is part of a software interface with various controls on the right side.

Map Type:  
Normal

Go To Location:

Go

Zoom Level: 7

ID

Details

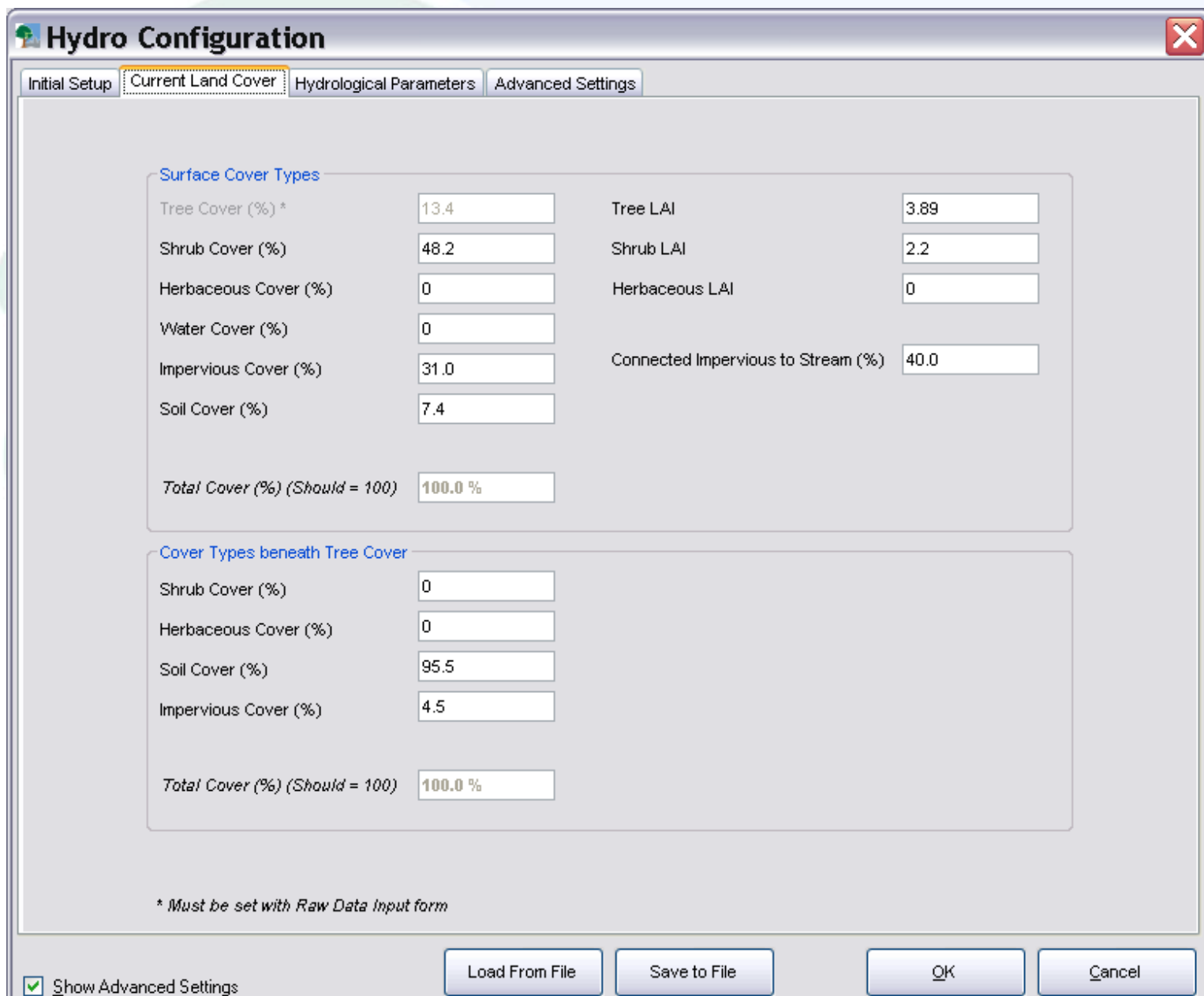
Select: Left Click Marker  
Zoom: Mouse Wheel  
Pan: Right Click & Drag

OK Cancel

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# Load files and enter cover data



The image shows a software window titled "Hydro Configuration" with a close button (X) in the top right corner. It has four tabs: "Initial Setup", "Current Land Cover" (which is selected), "Hydrological Parameters", and "Advanced Settings".

Under the "Current Land Cover" tab, there are two main sections:

- Surface Cover Types**: This section contains two columns of input fields. The left column lists cover types with their percentages, and the right column lists Leaf Area Index (LAI) values. A "Total Cover" field at the bottom shows 100.0%.
- Cover Types beneath Tree Cover**: This section contains input fields for the cover types beneath the tree canopy. A "Total Cover" field at the bottom shows 100.0%.

A note at the bottom of the dialog states: "\* Must be set with Raw Data Input form".

At the bottom of the window, there is a checkbox for "Show Advanced Settings" (which is checked), and three buttons: "Load From File", "Save to File", and "OK". A "Cancel" button is also present in the bottom right corner.

Surface Cover Types	
Tree Cover (%) *	13.4
Shrub Cover (%)	48.2
Herbaceous Cover (%)	0
Water Cover (%)	0
Impervious Cover (%)	31.0
Soil Cover (%)	7.4
Total Cover (%) (Should = 100) 100.0 %	

Cover Types beneath Tree Cover	
Shrub Cover (%)	0
Herbaceous Cover (%)	0
Soil Cover (%)	95.5
Impervious Cover (%)	4.5
Total Cover (%) (Should = 100) 100.0 %	

Parameter	Value
Tree LAI	3.89
Shrub LAI	2.2
Herbaceous LAI	0
Connected Impervious to Stream (%)	40.0

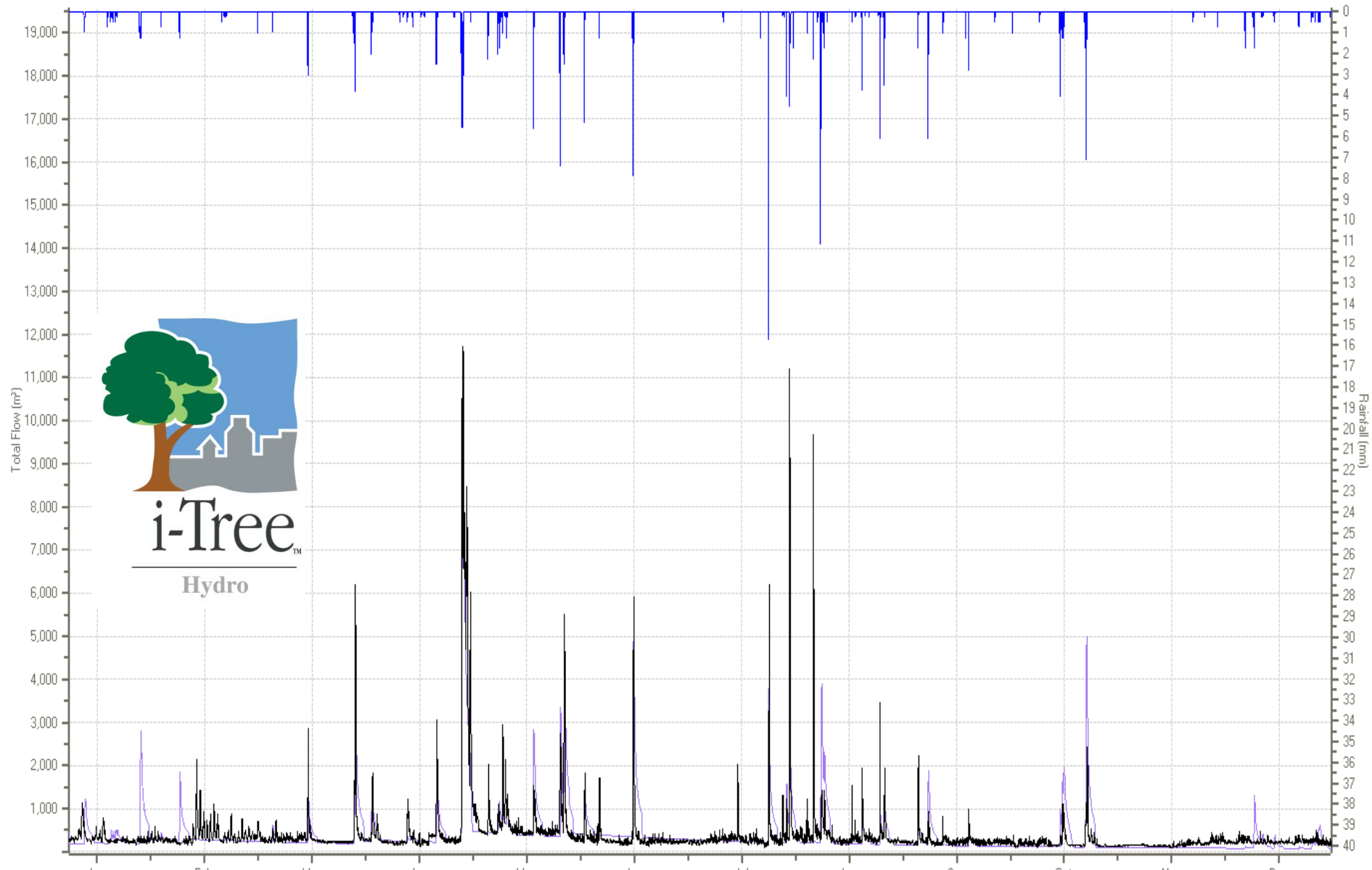
\* Must be set with Raw Data Input form

Buttons: Load From File, Save to File, OK, Cancel

Checkbox: ☒ Show Advanced Settings

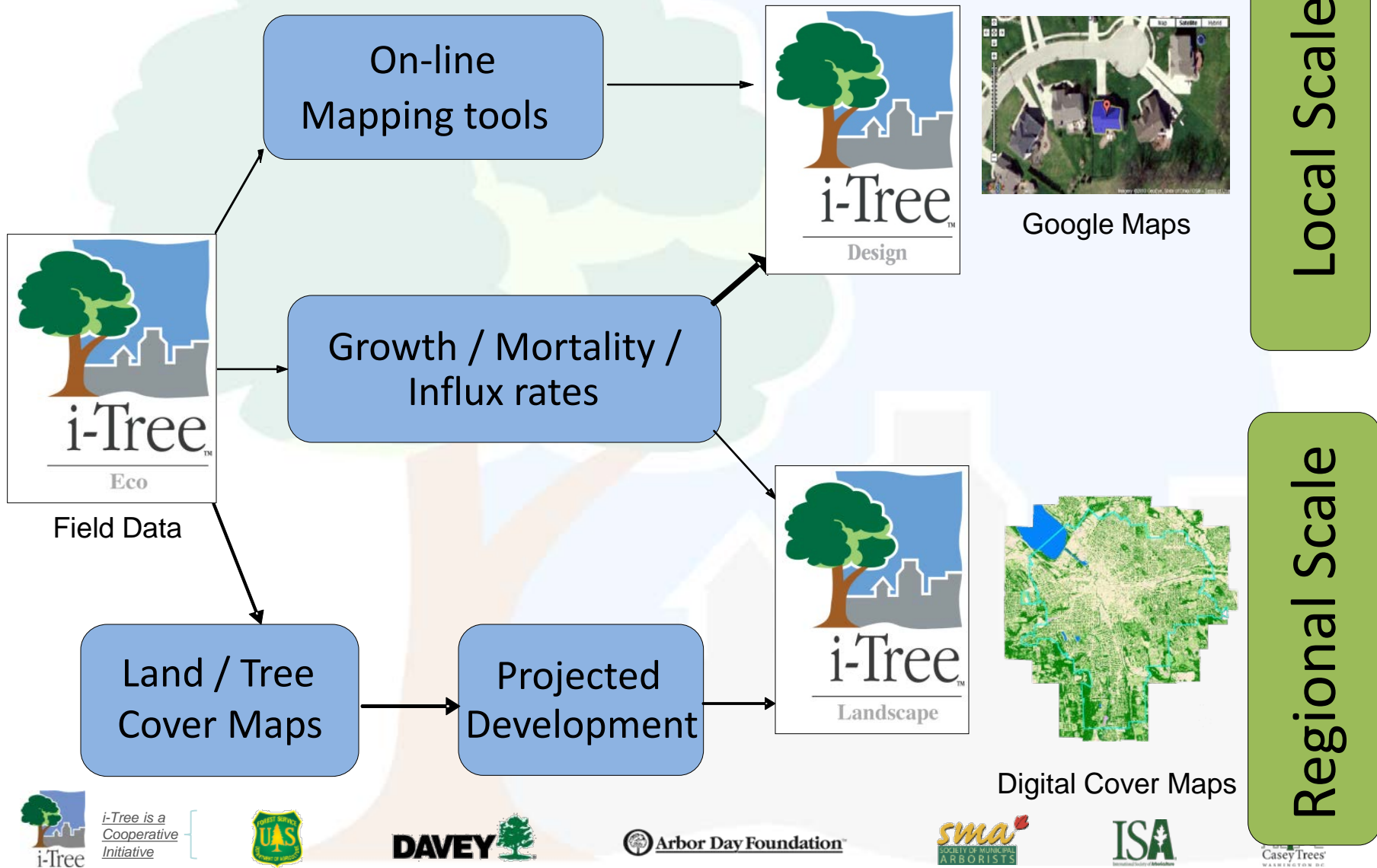


# Hydro Modeling





# i-Tree 2<sup>nd</sup> Generation





# i-Tree v4 Summary

- 🌳 Accessible urban forest assessment tools
- 🌳 Potential to reach new audiences
- 🌳 More options for creating value







*Thank you*

Visit: [www.itreetools.org](http://www.itreetools.org)

Email: [al.zelaya@davey.com](mailto:al.zelaya@davey.com)



i-Tree is a  
Cooperative  
Initiative

