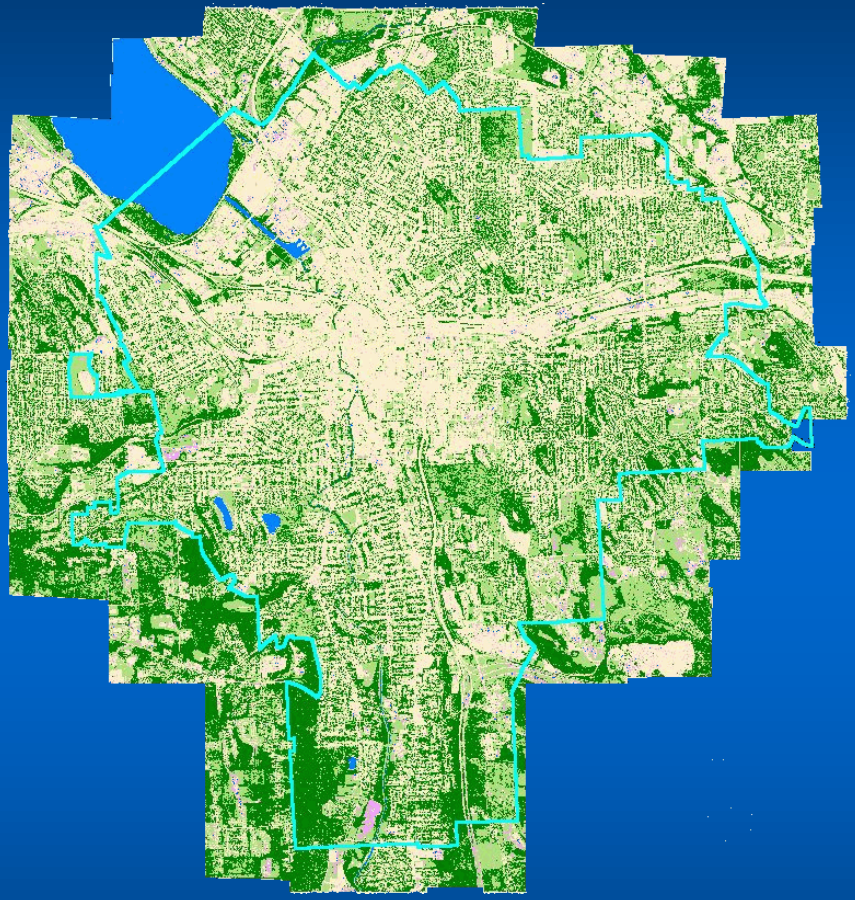
# Assessing Urban Forests



Top-down

Bottom-up

# Assessing Urban Forests

- **Top-down**
  - **Produces good cover estimates**
  - **Can detail and map tree and other cover locations**
- **Bottom-up**
  - **Provides detailed management information**
    - **No. trees, spp. composition, tree sizes and health, tree locations, risk information…**
  - **Provides better means to assess and project ecosystem services and values**
    - **Air pollution removal, carbon storage…**

# Top-down Approaches

- **30 m resolution imagery (NLCD)**
- **High resolution imagery (UTC)**
- **Photo-interpretation (GIS or iTree Canopy)**

# NLCD

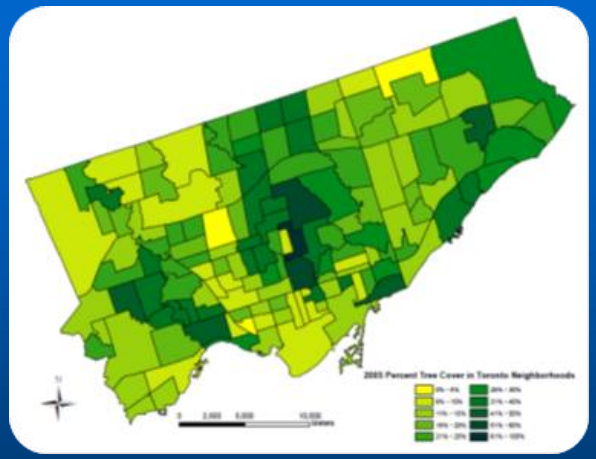
- Advantages
  - Free
  - Covers of lower 48 states
  - Data from circa 2011
- Disadvantages
  - Coarse resolution
  - Better suited for state or regional analyses
  - Initial analysis - underestimates tree cover
    - Eg. Syracuse  18% NLCD11 vs. PI 30% vs. UTC10 28%

# UTC

- ***Advantages***
  - Accurate, high-resolution cover map
  - Complete census of tree canopy locations
  - Integrates well with GIS
  - Allows the data to be summarized at a broad range of scales
  - Locates potentially available spaces to plant trees
- ***Disadvantages***
  - Can be costly if the data are low quality or incomplete (LiDAR)
  - Requires highly trained personnel along with specialized software
  - Significant effort and time needed to produce quality maps
  - Change analyses can locate false changes due to map inaccuracies

# Photo-Interpretation i-Tree Canopy

- ***Advantages***
  - Low cost
  - Accuracy can be easily increased
  - Can produce sub-area analyses
- ***Disadvantages***
  - Does not produce detailed cover map
  - Photo-interpreters can create errors though misclassifications
  - Leaf-off imagery can be difficult to interpret
  - i-Tree Canopy interpretation limited to Google images
  - Resulting data cannot be summarized at multiple, user-defined scales

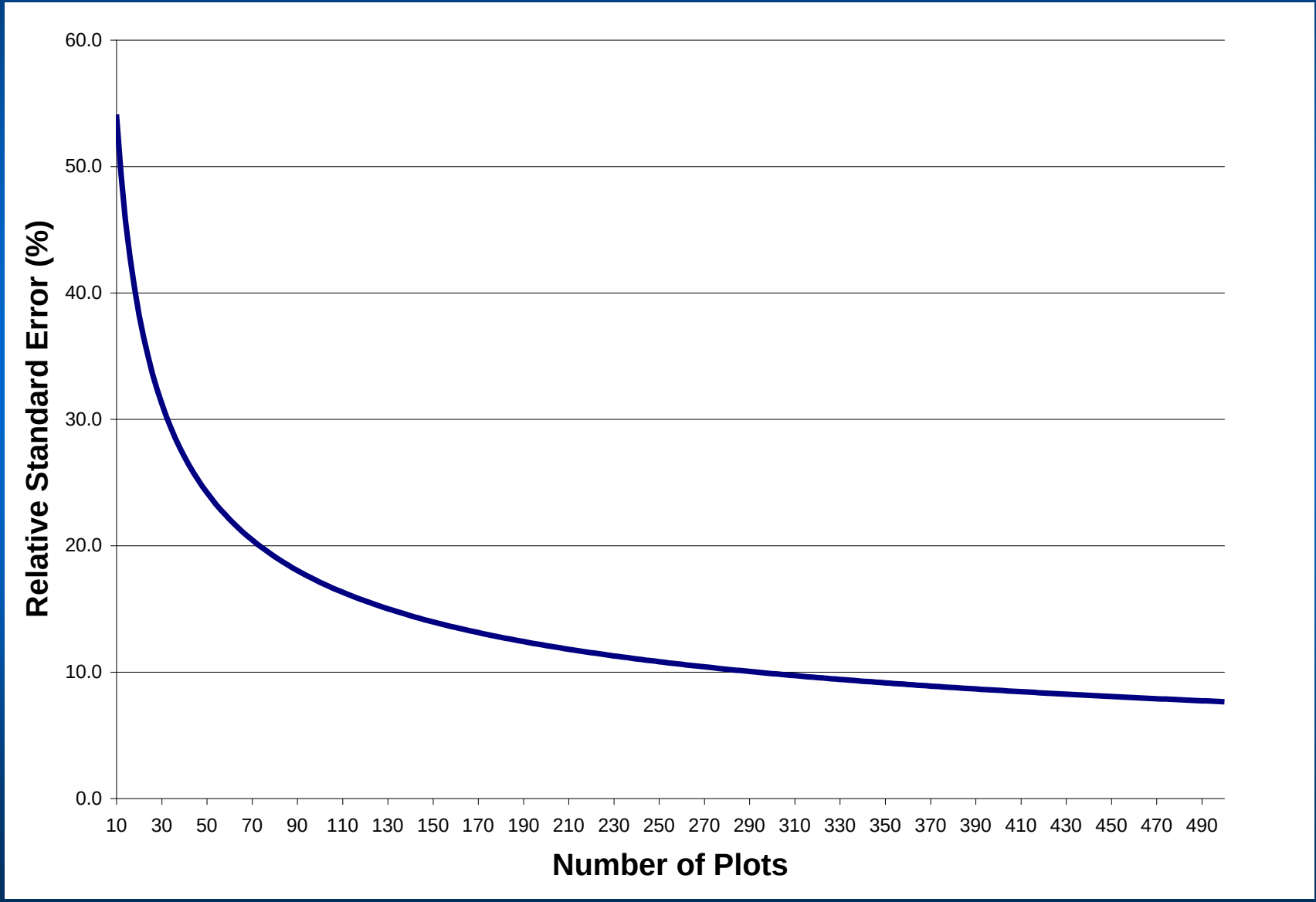


- N = Total points
- P = no. hits; Q = no. misses (N – P)
- p = % hits (P/N); q = % misses (Q/N)
- %cover = P/N
- SE = sqrt (p • q / N)

# Standard Error

- **Measure of precision**
  - **68% confidence = +/- 1 SE**
  - **95% confidence = +/- 1.96 SE**
  - **99% confidence = +/- 2.58 SE**
- **E.g., at 95% CI (Margin of Error)**
  - **30% canopy, 220 pts, ME +/- 6%**
  - **Between 24% and 36%**

# Effect of sample size on precision

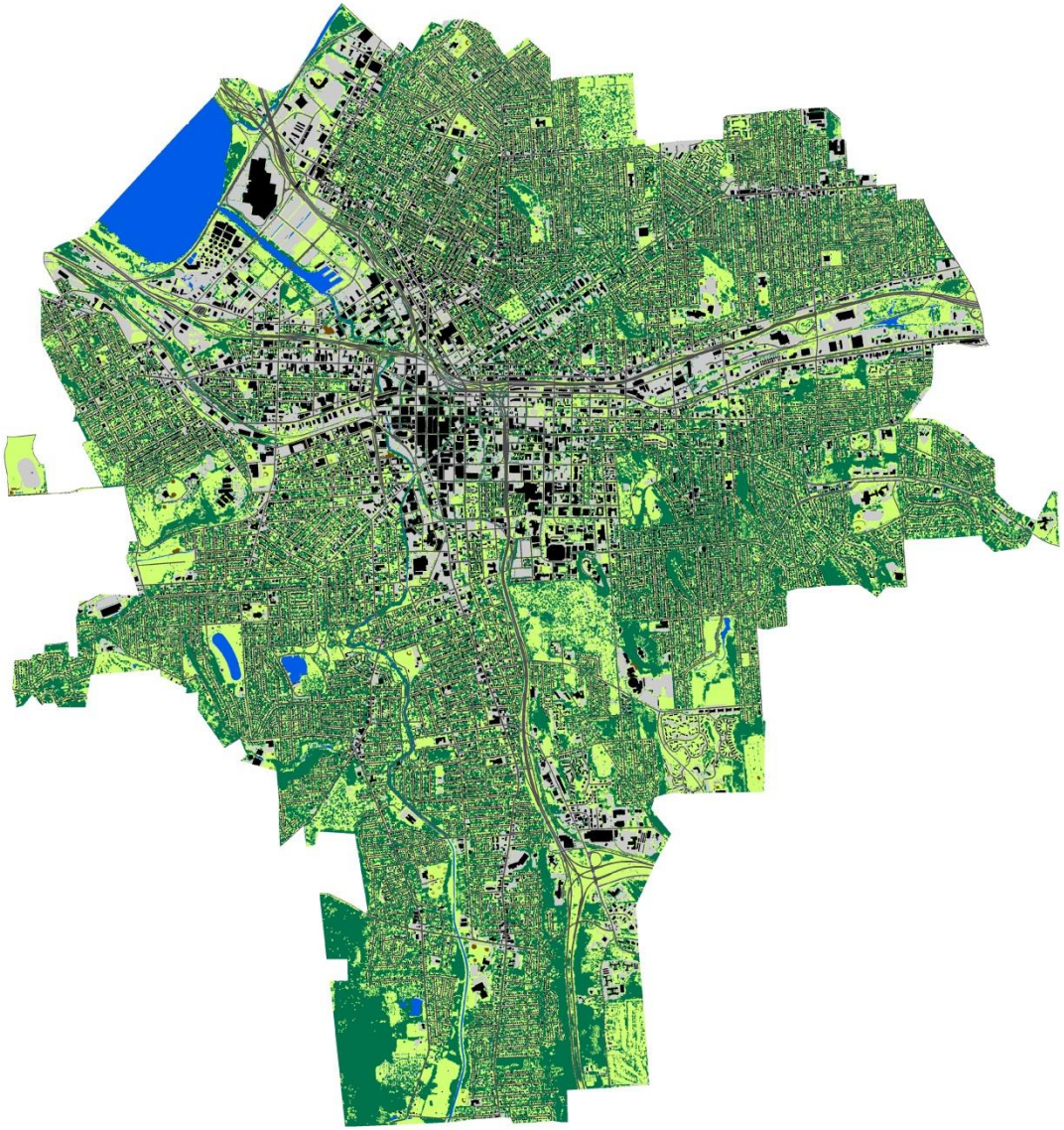


# Demo


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

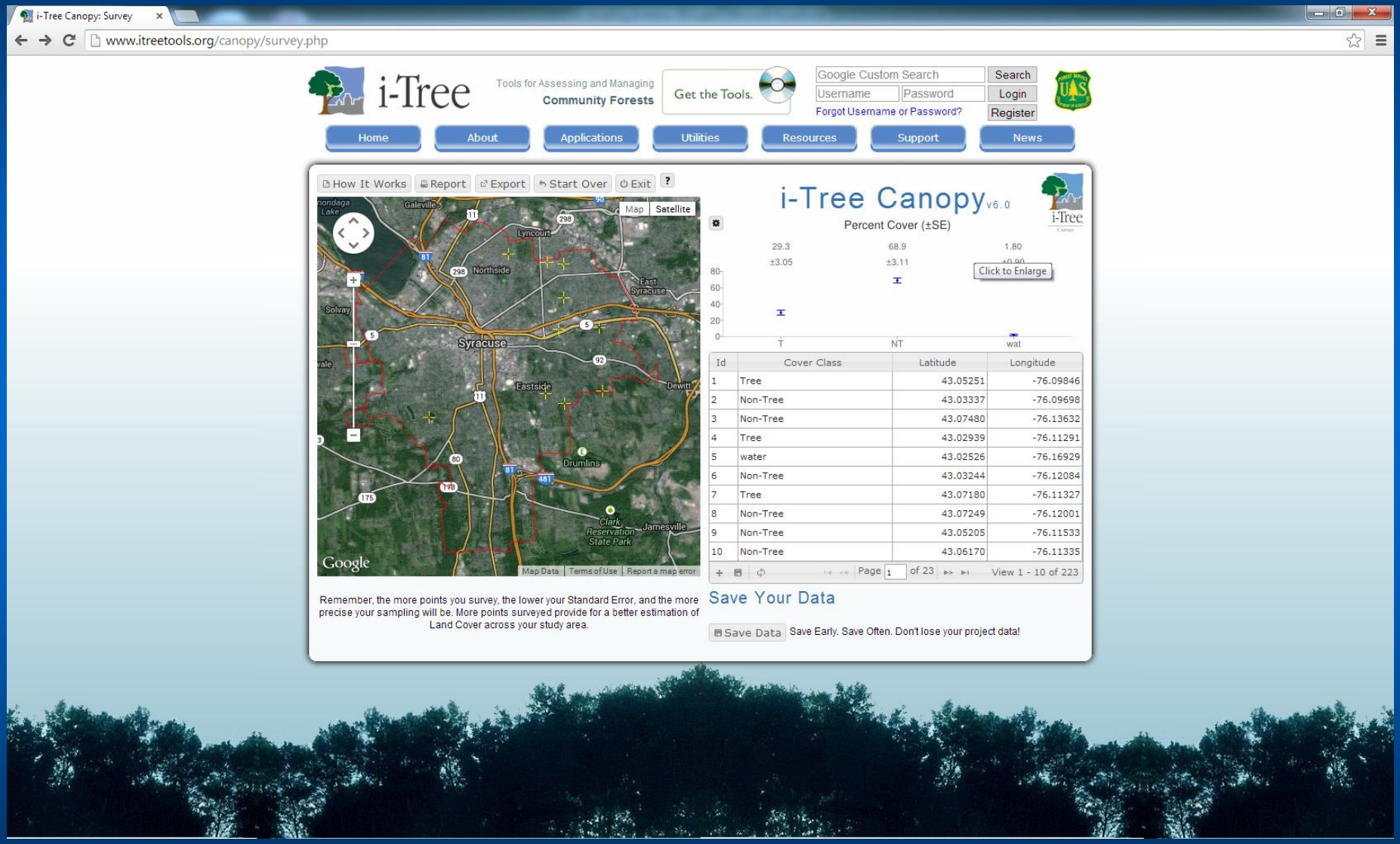
## NLCD11

- 18%
- 3,000 acres



## UTC 2010

- 28%
- 4,700 acres


i-Tree Canopy: Survey
www.itreetools.org/canopy/survey.php
i-Tree
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i-Tree Canopy v6.0
Percent Cover (±SE)
29.3
±3.05
68.9
±3.11
1.80
Click to Enlarge
80
60
40
20
0
T
NT
wat
Id
Cover Class
Latitude
Longitude
1 Tree 43.05251 -76.09846
2 Non-Tree 43.03337 -76.09698
3 Non-Tree 43.07480 -76.13632
4 Tree 43.02939 -76.11291
5 water 43.02526 -76.16929
6 Non-Tree 43.03244 -76.12084
7 Tree 43.07180 -76.11327
8 Non-Tree 43.07249 -76.12001
9 Non-Tree 43.05205 -76.11533
10 Non-Tree 43.06170 -76.11335
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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!

i-Tree Canopy: Cover Rep ×

www.itreetools.org/canopy/report.php?

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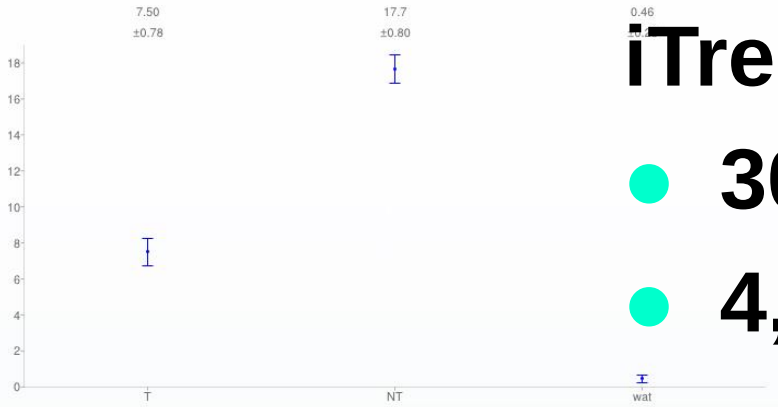
# i-Tree Canopy v6.0

## Cover Assessment and Tree Benefits Report

*Estimated using random sampling statistics on 6/03/14*

Land Cover (mi² ±SE)




| Cover Class | Description | Abbr. | Points | Land Cover |
|---|---|---|---|---|
| Tree | Tree, non-shrub | T | 65 | 7.50 ±0.78 |
| Non-Tree | All other surfaces | NT | 153 | 17.7 ±0.80 |
| water | | wat | 4 | 0.46 ±0.23 |

**Tree Benefit Estimates**

| Abbr. | Benefit Description | Value | ±SE | Amount | ±SE |
|---|---|---|---|---|---|
| CO | Carbon Monoxide removed annually | $3,595.48 | ±375.04 | 2.71 T | ±0.28 |
| NO2 | Nitrogen Dioxide removed annually | $440.33 | ±45.93 | 1.26 T | ±0.13 |
| O3 | Ozone removed annually | $231,331.57 | ±24,129.68 | 92.37 T | ±9.63 |
| PM2.5 | Particulate Matter less than 2.5 microns removed annually | $546,607.74 | ±57,015.43 | 5.13 T | ±0.54 |
| SO2 | Sulfur Dioxide removed annually | $331.38 | ±34.57 | 3.58 T | ±0.37 |
| PM10* | Particulate Matter greater than 2.5 microns and less than 10 microns removed annually | $151,887.48 | ±15,843.04 | 24.32 T | ±2.54 |
| CO2seq | Carbon Dioxide sequestered annually in trees | $457,473.05 | ±47,717.99 | 23,625.73 T | ±2,464.35 |
| CO2stor | Carbon Dioxide stored in trees (Note: this benefit is not an annual rate) | $13,876,649.26 | ±1,447,442.34 | 716,645.54 T | ±74,751.70 |

*i-Tree Canopy Annual Tree Benefit Estimates based on these values in lbs/acre/yr and $/T/yr: CO 1.123 @ $1,333.50 | NO2 0.524 @ $349.91 | O3 38.343 @ $2,513.37 | PM2.5 2.130 @ $106,919.88 | SO2 1.488 @ $92.80 | PM10* 10.094 @ $6,268.44 | CO2seq 9,807.385 @ $19.43 | CO2stor is a total biomass amount of 297,489.961 @ $19.43*

# iTree Canopy14

- 30%
- 4,800 acres

# Questions?