
Urban Tree Inventories
Urban Forestry Institute
Art Chappelka
May 6, 2013

What is a tree inventory?

- A tree inventory is the collection and *dissemination* of accurate information on the health and diversity of the urban/community forest

Why do we need to inventory our trees?-Definition-Dr. C.

- What do we have?
- What do we want?
- What are we going to do?

Specific Reasons for conducting tree inventories

- Determine the need for a tree management program
- Knowledge of the value of the urban forest resource
- Identify priorities
- Increase efficiency of tree management
- Public information and education

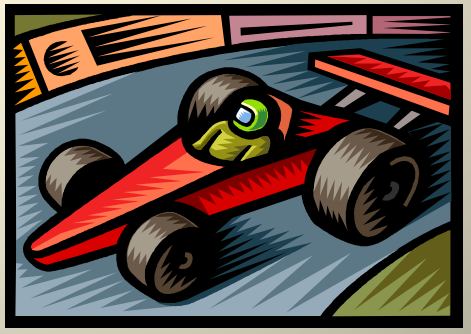
Identify priorities

- By knowing what you have and what it is worth helps you prioritize goals
- Accentuate assets-Reduce or remove liabilities
- Facilitate the planning process and development of a comprehensive community forest management plan

Increase efficiency of tree management

- This is related to prioritization
- Knowing what is the priority can help in your efficiency
  - Make a “to-do” list

Time is $



Public information and education

- Knowing what you have helps in educating the public as to what the resource is, worth ($) and what is being done or can be done to protect the resource

Things to think about before conducting an inventory

- **The minute/*second* you finish an inventory it is out-of-date!!!**
- How much money are you willing to pay influences the type of inventory?
- How much time do you want to spend?
- Do you have the expertise locally, or do you need to hire a consultant?
- ***Only collect data that will be used!!!!!!!!!!!!!***
  - ***What information do you want and why?***

Type of Inventory to use

Type of Inventory

- Specific Problem Inventories
- Partial Inventories
- Complete Inventories
- Cover Type Assessments

Specific Problem Inventories

- Collect specific information regarding one problem or condition
- Used to prepare contracts or schedule work
- Collect minimal data, relatively inexpensive and can be completed quickly (“windshield” survey, motorized vehicle, etc.)
- Examples:
  - Disease or insect surveys
  - Hazard tree survey**
  - Storm damage survey
  - Planting space survey

Partial Inventories

- Involve data collection from a sample or small portion of the city
- Depending on the type of survey the inventory can be rapid or more time-consuming, depending on the data to be collected

Types of Partial Tree Inventories

- **Windshield surveys-fairly inexpensive**
  - **The observer records data from the vehicle spending little time a each tree**
    - **Data collected could include tree species, relative size,**
    - **relative health, numbers of trees, etc.**
    - **Address of houses are generally not recorded**
    - **10% of total population is a goal**

Types of Partial Tree Inventories

- “On-ground” Inventories-more data collected on the tree including the address
- Most are used to prepare tree-work contracts (maintenance, etc.)
- These inventories can be expanded over time to include the entire population

Complete Inventories

- Examine the entire population
- Useful in smaller, “important” areas; parks, universities, historical areas, etc.
- Time consuming, labor intensive
- Provides a very accurate data set

Special types of inventory “Packages” Available

- Inventory applications
  - ArborVue
  - Arbor Pro
  - Tree Keeper
- Environmental services tools (i-Tree)
- Urban Tree Risk Index (UTRI)
- Post-storm debris estimation models
- Urban Tree Canopy Assessment (UTC) Tools
  - Hyperspectral imagery
  - i-Tree canopy/Vue
  - Ecognition
  - Other

Urban Canopy Assessment & Tools

Urban Tree Canopy Assessments

- Utilize aerial photographs, remote sensing, GIS, other techniques. Starting to become more popular as the technology gets better.
- Can provide useful information over a large area.
- Useful for planning purposes, especially if you
- have photographs over time.
- Cost can be relatively low, however you need competent technical support personnel.

UTC Assessments
Overall Goal

- To provide decision makers with detailed measures of the existing UTC. These data help in knowing current forest canopy cover, but allows for planning reasonable approaches in increasing UTC, ie, How much UTC do I have, and How much should/could I have?

How do we do this?

- Use a tool (s)!

UTC Tools

- Hemispherical photos
- Remote sensing
  - Landsat
  - Hyperspectral imagery
- Lidar
  - Aerial
  - Ground-based
- i-Tree canopy/Vue

Hemispherical photos

- “Hemispherical photography, also known as fisheye or canopy photography, is a technique to estimate solar radiation and characterize plant canopy geometry using photographs taken looking upward through an extreme wide-angle lens. Typically, the viewing angle approaches or equals 180-degrees, such that all sky directions are simultaneously visible. The resulting photographs record the geometry of visible sky, or conversely the geometry of sky obstruction by plant canopies or other near-ground features. This geometry can be measured precisely and used to calculate solar radiation transmitted through (or intercepted by) plant canopies, as well as to estimate aspects of canopy structure such as leaf area index.”
- Wikipedia

Hemispherical photos

- Advantages:
  - Relatively inexpensive
  - Can get a good measure of LAI and subsequent cover
- Disadvantages
  - **Lots** of photos
  - Somebody has to read and interpret them

Remote sensing

- Landsat data available
- Need expertise to interpret data; sometimes need additional software ($).
- Resolution problems
- Time of year important

Hyperspectral imagery

- “Hyperspectral imaging, like other spectral imaging, collects and processes information from across the electromagnetic spectrum. Much as the human eye sees visible light in three bands (red, green, and blue), spectral imaging divides the spectrum into many more bands. This technique of dividing images into bands can be extended beyond the visible.”
- Wikipedia

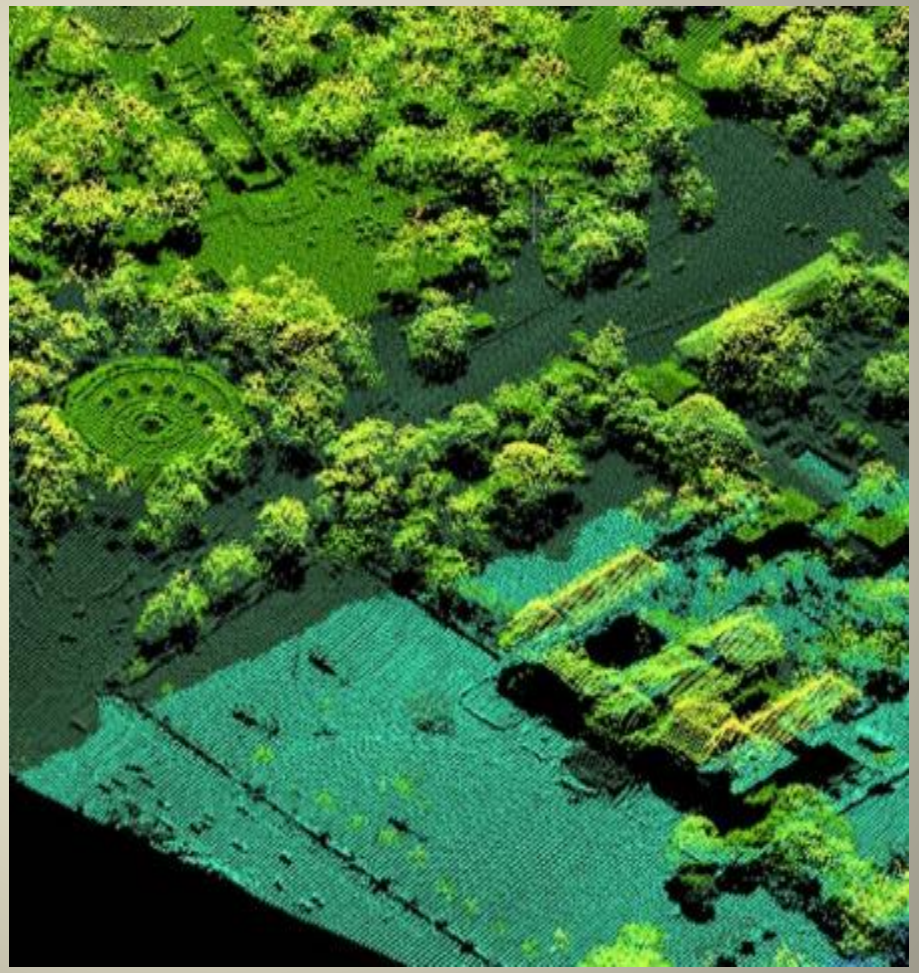
Hyperspectral imagery

- Advantages
- The entire spectrum is acquired
- Can determine the health of the forest
- Heat Islands, etc.
- Disadvantages
- Expensive & complex: Need fast computers, sensitive detectors, large data storage capacity

Lidar-Aerial

- **Lidar** (**LI**ght **D**etection and **R**anging or **L**aser **I**maging **D**etection and **R**anging) is an optical remote sensing technology that can measure the distance to, or other properties of, targets by illuminating the target with laser light and analyzing the backscattered light.
- Wikipedia

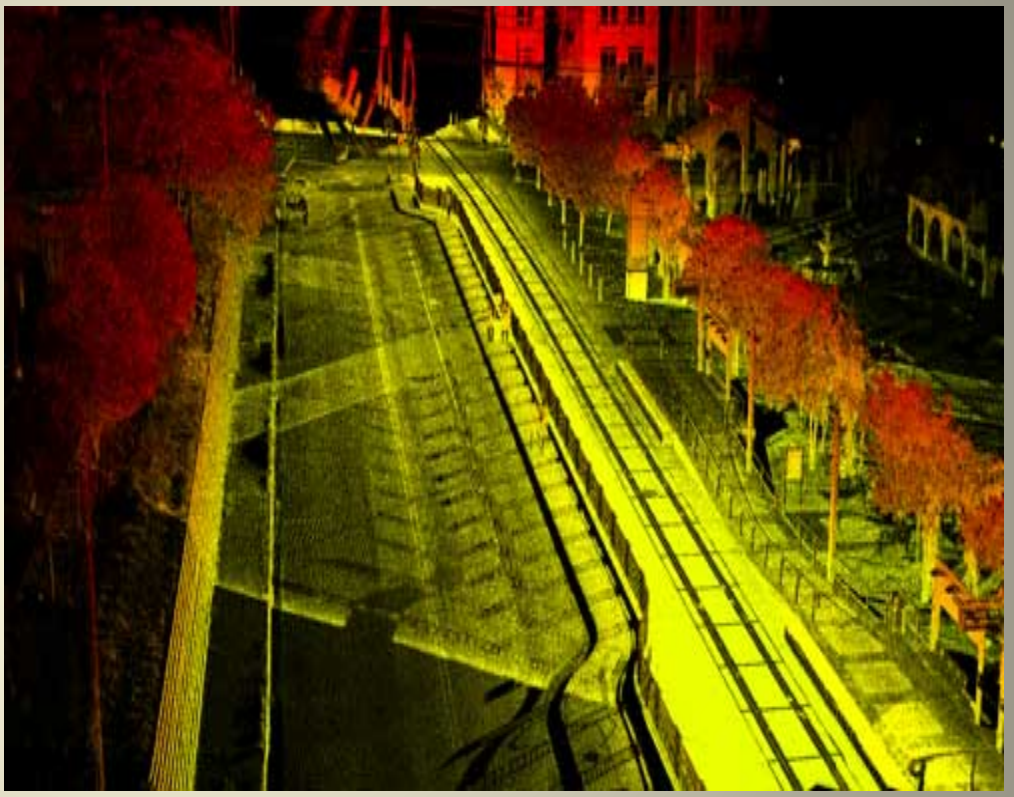
Lidar-Aerial



Lidar-Aerial

- Advantages
  - Very Accurate-3D
  - Covers large areas
- Disadvantages
  - Cost-plane, equipment, etc.
  - Computer space
  - Need expertise to conduct analysis

Lidar-Ground-based



Lidar-Groundbased

- Advantages
  - Accurate-3D
- Disadvantages
  - Equipment Cost (Expensive)
  - Need a lot of images-time
  - Need lots of computer space
  - Need expertise to conduct analysis

i-Tree Vue

- Part of the i-Tree Applications package
- i-Tree Vue-Allows one to make use of the free National Land Cover Database (NLCD) satellite-based imagery to assess urban land cover, including tree canopy, and provides estimates of various ecosystem services (C storage/sequestration, pollution removal). The effects of planting scenarios on future benefits can also be modeled.

i-Tree Vue

- Advantages
  - Simple to use
  - Free
  - Quick snapshot of landcover, including canopy cover & impervious surfaces
- Disadvantages
  - 30 m resolution-problems with cover types (young trees for example)
  - Use data available, may not be current year, or right time of year
  - Hard to discern various cover types

i-Tree Canopy

- “With i-Tree Canopy, you review Google Maps aerial photography at random locations to conduct a cover assessment within a defined project area.
- You draw your project area boundaries right onto Google Maps or you load an ESRI polygon shapefile in *latitude / longitude coordinates*
- i-Tree Canopy randomly generates sample points and zooms to each so you can choose from your pre-defined list of cover types for that location.
- 500-1000 survey points are suggested; the more points you complete, the better your cover estimate for your study area.” (refer to i-Tree applications)

i-Tree Canopy

- Advantages
  - Simple to use
  - Free
  - Fairly accurate estimate of canopy cover & various ecosystem services

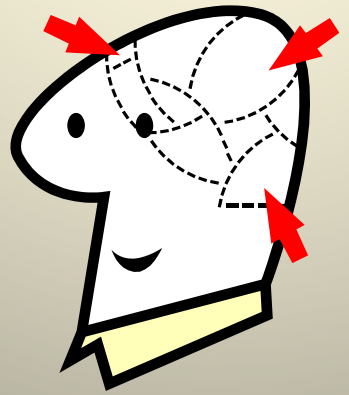
i-Tree Canopy

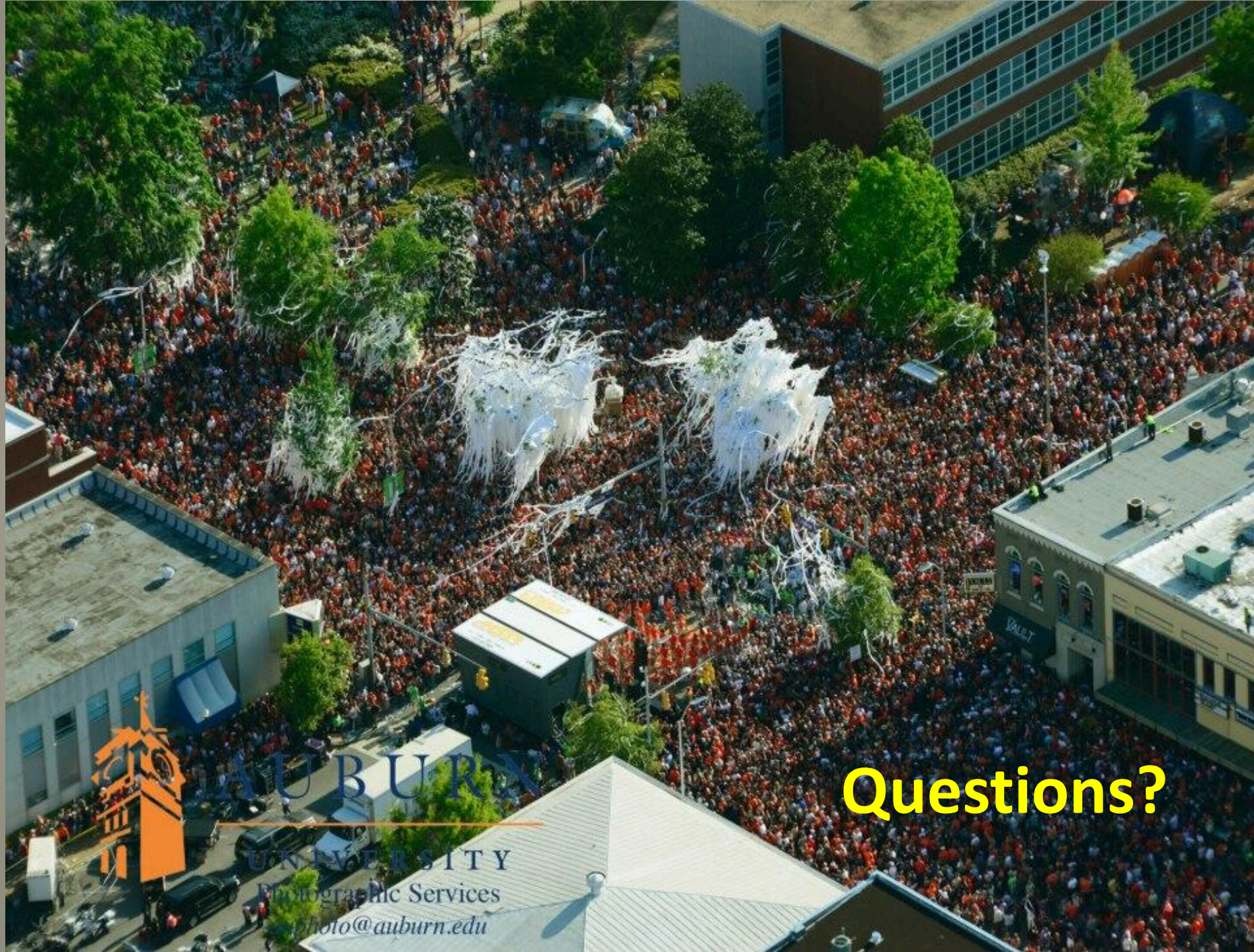
Limitations:

- “The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. Thus the classes that are chosen for analysis must be able to be interpreted from an aerial image. 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. Information on calculating standard errors can be found below.
- Another limitation of this process is that the Google imagery may be difficult to interpret in all areas due to relatively poor image resolution (e.g., image pixel size), environmental factors, or poor image quality.” (refer to i-Tree applications)

Conclusions

- **These are only tools**
- Use wisely
- Use what you **need** and can **afford**
- Understand the technology **BEFORE** you use it
- Know limitations of the method used
- Preplan




AUBURN
UNIVERSITY
Photographic Services
photo@auburn.edu
Questions?