Understanding our Urban Forest Assets:

Methods of Tree Inventory and Urban Tree Canopy Analysis

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Southern Regional Extension Forestry Webinar

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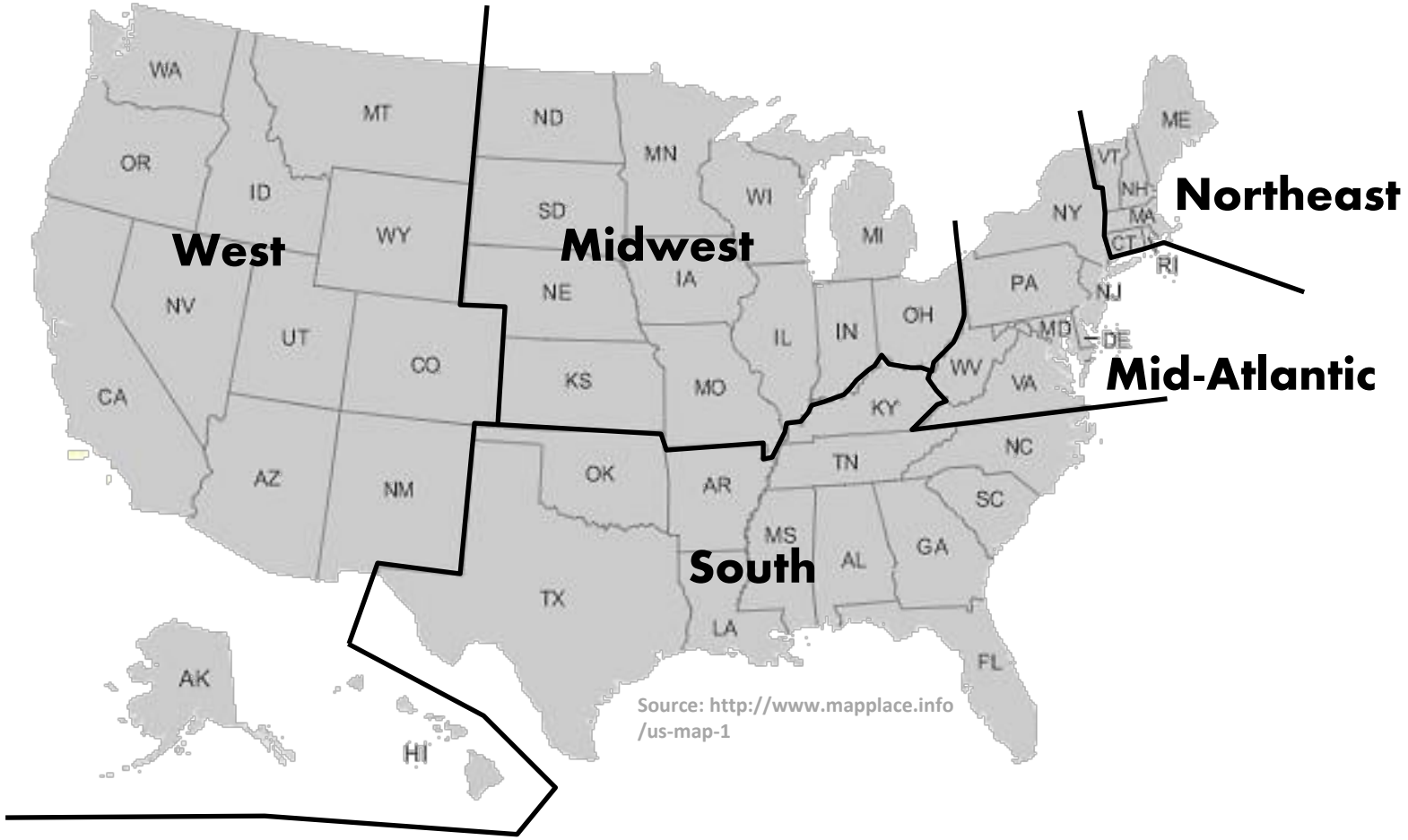
Virginia Cooperative Extension
Virginia Tech • Virginia State University

Learning Objectives

1. **Define urban forest assessment and discuss key concepts**
2. **Understand the basic applications and approaches of urban forest assessment**
3. **Understand the capabilities and limitations of urban forest assessment approaches**
4. **Identify tree inventory methods and tools for conducting them**
5. **Identify UTC analysis methods and tools for conducting them**

Where are you viewing from today?



A. West

B. Midwest

C. South

D. Northeast

E. Mid-Atlantic

What's your affiliation?

A. Commercial arborist/consultant

B. Municipal arborist/urban forester

C. State/federal agency or university

D. Non-profit or civic group

E. Other

What's your urban forest assessment background?

A. I'm a pro...I've done a bunch!

B. I've worked on a few, but I'm still figuring it all out.

C. I've read about them, but have never done one myself!

D. Uhh...what's an urban forest assessment?

What is Urban Forest Assessment?

Urban Forest Assessment ~
Observation and evaluation of the quantity, quality, and distribution of urban forest resources within a defined geographic area of interest.

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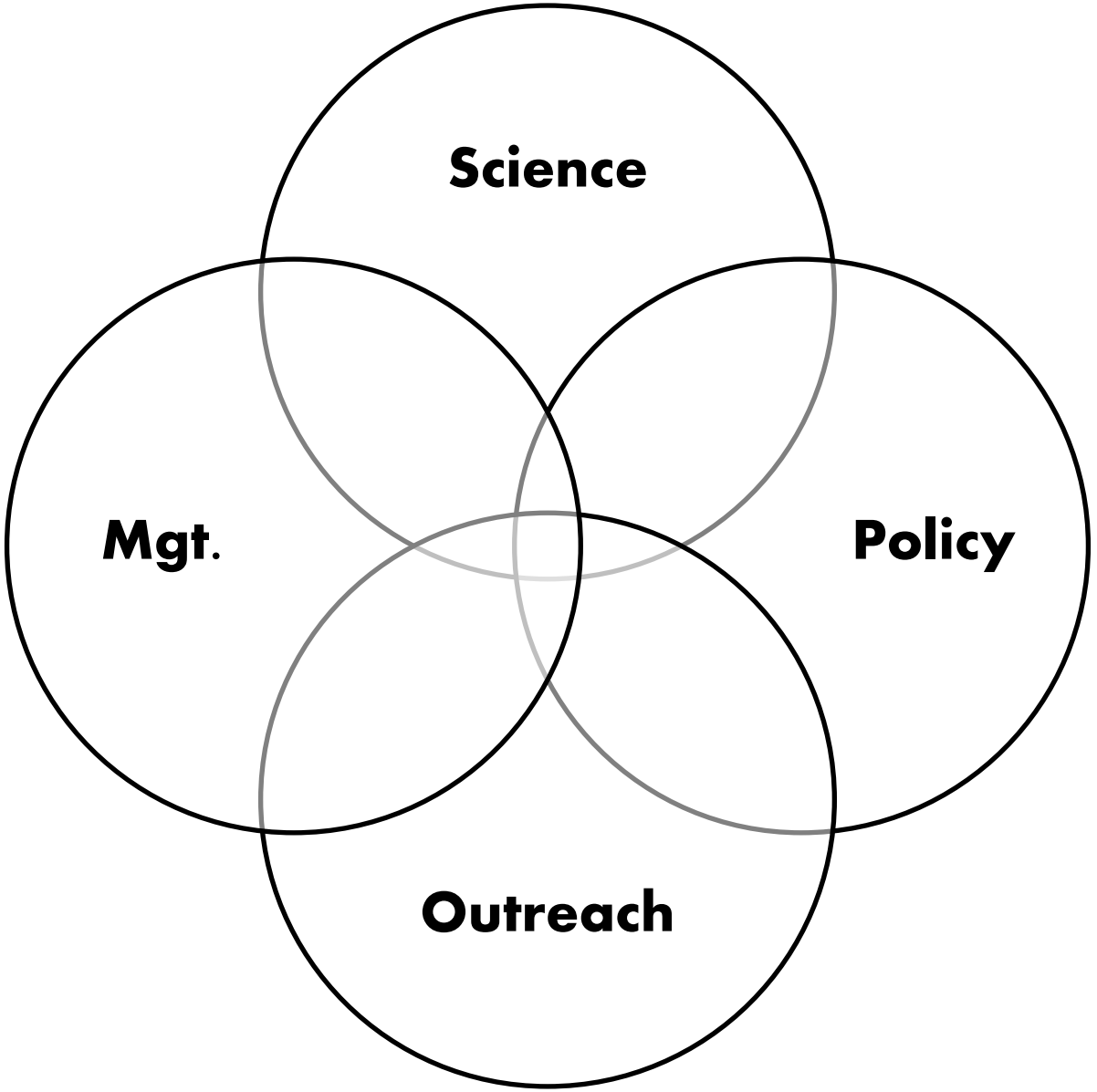
Observation and evaluation of the quantity, quality, and distribution of urban forest resources within a defined geographic area of interest.

Observation
Locating
Identifying
Measuring
Classifying
Rating

⇨ **DATA** ⇨

Evaluation
Existing & Potential UTC
Tree Population Metrics
Connectivity & Spatial Relations
Assets, Liabilities, & Risks
Hi-Value/Low-Value Resources
Threatened/Secure Resources
Management Opportunities
Ecosystem Function
Benefits and Costs

Applications of Urban Forest Assessment



Applications of Urban Forest Assessment

What Do We Have?

Resource Assessment

What Do We Want?

Management Objectives

How Do We Get There?

Management Plans

Are We There Yet?

Reassessment

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TREE INVENTORY
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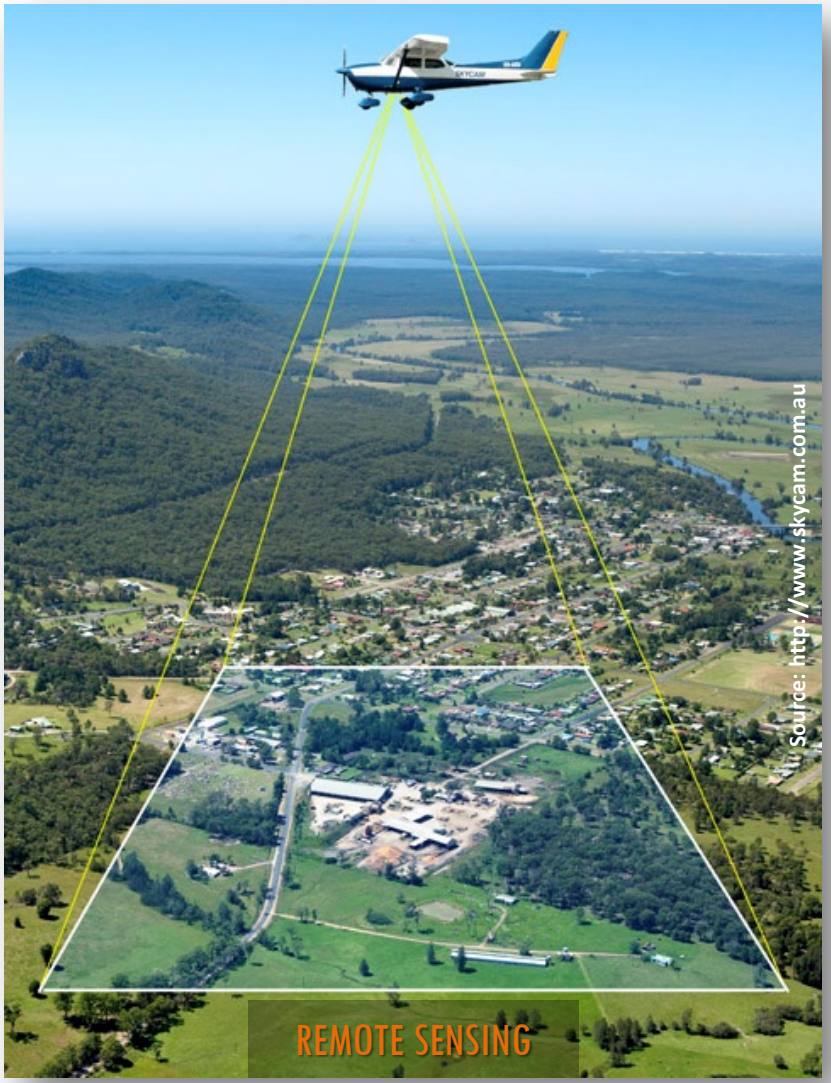
Approaches of Urban Forest Assessment

Bottom-Up Approach

Top-Down Approach

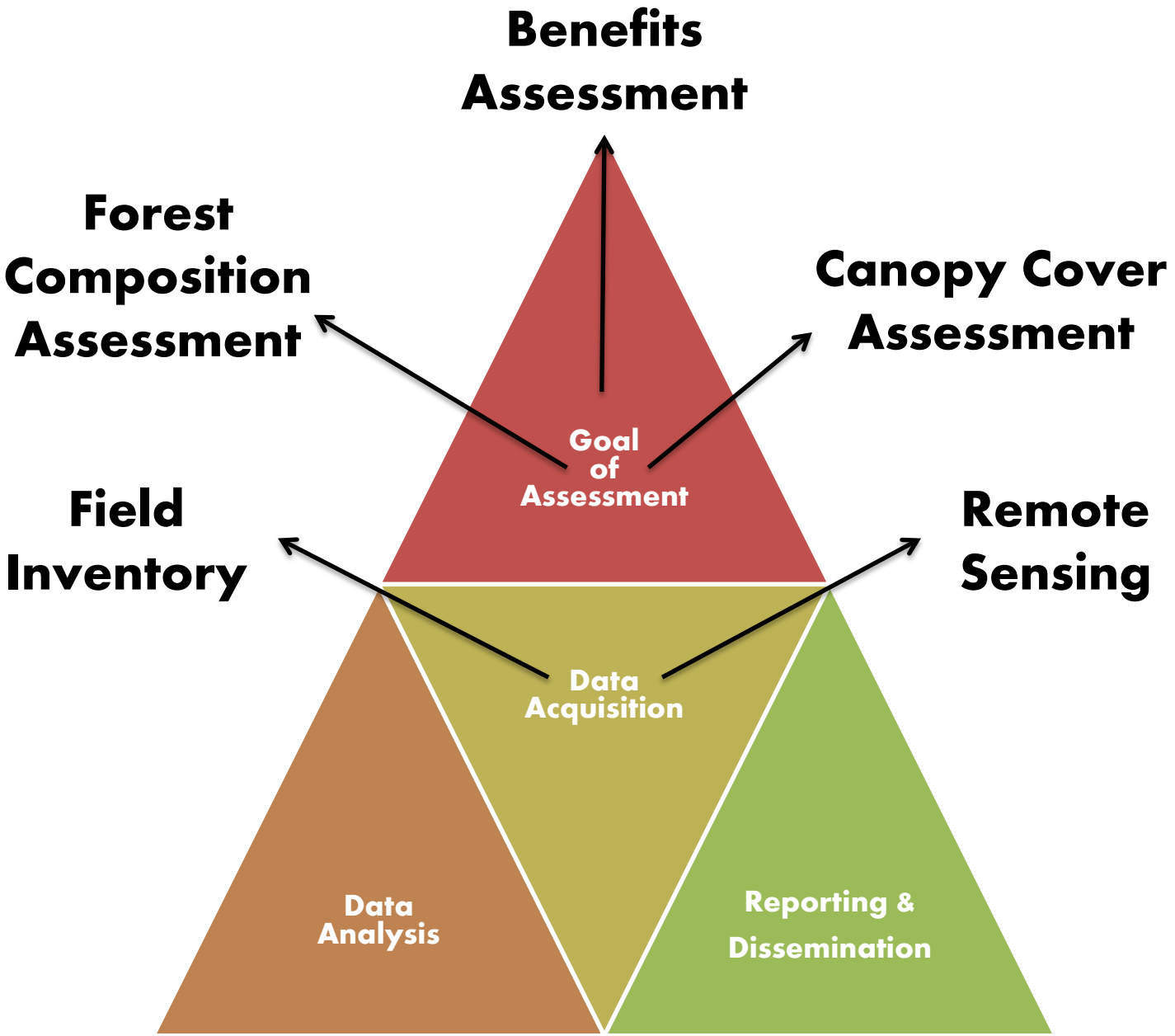


Capabilities of Assessment Approaches

Data Acquisition and Application (Poor / Fair / Good / Excellent)	Bottom-Up	Top-Down
Cost – Time – Expertise	varies	varies
Tree Canopy Cover	P	E
Leaf Area and Biomass	G	F
Tree Abundance and Density	E	F
Tree Size/Age Distribution	E	F
Species Composition and Diversity	E	F
Tree Condition	E	F
Tree Disorders and Pests	E	F
Failure or Conflict Risks	E	P
Tree Maintenance Needs	E	P
Potential Planting Space	G	G
Site Quality	E	P
Ground Cover	E	F
Ecosystem Functions & Values	G	G

Adapted from US Forest Service NRS-INF-24-14

The Urban Forest Assessment Model



Pop Quiz

Question 1:

The two basic approaches of urban forest assessment include:

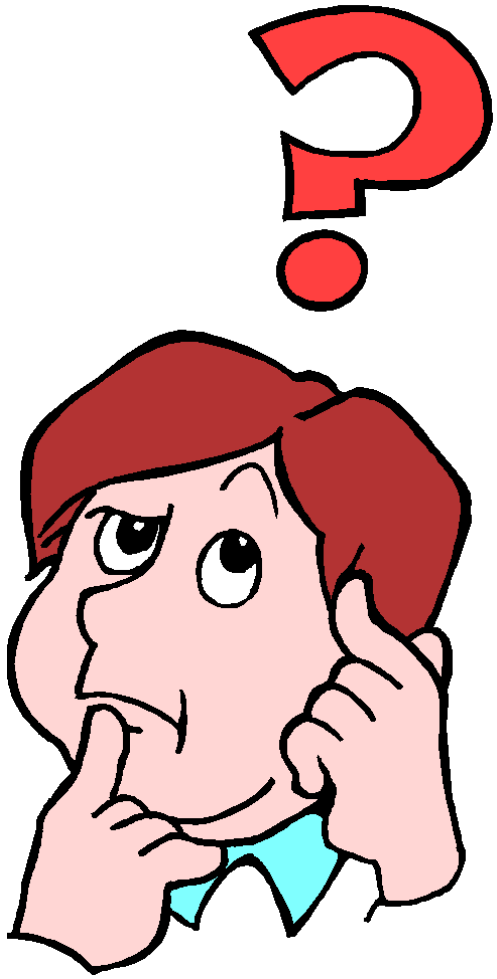
A. Bottom-Up Approach

B. Top-Down Approach

C. Right-Side-Up Approach

D. A & B only

E. B & C only



Pop Quiz

Question 2:

In choosing an urban forest assessment approach, one must consider

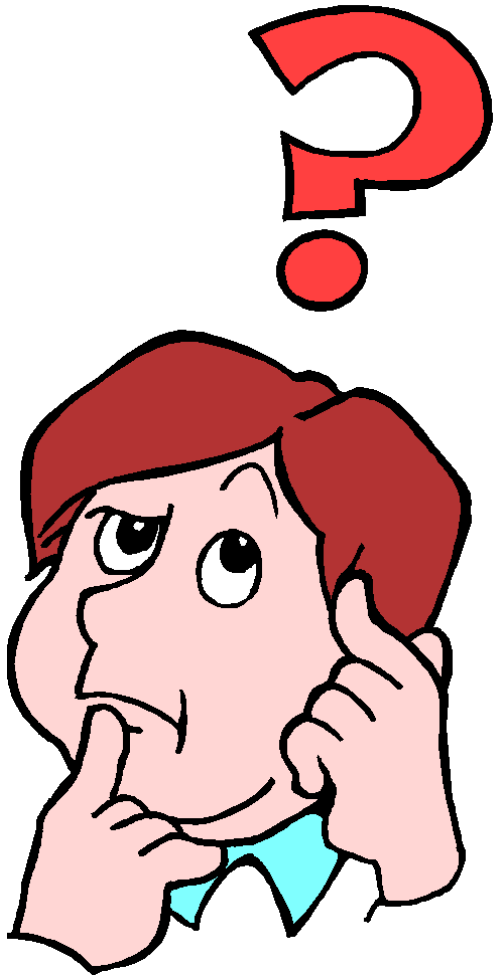
A. The assessment goal

B. Available resources & expertise

C. Capabilities of the assessment approach

D. All of the above

E. None of the above



Types of Tree Inventories

Complete Inventory

- "Census"
- Inventory of the entire tree population

Sample Inventory

- "Sample"
- Inventory of a representative portion of the tree population

Partial Inventory

- "Survey"
- Inventory of a critical portion of the tree population

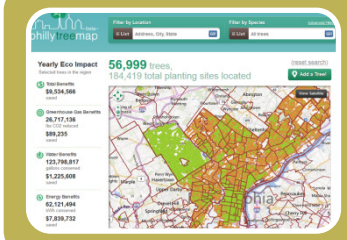
Tree Inventory Options

User-Customized

- Pencil-and -Paper
- Technology-Based

i-Tree Tools

- i-Tree Streets
- i-Tree Eco



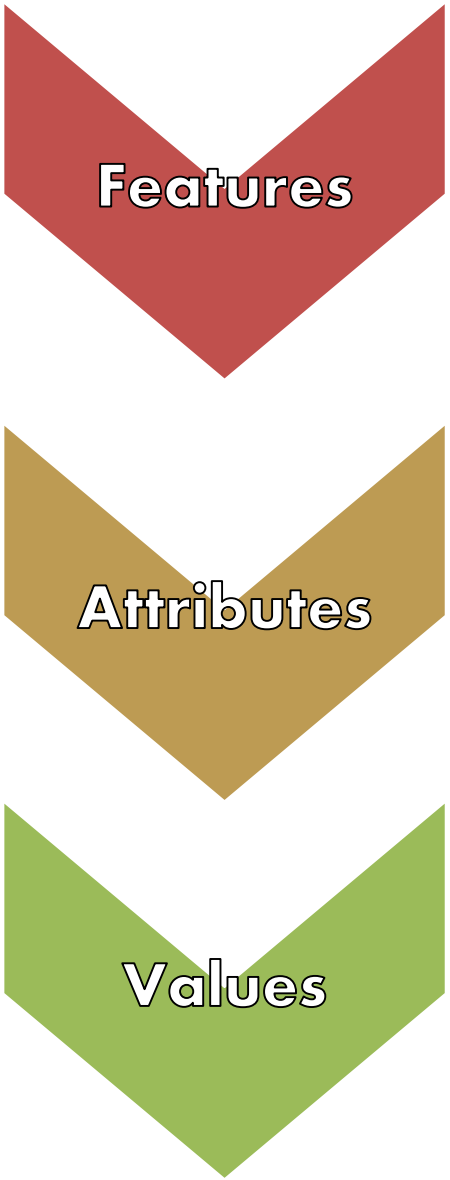
Crowd-Sourced

- OpenTreeMap (Azavea)
- Tree Plotter LITE (Plan-It Geo)

Commercial

- Bartlett Inventory Solutions (Bartlett Tree Experts)
- TreeKeeper Suite (Davey Resource Group)

Tree Inventory Data Hierarchy



- Live Trees
- Dead Trees
- Stumps
- Available Planting Spaces

- Location
- Physical Dimensions
- Characteristics (Ownership, Spp. Name, Condition, Site Descriptors)
- Maintenance History/Needs/Priority

- Qualitative (name; condition; yes/no)
- Quantitative
  - Class (e.g., 0-8″, 9-16″, 17-24″, >24″)
  - Unit (e.g., 25% UTC, 14″ DBH, 45′ Tall)

Examples of Tree Inventory Uses

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UTC ANALYSIS

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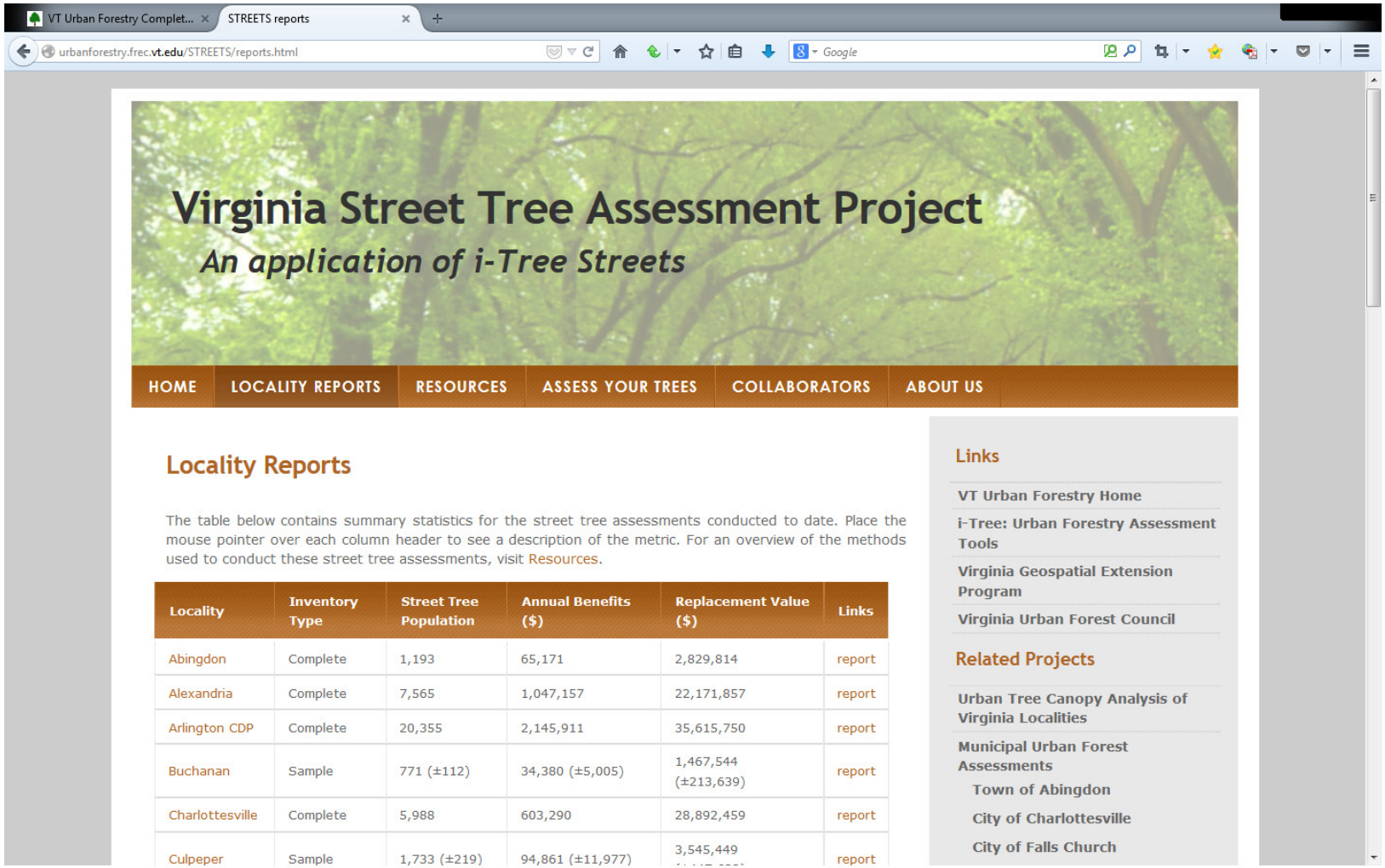


Pop Quiz

Question 3:

A complete urban tree inventory:

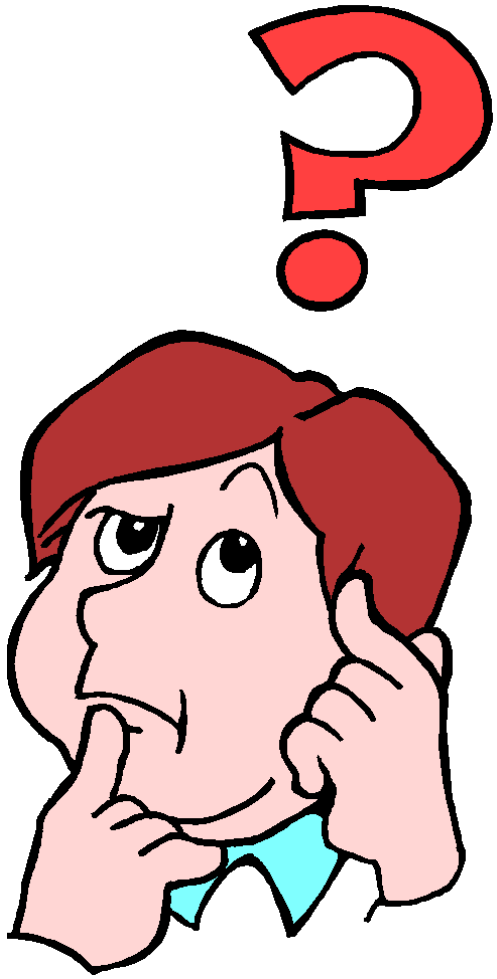
A. **Is also called a census**

B. **Is an inventory of the entire tree population in a defined area**

C. **Requires careful selection of data features, attributes, and values**

D. **All of the above**

E. **None of the above**



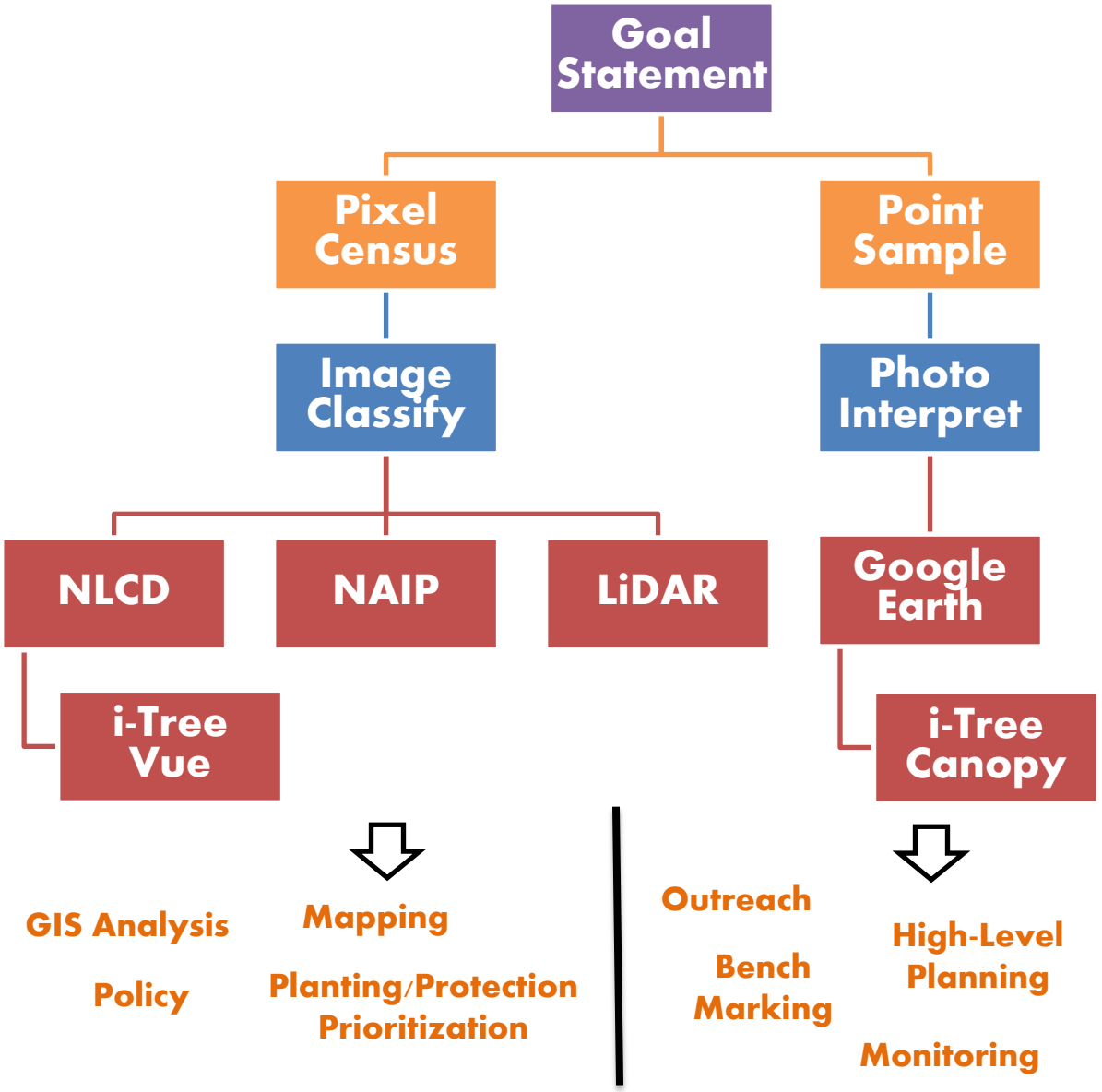
Selecting a UTC Analysis Method

Data Application Goal

Data Acquisition Method

Data Resolution Need

Data Application Examples



UTC Analysis – Image Classification

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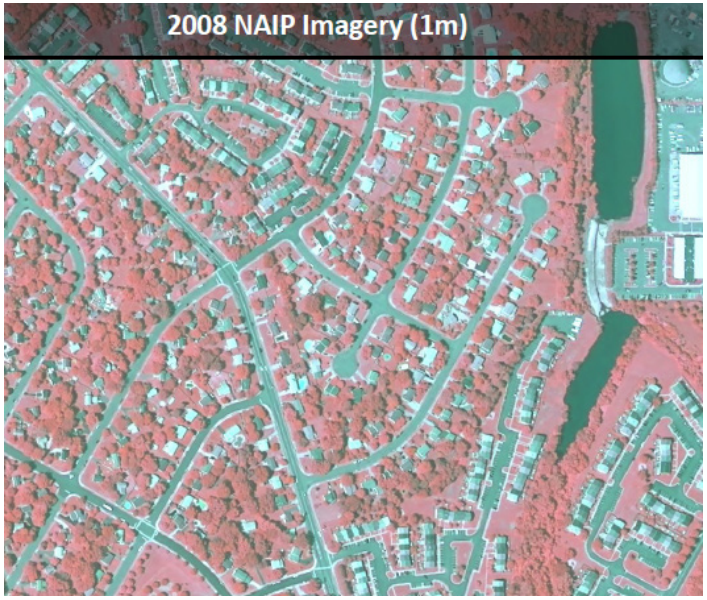

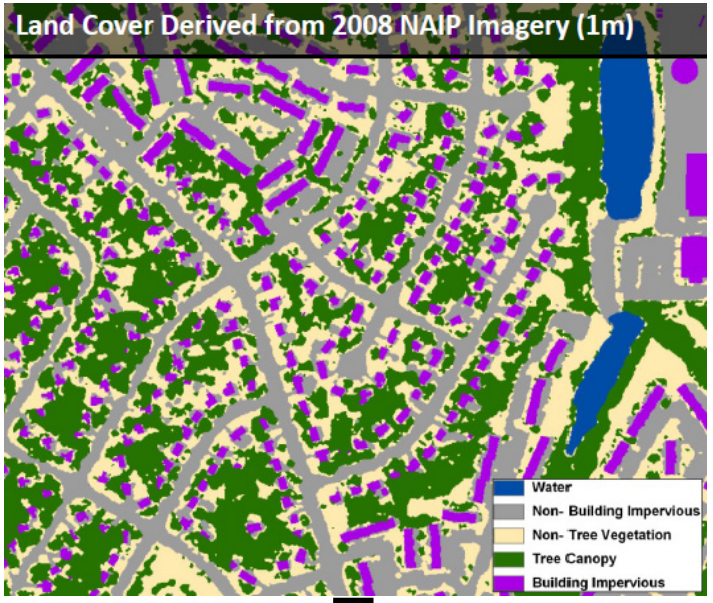

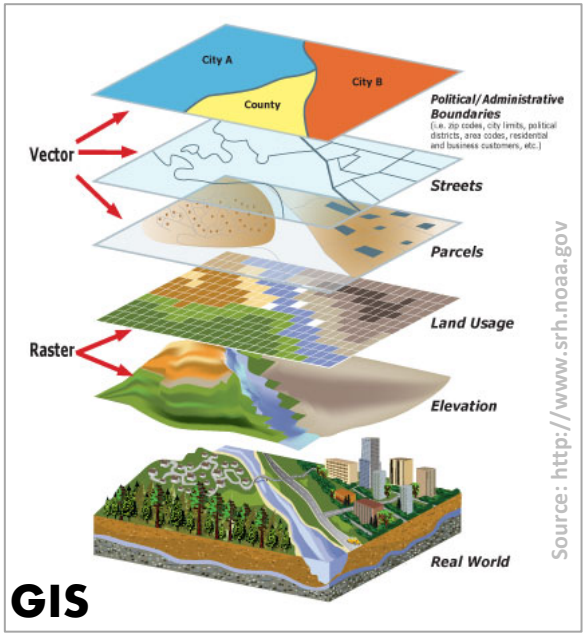

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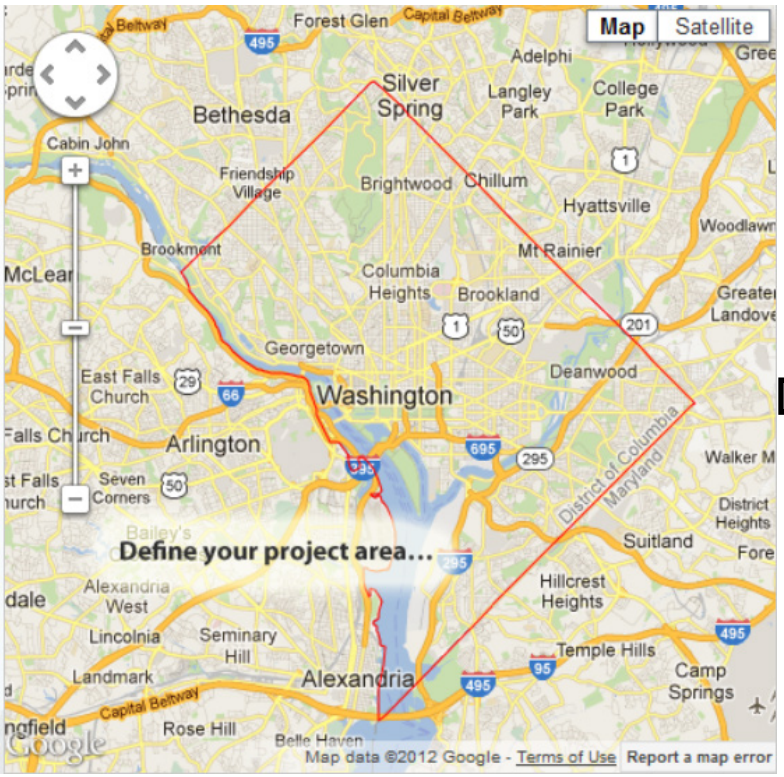
UTC Analysis – Photo Interpretation

i-Tree Canopy



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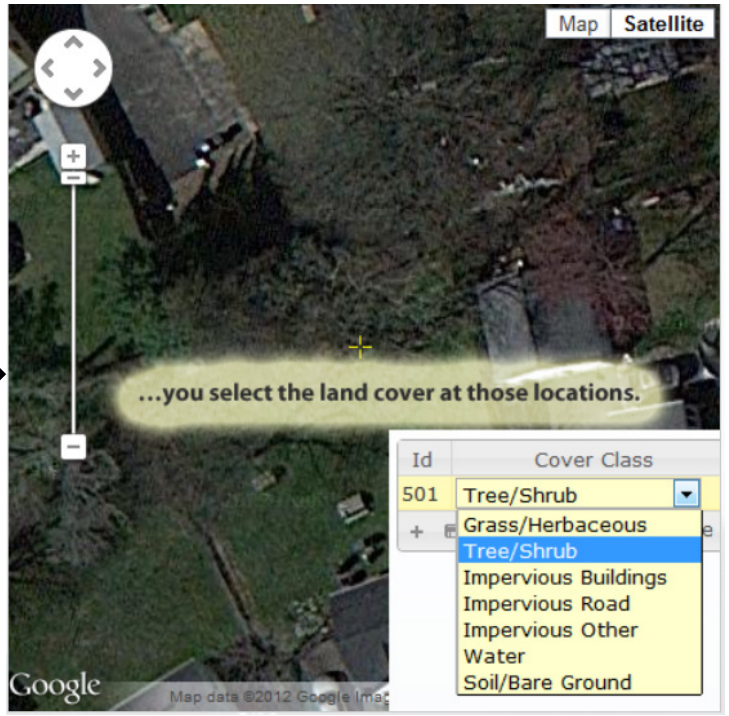
i-Tree Canopy



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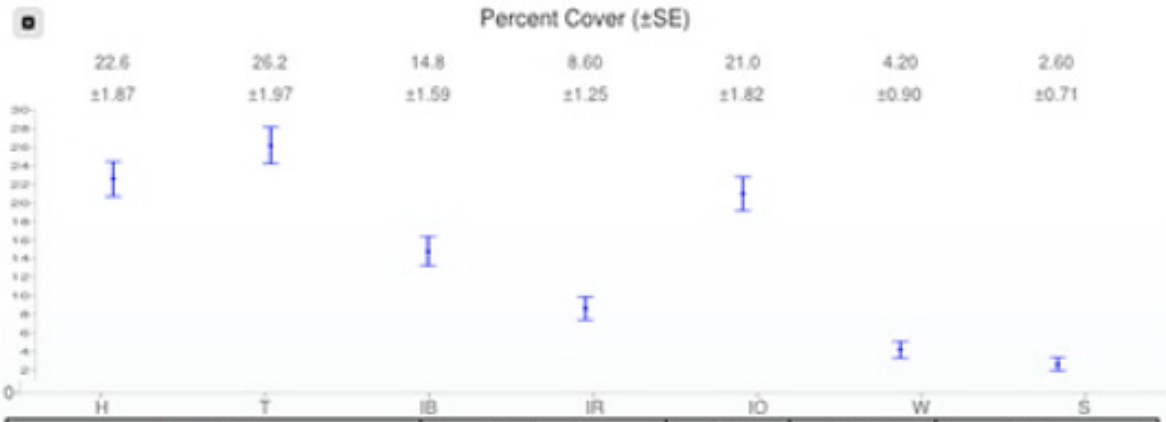
UTC Analysis – Photo Interpretation

i-Tree Canopy

Cover Report



Cover Class	Description	Abbr.	Points	% Cover
Grass/Herbaceous		H	113	22.6 ±1.87
Tree/Shrub		T	131	26.2 ±1.97
Impervious Buildings		IB	74	14.8 ±1.59
Impervious Road		IR	43	8.60 ±1.25
Impervious Other		IO	105	21.0 ±1.82
Water		W	21	4.20 ±0.90
Soil/Bare Ground		S	13	2.60 ±0.71

Tree Benefit Estimates

Abbr.	Benefit Description	Value	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	$0.00	±0.00	0.00 oz	±0.00
NO2	Nitrogen Dioxide removed annually				
O3	Ozone removed annually				
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually				
PM2.5	Particulate Matter less than 2.5 microns removed annually				
SO2	Sulfur Dioxide removed annually				
CO2seq	Carbon Dioxide sequestered annually in trees				
CO2stor	Carbon Dioxide stored in trees	$0.00	±0.00	0.00 oz	±0.00

Save your project for later use and print out a summary report.

Examples of UTC Analysis

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Virginia Urban Tree Canopy Analysis

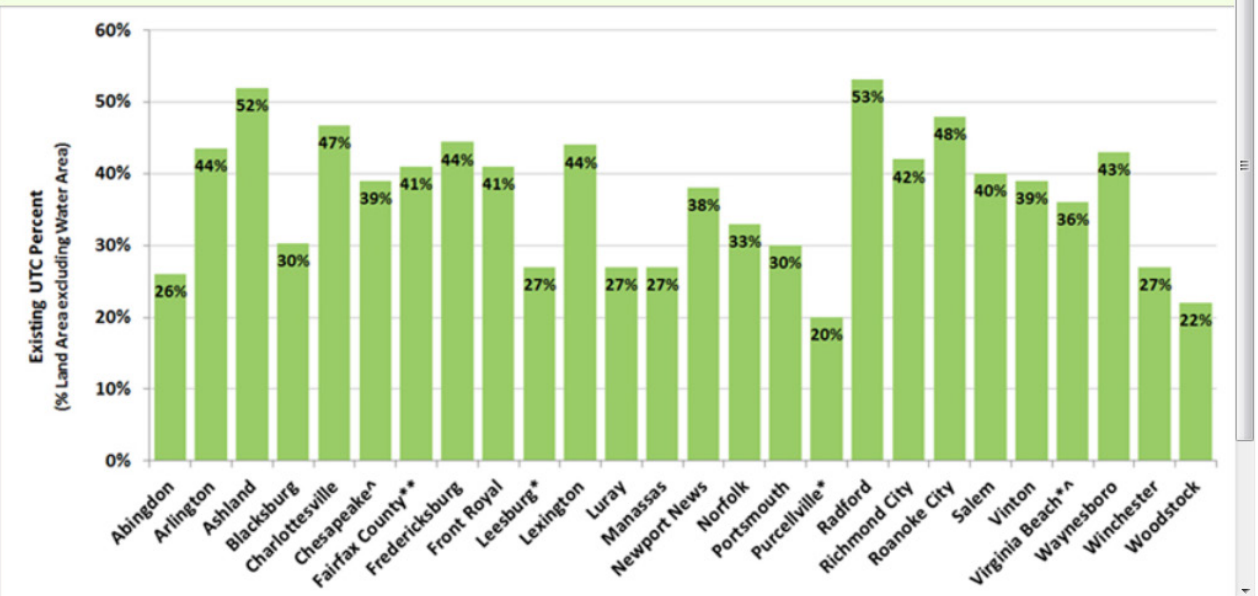
gep.frec.vt.edu/va_utc.html

Spatial Analysis Laboratory (SAL) of the University of Vermont

UTC in the News

Participating Localities

- Abingdon (report)
- Arlington County (report)
- Ashland (report)
- Blacksburg (report)
- Charlottesville (report)
- Chesapeake (report)
- Fairfax County (Fairfax County 30 Year Tree Canopy Goal website)
- Fredericksburg (report)
- Front Royal (report)
- Leesburg (Leesburg Tree Canopy website)
- Lexington (report)
- Luray (report)
- Manassas (report)
- Newport News (report)
- Norfolk (report)
- Portsmouth (report)
- Purcellville (report)
- Radford (report)
- Richmond (report)
- Roanoke City (report)
- Salem (report)
- Vinton (report)
- Virginia Beach (report)
- Waynesboro (report)
- Winchester (report)
- Woodstock (report)



www.uvm.edu/envnr/sal/

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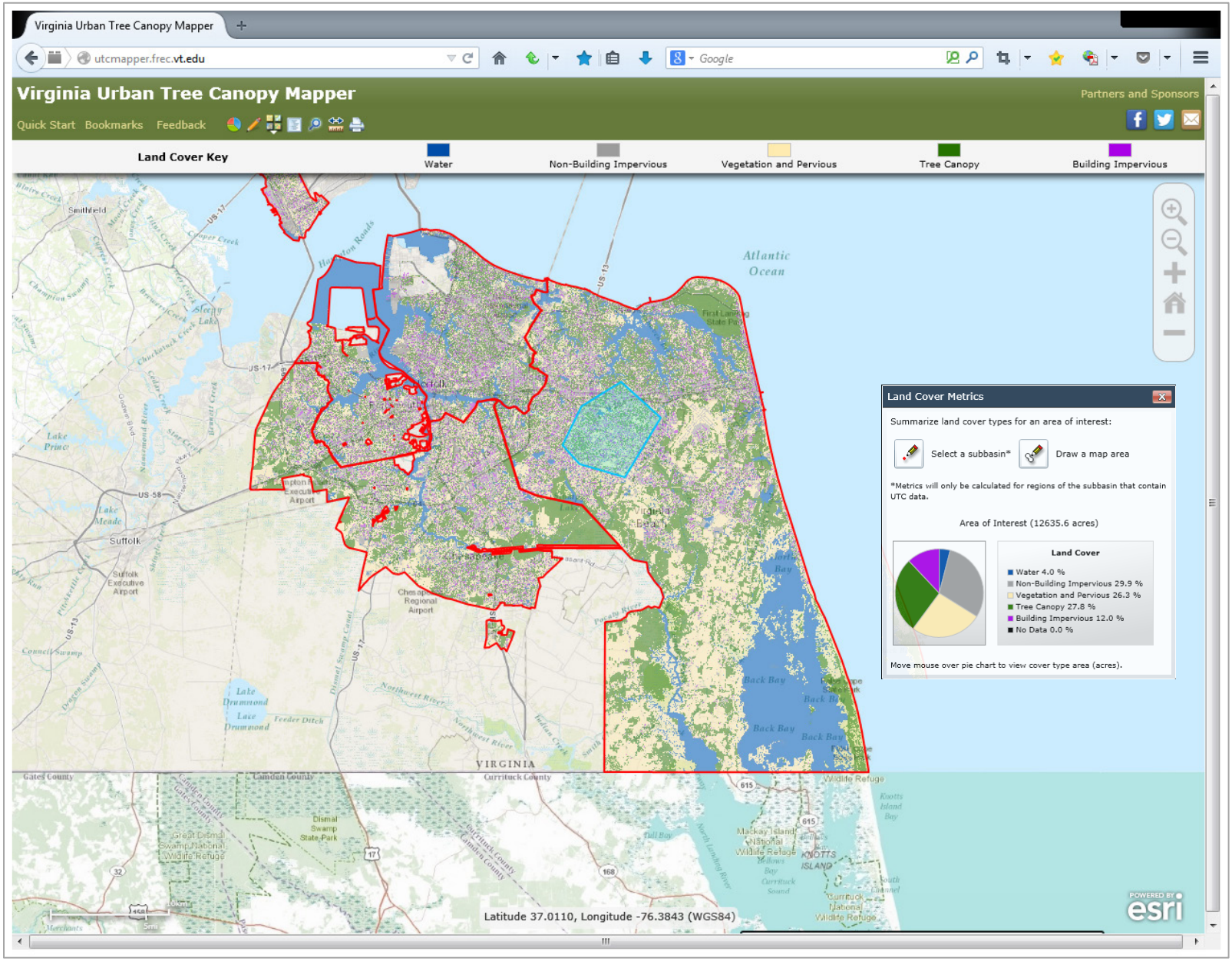

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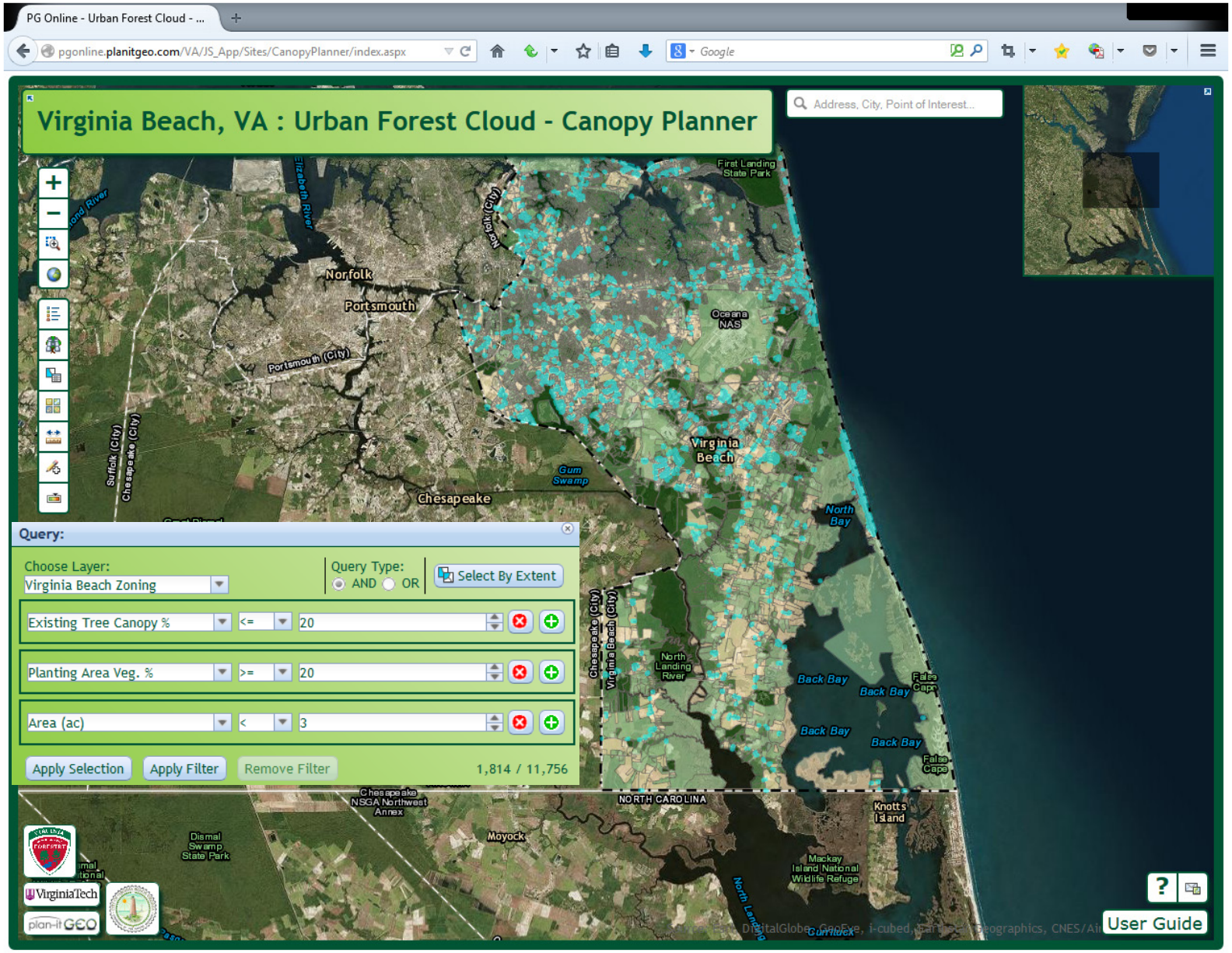

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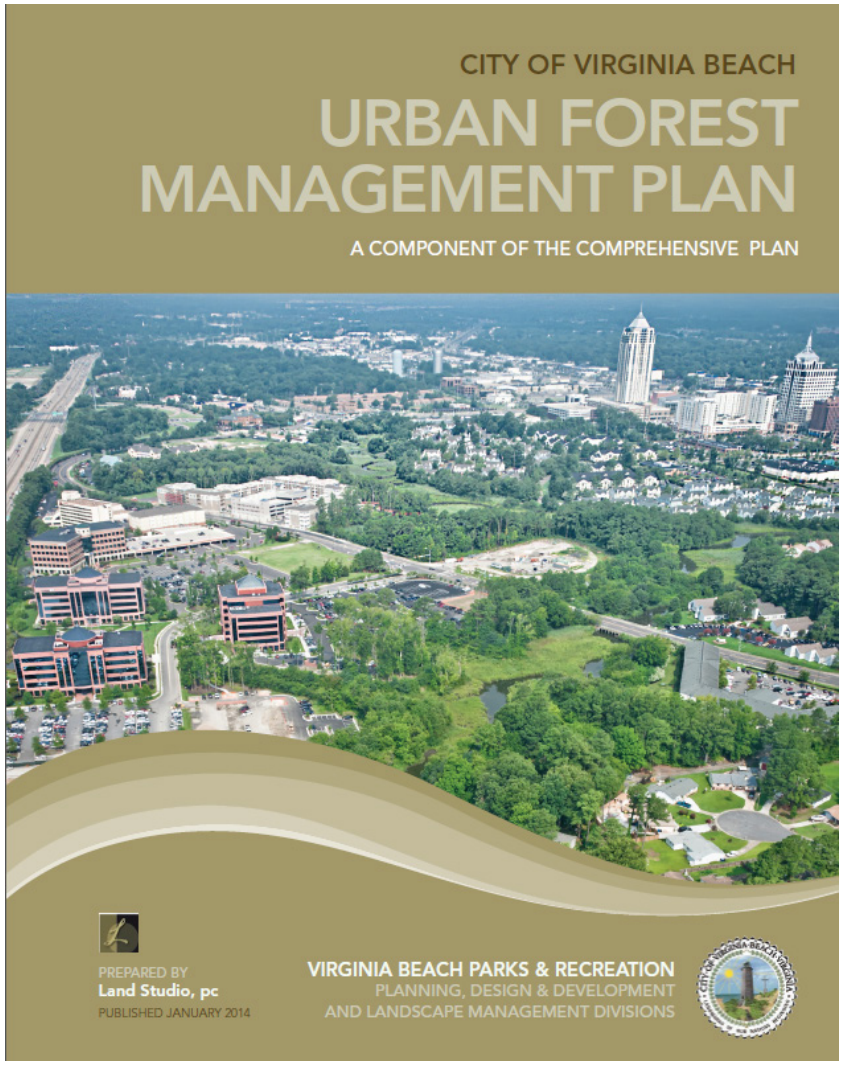


CITY WIDE ANALYSIS

Land Area Type	Land Area Type (Acres)	Tree Canopy (Acres)	Tree Canopy Percentage	Possible UTC Vegetation/ Impervious	Factors Affecting UTC Percentages
State & Federal Property	29,005	13,219	46%	26% / 6%	
Entire City with State & Federal Property	155,314	58,291	38%	41% / 11%	State and federal property consisting of parks and military facilities add 2% to the city's overall UTC.
Without State & Federal Property	126,309	45,072	36%	41% / 11%	Residential tree cover and buffers along the city's waterways make up the majority of the city's UTC.

Note: Land area acreage identified does not include water or state and federal property.

The city's urban forest contains an estimated 3 million trees. Using the National Tree Benefit Calculator, which was developed based on the i-Tree street tree assessment tool, those trees provide over $83 million in annual stormwater benefits to the city. As new software tools and more detailed tree inventory information becomes available, these numbers will be adjusted accordingly. The i-Tree software was developed from empirical models, based on observations in the field, and peer-reviewed studies over the last decade. Technical documents and information about the research behind the i-Tree application and utilities can be found at **www.itreetools.org/resources/archives.php**

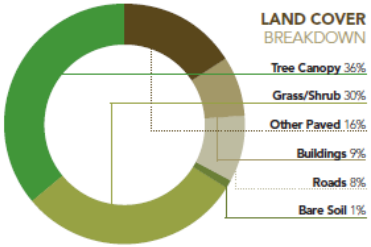
Assessment of Urban Tree Canopy (UTC)

In 2008, the City received a Water Quality Improvement grant from the Virginia Department of Forestry and the Virginia Department of Conservation and Recreation to develop its first Urban Tree Canopy assessment. In 2013, the City received a Technical Assistance Grant from the Virginia Department of Forestry to develop a UTC Implementation Plan based on the 2008 UTC data assessment. The information provided on the following pages establishes the baseline for analysis of UTC percentages city-wide, as well as in many individual planning and land use categories. Tree canopy goals that are included in this Plan are also detailed. Another UTC data assessment is planned for 2014, and the changes in the city's UTC will be evaluated to determine trends in tree canopy expansion or loss. In addition, software is currently being developed as part of the Technical Assistance Grant which will assist the City in prioritizing tree preservation and planting sites.

Overall Characteristics

Based on the 2008 data, the city's overall tree canopy is 36%, not including state and federal properties. When state and federal property are included, the city's overall tree canopy is 38%. However, this assessment only includes areas within which the city has some level of planning control. Beyond the tree canopy, 31% of Virginia Beach's land area consists of pervious cover (grass/shrub and soil), and the remaining 33% is comprised of impervious cover including buildings, roads and other hard surfaces.

American Forests recommends a minimum of 40% UTC for cities in the mid-Atlantic region of the U.S. To meet this minimum, the city would have to increase its overall UTC by 4%. As a point of reference, an estimated number of additional trees needed to increase the city's UTC by 1% is 80,000. This 1% increase would happen after a 15-20 year growth period and does not take into account tree removals or growth of existing trees. This example highlights the fact that although tree planting is an important element of increasing canopy cover, there are many other equally important elements that are essential to increasing UTC over time. Increasing the city's UTC is a multifaceted process that involves a wide variety of strategies such as:



- Actively maintaining the trees we have on public property to ensure that they increase in size
- Continuing to educate and encourage the planting of trees on private property
- Replacing dead or diseased trees on public property
- Working cooperatively with developers to preserve existing trees during development
- Educating the public to plant trees that contribute to species diversity, minimizing the chance of species 'meltdowns'
- Identifying and preserving publicly-owned open space that can be allowed to regenerate to forest
- Managing pests and diseases effectively

Using these and other new strategies outlined in this Plan, the city will be able to successfully increase its UTC. A citywide goal of reaching 45% canopy coverage over the next 20 years is achievable and will encourage other cities to adopt similar beneficial goals.

Pop Quiz

Question 4:

An urban tree canopy (UTC) analysis can be used for:

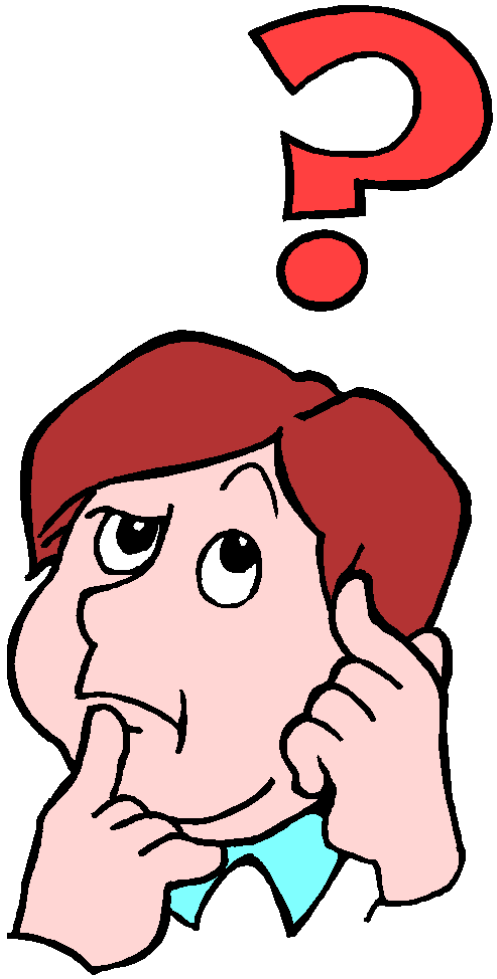
A. **Quantifying tree canopy and other land cover types**

B. **Prioritizing areas for tree planting and forest protection**

C. **Educating the public and decision-makers about UTC**

D. **All of the above**

E. **None of the above**



Pop Quiz

Question 5:

i-Tree Canopy is an example of an application used to perform a(n):

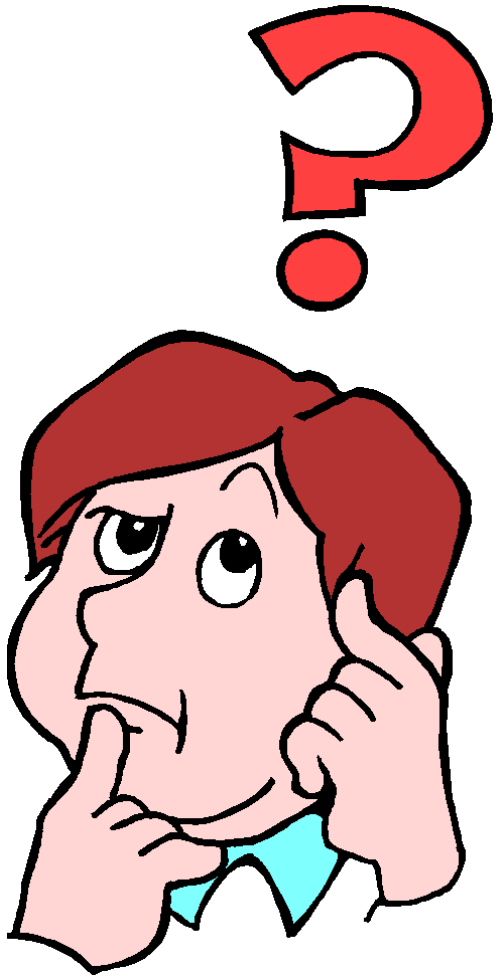
A. Sample tree inventory

B. Image classification UTC analysis

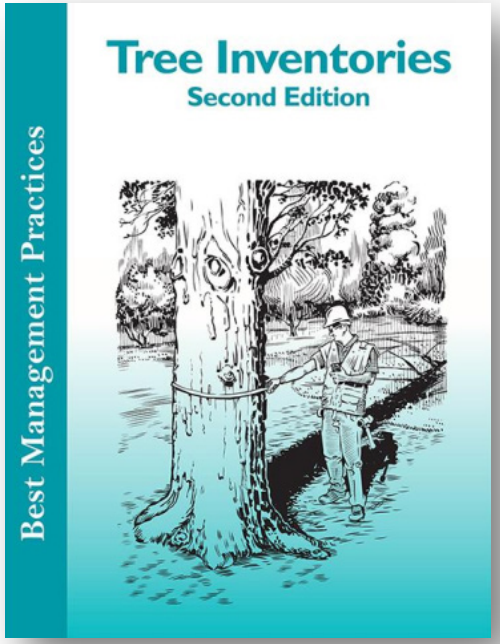
C. Photo interpretation UTC analysis

D. All of the above

E. None of the above



Urban Forest Assessment Resources



Best Management Practices–
Tree Inventories, 2nd Ed.
Jerry Bond (2013)
International Society of Arboriculture

Urban Forest Assessments Resource Guide
American Forests (2014)
http://www.americanforests.org/our-programs/urbanforests/urban-forests-tools-resources

Urban Forest Assessment Resources

A Guide to Assessing Urban Forests

David Nowak (2013)

US Forest Service Northern Research Station

NRS-INF-24-13

i-Tree Tools 6.0.5

US Forest Service and Partners (2014)

http://www.itreetools.org

Urban Forest Assessment Resources

Urban Forest Publications & Data
US Forest Service
Northern Research Station
http://www.nrs.fs.fed.us/data/urban

Urban Tree Canopy Assessment
US Forest Service
Northern Research Station
Morgan Grove
http://www.nrs.fs.fed.us/urban/utc

Presentation Summary

- Urban forest assessment is the observation and evaluation of urban forest resources for applications in science, policy, management and outreach
- Urban forest assessment includes both bottom-up and top-down approaches, which have different capabilities and limitations depending on their application
- A tree inventory is powerful for understanding urban forest composition, tree maintenance needs, and ecosystem services
- A UTC analysis is powerful for understanding tree canopy amount, distribution, and spatial relationships with the human environment
- Numerous resources are available in the public and private sector for conducting an urban forest assessment

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Thank you for participating!

Please type questions/comments
in the chat box
or
email to arborist@vt.edu for follow-up later!

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