Estimating Tree Canopy Cover

2010 SMA Conference
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Presentation Goal

- To present a simple, low-tech method of estimating tree canopy and other land cover for the purpose of developing baseline data and trends for use in community forest management programs.
Presentation Content

- Resources
- Process
- Case Studies
- Final Thoughts
Resources

People
Aerial Photographs
Supplies
People

• Coordinate and provide quality checks
  – Forester or arborist with photo interpretation skills
  – More than one person is necessary if the group is large
• Measure
  – Staff
  – Interns
  – Tree boards
  – NGO and citizen volunteers
  – Students (high school, college)
  – Elected officials
  – Landscape contractors
Aerial Photographs

- Use most recent digital aerial photography
- Available in most communities, often at little to no cost (GIS technician time and printing costs), from:
  - City or county GIS department
  - Regional Commission/Development Commission
  - State Forestry Commission
- Scale of 1 inch = 300 feet
Aerial Photographs

• Recommended size of printed photographs is from 18 x 18 inches up to 24 x 36 inches
• Include city limits on the photographs and shade or hatch areas that are outside the city
• Include match lines where photos overlap
City limit lines (purple) and photo match lines (red) and areas outside of the city (shaded areas) should be included on the aerial photographs.
The Dot Grid

• A dot grid is placed on the aerial photographs by the GIS technician before printing
• Yellow is the best color
• Size of dots is 1/16 inch
• Dots are placed in a ½ by ½ inch grid which is equivalent to 150 feet apart
Aerial Photographs

• Most aerial photography is flown in February in our area, which means that it is leaf-off

• This makes it a little harder to interpret deciduous tree canopy cover, but it’s not too hard once a person gets used to looking at the deciduous tree crowns
Land Cover Categories

• Tree canopy
  – Includes trees canopy covering buildings, roadways
  – Does NOT include tree shadows

• Other vegetation
  – Grass
  – Herbaceous plants
  – Shrubs
  – Kudzu
Land Cover Categories

- Impervious surfaces
  - Rooftops
  - Parking lots
  - Streets
  - Vehicles
- Bare soil
- Water
Materials

- Crayons (8-pak)
- Gum erasers
- Ruler
- Tally counter
- Magnifying glass
- Calculator
- Tally sheet
- Project sign-in sheet
CITY OF JEFFERSON, GEORGIA
TREE CANOPY COVER MEASUREMENT
TALLY SHEET

VOLUNTEER NAME: ___________________________ DATE: ____________
MAP NUMBER: ___________________________ TOTAL # DOTS: ______________

Use a separate tally sheet for each separate map. If you number or code the lines or define map sections, enter the numbers or codes for those lines or sections in the leftmost column. Record the number of dots of each of the 5 cover types by line, map section, or entire map. After counting all dots, total the number of dots by column, then add up the totals from all columns and enter the total number of dots in the space provided above.

<table>
<thead>
<tr>
<th>Line # or Map Section</th>
<th>Tree Canopy</th>
<th>Other Vegetation</th>
<th>Hard Surfaces</th>
<th>Bare Soil</th>
<th>Water</th>
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<tbody>
<tr>
<td></td>
<td>GREEN</td>
<td>ORANGE</td>
<td>RED</td>
<td>BLACK</td>
<td>BLUE</td>
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</tbody>
</table>

| TOTAL                  | TOTAL         | TOTAL           | TOTAL        | TOTAL     |       |

Please PRINT your name and contact information, the time you ARRIVE and PLEASE DON'T FORGET to write in the time you LEAVE. Thank you.

DATE: November 11, 2009

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<th>NAME</th>
<th>E-MAIL ADDRESS</th>
<th>PHONE NUMBER</th>
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<td>Brad Green</td>
<td>Legacy</td>
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<td>Steve Coleman</td>
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<td>Barbara Johnson</td>
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<td>678-263-9065</td>
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<td>5:15</td>
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<td>Harry Bryan</td>
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<td>Mary Dugan</td>
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<td>Joe Campbell</td>
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<tr>
<td>Nathan Austin</td>
<td></td>
<td>706-214-0034</td>
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<tr>
<td>Andrew Patrick</td>
<td></td>
<td>706-307-0393</td>
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<td>4:30 pm</td>
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<tr>
<td>Kay Dent</td>
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<td>706-367-8894</td>
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<tr>
<td>Jeff Kilby</td>
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<td>706-347-1952</td>
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<tr>
<td>Susan Russell</td>
<td></td>
<td>706-349-1953</td>
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<tr>
<td>Heidi Collis</td>
<td></td>
<td>706-749-7419</td>
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<tr>
<td>Charles Holley</td>
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City of Jefferson Sustainable Community Forest Project
2006 USCF Project Number 59.19
Process

Prior to Event
Day of the Event
After the Event
Prior to Event

- Advertise measurement event and the volunteer opportunity
- Sign up participants ahead of time
- Set up room to accommodate the large format maps
- Need good lighting, large tables, and comfortable chairs
- Arrange for refreshments, lunch
Day of the Event

- Describe the process
- Describe the cover types
- Have participants divide the photographs into sections if necessary (blocks, lines, etc.), *between the dots on the grid* to make counting more manageable
Familiarization

• Provide examples of land cover types on a sample map and allow participant to familiarize themselves with the photo features
  – Recognize trees versus other vegetation
  – Hardwood trees (with no leaves) versus pine trees
  – Trees versus tree shadows
  – Grass, especially if dormant and brown
  – Water, which is often smooth and dark green
  – Recognize other common features such as buildings, roadways, gravel, railroad tracks, bare soil, swimming pools, water treatment ponds, etc.
Color Coding and Counting

- Color code each dot by putting a small slash through the dot with the appropriate color crayon
- Count the dots of each color across the map or within each section and enter totals on the tally sheet
- Have another participant recount the dots to increase accuracy
Monitoring

• Coordinators need to monitor the process
  – More than 1 person is preferable
  – Make sure that everyone is using the same color for the same category
  – Answer questions
  – Check for errors and consistency

• Be prepared to provide a lot of guidance early in the process to avoid having to make a lot of corrections later and redo work
After the Event

• The coordinator should:
  – Check all photographs to ensure consistency
  – Recolor dots if necessary
  – Recount all dots
  – Summarize all tally sheets
  – Prepare a summary report of the results
Case Studies

Jefferson
Rome
Smyrna
Jefferson

- Fast growing, north Georgia community (7th fastest growing county in nation)
- 21.78 square miles
- Population 8,500
- Have an active Jefferson Heritage Tree Council
- Have a complete city tree inventory
- Have a contract city arborist
Aerial Photographs

• Photography from February 2009
• 20 aerial photographs 24 x 36 inches
• Purchased from the North Georgia Regional Commission for ~$900
• The photos were also provided on a DVD as PDF files
• Dots on the aerial photographs were geo-referenced
In Jefferson, a total of 20 photographs or tiles, with a printed size of 24 x 36 inches, were needed for complete coverage of the city.
Participants

• Jefferson Heritage Tree Council members
• City staff and elected officials
  – City manager
  – City councilman
  – Public Works Director
  – Parks and Recreation personnel
• Citizen volunteers
• City’s landscape contractor personnel
Measurement Event

• Measurements were done in a 2-day event in the ballroom of the Jefferson Civic Center
• Some people took photographs home after the event to finish the color coding and dot counting
• JHTC provided refreshments
Results

• 100 hours of staff and volunteer time were dedicated to the project
• 26,990 dots were color coded and counted
• Land cover results:
  – 1% water
  – 3% bare soil
  – 11% impervious surfaces
  – 29% other vegetation
  – 56% tree canopy cover
Results

• No net loss of tree canopy cover goal adopted
• A Sustainable Community Forest Master Plan has been completed
• Tree program budget has been increased from $1,500 to $22,000 as a result of the past program successes
Rome, Georgia

- Moderate sized community in northwest Georgia
- Population 35,000
- 31 square miles
- Have a full-time city forester and 3-person tree crew
- Keep Rome-Floyd Beautiful is very active in the community tree management program
- Have an active Tree Board
- Have a partial tree inventory
- Have a community forest master plan
Aerial Photographs

- Photography from February 2008
- Provided by the city’s GIS department
- 77 photographs ~16.5 inches square
Study Participants

• City staff
  – City arborist
  – Tree crew
  – Environmental compliance manager

• Keep Rome-Floyd County Beautiful Executive Director and volunteers

• Home-schooled high school students (5)
Measurement Event

• 3-day event at city hall in Council conference room in January 2009
• Some staff and volunteers took photographs home after the event to finish the color coding and counting
Results

• 84.5 hours committed by 18 people
• 38,401 dots color coded and counted
• Land cover results:
  – 2% water
  – 2% bare soil
  – 23% impervious surfaces
  – 24% other vegetation
  – 49% tree canopy cover
Results

• City adopted a goal of 55% tree canopy cover
• Tree canopy cover goals by zoning district were recommended in the city’s community forest master plan
• City is in the process of revising their unified land development code to help achieve this goal
Smyrna

- In the Atlanta Metropolitan Statistical Area
- Population of 50,000
- 15.16 square miles
- Have an active Tree Board
- Have completed Phase I and Phase II of city tree inventory
- City has planted thousands of trees over the last few years in parks, along trails, and around city facilities
- Have a contract City Arborist
Aerial Photographs

• Photography from February 2009
• Produced by the GIS Manager in the Community Development Department
• 39 photographs 18 x 18 inches in size
In Smyrna, a total of 39 photographs or tiles, with a printed size of 18 x 18 inches, were needed for complete coverage of the city.
Study Participants

- 60 high school students in horticulture and agriculture class of Ms. Sharon Harper from Campbell High School
- Smyrna Tree Board members (4)
- City Councilman attended to thank students and Ms. Harper and hand out awards
Measurement Event

- 6-hour event at Smyrna Civic Center
- Pizza provided by local restaurant sponsor for lunch
Results

• 420 hours of time committed by students
• 15.5 hours of time committed by Tree Board members
• 18,790 dots color coded and counted
• Land cover results:
  – 1% water
  – 1% bare soil
  – **34% impervious surfaces**
  – 25% other vegetation
  – **39% tree canopy cover**
Results

- Tree board is planning neighborhood tree planting programs and tree care education programs to begin this fall and winter
- Phase III of the city’s tree inventory will begin this fall
- Opportunities to utilize the tree canopy cover information in all city tree management efforts are being identified
Final Thoughts
Project Benefits

• Results can be used for
  – Goal setting
  – Budgeting
  – Policy decisions
  – Community education

• Knowing the tree canopy cover % gives tree boards POWER!
Project Benefits

• Excellent educational tool that can promote awareness of the extent and importance of tree canopy

• Can be utilized as an in-kind activity and match for grant projects
Final Thoughts

• To date we have not felt the need to ground truth any dots (plots), but this is an option if the resources are available

• Consistency is greater the fewer the number of people involved

• Education is greater the more people that are involved
Final Thoughts

• Dots can be geo-referenced and could be followed over time to determine changes on a parcel, neighborhood, or community basis

• Photos and the dot grid can be used to monitor tree canopy cover for development code compliance
Final Thoughts

• Method is repeatable and should be repeated as often as practical with the available resources to develop trends
• However, be aware that 2 years of measurement do not make a trend
• If you have historical photos, preferably at the same scale and of the same quality, these could be used to develop a trend
Final Thoughts

• Spread the word about the results and keep the tree canopy cover percent in the public consciousness
• Use the number when talking about tree program needs and accomplishments
• Set a tree canopy cover goal and enlist the help of everyone in achieving that goal
Thank you!

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