Urban Forest Inventory: i-Tree Eco Pilot Project at Auburn University

SAVANNAH, GEORGIA
FEBRUARY 22, 2011
I-TREE ECO PILOT PROJECT

Project Overview:
- Project was initiated in May 2009
- Inventory managed areas of the AU campus

Project Objectives:
- Conduct a 100% inventory an i-Tree Eco compatible form and complete GIS database layer from the data (i.e. tree locations will be captured).
- Analyze model components relative to southern species & models, and make i-Tree Eco plot sampling comparisons with the 100% inventory.
- Develop class & field training material and conduct a regionally advertised training class for i-Tree Eco including QA/QC components.
Auburn University is a Certified Tree Campus USA

Standards:

1) Campus Tree Advisory Committee
2) Campus Tree Care Plan
3) Dedicated annual expenditures for the Campus Tree Care Program
4) Arbor Day Observance
5) Service Learning Project
i-Tree Eco Summer Training Workshop
- June 15-17th, 2010 at Auburn, AL
  - i-Tree Eco
  - GPS equipment
  - Field data collection
  - i-Tree Eco Shell set-up
  - i-Tree Eco Shell output reports
- Regional Training Center
Specific Objectives:

1) Conduct a 100% tree inventory of all managed areas of the AU campus
2) Compare ecosystem services between an urban protected and urban managed forest
3) Develop predictive open-grown crown width equations for 3 southern urban tree species
4) Evaluate i-Tree Eco plot sampling protocol
100% INVENTORY

Conduct 100% inventory in i-Tree Eco compatible form and complete GIS database layer from the data

- 1, 2, or 3 person crew
- GPS collection unit, ‘Loggers tape’, laser hypsometer
- 16 attributes
- Inventory completed in Spring 2010
- Inventory covered approximately 600 ac:
  - AU main campus = 587 ac
  - Davis Arboretum = 13.5 ac
100% INVENTORY RESULTS AS OF JUNE 2010

- Total of 8,236 trees
- 3,980,914 lbs of stored Carbon
- Sequesters 173,424 lbs of Carbon/year
- Auburn main campus:
  - Top species:
    - Crapemyrtle (*Lagerstroemia* spp.) 20.2%
    - Willow oak (*Quercus phellos*) 7.3%
    - Loblolly pine (*Pinus taeda*) 7.1%
<table>
<thead>
<tr>
<th></th>
<th>AU Campus</th>
<th>Davis Arboretum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area (ac)</td>
<td>587</td>
<td>13.5</td>
</tr>
<tr>
<td>Number of Trees</td>
<td>7,345</td>
<td>891</td>
</tr>
<tr>
<td>Number of Tree Species</td>
<td>139</td>
<td>160</td>
</tr>
<tr>
<td>Average dbh (in)</td>
<td>6.5</td>
<td>9.6</td>
</tr>
<tr>
<td>Average height (feet)</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>Estimated Canopy Cover</td>
<td>16</td>
<td>62</td>
</tr>
<tr>
<td>Carbon Storage (lbs)</td>
<td>3,472,400</td>
<td>508,514</td>
</tr>
<tr>
<td>Gross Carbon Sequestration</td>
<td>152,123</td>
<td>21,301</td>
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<tr>
<td>(lbs/year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Pollution Removal Value</td>
<td>15,880</td>
<td>3,013</td>
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</table>
Tree Condition Rating evaluation

% Dieback vs. Overall Tree Condition Rating

<table>
<thead>
<tr>
<th></th>
<th>Overall Condition</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>E</td>
<td>G</td>
<td>F</td>
<td>P</td>
<td>VP</td>
<td>D/D</td>
<td>Total</td>
</tr>
<tr>
<td>E</td>
<td>9</td>
<td>4113</td>
<td>1387</td>
<td>292</td>
<td>71</td>
<td>1</td>
<td>5873</td>
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<tr>
<td>G</td>
<td>0</td>
<td>319</td>
<td>480</td>
<td>147</td>
<td>43</td>
<td>1</td>
<td>990</td>
</tr>
<tr>
<td>DIEBACK</td>
<td>F</td>
<td>0</td>
<td>13</td>
<td>130</td>
<td>115</td>
<td>68</td>
<td>2</td>
</tr>
<tr>
<td>P</td>
<td>0</td>
<td>0</td>
<td>17</td>
<td>19</td>
<td>22</td>
<td>11</td>
<td>69</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>13</td>
<td>4</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td>D/D</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>47</td>
<td>5</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>4445</td>
<td>2016</td>
<td>633</td>
<td>213</td>
<td>29</td>
<td>7345</td>
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</table>
- Crew Size Evaluation
- Trees $\leq 10$ in
- Appropriate crew size will vary

<table>
<thead>
<tr>
<th>Crew Size</th>
<th>Trees Inventoried</th>
<th>Average Time (minutes/tree)</th>
<th>Average Inventory (trees/hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 person</td>
<td>581</td>
<td>2.18</td>
<td>27.5</td>
</tr>
<tr>
<td>2 person</td>
<td>716</td>
<td>1.77</td>
<td>33.9</td>
</tr>
<tr>
<td>1 person</td>
<td>365</td>
<td>2.12</td>
<td>28.3</td>
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</tbody>
</table>
ECOSYSTEM SERVICES COMPARISON

- Evaluation of Ecosystem Services
  - Compared AU main campus (urban) vs. the Davis Arboretum (protected)
  - Specifically: Carbon sequestration
  - Determined that Davis Arboretum sequesters 6x the amount of the AU main campus on a per acre basis
    - AU campus = 259 lbs/ac/year
    - Davis Arboretum = 1,578 lbs/ac/year

- Protected Areas
PREDICTIVE O-G CROWN WIDTH EQUATIONS

- 3 common southern urban tree species:
  - *Quercus lyrata* (overcup oak)
  - *Quercus Nuttallii* (Nuttall oak)
  - *Quercus phellos* (willow oak)

- Model: crown width = $\beta_0 + \beta_1 \text{dbh} + \beta_2 \text{dbh}^2$
  - crown width = dependent variable
  - dbh = independent variable
  - $\text{dbh}^2$ = independent variable

- Reduced field work
Evaluation of plot sampling protocol for i-Tree Eco

- Standard protocol: 200, 1/10 acre circular plots

Determine the number of plots needed

- Ecosystem Services
- Proportionality (% total area)
- Ran different sample sizes vs. the 100% inventory
  - Air pollution removal value ($)
  - Values were broken up into 5 categories
  - Ran 100 simulations per sample size
  - Chi-square comparison
  - 80% agreement
Sample vs. Predicted Values 1977-1979

Average P-value (100 iterations)

Areal Scale (acres)

Proportion of Chi-square tests, H<sub>0</sub> accepted (alpha = 0.05)
Preliminary Conclusions:
- Samples sizes ran:
  - 2-10, 13, 14% samples

Future Analyses:
- Run smaller sample sizes
- Run with out the arboretum
- Stratified Sampling
  - Save time & money
POST I-TREE ECO PROCESSING

- Tying i-Tree Eco Ecosystem Services data to the inventoried tree data and locations in a GIS program
- Perform more analyses
ACKNOWLEDGEMENTS

- Auburn University
  - School of Forestry & Wildlife Sciences
  - Committee:
    - Dr. Arthur H. Chappelka, SFWS
    - Dr. Gary J. Keever, Department of Horticulture
    - Dr. Edward F. Loewenstein, SFWS

- USDA Forest Service
  - Urban Forestry South
    - Dudley Hartel
    - Eric Kuehler
QUESTIONS/COMMENTS?