

Talking points

- Upcoming Urban Forest Tools and Technologies
- Topics, research, extension
- Pending UFI questions on tools/technologies

Tools and Technologies

- LiDAR
- Google Earth/Digital Cameras
- Ecosystem Service Models
 - InVEST
 - MIMES
 - ARIES
- Urban carbon flux measurements
- Urban forest structure data applications

Light Detection and Ranging and Aerial Imagery

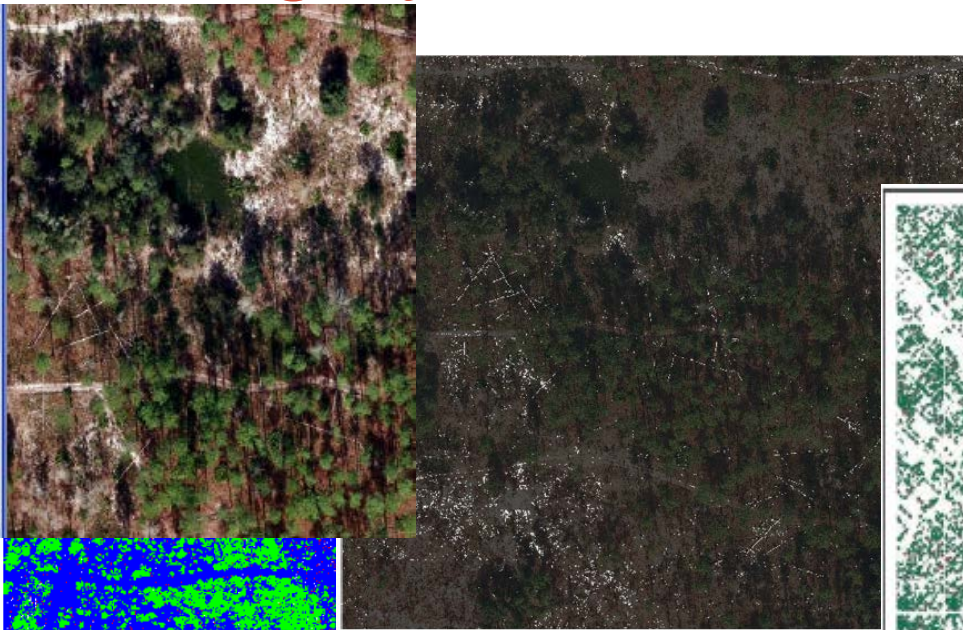
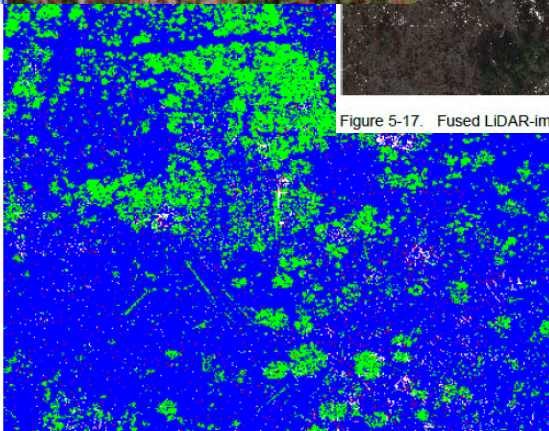


Figure 5-17. Fused LiDAR-image SVM classification visual



Volume = 3-49% Error

Figure 5-2. Segmentation of LiDAR points. The legend provides the segments.

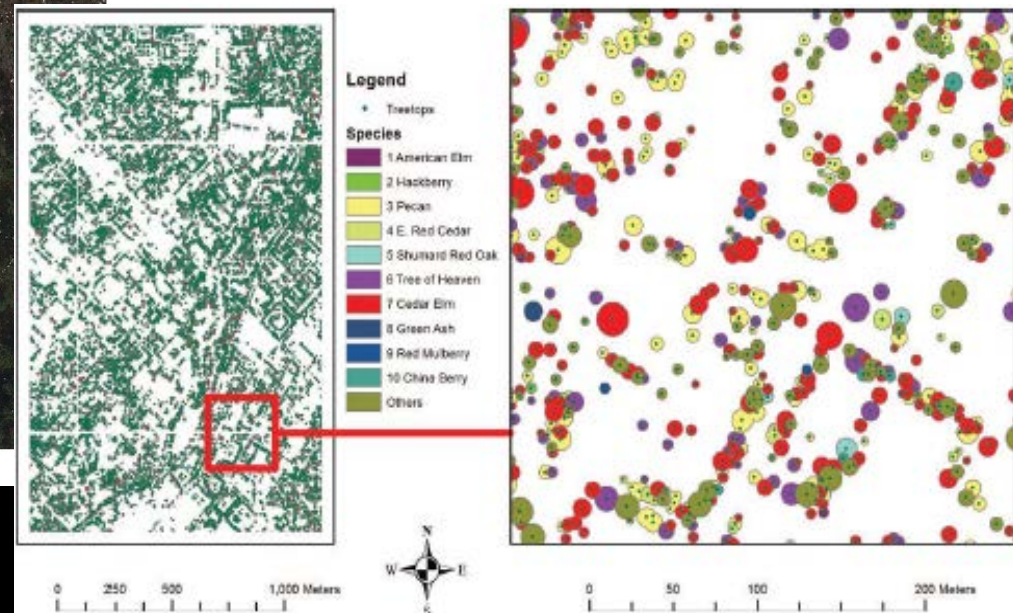
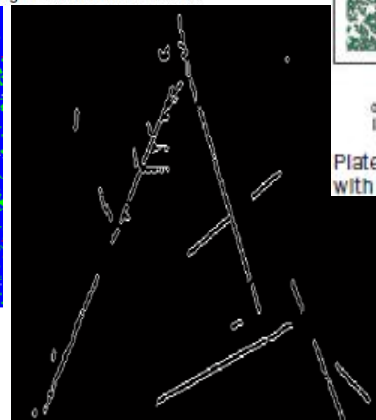


Plate 1. Species Map on the Crown Level with the Detected Treetops. The complexity of the urban forest with rich species, varying crown size, and high spatial heterogeneity, are presented.

Photogrammetric Engineering & Remote Sensing
Vol. 78, No. 10, October 2012, pp. 1079–1087.

Community Inventories/ Google Earth

i-Tree ECO data element	Field measurements	Google aerial	Photogrammetry	
A.H. Abd-Elrahman et al. / International Journal of Applied Earth Observation and Geoinformation 12 (2010) 249–260			Canon Xci	Kodak Z740
ID #	1	1	1	1
Species	<i>Quercus virginiana</i>	◇	<i>Q. vir</i>	<i>Q. vir</i>
# of DBH's ^b	1	◇ ^a	1	1
DBH measurement Ht	1.37 m	◇ ^a	1.40	1.33
DBH ^c	0.64 m	◇ ^a	0.56	0.52
Tree height	12.46	◇ ^a	12.14 m	12.02 m
Crown-base height ^d	1.875 m	◇ ^a	1.87 m	1.83 m
Crown width	15.7 m	14.03 m	15.00 m	15.70 m

<http://www.azavea.com/products/opentreemap/>

Asheville Tree Map

Home FAQ Resources Tree Keys Explore Trees Contact Terms and Conditions

Advanced Filters

Search for Species List All trees Location List City of Asheville Search

Yearly economic impact summary

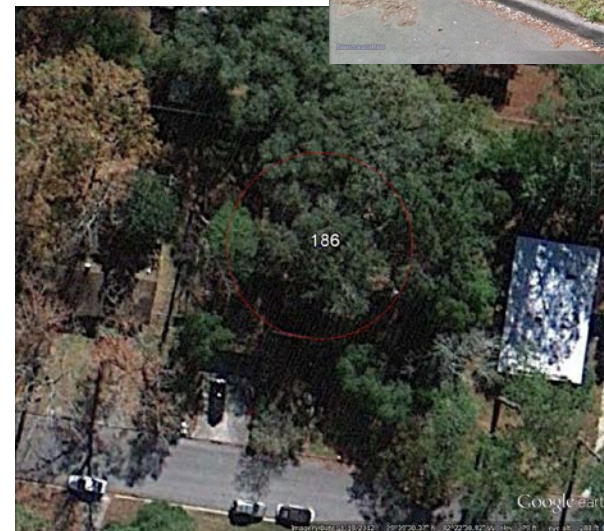
Total Trees	6,304
Total Benefits	\$138,245.72 saved
Carbon dioxide stored	1,421,733 lbs CO2 stored \$211,532.49 saved
Greenhouse Gas Benefits	1,269,610 lbs CO2 reduced \$26,913.44 saved
Water Benefits	\$7,320.126 gallons conserved 73,201.26 saved
Energy Benefits	750,474 kWh conserved \$36,117.71 saved
Air Quality Benefits	8,902 lbs pollutants reduced \$13.32 saved

10 Most Common Trees

1 Red Maple	569
2 Eastern White Pine	462

How to use the Asheville Tree Map

- 1 **Login** Log in using your Asheville Tree Map user name (login) or sign up for a Asheville Tree map user name (login). Go »
- 2 **Find a tree** Search for the trees near you. Find trees that bear edible fruits and nuts or those with beautiful flowers. Search for the biggest trees in your neighborhood -- then go out! Please! Go »
- 3 **Add a tree** The Asheville Tree Map grows as citizen foresters like you add trees. Show a tree's location by putting a dot on the map, then provide as much information as you can. Go »
- 4 **Edit a tree** Check out the facts about the trees around you and update when you can. Don't forget to add alerts. With your help, we'll track changes in the urban forest and watch it grow. Go »



Ecosystem Service Models

- CITYgreen
- i-TREE
- InVEST
- MIMES
- ARIES
- Climate models



GIEM • Gund Institute for Ecological Economics • MIMES



MIMES

Multiscale Integrated Models of Ecosystem Services

What are ecosystem services?

Ecosystem services are defined as those functions of ecosystems that support (directly or indirectly) human welfare. They occur at multiple scales, from climate regulation and carbon sequestration at the global scale, to flood protection, soil formation, and nutrient cycling at the local and regional scales. They are both directly (as in recreational opportunities) and indirectly (as in climate regulation) connected to human welfare.

The goal of MIMES is to illuminate the value of ecosystem services and to aid decision-makers in making more informed decisions about their management.

What is MIMES?

MIMES is a multi-scale, integrated suite of models that assess the true value of ecosystem services in a sophisticated and transferable system to allow ecosystem managers to quickly understand the dynamics of ecosystem services, how their services are linked to human welfare, how their function and value might change under various management scenarios. It will facilitate understanding of the context of spatial patterns of land use, the dynamics of value, and the scale at which information is available for estimating ecosystem services at various scales (e.g. watershed, national and global).



ARIES

ARTificial Intelligence for Ecosystem Services

InVEST

← → ↻ http://www.naturalcapitalproject.org/InVEST.html Natural Capital Project - In...

File Edit View Favorites Tools Help

InVEST in Practice:
PRSPs
InVEST in Practice:
Carbon Offsets
InVEST in Practice:
Mitigation and Offsets

ES Project Database
(.ods)
ES Project Database
(.xls)

InVEST Includes

Lands and waters:

- Biodiversity
- Carbon
- Hydropower
- Water purification
- Reservoir sedimentation
- Managed timber production
- Crop pollination

Oceans and coasts:

- Wave energy
- Coastal vulnerability
- Marine fish aquaculture
- Aesthetic quality
- Overlap analysis: fisheries-recreation
- Habitat risk assessment

InVEST Updates

Who Should Use InVEST

Governments, non-profits, and corporations manage natural resources for multiple uses and inevitably must evaluate trade-offs among these uses; InVEST's multi-service, modular design provides an effective tool for evaluating these trade-offs.

How it Works


```
graph TD; A[Stakeholder Engagement] --> B[Scenarios]; B --> C[Biophysical Models]; C --> D[Economic Models]; D --> A; C --> E[Maps<br/>Tradeoff curves<br/>Balance sheets]; D --> F[Dollar values<br/>Maps<br/>Tradeoff curves<br/>Balance sheets];
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© 2007 Natural Capital Project

InVEST is most effectively used within a decision-making process that starts with stakeholder consultations.

Through discussion, questions of interest, management choices, and/or policy options are identified.

Stakeholders develop spatial "scenarios" to show, for example, several alternative areas where fishing might be prohibited, where agricultural land might be converted

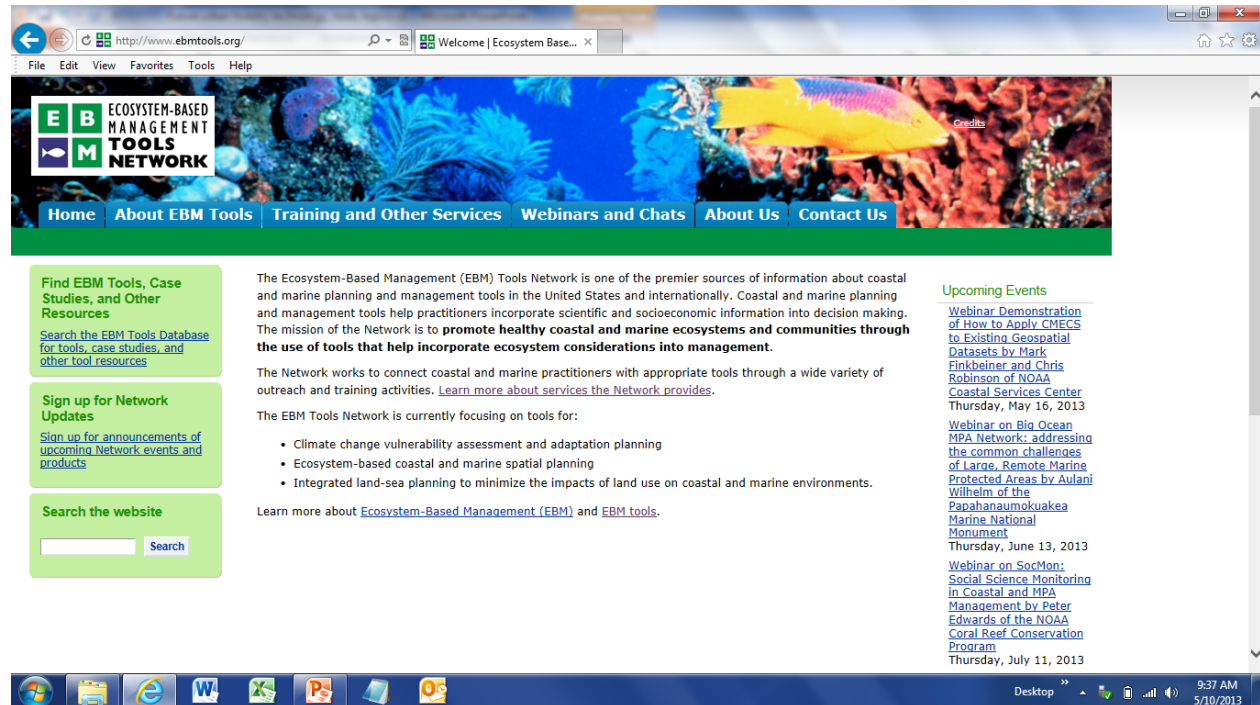


Desktop 9:25 AM 5/10/2013

- Modeling platform rather than a single model or collection of models.
- Incorporates existing ecological process models where appropriate and turns to ad hoc models where existing process models do not exist or are inadequate for local contexts
- Using the data to derive the relationships between variables rather than specifying the equations that define the relationships between model variables

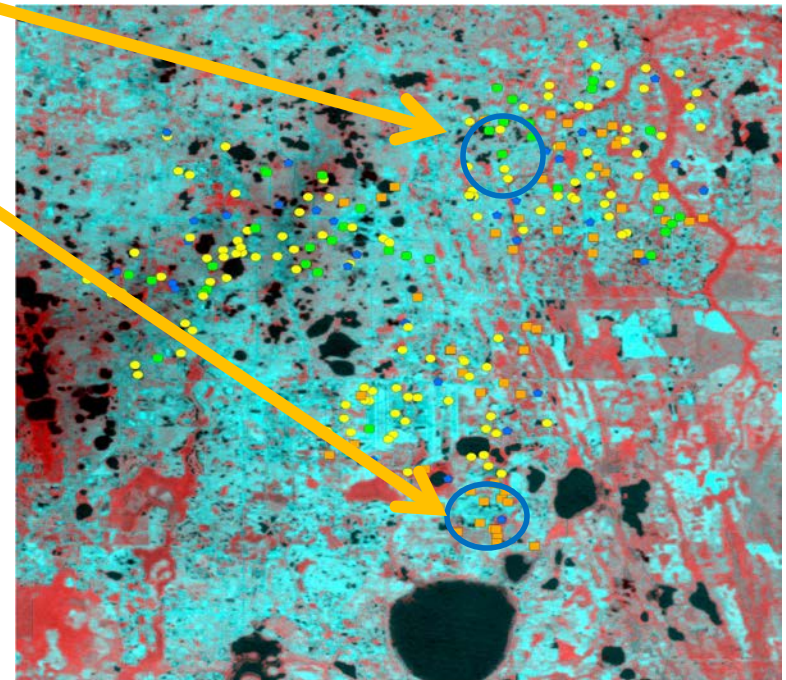
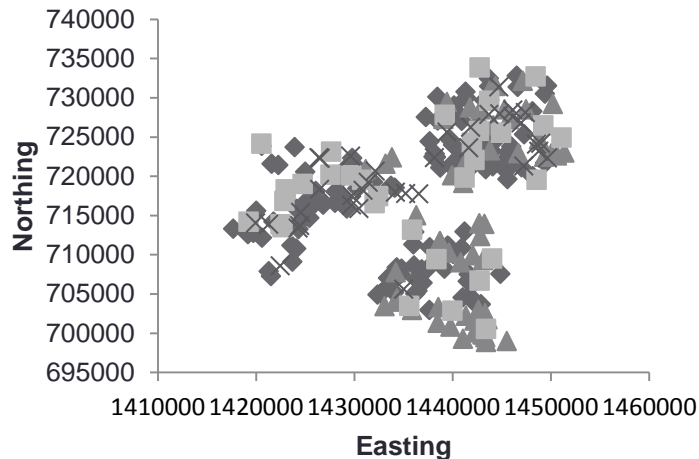
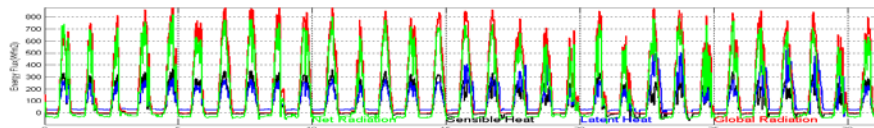
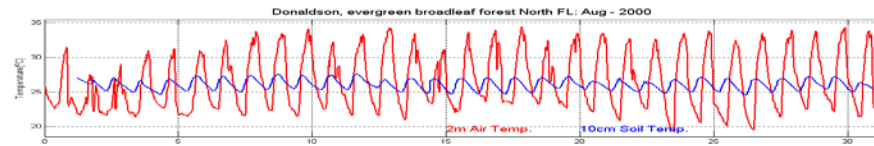
Ecosystem Based Management Tools Network

- MIMES use input data from GIS sources, time series, etc. to simulate ecosystem components at under different scenarios defined by stakeholder input
- Building interactive databases for regional, integrated decision making

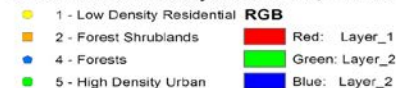


Using Regional Climate Models

Model heat and humidity using
“clusters” of Orlando ECO plots

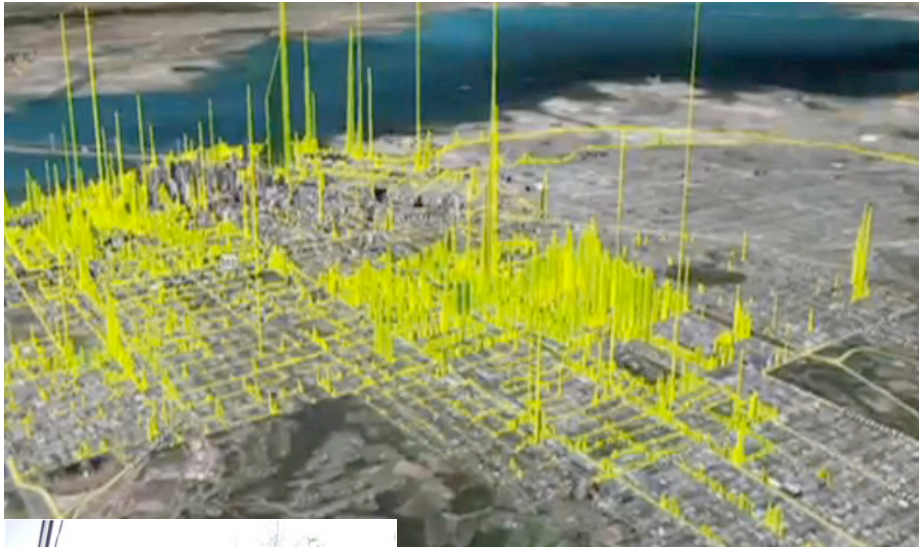


UFORE - Cluster analysis Orlando, FL - 2008-05-16

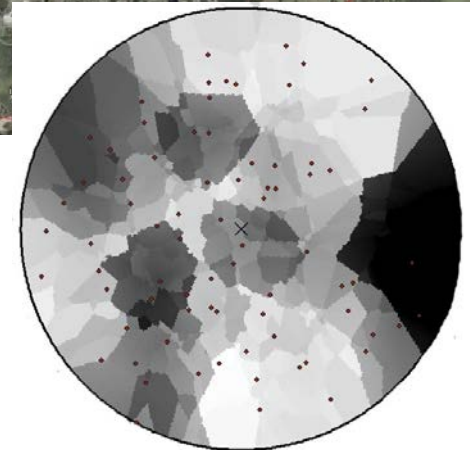
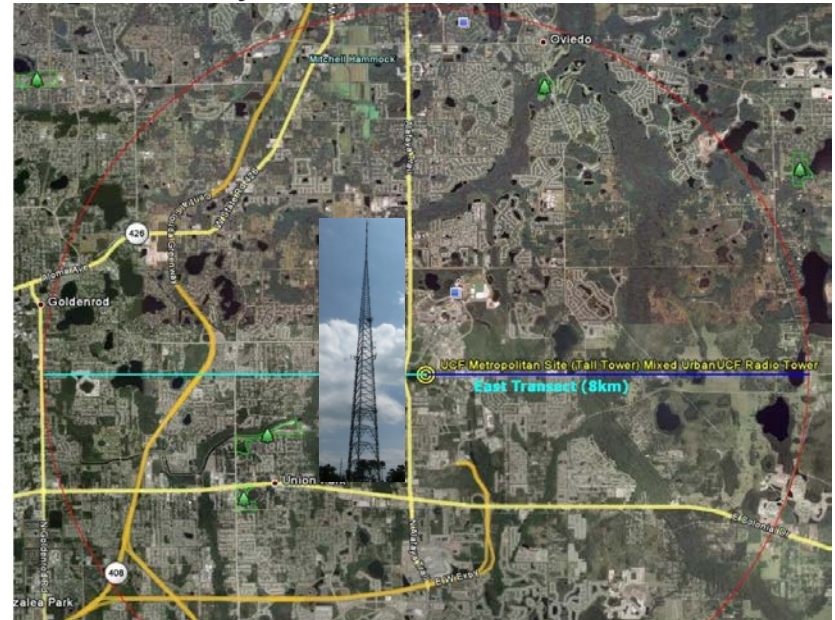


Urban Carbon Metabolism

Boston University ULTRA-Ex C

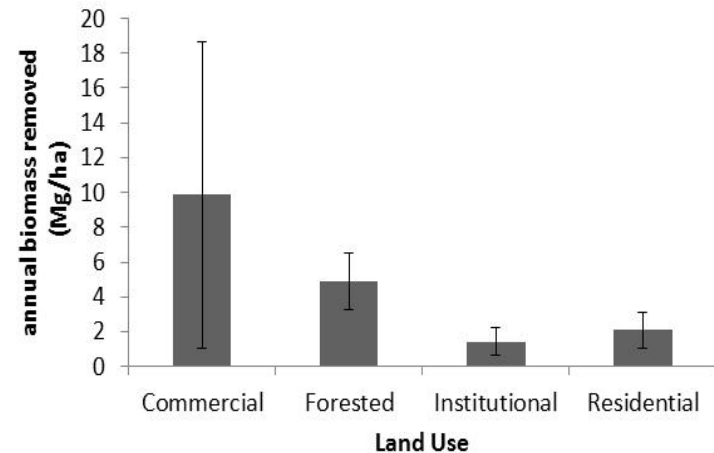


University Central FL- C Flux Tower

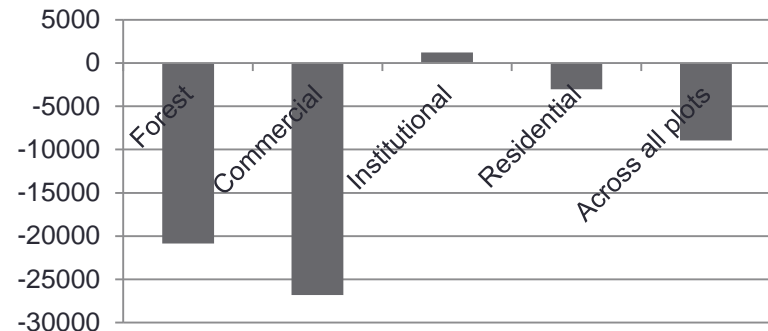


Urban Forest Data Applications

- Long-term Monitoring
- Urban Green Waste Supply/yield
- Hurricane planning and response
- “Drivers” of urban forest
- Social and economic analyses



Crown volume change (m³/ha)



Storms and Surveys

- Urban Tree Risk Index Model
 - <http://www.urbanforestrysouth.org/resources/library/ttresources/utri-data-process-and-gis-tool-description/view>
- Conjoint Analysis
 - Choice Modeling

Topics

- Importance of “drivers and tradeoffs” in urban forest assessments
- Relevant but unexplored ecosystem services
 - Economic value, storm mitigation, etc
- Research on quantifying effects of urban green spaces on human health
 - Study in Finland and Japan
- Role of non-native vegetation; function as an objective rather than structure

Questions on Tools/Technologies

- Pending Questions
 - On tools/technologies
 - On concepts/areas
- Wrap up
- UFI Participant Experiences

E-mail: fescobed@ufl.edu

Web site: <http://sfrc.ufl.edu/urbanforestry>

Extension:

http://edis.ifas.ufl.edu/topic_urban_forestry



Case Studies: Transferring Research to Management

- UFORE/ECO Assessments
 - San Juan, Gainesville, Miami-Dade, Pensacola, & Orlando
- Other Research
- Hurricane Debris Estimates
 - i-Tree STORMS,
 - Post-Hurricane Ike
- Open, candid communication between researchers and managers (policy makers).

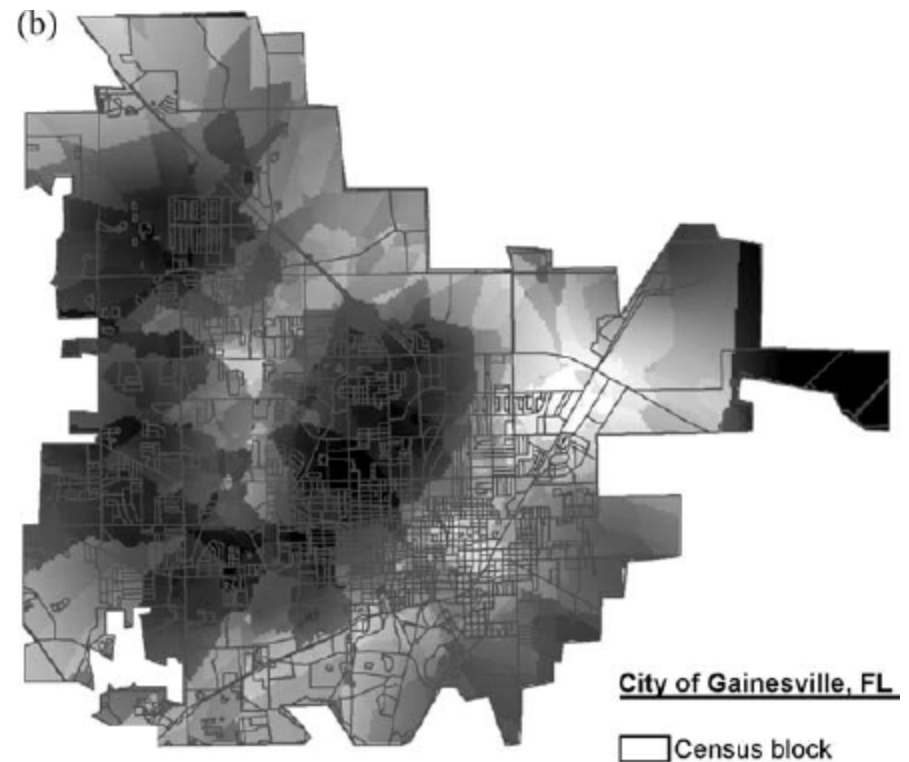
ECO Assessment of Gainesville's Urban Forest

Air Pollution Removal	390 t/year (\$2.2 M/year)
Carbon Storage	374,593 t (\$5.6 M)
Carbon Sequestration	9,738 t/year (\$146,000/year)
Building Energy Savings (Kwh)	\$973,000/year
Energy-Carbon avoided	4,500 t/yr (\$28,500)
Average Tree Value (Replacement)	\$33,900/acre

Economic Value of Ecosystem Services

UF-SFRC Research in Gainesville

- Re-measured ECO plots in 2006 and 2009
- Soil physical and Chemical properties
- Ecosystem Services Mapping
- Tree C Equations
- Invasives Mapping
- Cost survey



San Antonio, TX: Developing Tree Ordinances Using Tools

- Ordinance Provisions that address tree canopy at the parcel-level
 - *“WHEREAS, in the Spring of 2009 American Forests... studied the San Antonio area tree canopy and determined that between the years 2001 and 2006 there has been a reduction in the tree canopy for the urban core of the City.....”*
 - Establishes the minimum percentage of all diameter inches or percent tree canopy of significant or heritage trees that must be preserved or mitigated
 - http://isatexas.com/Members/Ordinances/2012_Ordinances/Tree_Preservation_Ordinances/San%20Antonio%20-%20Tree%20Preservation%20Ordinance.pdf

City of Orlando, Florida

USDA Forest Service

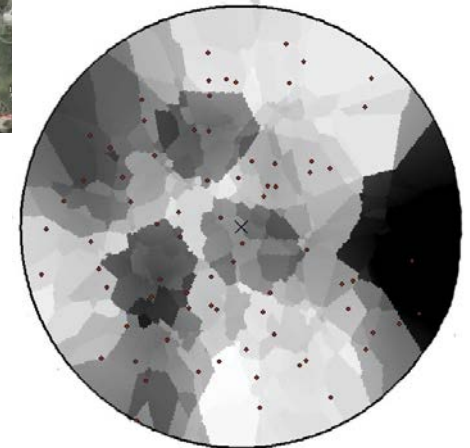
- i-TREE STREETS
reference city

UCF/UF

- i-Tree ECO
- Remeasured ECO plots 2008 and 2010
- Maintenance Survey
- C Flux Tower

UCF

- Many other projects



Orlando, Florida: Use of Tools for Advocacy

Andy Kittsley- Urban Forest Manager (2010)

- “Because ...STREETS and UFORE ... were easily acceptable as valid....Last year culmination of 4 years of austere budget preparations lay-offs were across the board.... Even fire and police suffered some losses.”
- “Forestry was the sole exception. Our budget force was doubled in direct response to the presentation we made to the mayor and commissioners about the value ..[of]...trees..”

Hillsborough County

- Focus groups used to develop survey
 - Extension agents
 - County/City Personnel
 - Research Social Scientist
- Developed into Research Project
 - Published peer-reviewed and extension publications
 - Used to develop additional project in Tampa

Social Benefits of Urban Forests

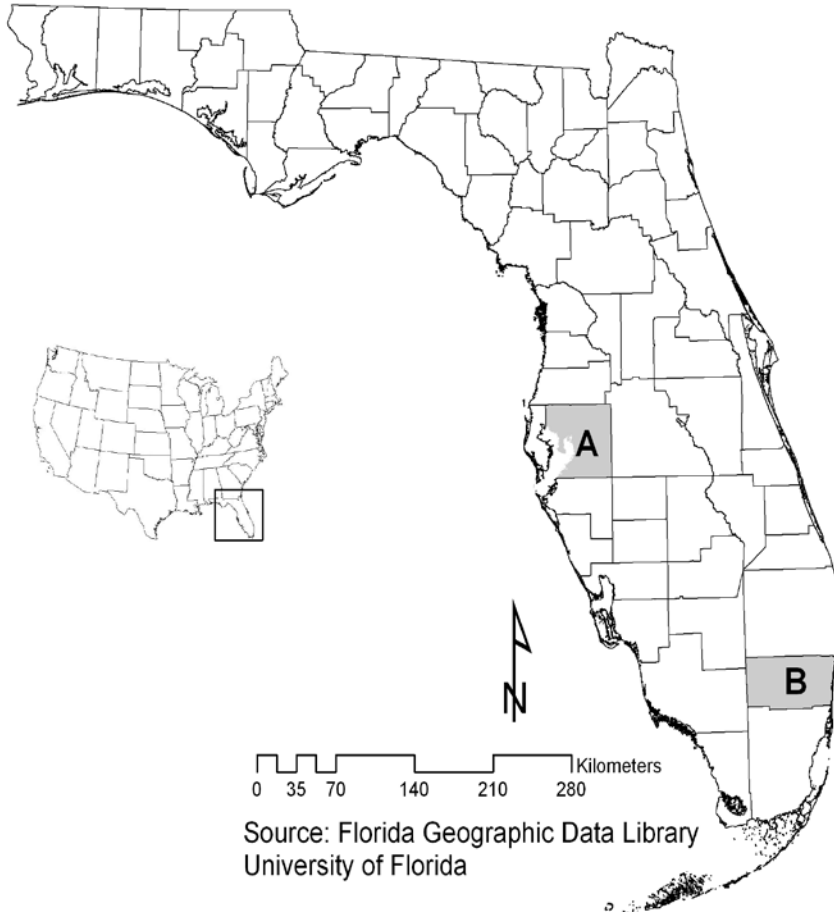
Focus Groups in Hillsborough County

“What people value about urban forests”

1. Provide shade
2. Aesthetics
3. Habitat for animals
4. Beauty/distinction
5. Supplies oxygen



¹Northrop, R., F. Escobedo, and J. Seitz. 2007. An urban forestry needs assessment for rapidly urbanizing Florida – assessing community perceptions and attitudes towards urban and urbanizing forests. In *Emerging Issues Along the Urban/Rural Interface 2: Linking Land Use Science and Society Conference Proceedings*, ed. D. N. Leband, 180-181. Auburn, AL: Auburn University Center for Forest Sustainability.



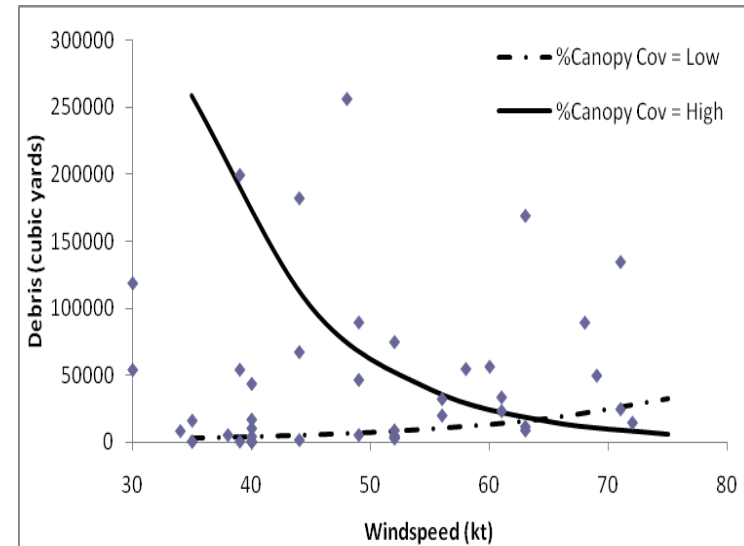
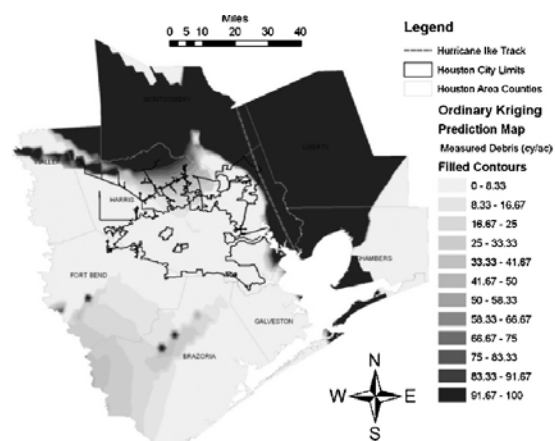
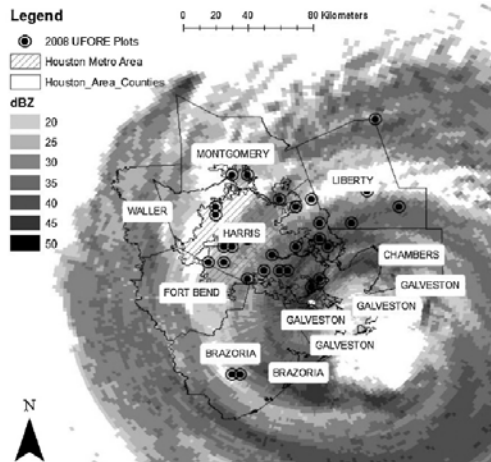
- 1,219 mail surveys to HOA leaders
- 22% response in Broward (A); 27% response in Hillsborough (B)
- 5-point Likert scale to assess level of importance to benefits and costs
- ANOVA in each county compared responses of favoring “increasing urban forests”
- A binomial logit regression model assessed probability of respondent favoring increase in urban forests:

$$P(y = 1|x) = \frac{e^{(\beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots)}}{1 + e^{(\beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots)}}$$

What do Homeowner Association Leaders think of the benefits and costs of urban forests?

Hurricane Debris Estimates

- i-Tree STORMS, Post-Hurricane Ike



Debris assessment within City of Houston	Average debris (cy/acre)	Total debris (1000 cy)	Comparison to PW data (vegetation and mixed) ^a	Comparison to PW data (vegetation) ^a
Project worksheet debris (mixed and vegetation)	15.01	6116.00	0	N/A
Project worksheet debris (vegetation)	11.26	4587.00	N/A	0
Modeled debris (statistical)	14.05	5726.43	-6%	+25%
Modeled debris using spatial interpolation	15.28	6227.34	+2%	+36%
HDEM ^b	8.58	3494.60	-43%	-24%
i-Tree STORM ^c	15.27	6221.00	+2%	+36%

Is Research Working?

- Have you/do you work with researchers
 - Why not?
- Do you use scientific papers for informing management decisions?
 - If not, what do you use
- How can researcher communicate better with managers/policy makers?
- Other experiences