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

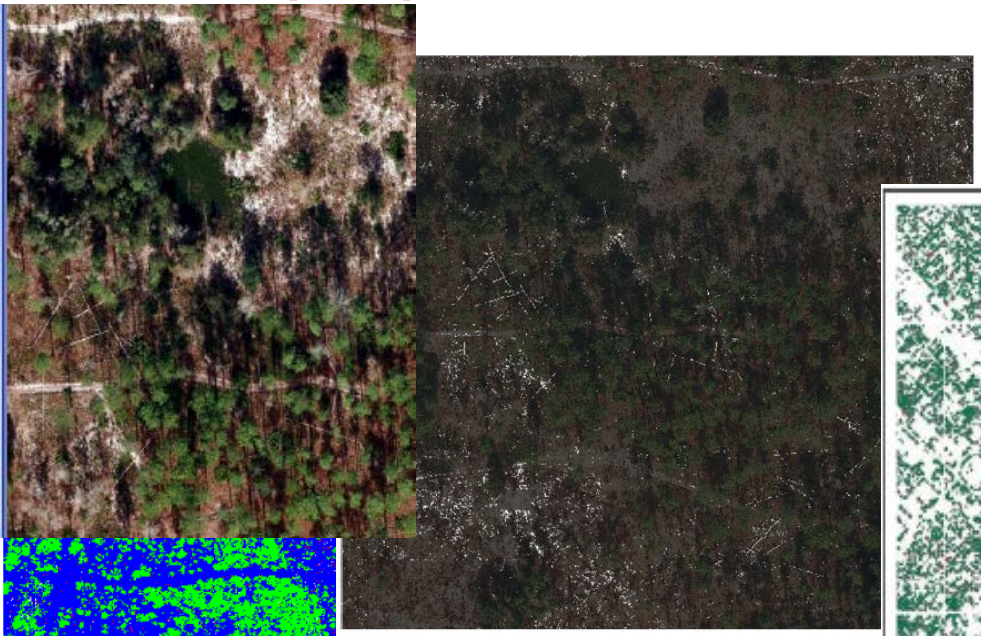
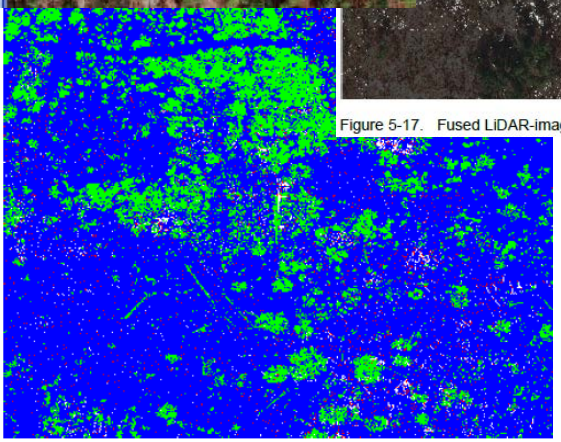
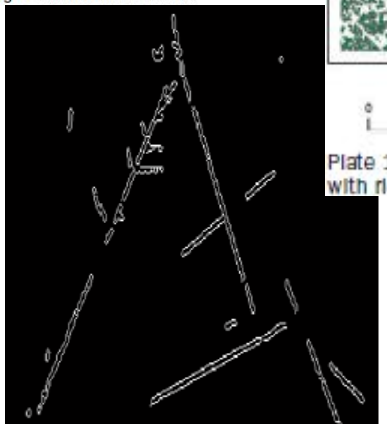


Figure 5-17. Fused LiDAR-image SVM classification visual





GROUND

NEAR-NON GROUND

Volume =3-49% Error

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

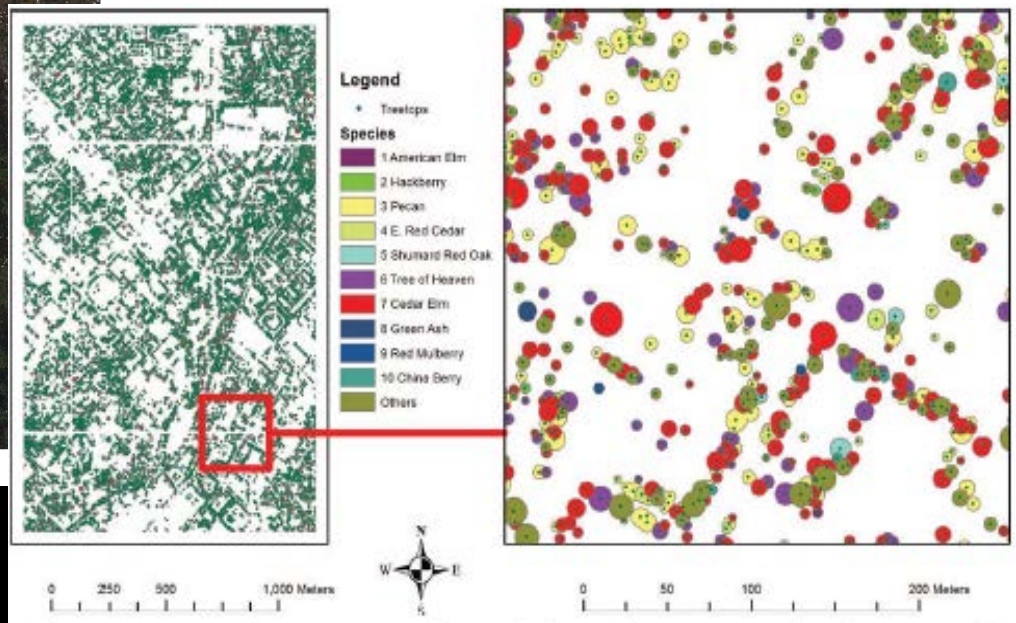


Plate 1. Species Map on the Crown Level with the Detected Treetops. The complexity of the urban forest with rich species, varying crown size, and high spatial heterogeneity, are presented.

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

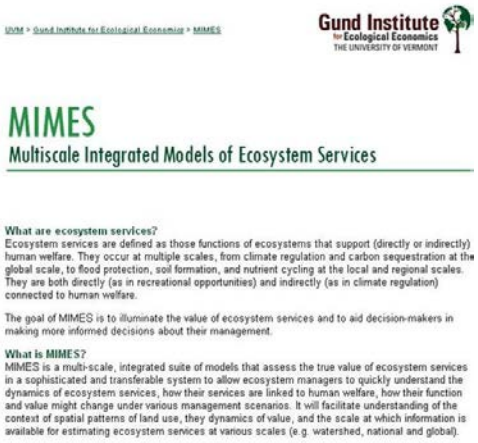
Community Inventories/ Google Earth

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	*Quercus virginiana*	◊	*Q. vir*	*Q. vir*
# 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/

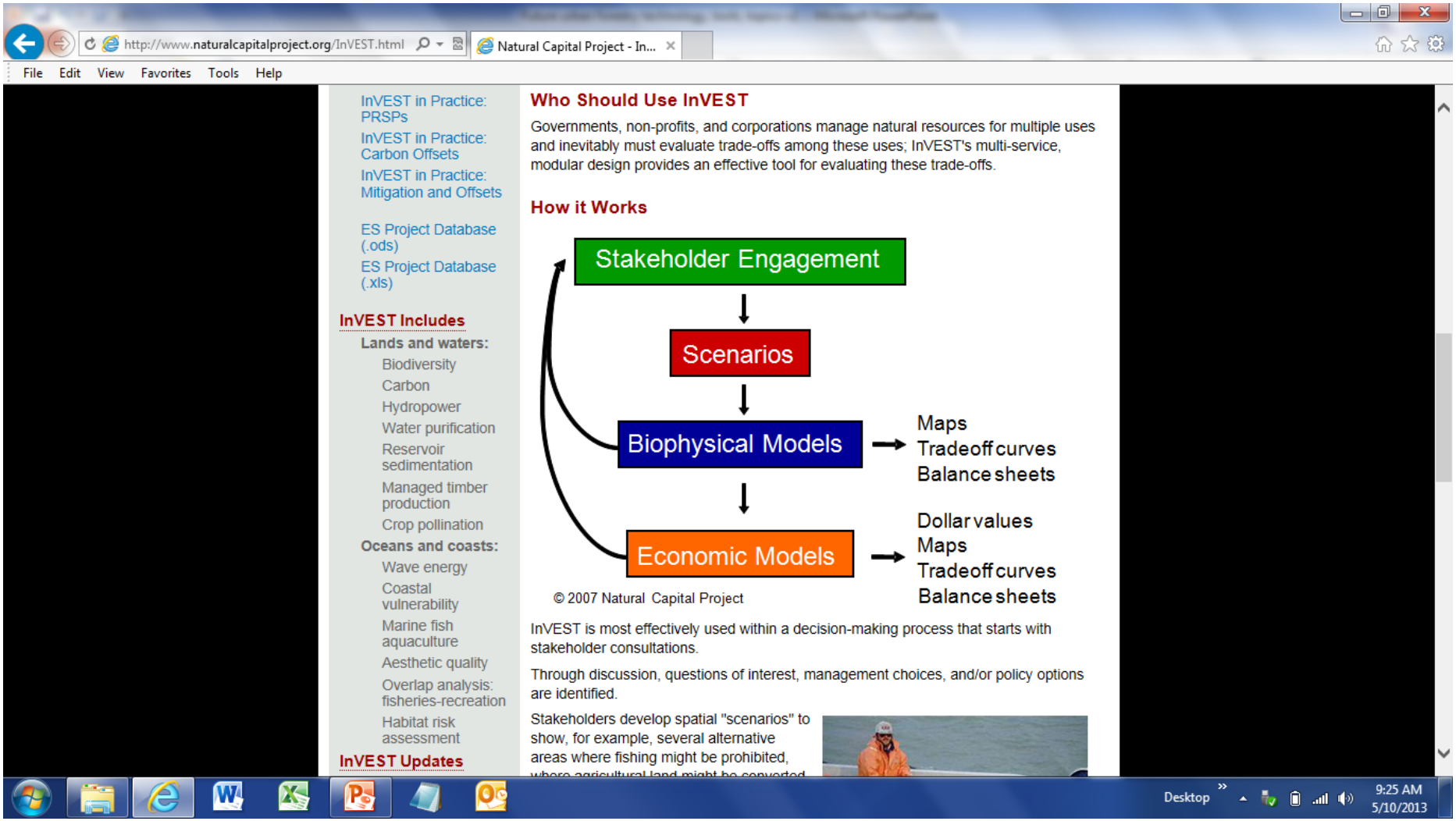
Ecosystem Service Models

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



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
Stakeholder Engagement
Scenarios
Biophysical Models
Maps
Tradeoff curves
Balance sheets
Economic Models
Dollar values
Maps
Tradeoff curves
Balance sheets
© 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,
Desktop
9:25 AM
5/10/2013

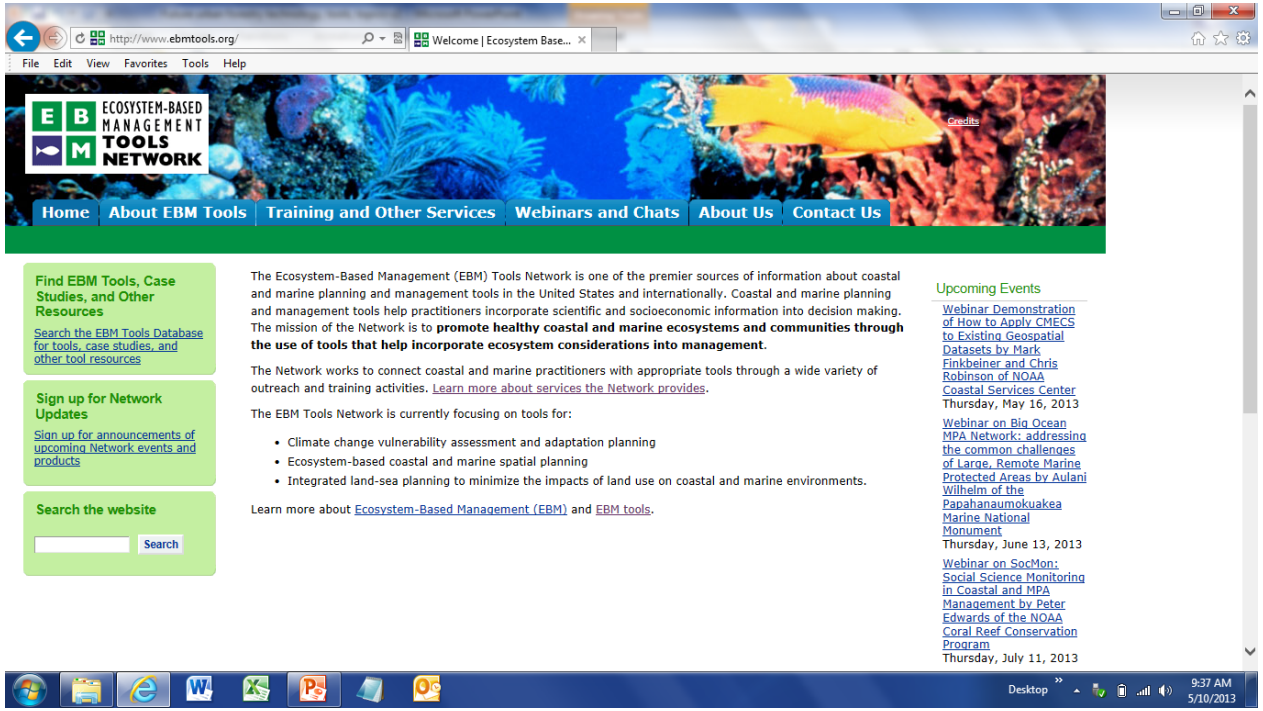
ARIES

ARtificial Intelligence for Ecosystem Services

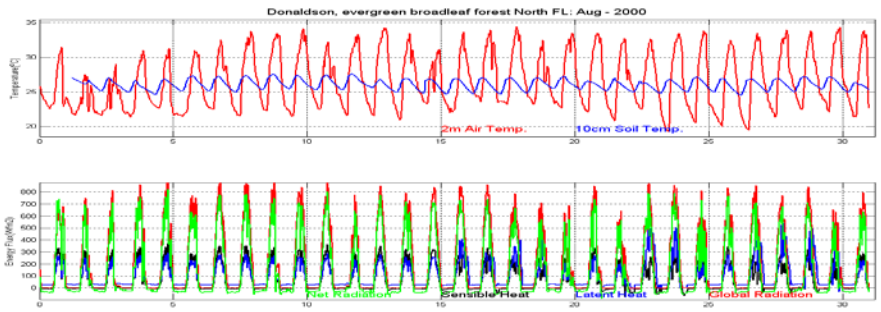
- Modeling platform rather than a single model or collection of models.
- Incorporates existing ecological process models where appropriate and turns to ad hoc models where existing process models do not exist or are inadequate for local contexts
- Using the data to derive the relationships between variables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

Ecosystem Based Management Tools Network

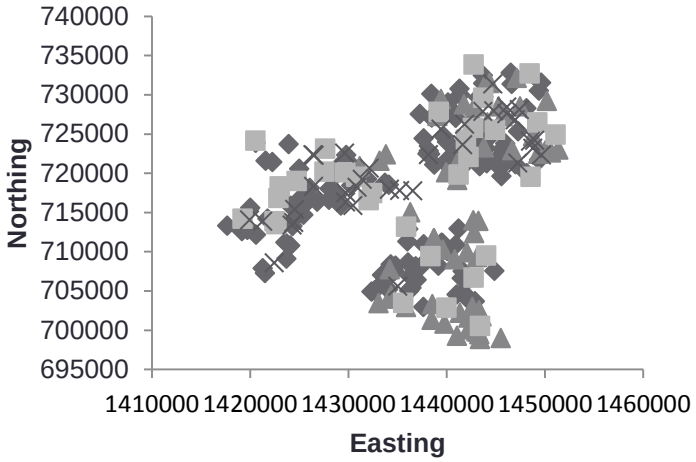
- MIMES use input data from GIS sources, time series, etc. to simulate ecosystem components at under different scenarios defined by stakeholder input
- Building interactive databases for regional, integrated decision making

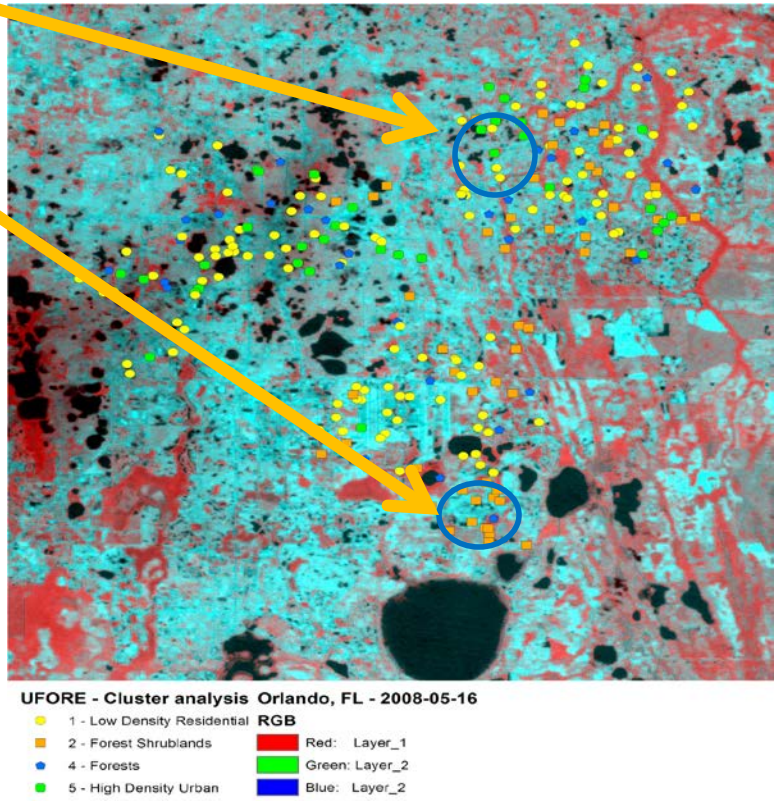


Using Regional Climate Models



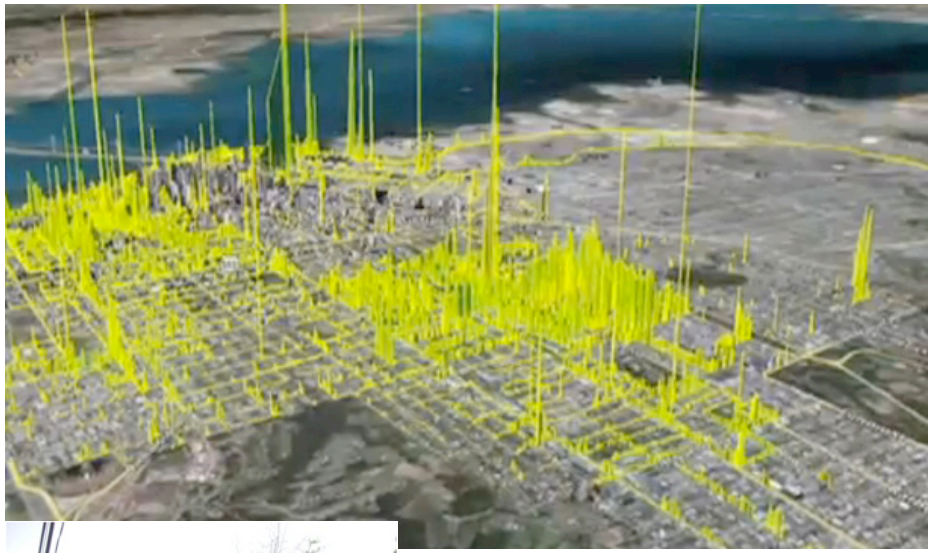
Model heat and humidity using "clusters" of Orlando ECO plots



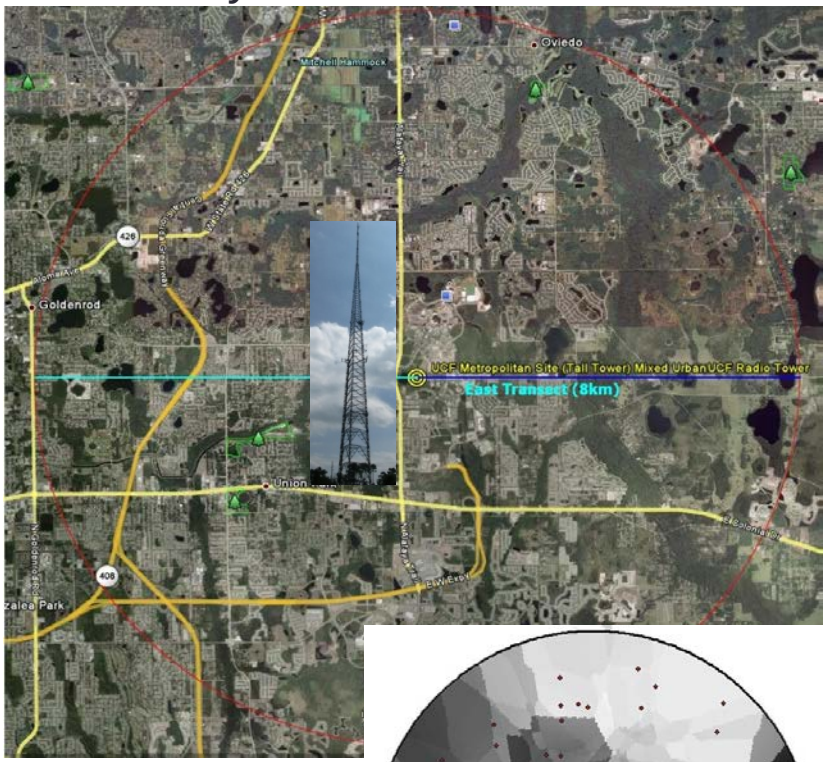


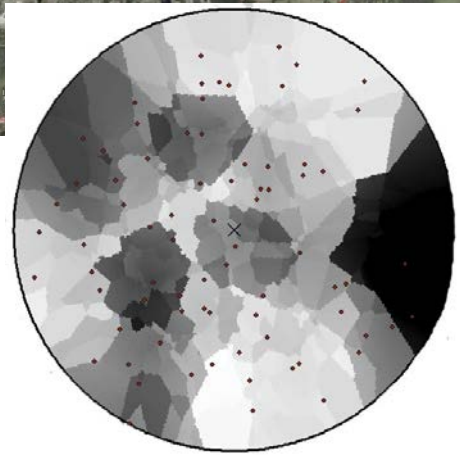
Urban Carbon Metabolism

Boston University ULTRA-Ex C



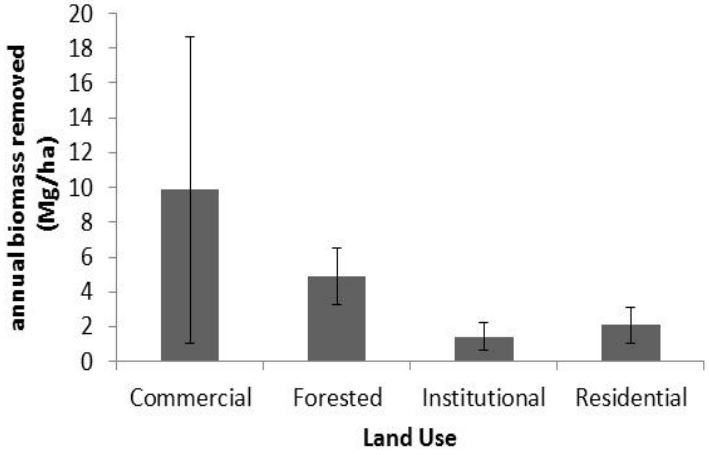
University Central FL- C Flux Tower

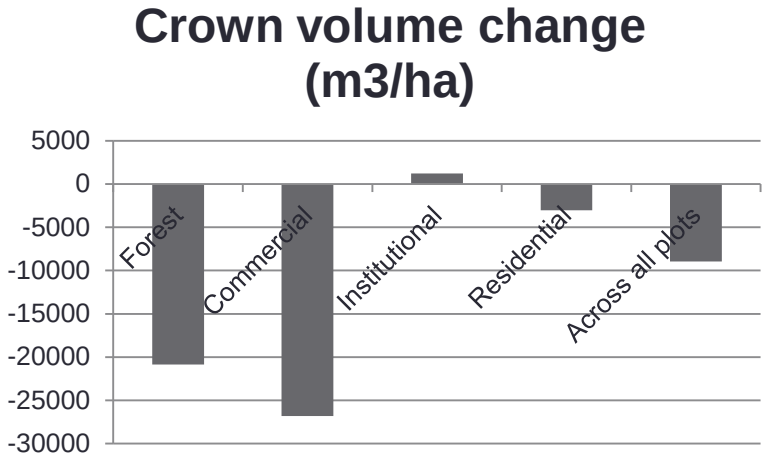




Urban Forest Data Applications

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





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).

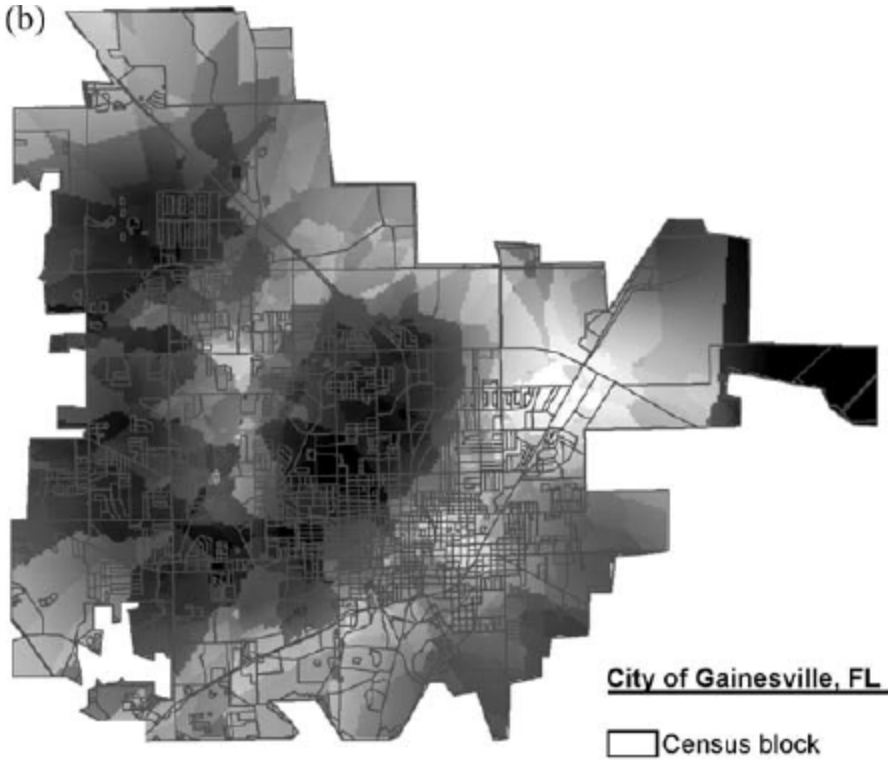
ECO Assessment of Gainesville's Urban Forest

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

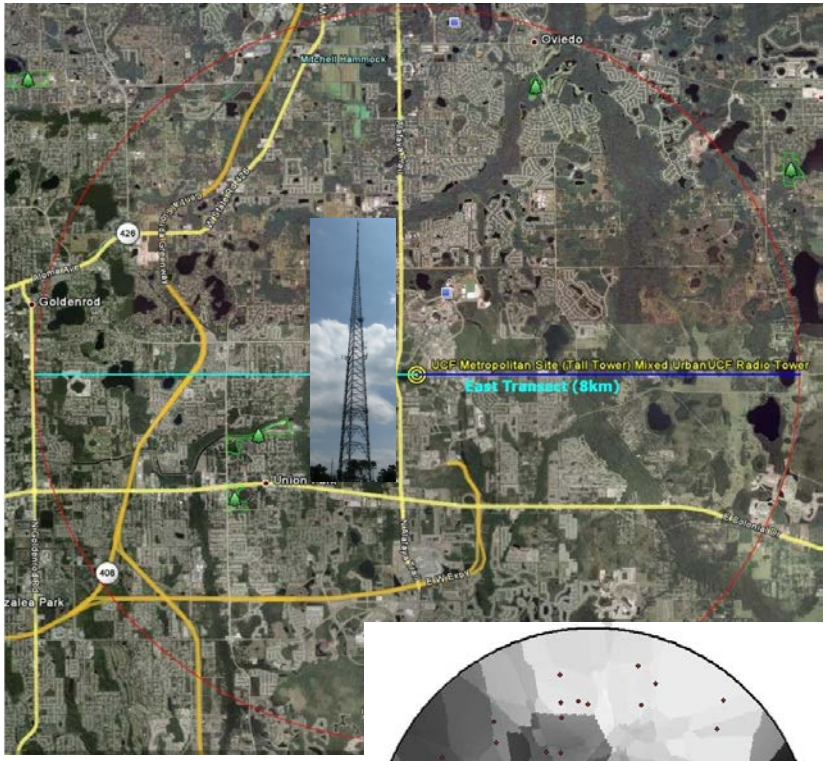
- i-TREE STREETS reference city

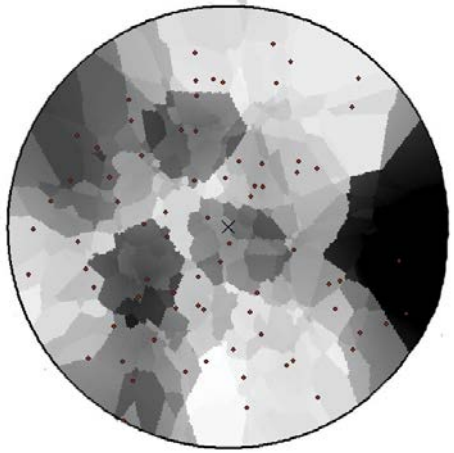
UCF/UF

- 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

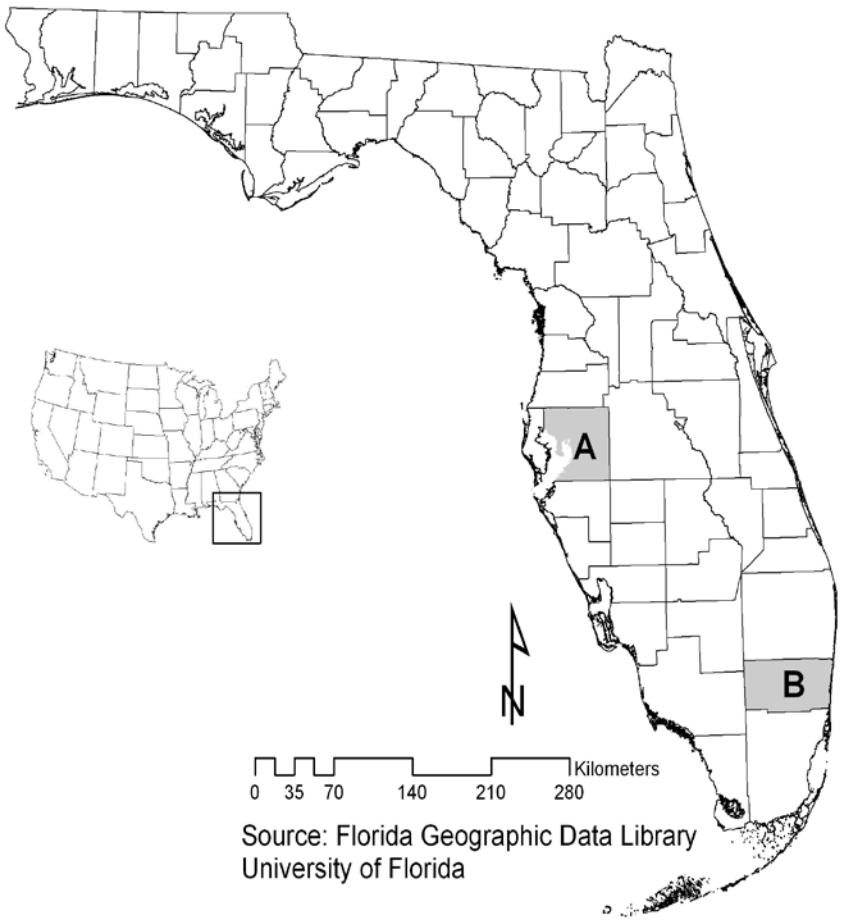
Social Benefits of Urban Forests

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

[1]*Northrop, 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:

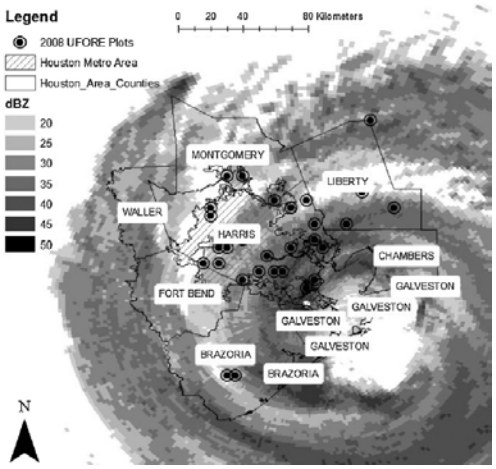
$$P(y = 1|x) = \frac{e^{(\beta 0 + \beta_1 x_1 + \beta_2 x_2 \ldots)}}{1 + e^{(\beta 0 + \beta_1 x_1 + \beta_2 x_2 \ldots)}}$$

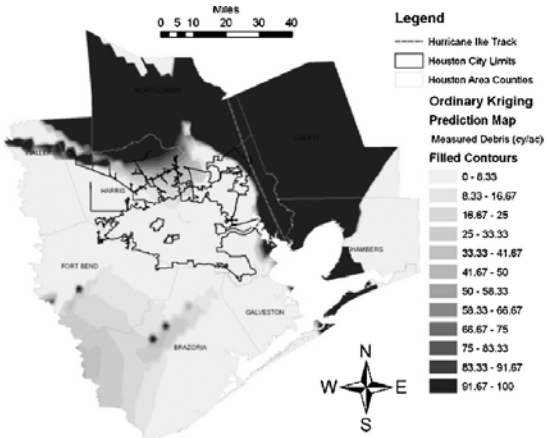
What do Homeowner Association Leaders think of the benefits and costs of urban forests?

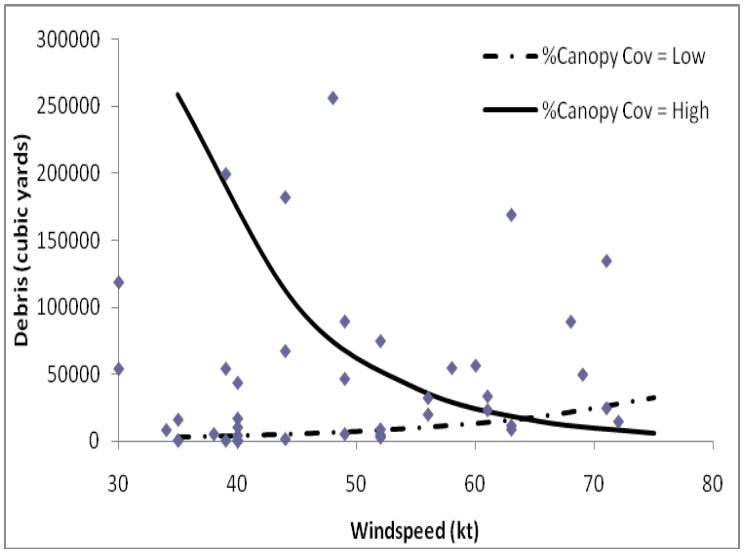
Wyman, M., Escobedo, F., Stein, T., Orfanedes, M., Northrop, R. 2012. Community leader perceptions towards coastal urban forests and hurricanes in Florida. Southern Journal of Applied Forestry, Accepted

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