GIS: Story-Making for Social and Environmental Change

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What is GIS?

- The greatest value of a picture is when it forces us to notice what we never expected to see.
  - *John W. Tukey - Exploratory Data Analysis (1977)*

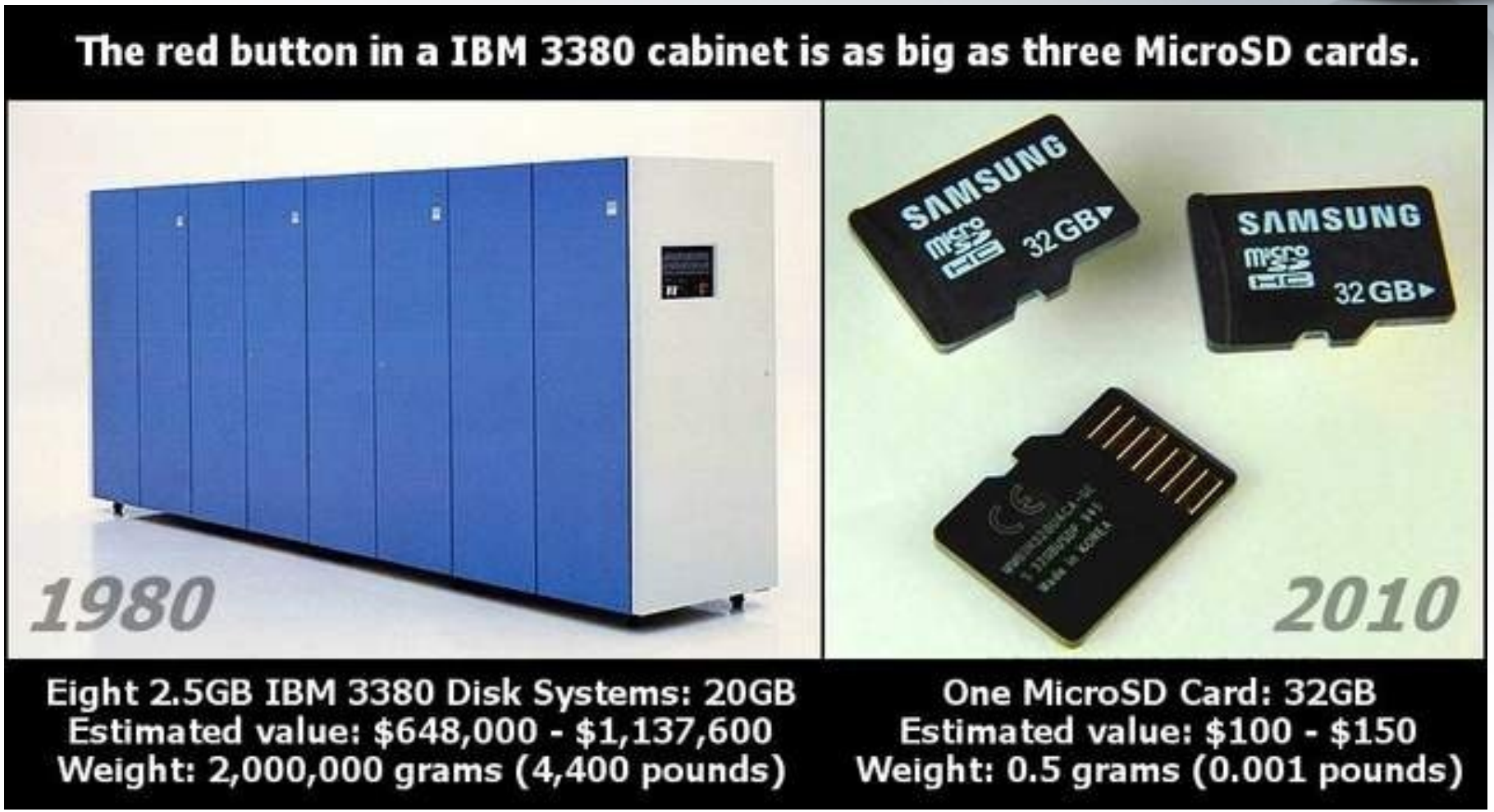
- GIS is *not* about making maps, *per se*.
  - It is about analyzing often large sets of data to generate information – hypotheses, conclusions, insights, new hunches – about widely varied socio-economic phenomena… It is about telling a story…
    - J. T. Johson – GIS as a unifying methodology in ***journalism***

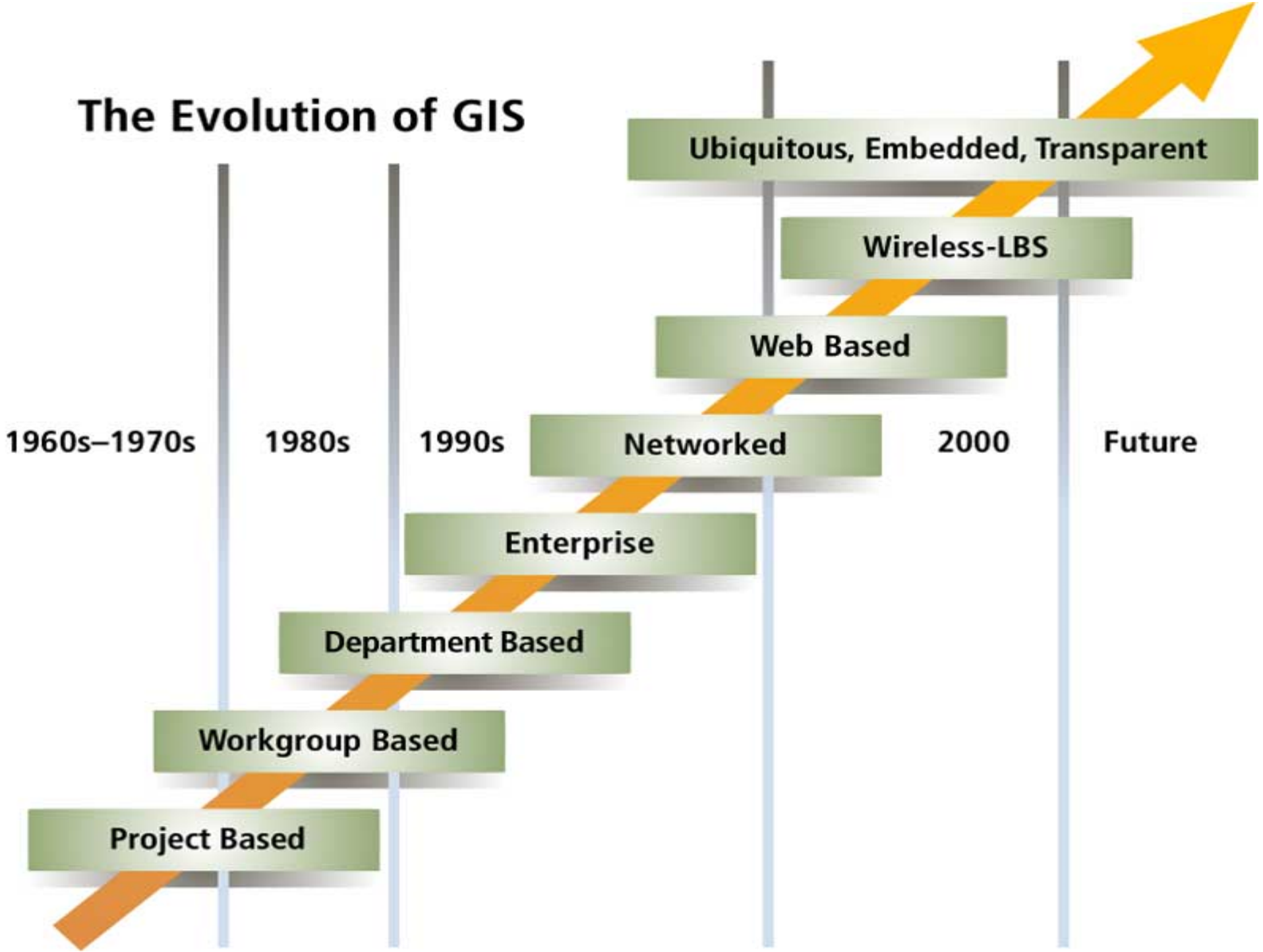
Where to start…with GIS

- Often with GIS the focus is on the technology…

- Fred Latham using a video projections system as a part of the Oak Ridge GIS technologies. It projected onto a paper map a light beam that instantaneously followed the operators mouse…. (1980)

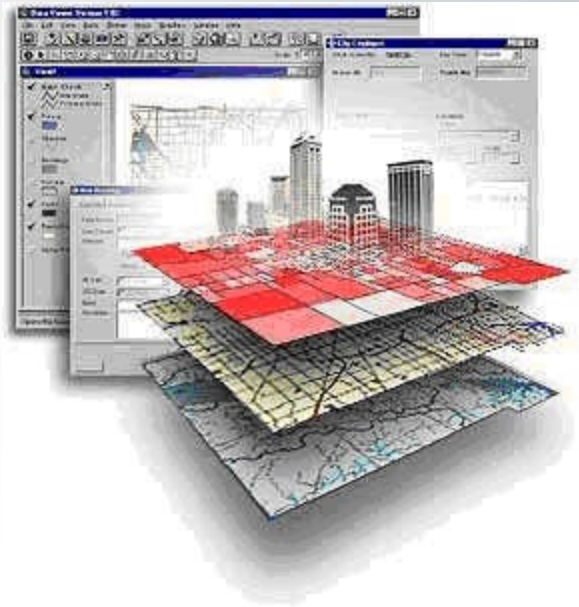
The times sure have changed…




The Evolution of GIS
Ubiquitous, Embedded, Transparent
Wireless-LBS
Web Based
1960s–1970s
1980s
1990s
Networked
2000
Future
Enterprise
Department Based
Workgroup Based
Project Based

What do we (not) know?

- In 1994, the first United States conference on the educational application of GIS was held, sponsored by the National Science Foundation (NSF).
  - During that conference, NSF Program Officer Gerhard Salinger asked a set of important and poignant questions…



What do we need to know?

- What is the learning that produces understanding of concepts and processes students should know and be able to apply?
- What insights does GIS allow that the other ways of learning do not?
- What is GIS going to allow in education that we cannot do in other ways? (Salinger, 1995 p. 24).

We do not wish to fall prey to *technocentrism*, the justification for the use of technology because of the so called Mount Everest rationale—we use it "because it is there"

Bednarz and Ludwig, (1997)

Evolving understanding of GIS

- Berdarnz (2004) put forth three primary justifications
  - **Educative justification** based on GIS and the teaching and learning of geography and environmental education
  - **a workforce** based upon the growing need for GIS skilled workers
  - **place-based** learning justification.
  - We added a **scientific justification** (to appear in handbook on environmental education)

GIS is useful…

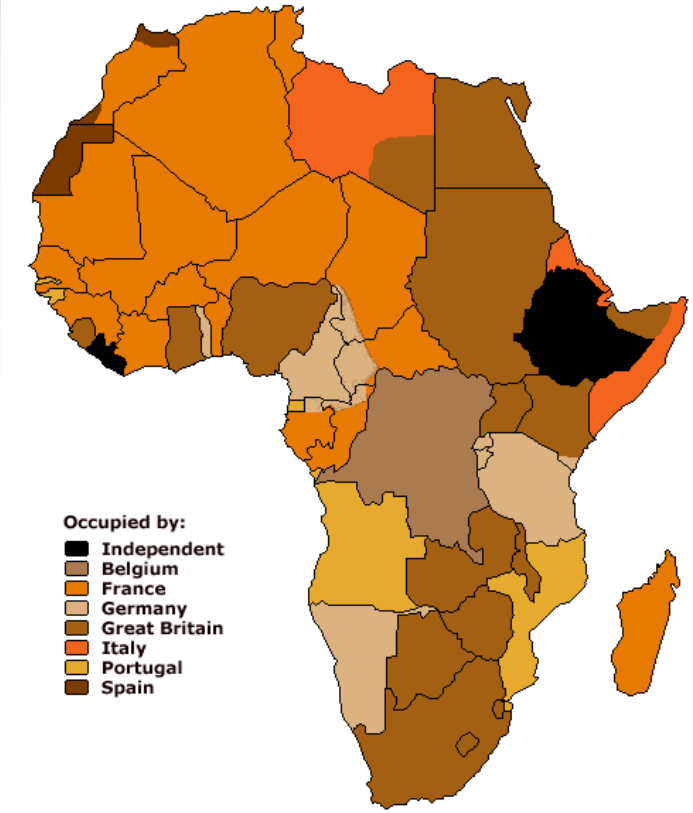
- Facilitates scientific visualization (graphic/ cartographic display)
- Engages students in the inquiry process
- Enables visual and computational comparison of multiple data layers,
- Provides users with an understanding and sense of place, and
- Facilitates the investigation of problems from interdisciplinary perspectives by the use of multiple data sources.

Deeper questions/critique… opportunity

- Recognition that GIS can
  - Simultaneous ability to empower and marginalize
    - in local politics, representations of multiple realities and local knowledges, and the scale-dependence of power-knowledge in GIS (e.g., Elwood and Leitner 1998; Weiner and Harris 1999; Sieber 2000; Elwood 2001)
- GIS can be used in ways that rigidify power structures while simultaneously masking – through the legitimizing strengths of "science" and gee-whiz displays…

Maps and knowledge

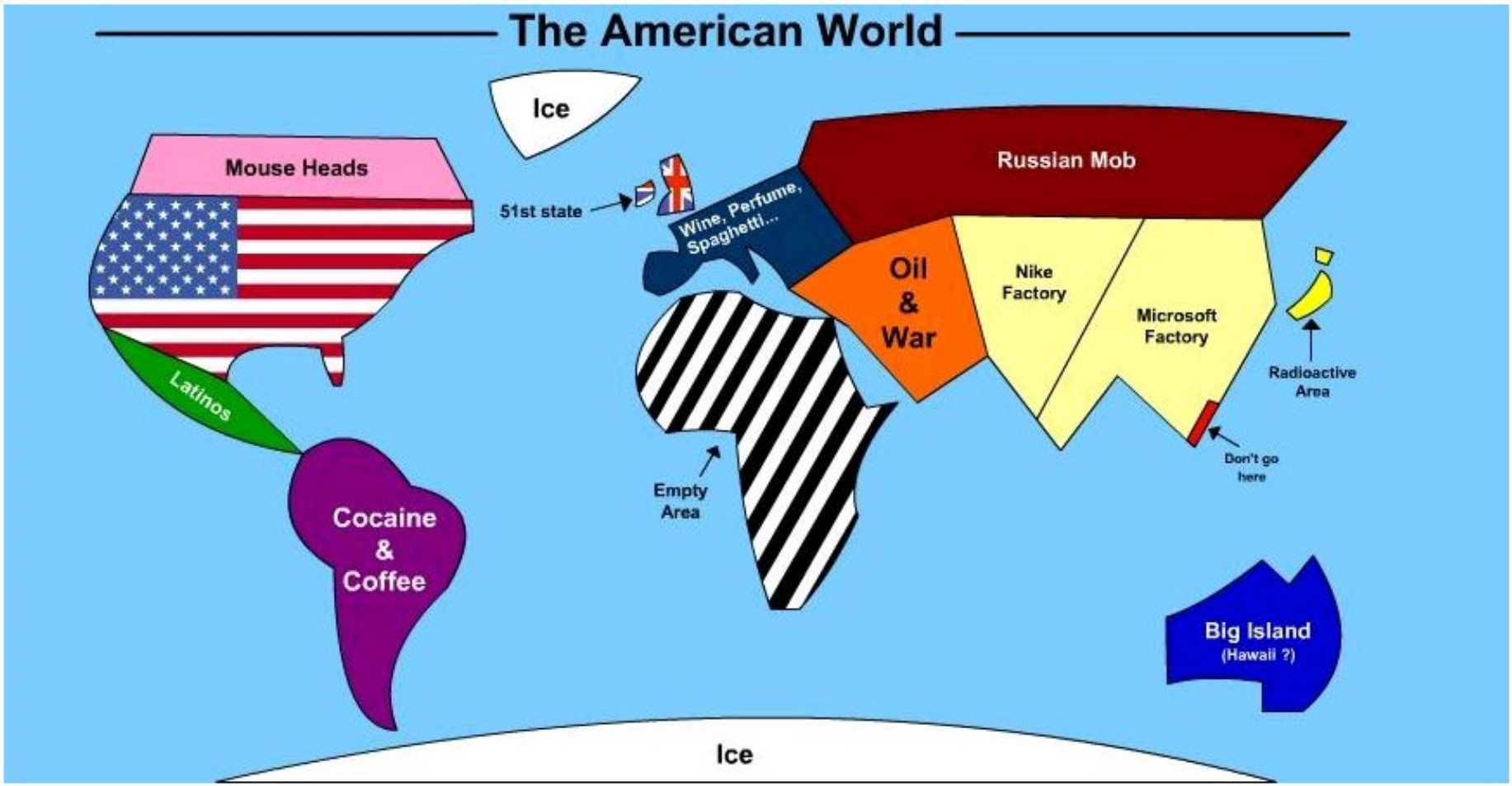
- Maps are visual artifacts of how people see the world as mediated by their particular value systems and relationships of power
  - Used during the area of colonization to trace their conquest of the modern world
  - Used to “define” an area and who lives there
- Opportunity to “unmask” and discover and tell stories



GIS, Science, and Story Making

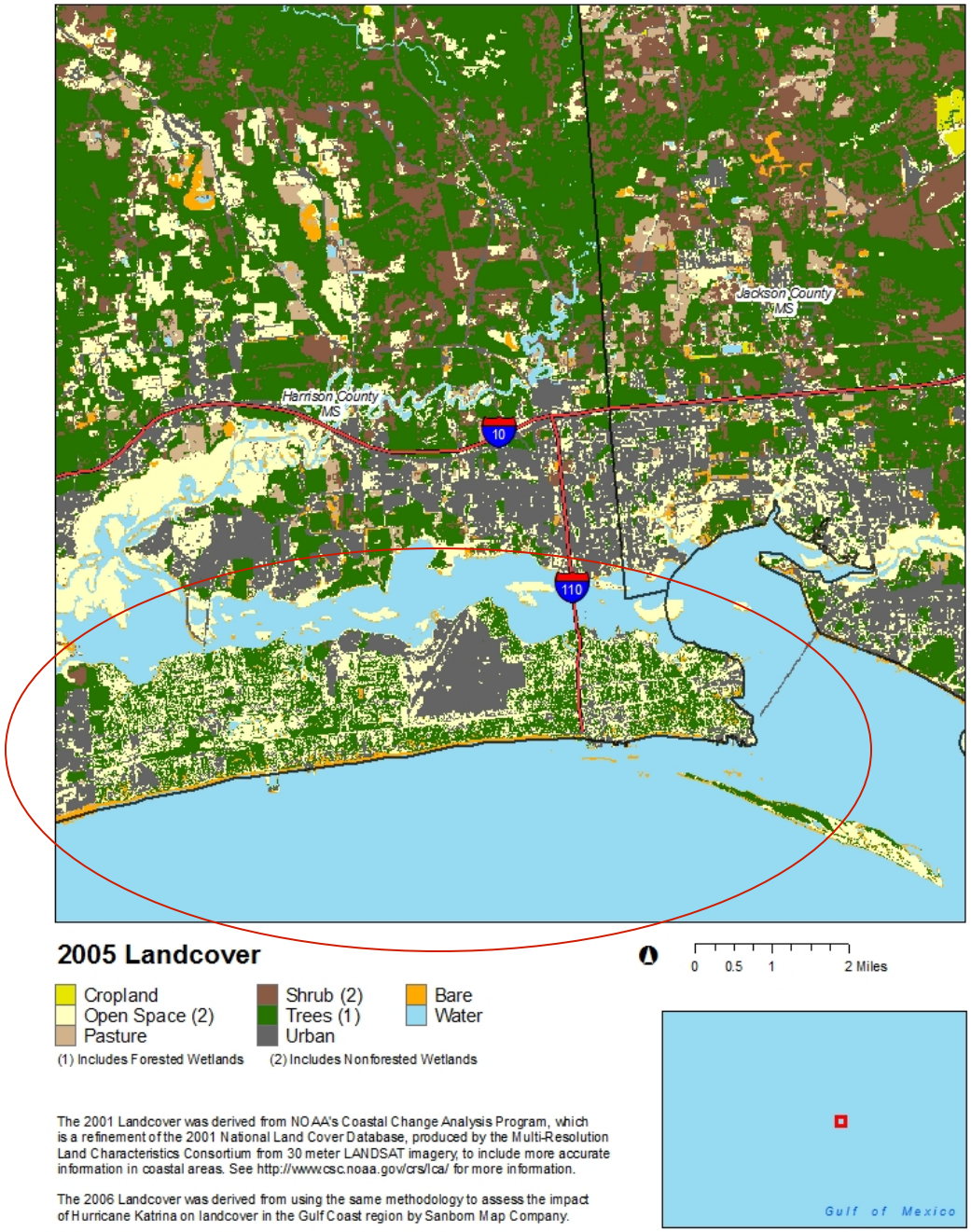
- Story-making is part of any scientific endeavor that often describes a beginning, middle, and an end to an experiment, a survey, or a process of some type (Polanyi, 2000, Wright, Duncan, Lach, 2008)
- Storytelling can also be defined as narratives of possible futures
  - to help bring future considerations into present decisions when predictions are not possible.
- GIS offers a chance to blend the older and less technological methods of sharing knowledge and couple them with information visualization.

Every map tells a story… from a certain perspective….



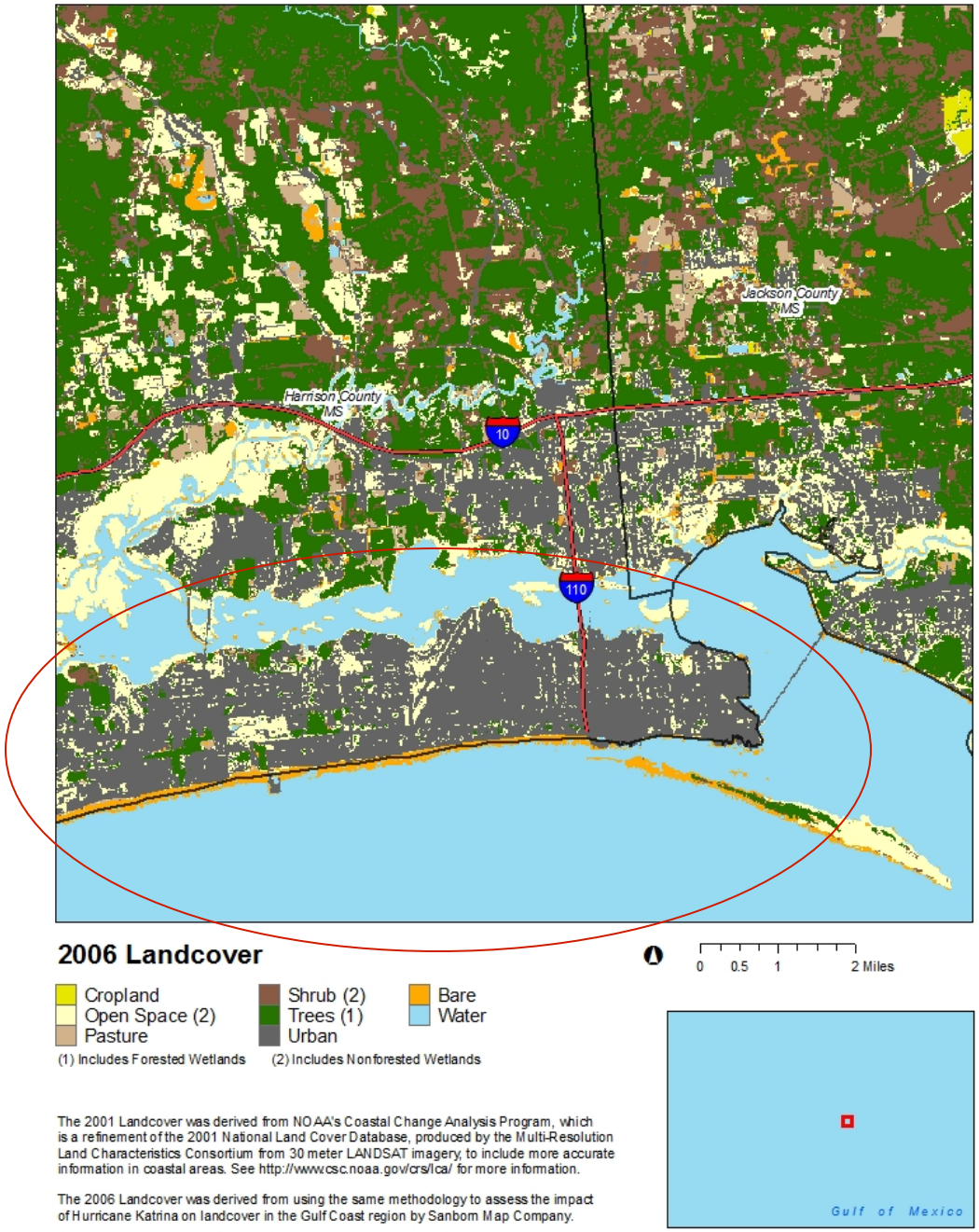
Maps tell a story… the trick is what is it?

- Project Flow Data: http://projects.flowingdata.com/



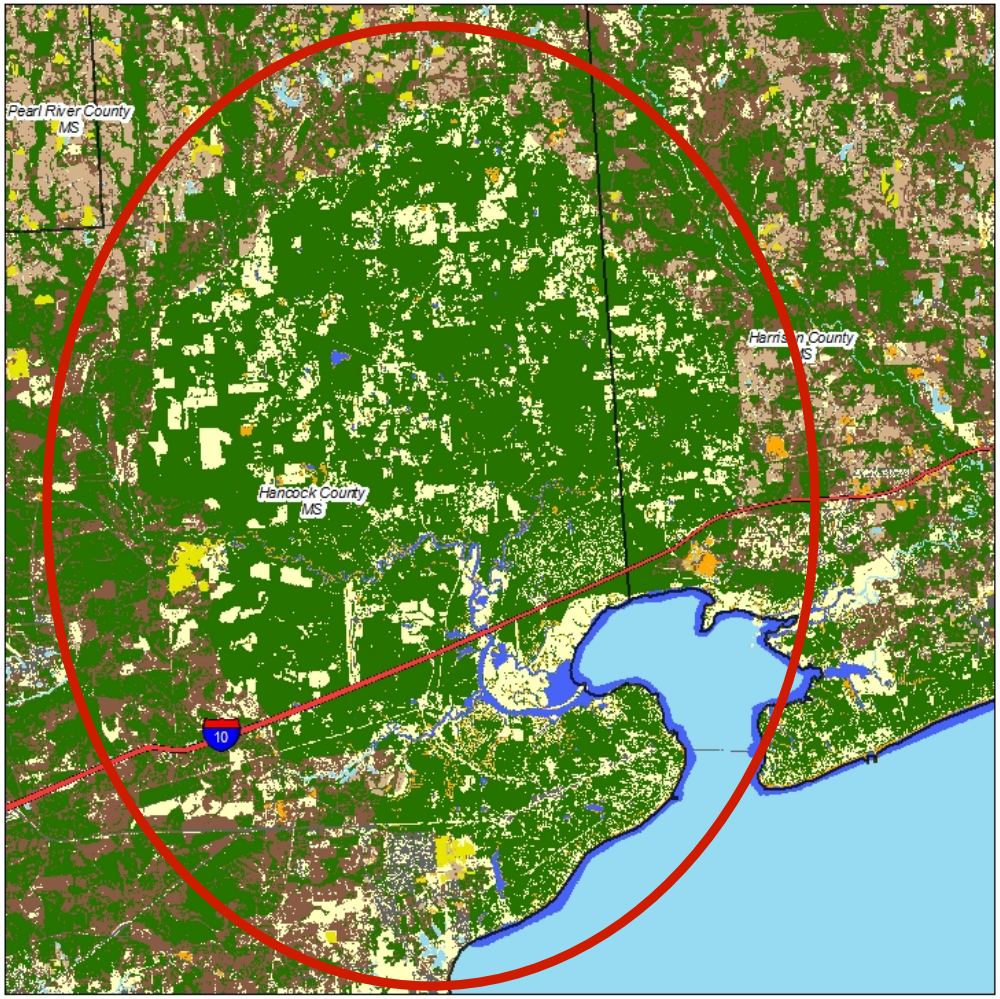
Biloxi, Mississippi

Pre - Katrina



Biloxi, Mississippi

Post- Katrina



Hancock, County

Post- Katrina

2005 Landcover

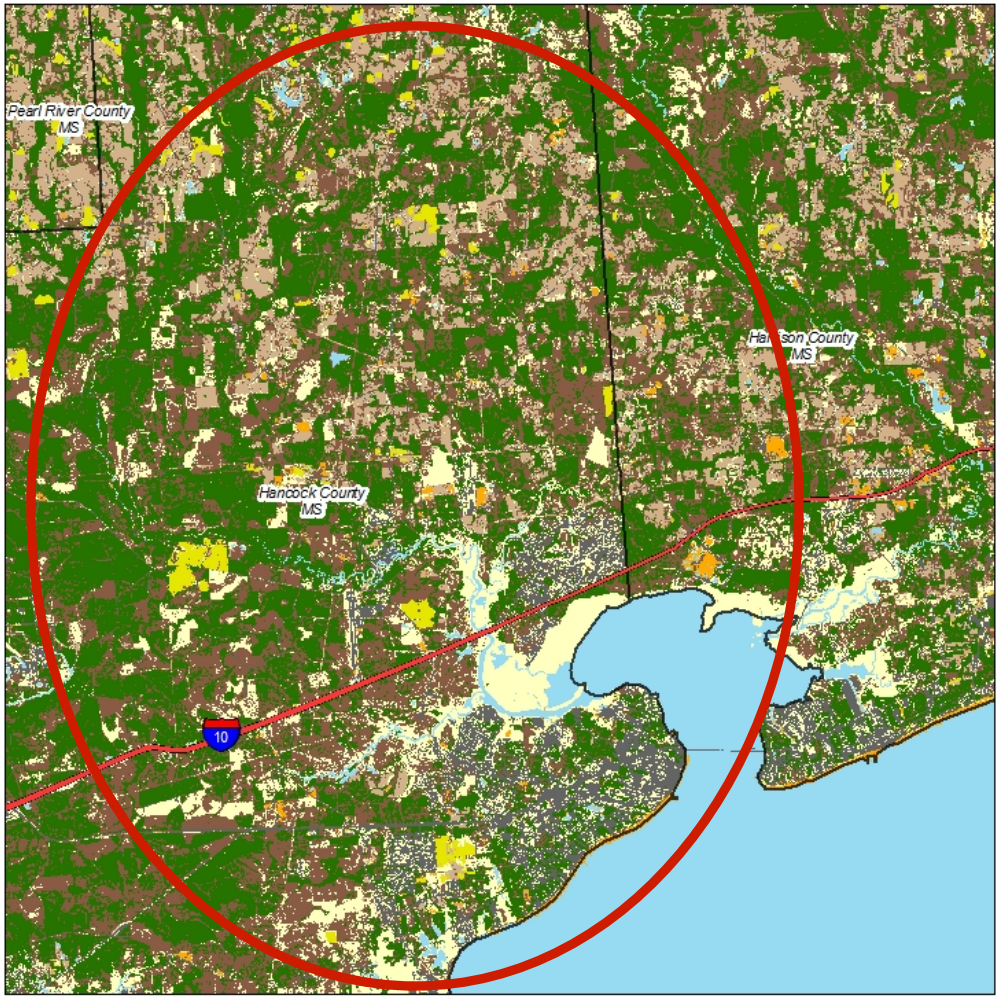
Cropland
Open Space (2)
Pasture
Shrub (2)
Trees (1)
Urban
Bare
Water

(1) Includes Forested Wetlands (2) Includes Nonforested Wetlands

0 1.25 2.5 5 Miles

The 2001 Landcover was derived from NOAA's Coastal Change Analysis Program, which is a refinement of the 2001 National Land Cover Database, produced by the Multi-Resolution Land Characteristics Consortium from 30 meter LANDSAT imagery, to include more accurate information in coastal areas. See http://www.csc.noaa.gov/crs/lca/ for more information.

The 2006 Landcover was derived from using the same methodology to assess the impact of Hurricane Katrina on landcover in the Gulf Coast region by Sanborn Map Company.



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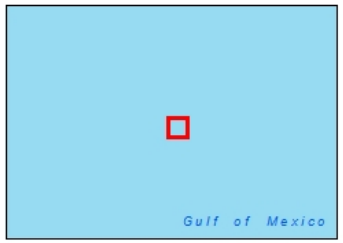

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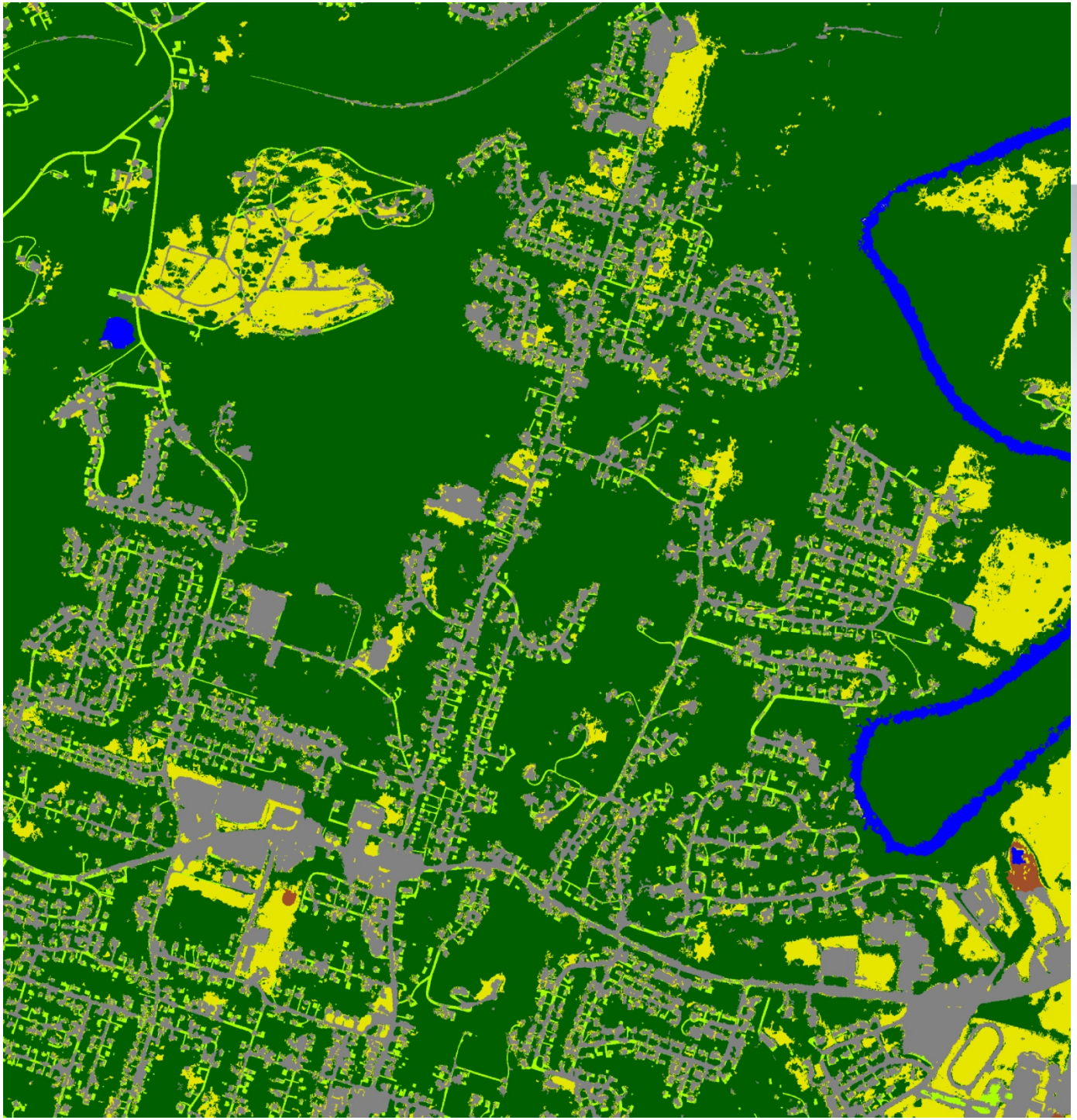
Post- Katrina

- Courtesy of Binesh Maharjan at American Forests



- Courtesy of Binesh Maharjan at American Forests

New fields of GIS emerging

- Critical GIS
  - Critical, feminist, and postcolonial cartographers
- Kwan
  - GIS can allow the creation the of “subversive cartographies” which challenge dominant representations of the world
  - Illuminate the meaningful aspects of everyday life
- Participatory Public GIS
  - Engaging the public in creation and data generation of locally relevant maps
- CRSA – critical race spatial analysis

Empowerment using GIS

- Central to many emerging ideas regarding the use of the GIS in education is empowerment to critique and “unmask” what is hidden in a map…

- “You’re not up to date in social justice advocacy if you don’t know how to use GIS maps,”
  - Anita Earls, director of the Southern Coalition for Social Justice

Critical Pedagogy and GIS

- Creating pedagogical spaces that enable students to move from *object* to *subject* position produces more far-reaching, positive effects than the implementation of a particular teaching methodology
- GIS is a tool for examining and building contexts that maximize students' ability to make this shift

A Case study of empowering youth using GIS

- How can we reduce violence in our schools?
- How can we reduce dropout rates in our schools?
- What are ways that we can improve our neighborhood to impact violence and dropout rate?

Same Development: Chicago

Same Development Chicago

Green space: Reduces violence

- Kuo and Sullivan (2001 in Environment and Behavior)
- In 145 adult women randomly assigned to a series of architecturally identical apartment buildings, levels of aggression and violence were significantly
  - lower among individuals who had some nearby nature outside their apartments than among their counterparts who lived in barren conditions.
  - demonstrated reliably better performance on measures of attentional functioning (mental fatigue)

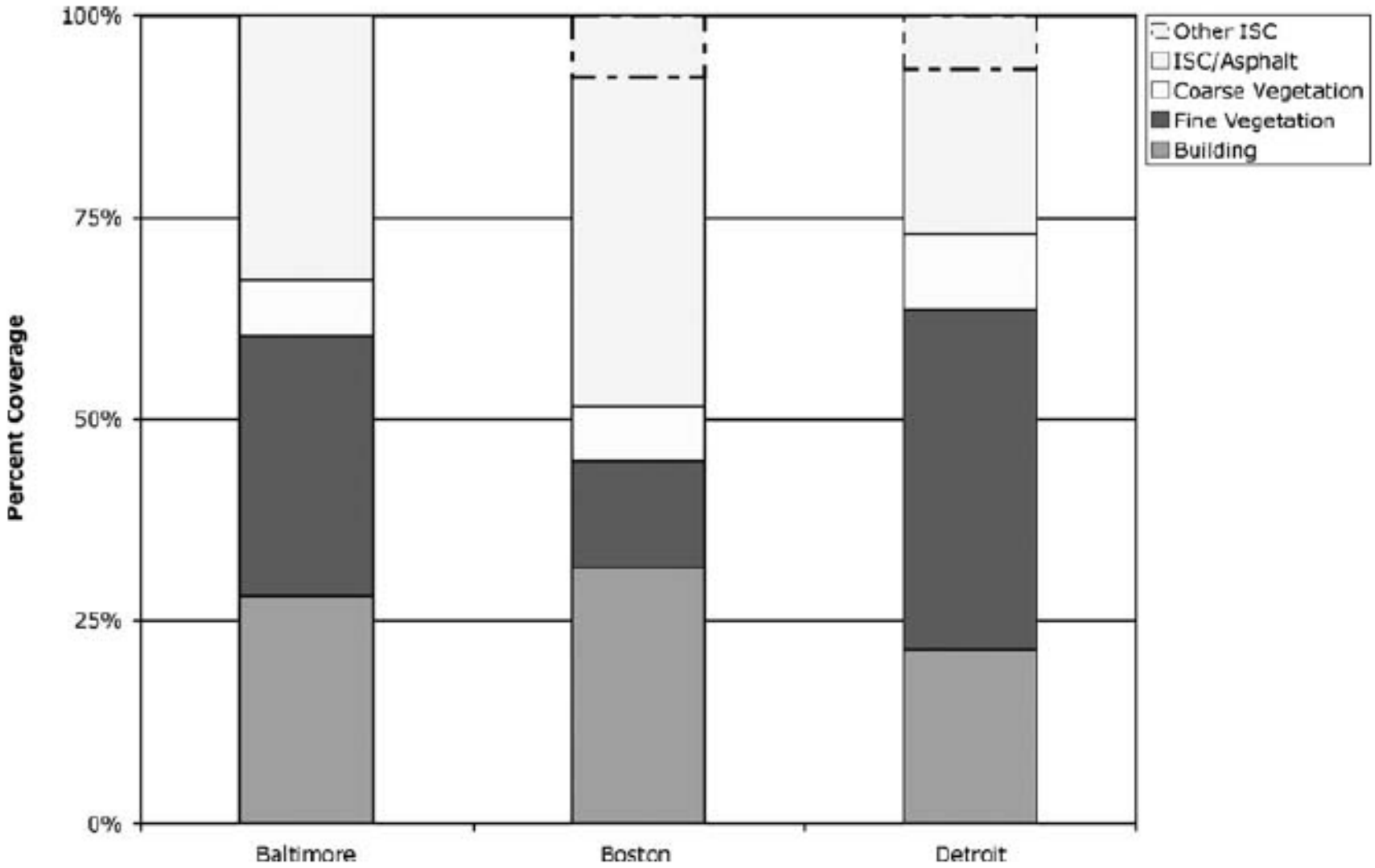
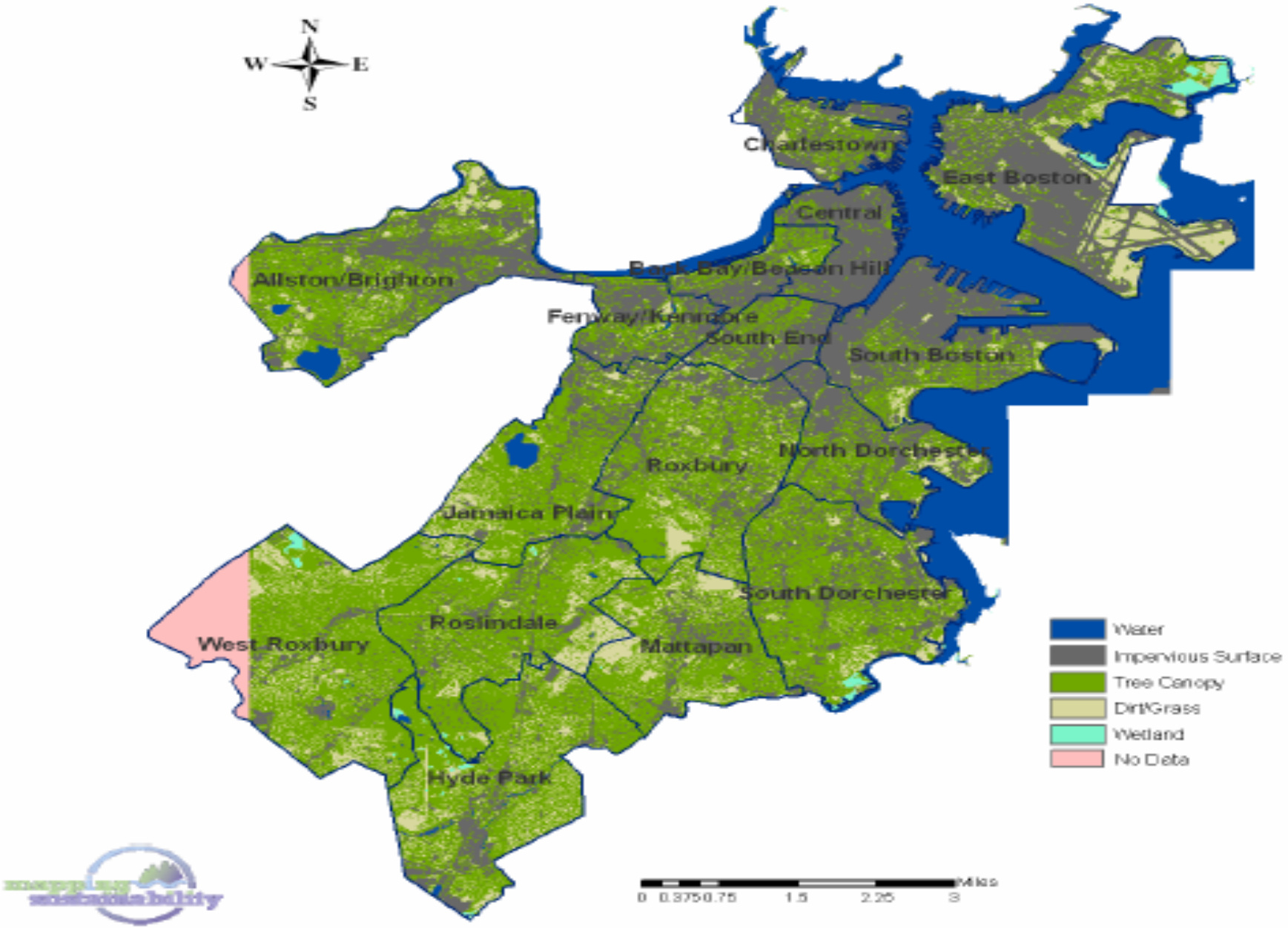


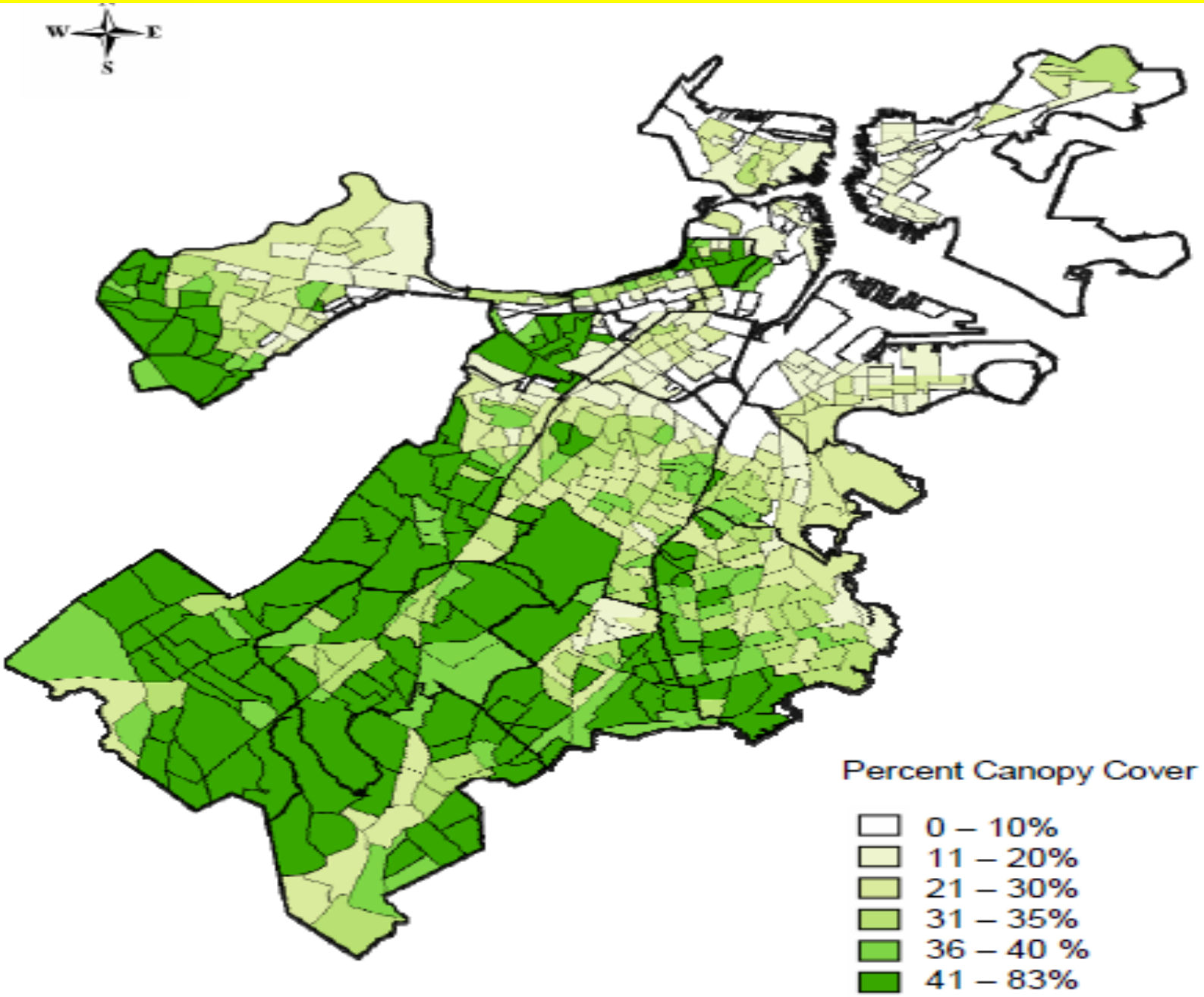
Fig. 2 The average school property in Baltimore was found to be 27.987% building, 32.26% fine vegetation, 6.75% coarse vegetation, and 33.01% ISC. In Boston, it was 31.77% building, 13.10% fine vegetation, 7.00% coarse vegetation, 40.81% asphalt, and 7.32% light colored ISC. In Detroit, it was 21.38% building, 42.09% fine vegetation, 9.30% coarse vegetation, 20.62% asphalt, and 6.61% light colored ISC

Schulman & Peters (2008) – Journal of Urban Ecosystems

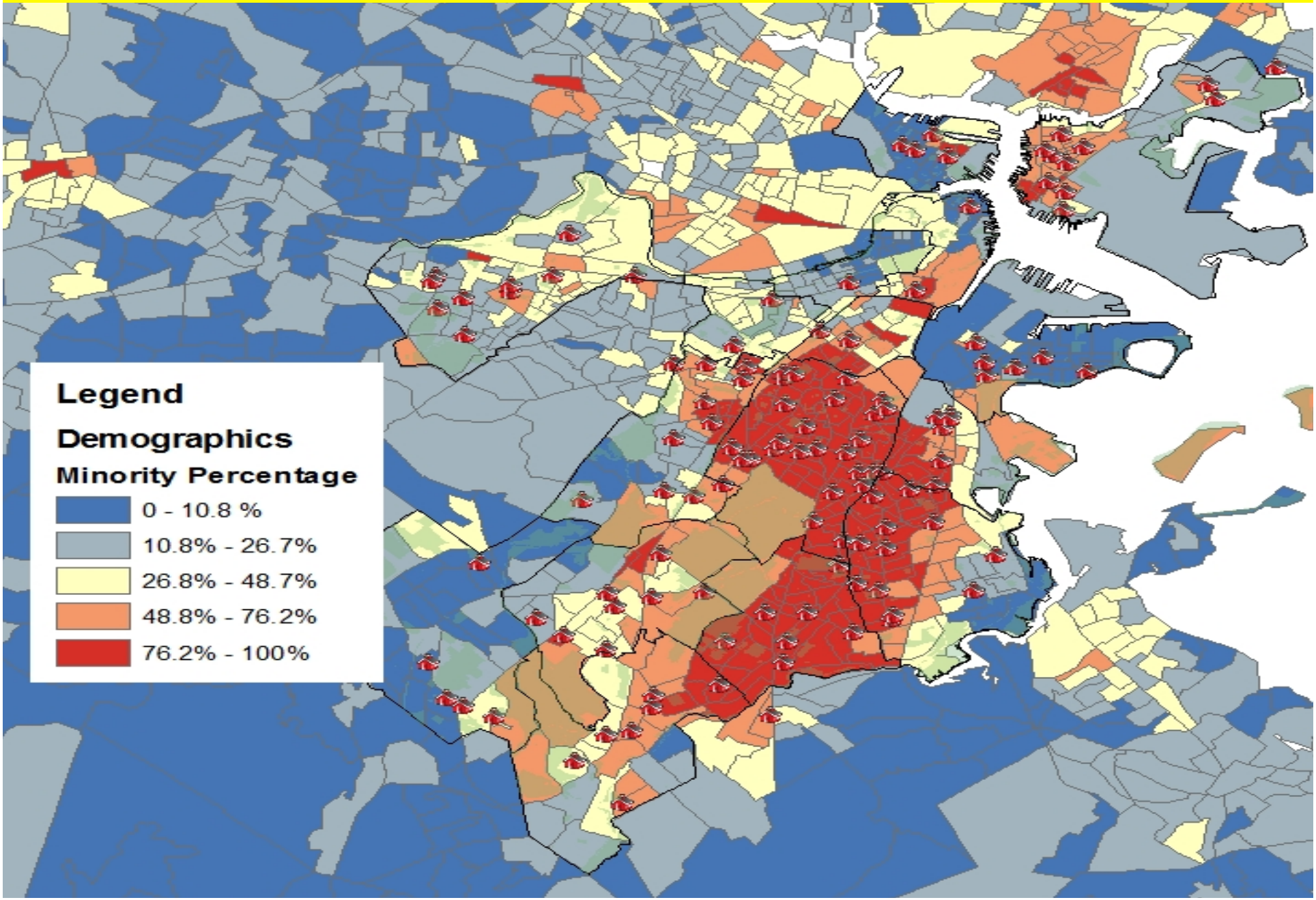
Boston Land Cover



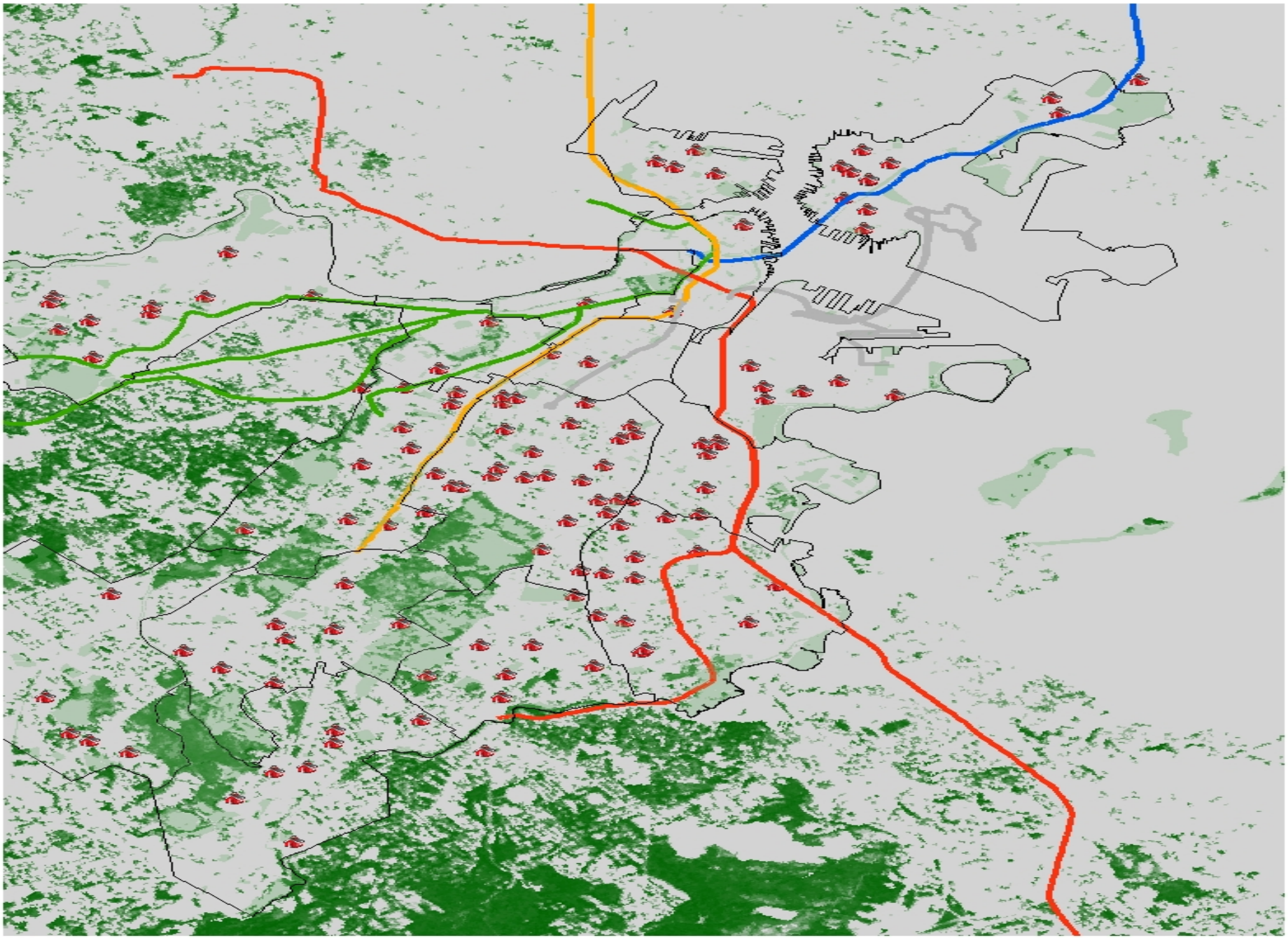
Boston: Tree cover by census tract



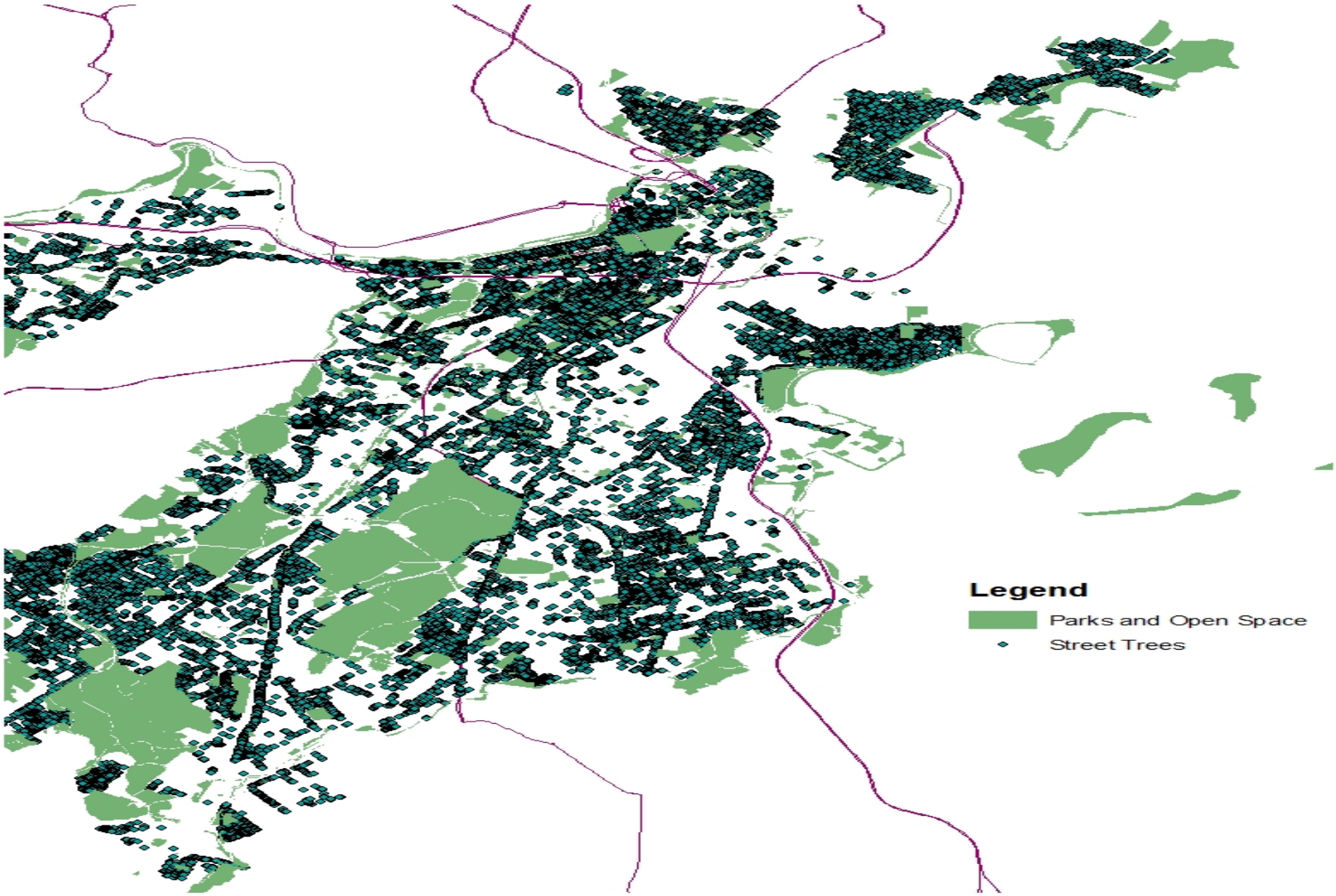
Demographics



Schools and Greenery

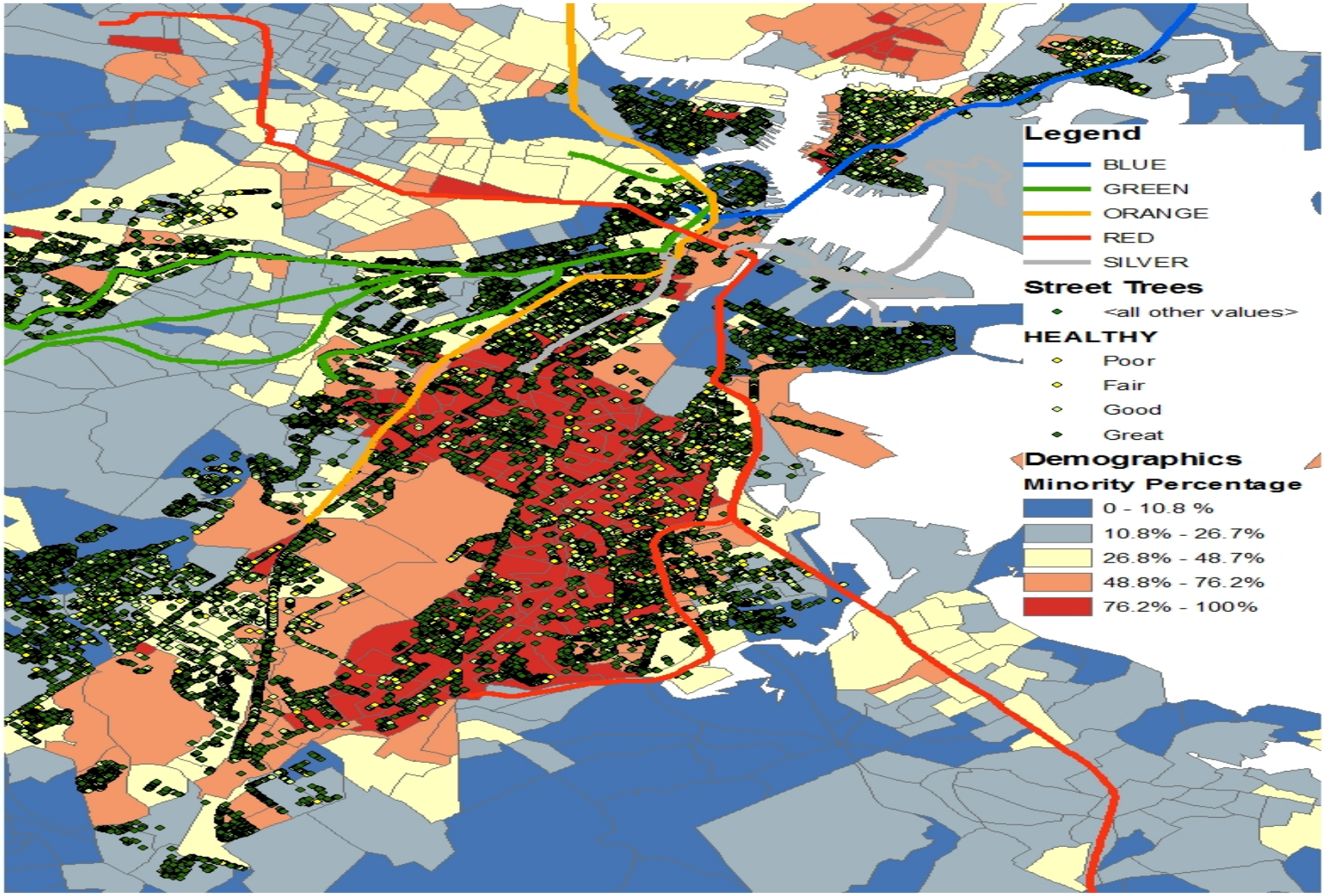


Boston Street Tree Inventory + Green Space

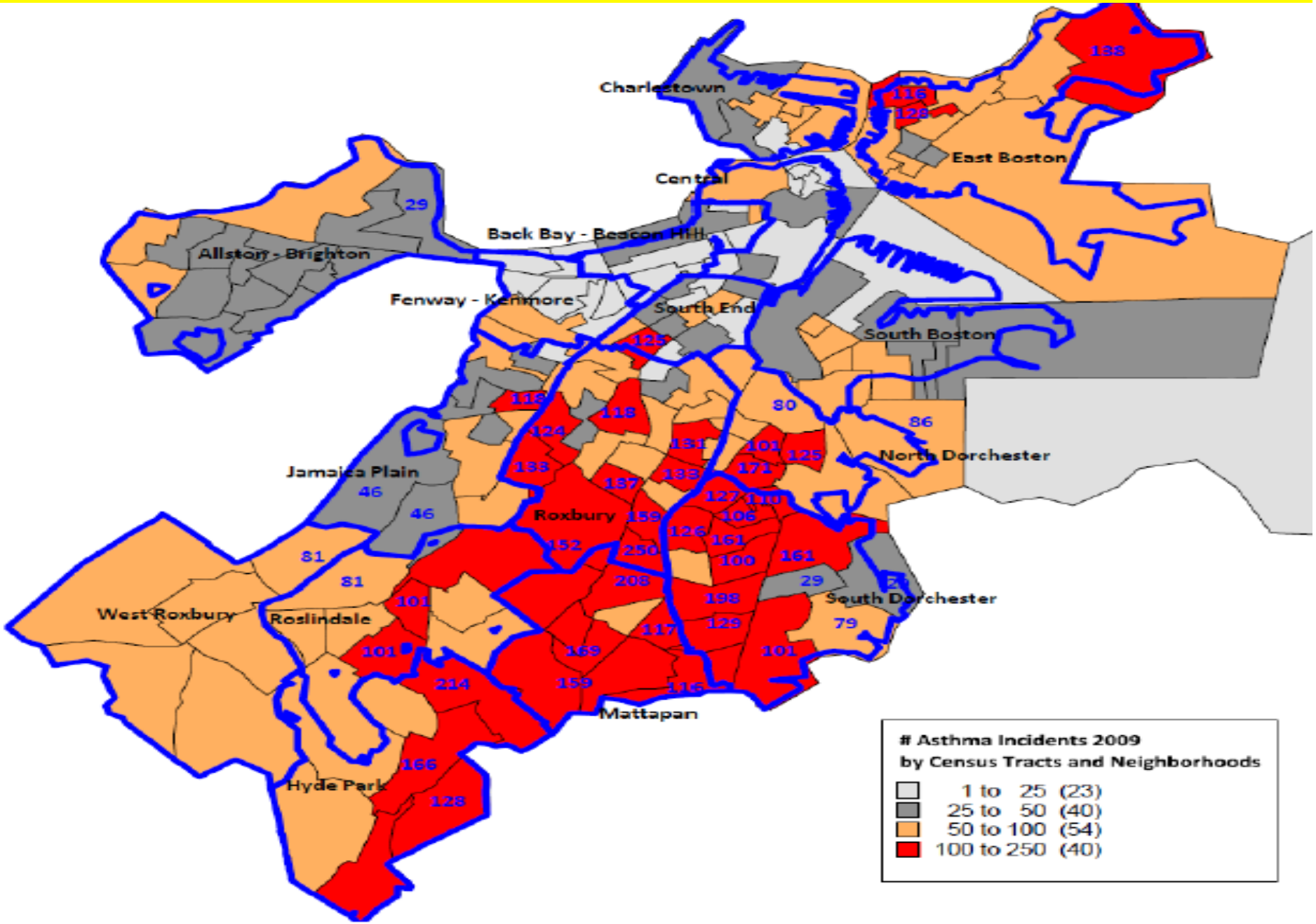


Boston Street Trees and Green Space

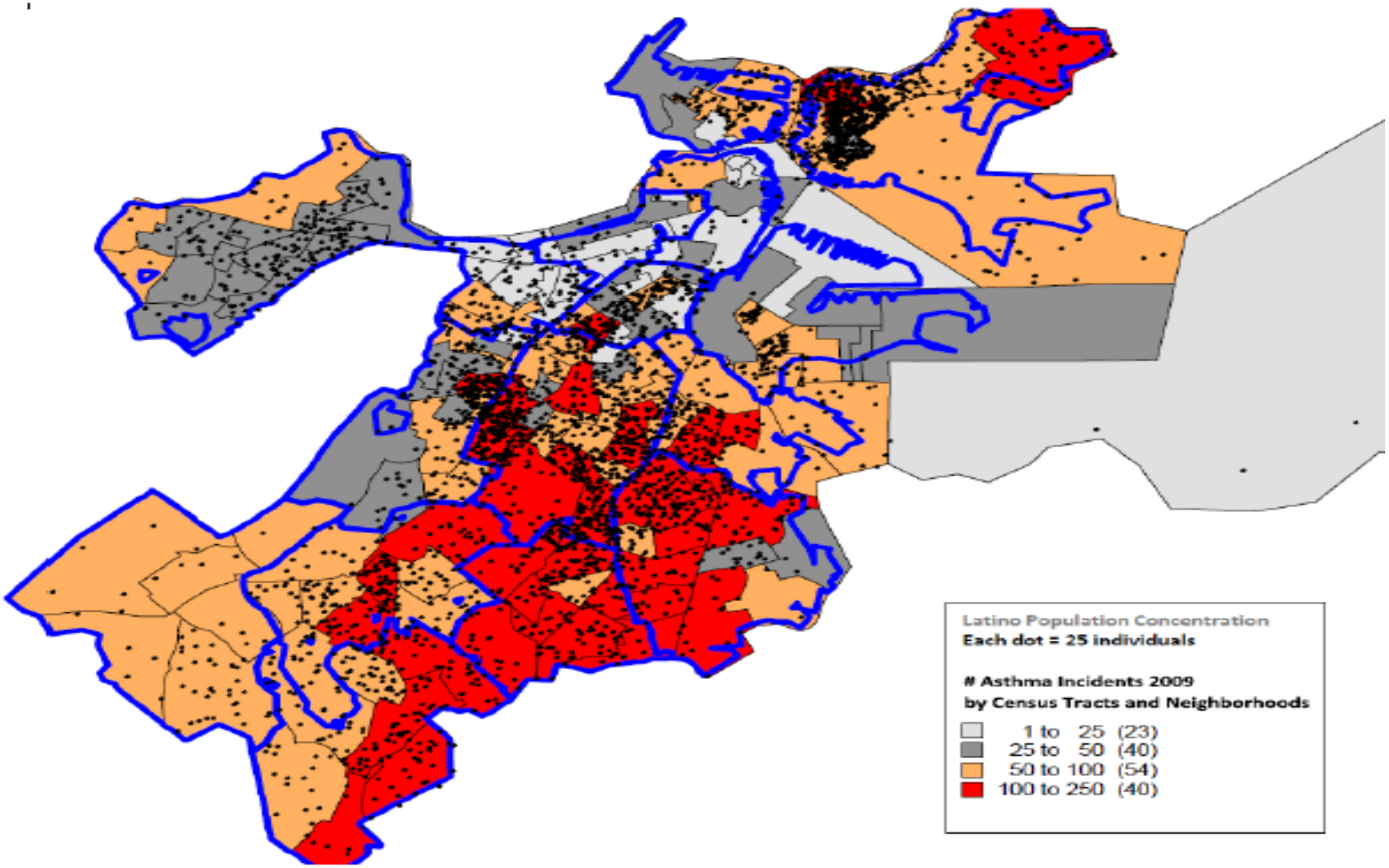
Tree health patterns: Minorities, a relationship?



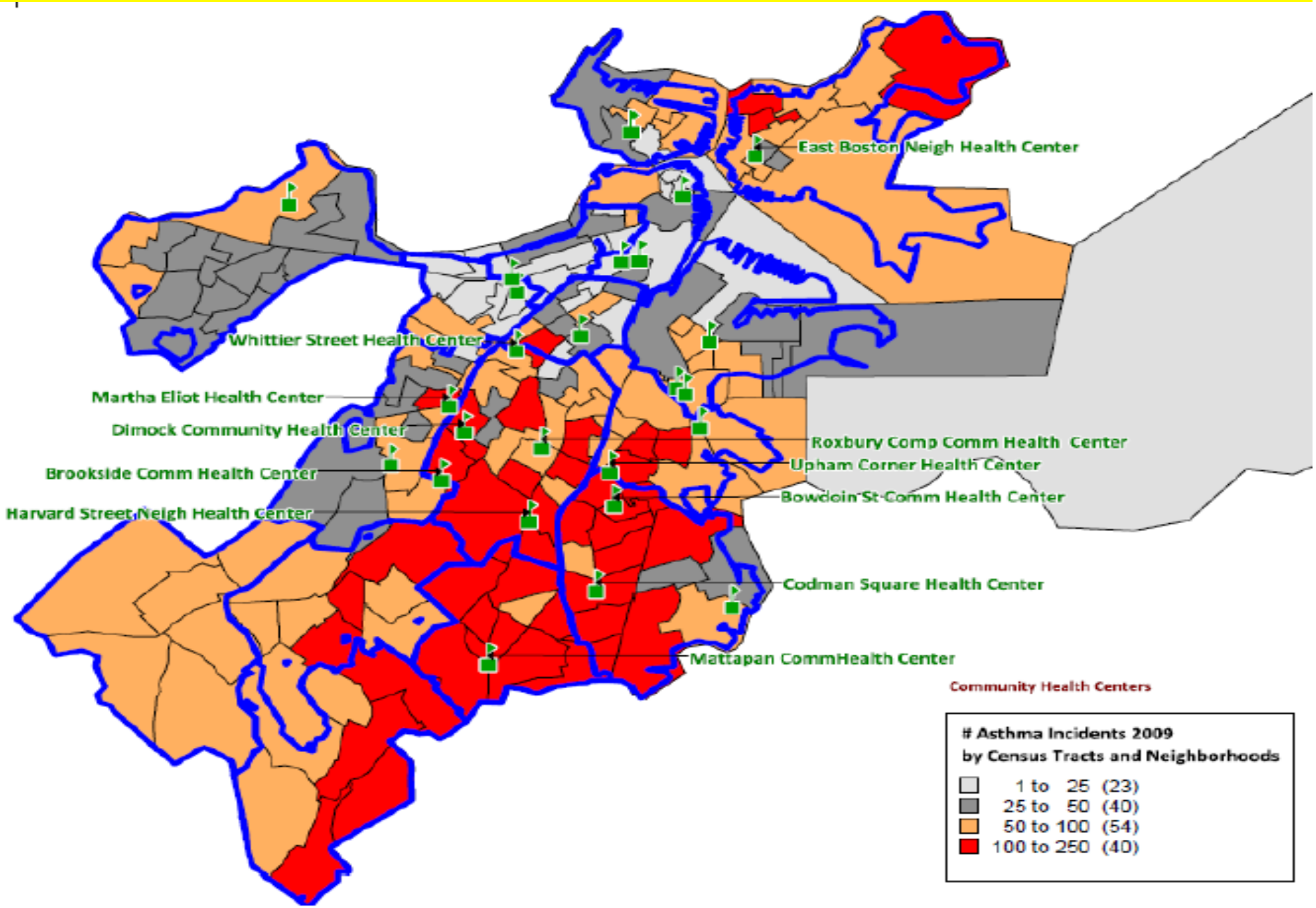
Asthma Incidents



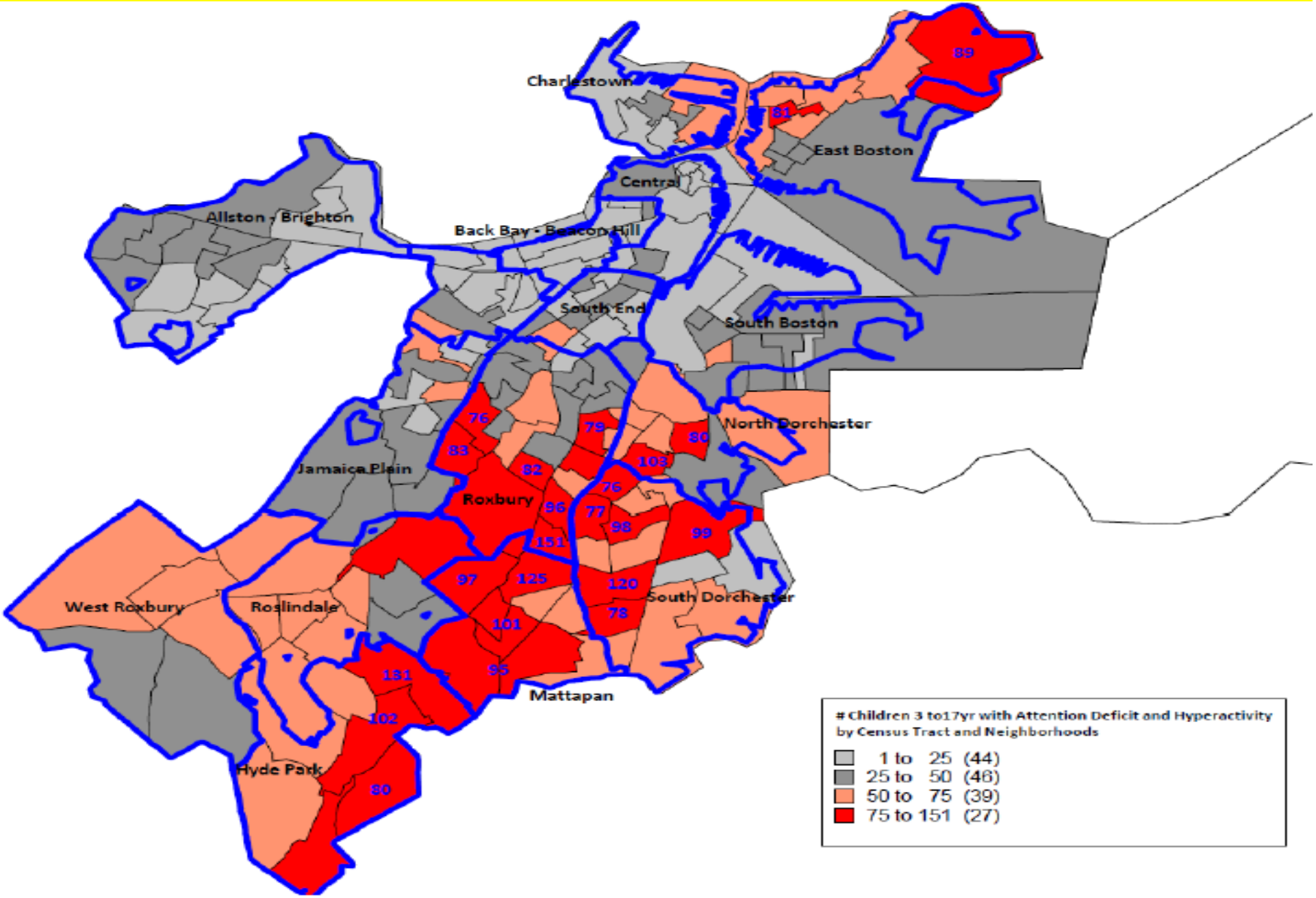
Asthma Cases - Latinos



Access to Health Center



Hyperactivity and Attention Deficit Disorder



What can we do?

High School Land Cover

Ecological Value of the site

FORESTS americanforests.org

Analysis Report
for
Brighton High Study Site

CITYgreen

Land cover in acres and percentages

Impervious Surfaces: Buildings/ structures	1.2	17.7%
Impervious Surfaces: Paved: Drain to sewer	2.2	32.9%
Open Space - Grass/Scattered Trees: Grass cover > 75%	2.7	39.8%
Trees: Impervious understory	0.6	9.6%
Total:	6.7	100.0%

Tree Canopy: 0.6 acres (9.6%)

Air Pollution Removal

Nearest air quality reference city: ***Boston***

	Lbs. Removed/yr	Dollar Value/yr.
Carbon Monoxide:	2	$1
Ozone:	22	$76
Nitrogen Dioxide:	12	$42
Particulate Matter:	16	$38
Sulfur Dioxide:	6	$5
Totals:	**58**	**$163**

Dollar values are based on 2009 dollars

Carbon Storage and Sequestration

Lbs. Stored **(Total)**:	**55,015**
Lbs. Sequestered **(Annually)**:	**428**

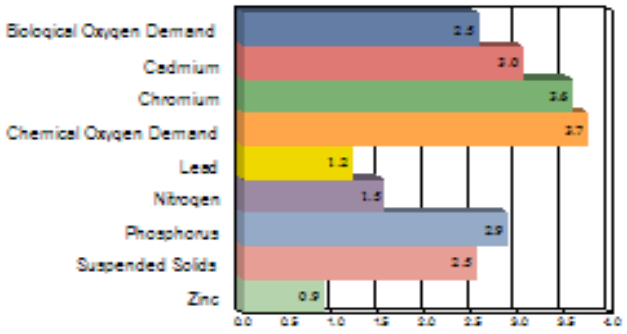
Stormwater Management

Water Quantity (Runoff Volume)

2-yr, 24-hr Rainfall in inches:	3.25
Curve Number reflecting existing conditions:	83
Curve Number of replacement land cover:	83
Dominant Soil Type: B	
Replacement land cover type: (existing condition) Impervious Surfaces: Buildings/ structures	
Additional cu. ft. storage needed:	**1,182**
Construction cost per cu. ft.:	$2.00
Total Stormwater Value:	**$2,364**
Annual Stormwater Value: (based on 20-year financing at 6% interest)	**$206**

Water Quality (Contaminant Loading)

Percent change in contaminant loadings



Ecological Value with 15% trees

Analysis Report
for
Brighton High Study Site: 15% Trees

Land cover in acres and percentages

Impervious Surfaces: Buildings/ structures	1.2	17.7%
Impervious Surfaces: Paved: Drain to sewer	1.8	27.5%
Open Space - Grass/Scattered Trees: Grass cover > 75%	2.7	39.8%
Trees: Impervious understory	1.0	15.0%
Total:	6.7	100.0%

Tree Canopy: 1.0 acres (15.0%)

Air Pollution Removal

Nearest air quality reference city: ***Boston***

	Lbs. Removed/yr	Dollar Value/yr.
Carbon Monoxide:	3	$1
Ozone:	34	$120
Nitrogen Dioxide:	19	$66
Particulate Matter:	25	$59
Sulfur Dioxide:	10	$8
Totals:	**90**	**$255**

Dollar values are based on 2009 dollars

Carbon Storage and Sequestration

Lbs. Stored **(Total)**:	**86,222**
Lbs. Sequestered **(Annually)**:	**671**

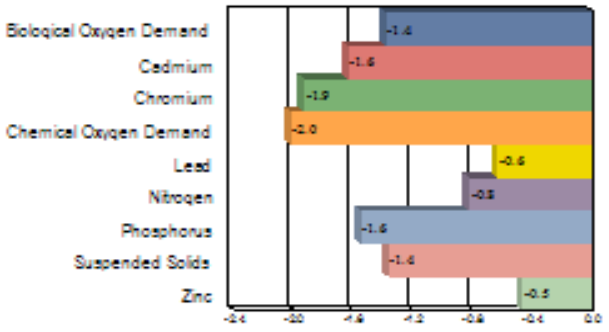
Stormwater Management

Water Quantity (RunoffVolume)

2-yr, 24-hr Rainfall in inches:	3.25
Curve Number reflecting existing conditions:	83
Curve Number of replacement land cover:	82
Dominant Soil Type: B	
Replacement land cover type: (existing condition) Impervious Surfaces: Buildings/ structures	
Additional cu. ft. storage needed:	-635
Construction cost per cu. ft.:	$2.00
Total Stormwater Value:	**$-1,269**
Annual Stormwater Value: (based on 20-year financing at 6% interest)	**$111**

Water Quality (ContaminantLoading)

Percent change in contaminant loadings



Some Takeaways

- Students/Youth have an opportunity to uncover, map, dissect, and use maps for social change
- Engage students in an inherently local study that connects to larger global/social/regional issues
- Students learn to analyze their community and connect where they live to larger social dynamics of privilege and oppression they will be able to challenge the dominant narrative in which they have been “boxed”

A shift to Participatory GIS Culture

- Foucault's (1980) well-established claim that access to knowledge will change power relations reflects the tension between scientists as producers and practically everyone else as consumers of sufficiently "tested" knowledge.
- This long-established relationship has placed scientists in the position of framing the questions that ultimately generate new knowledge.
- Public participation, by Foucaultian measures, tends to disrupt such a relationship.

Emerging Field of PGIS

- Public Participation GIS
  - is an interdisciplinary research, community development and environmental stewardship tool grounded in value and ethical frameworks that promote social justice, ecological sustainability, improvement of quality of life, redistributive justice, nurturing of civil society, etc;

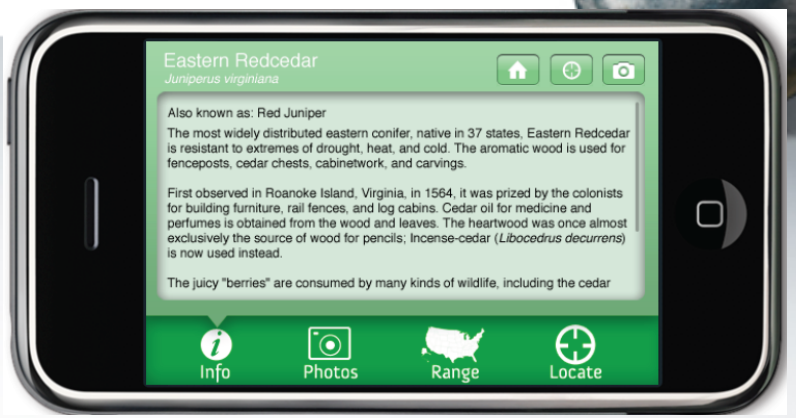
(By Doug Aberley and Renee Sieber

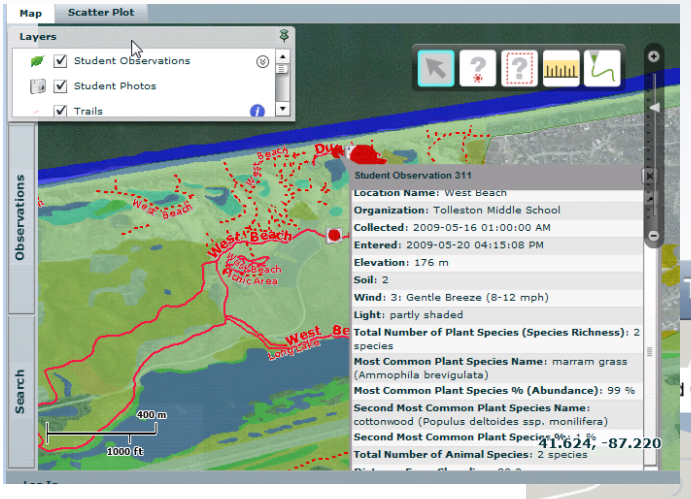
Important of PGIS

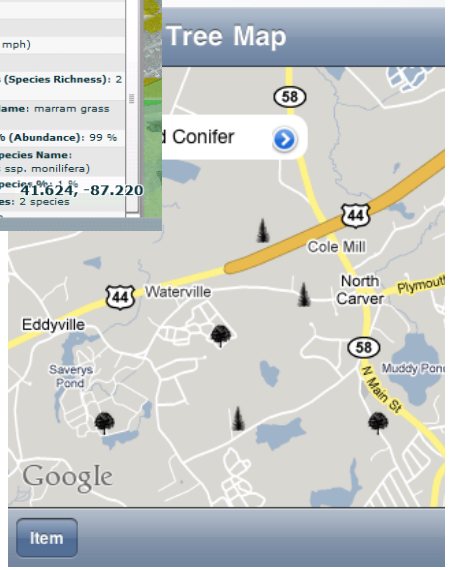
- The PGIS literature reveals that a fundamental issue in the use of GIS for decision-making purposes
  - requires collaboration among stakeholders, scientists, and decision-makers in all areas,
    - including the design of analysis questions.
- Shift from unilateral story-making by mapmakers enhances trust of the public/user/listener

Ecological Data Collection

- Mobile Data collection devices
  - Master database of ecological values
  - GPS enables phone
    - Tell you what tree you just walked by
  - For anything really…

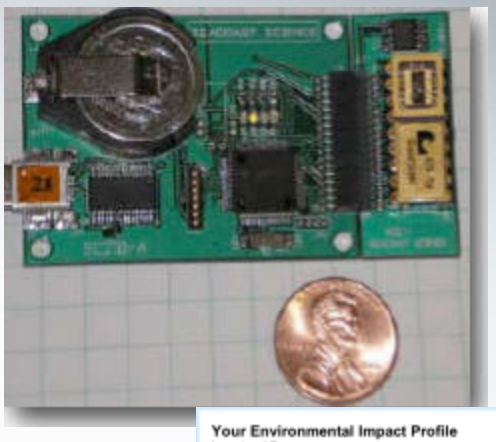


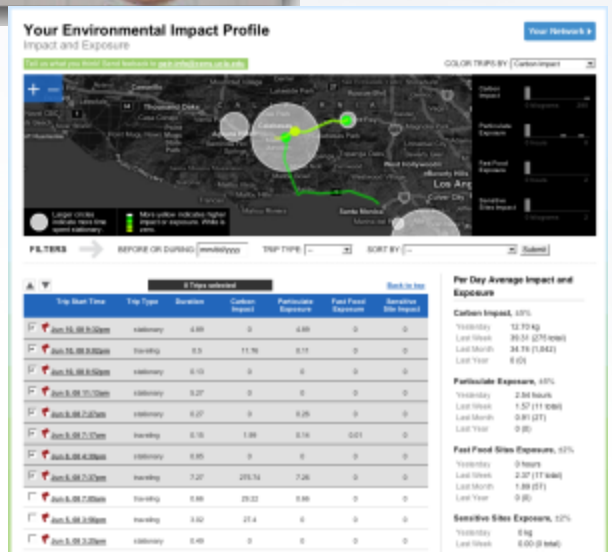




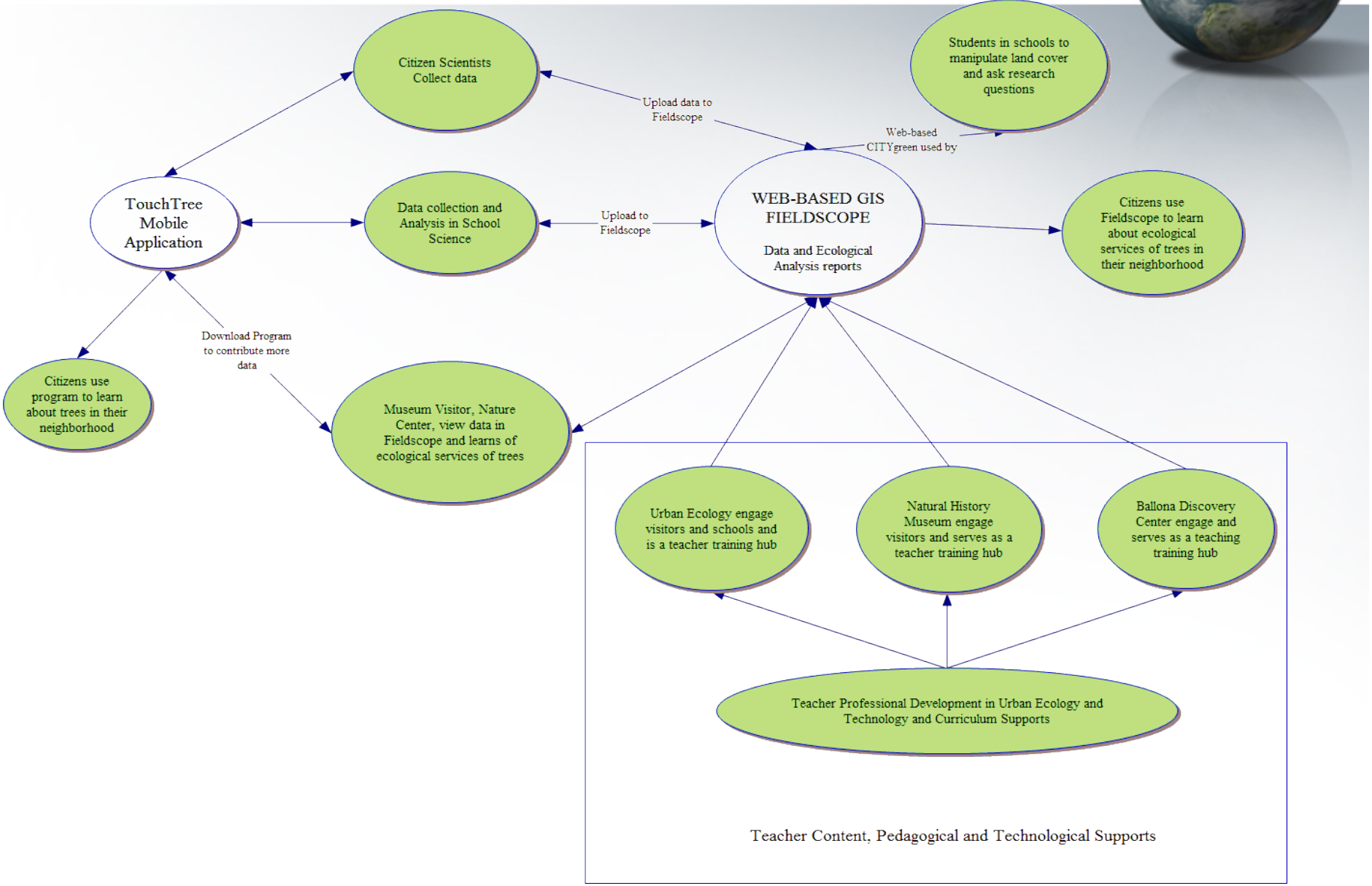
Next generation

- Citisense – cell phone air quality
  - San Diego City residents
  - Linked to maps
- PEIR
  - http://peir.cens.ucla.edu/index.php/about/





Blurring of Formal/Informal



Thank you

- To continue reflecting on what we do…. So we don't ever get to confident…

- "We're going to have a whole generation of people who (won't) know how to use a map. … I was driving across the Golden Gate Bridge and my GPS said, 'Take a right turn.' (I'm thinking:) 'Why? Have you seen my movies lately?'

  ––Robin Williams

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