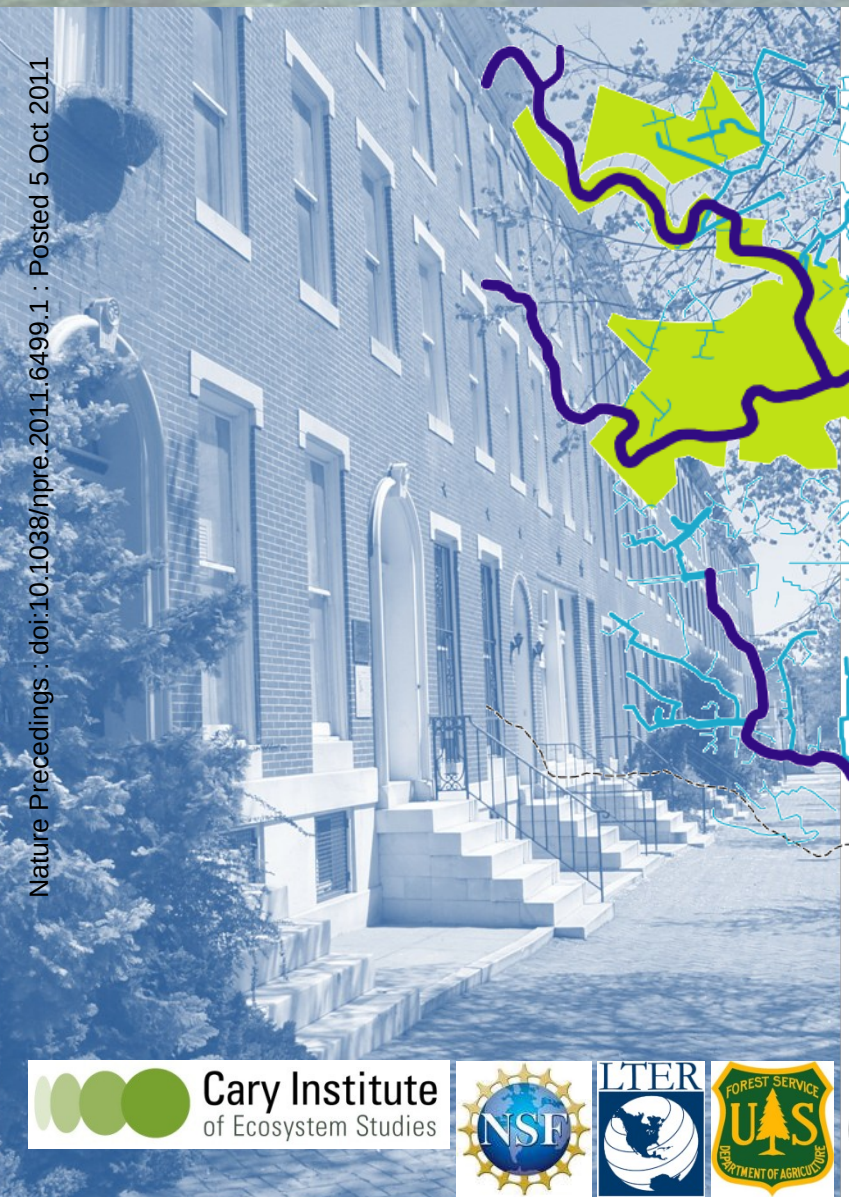
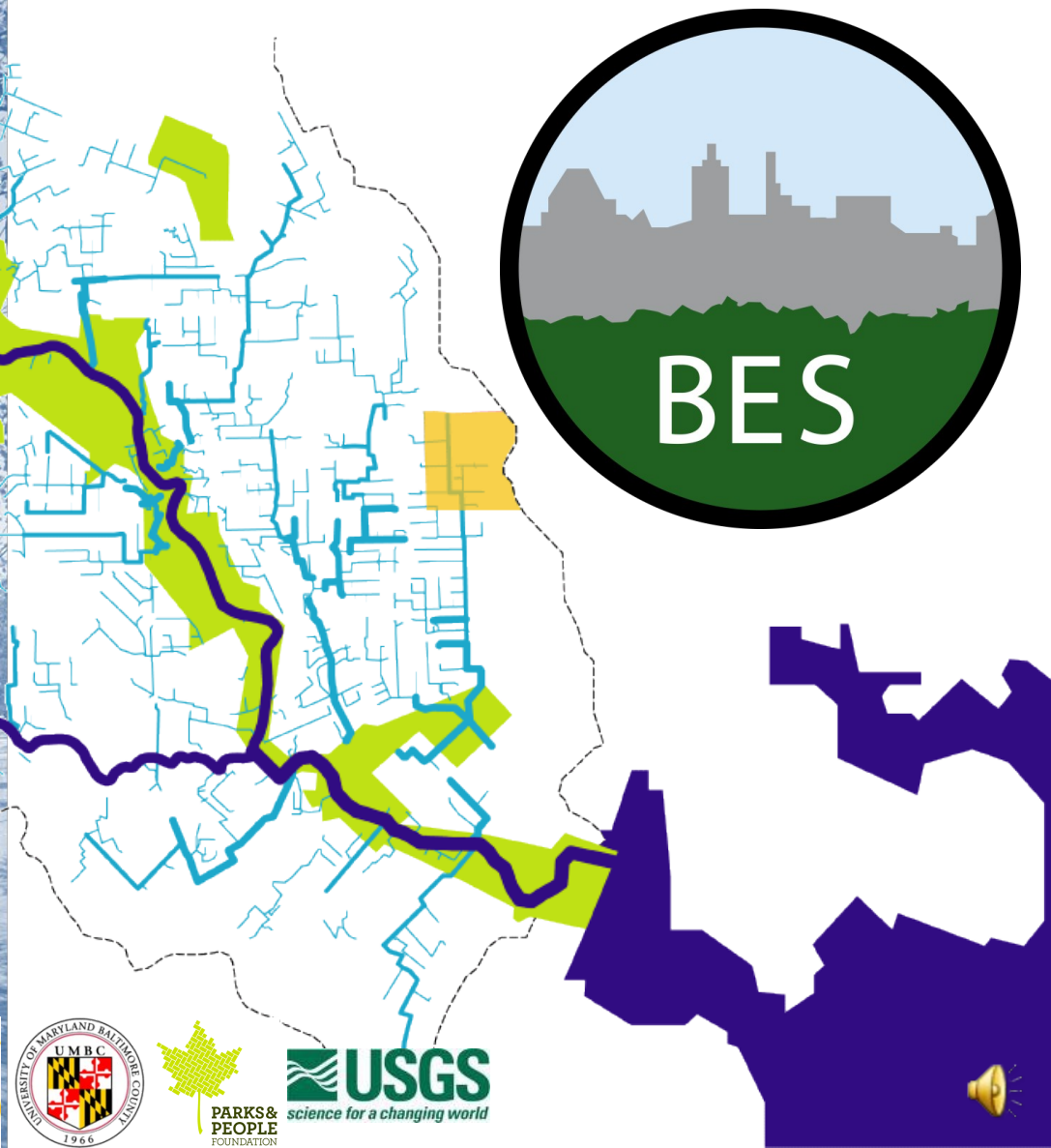
Baltimore Ecosystem Study III





Nature Precedings : doi:10.1038/npre.2011.6499.1 : Posted 5 Oct 2011

BES

Cary Institute of Ecosystem Studies

NSF

LTER

Forest Service U.S. Department of Agriculture

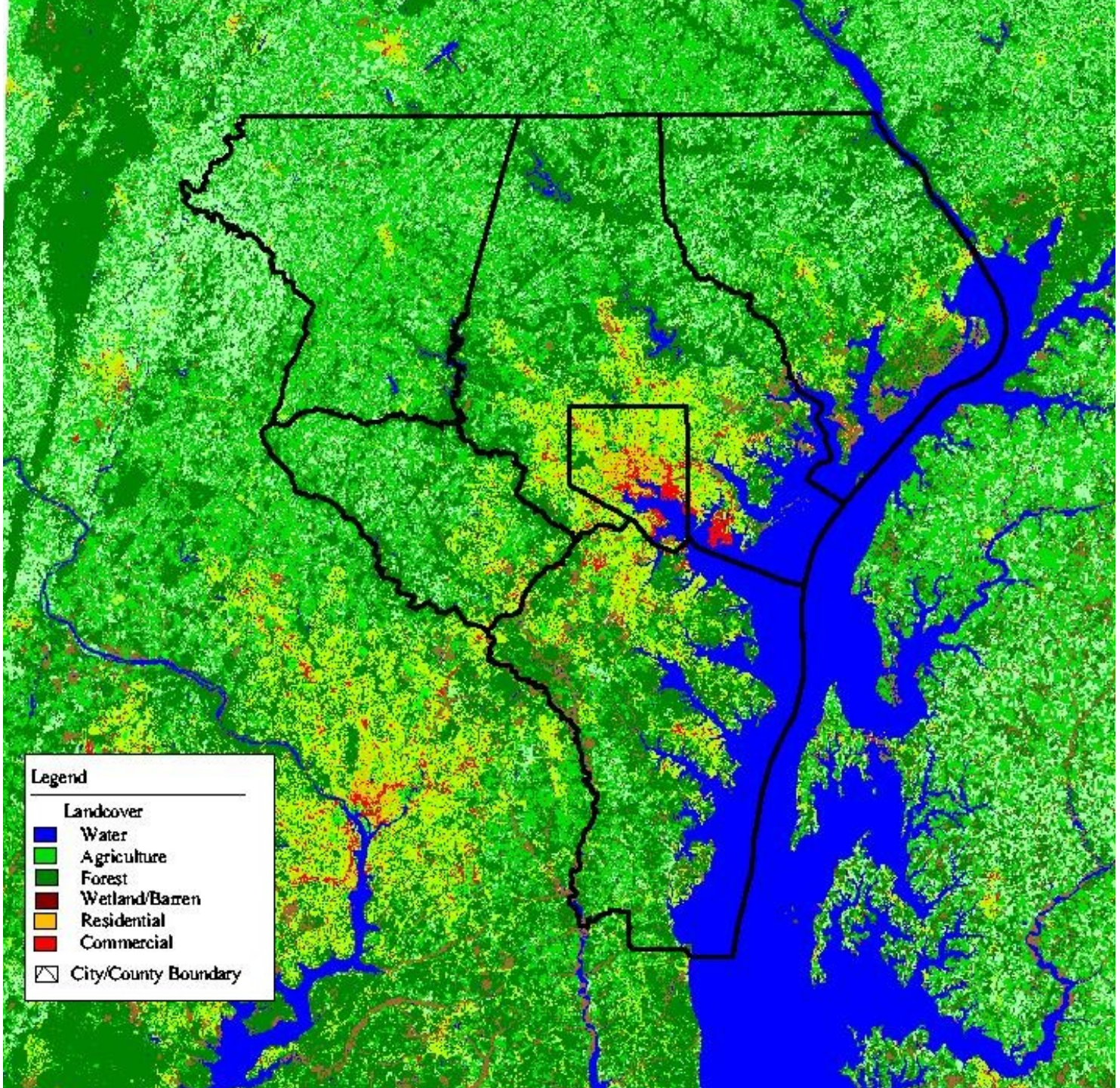
University of Maryland Baltimore County UMBC 1966

Parks & People Foundation

USGS science for a changing world

Evolution of Approach

- Mainstream ecology in urban
- LTER as experiment
- Clarify theoretical motivation
- Improved integration with human



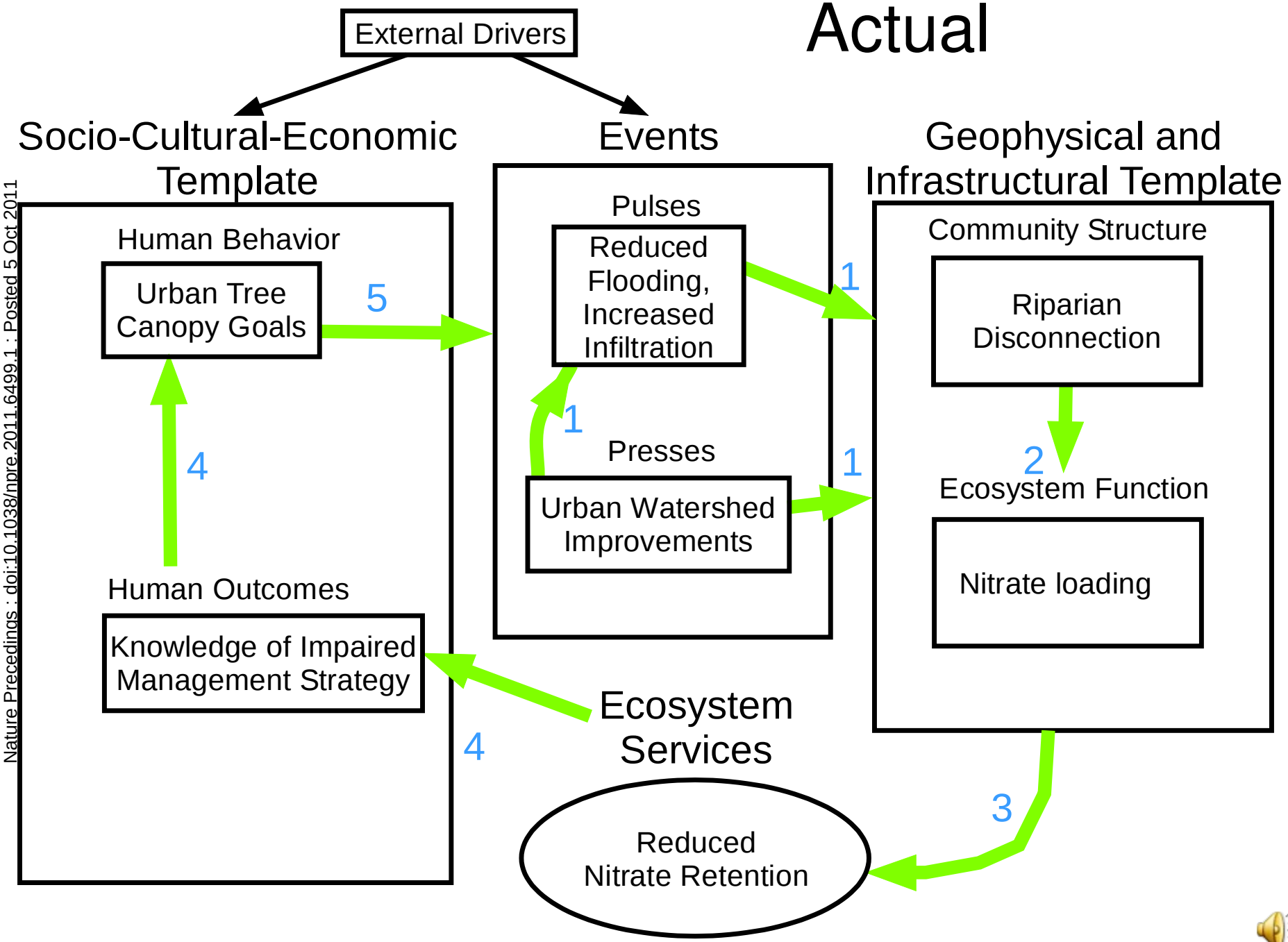
Initial Frameworks

- Watershed
- Patch dynamics
- Human ecosystem framework

Initial Questions

- Patch structures, change, and interactions
- Flux, control, interactions
- Understanding and quality of life

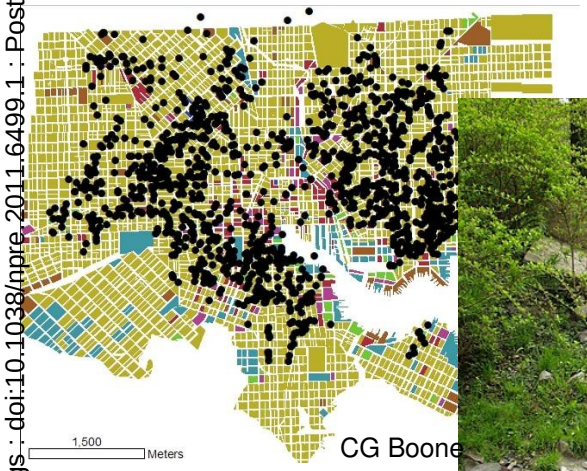
Actual

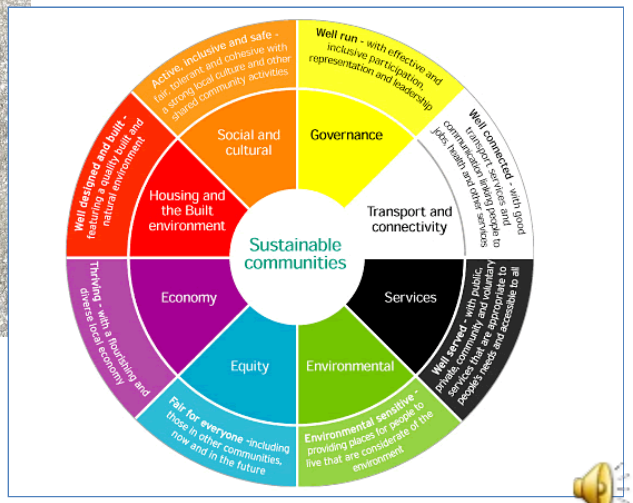


Cadenasso et al. 2008

BES III Focus

- Sanitary City to Sustainable City





Components of Shift

- *Urban* sustainability paradigm
- *Changing* world: policy and environment
- Social & biophysical *adaptive* processes
- *Resilience* of socio-ecological system
- How social & biogeophysical components *adjust*

Phase III Framework

- Policy context
- Guiding question
- General research questions
- Hypothetical feedback models
- Cross-cutting theories
- Expand research arena

Policy context

- Sustainability paradigm
- Climate change

Guiding question

- What are the effects of adaptive processes aimed at sustainability in the Baltimore socio-ecological system?

Underlying Determinants of Adaptive Capacity

Social Adaptive Processes

- Range of technologies available
- Available resources & distribution among population
  1. Human capital
  2. Organizational & social capital
  3. Financial capital
  4. Built capital
  5. Access to risk spreading structures
- Structure of decision making institutions
  1. Flexibility
  2. Coordination
  3. Participation
  4. Planning
- Ability to manage & evaluate information
- Public perceptions of stress & local manifestations
  1. Public support
  2. Sense of urgency

Biophysical Adaptive Processes

- Genetic variation & evolution
- Organismal plasticity
- Species & functional group richness
- Regulatory population feedbacks
- Resource stocks & retention
- Key biogeophysical structures
- Metacommunity & patch dynamics
- Scaled connectivity
- Compartmentalization of disturbance

General Research Question 1

- How do biophysical & social adaptive processes interact in the sanitary city vs. in the sustainable city?
  - Cf: “city”

General Research Question 2

- How do adaptive processes change to reflect policies aimed at sustainability in the Baltimore region?

General Research Question 3

- How can information exchange, education, & urban design improve adaptive processes?

Feedback Hypotheses

H: HUMAN & SOCIAL

Ha. Behavior & Actions

Ha1: Sustainability plans
Ha2: Regional greenhouse gas policy
Ha3: Transportation behavior
Ha4: Locational choice
Ha5: Energy conservation strategies
Ha6: Zoning changes
Ha7: Urban design & planning
Ha8: Lawn management
Ha9: Recreation
Ha10: TMDLs
Ha11: BMPs
Ha12: Social networks
Ha13: Information flow
Ha14: Environmental monitoring
Ha 15: Environmental regulations
Ha16: Incentives

Hb. Outcomes

Hb1: Energy consumption
Hb2: Equity (benefits/hazards)
Hb3: Community cohesion
Hb4: Human health
Hb5: Property values
Hb6: Property regimes

Sustainability Paradigm (SP)

Ps: Pulse Events

Ps1: Real estate value shifts
Ps2: Floods (stream/tidal)
Ps3: Heat waves
Ps4: Infrastructure failure

Pr: Press Events

Pr1: Climate change
Pr2: Land cover change
Pr3: Land use change
Pr4: Canopy cover
Pr5: Infrastructure retrofit/improvement

ES: Ecosystem Services

WS: Provision of clean water
WS1: Nitrate retention

WF: Regulation of water flow
WF1: Stormwater flow

CS: Net carbon storage
CS1: Climate regulation
CS2: Human comfort/risk
CS3: Air quality

B: BIOGEOPHYSICAL

Ea. Ecosystem Structure

Ea1: Vegetation structure
Ea2: Vegetation cover
Ea3: Spatial heterogeneity
Ea4: Surface permeability
Ea5: Hydrological connectivity
Ea6: Stream habitat
Ea7: Stream community
Ea8: Soil organic matter

Eb. Ecosystem Functioning

Eb1: Vegetation nutrient uptake
Eb2: Decomposition
Eb3: Dissimilatory nitrate reduction
Eb4: Microbial immobilization
Eb5: Net ecosystem production
Eb6: Net ecosystem exchange
Eb7: Export & harvest

Cross Cutting Theories

- Locational choices by households & firms
- Urban stream dis/continuum
- Biotic metacommunity

Questions on Locational Choice

- Ecosystem services affect locational choice
- Understanding & valuation of ecosystem services
- Adaptation of social processes to diminished biophysical
- Changes in governance

Questions on Stream Dis/continuum

- Ecosystem functions & services along the dis/continuum
- Urban structure & altered riparian zones
- Social processes affect stream dis/continuum

Questions on Biotic Metacommunity

- What biotic components reflect metacommunity
- Direct vs. indirect human effects
- Social processes reinforce or constrain metacommunity dynamics

Diagrammatic Summaries

- Hierarchy of questions
- Four major research approaches

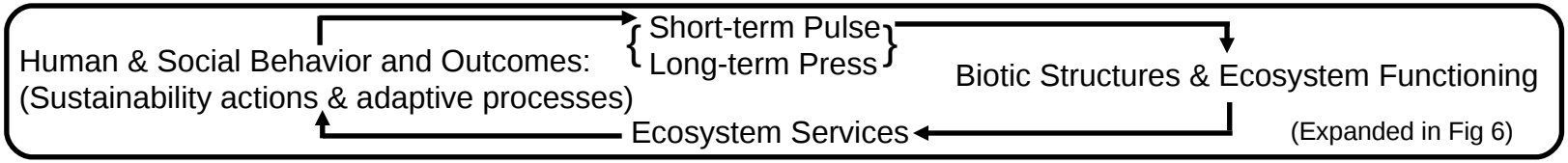
I. Policy Context: **Sustainability Paradigm**

II. Guiding Question: What are the effects of adaptive processes aimed at sustainability in the Baltimore socio-ecological system?

III. General Research Questions:

1. How do biogeophysical & social adaptive processes interact &change from the sanitary city to the sustainable city?
2. What future scenarios of biogeophysical & social adaptive processes reflect different policies aimed at sustainability?
3. How can information exchange & education improve biogeophysical & social adaptive processes?

IV. Feedbacks:



V. New Theoretical Areas & Cross Cutting Questions:

Locational Choice

L.1: Which ecosystem services affect locational choice, and by how much? How has this changed over time?
L.2: How has understanding & valuation of ecosystem services changed over time, and how does this affect locational choices?
L.3: Over time, how have social processes adapted to diminished biophysical adaptive processes due to urbanization and climate change
L.4: How have changes in governance structure followed or changed in response to other adaptive processes through time?

Urban Stream Dis/Continuum

S.1: How have ecosystem functions and services changed along the urban stream dis/continuum?
S.2: How do urban structure and altered riparian zones change how the urban stream continuum functions compared to non-urban?
S.2: How do social processes, restoration, and management actions affect different parts of the stream dis/continuum?

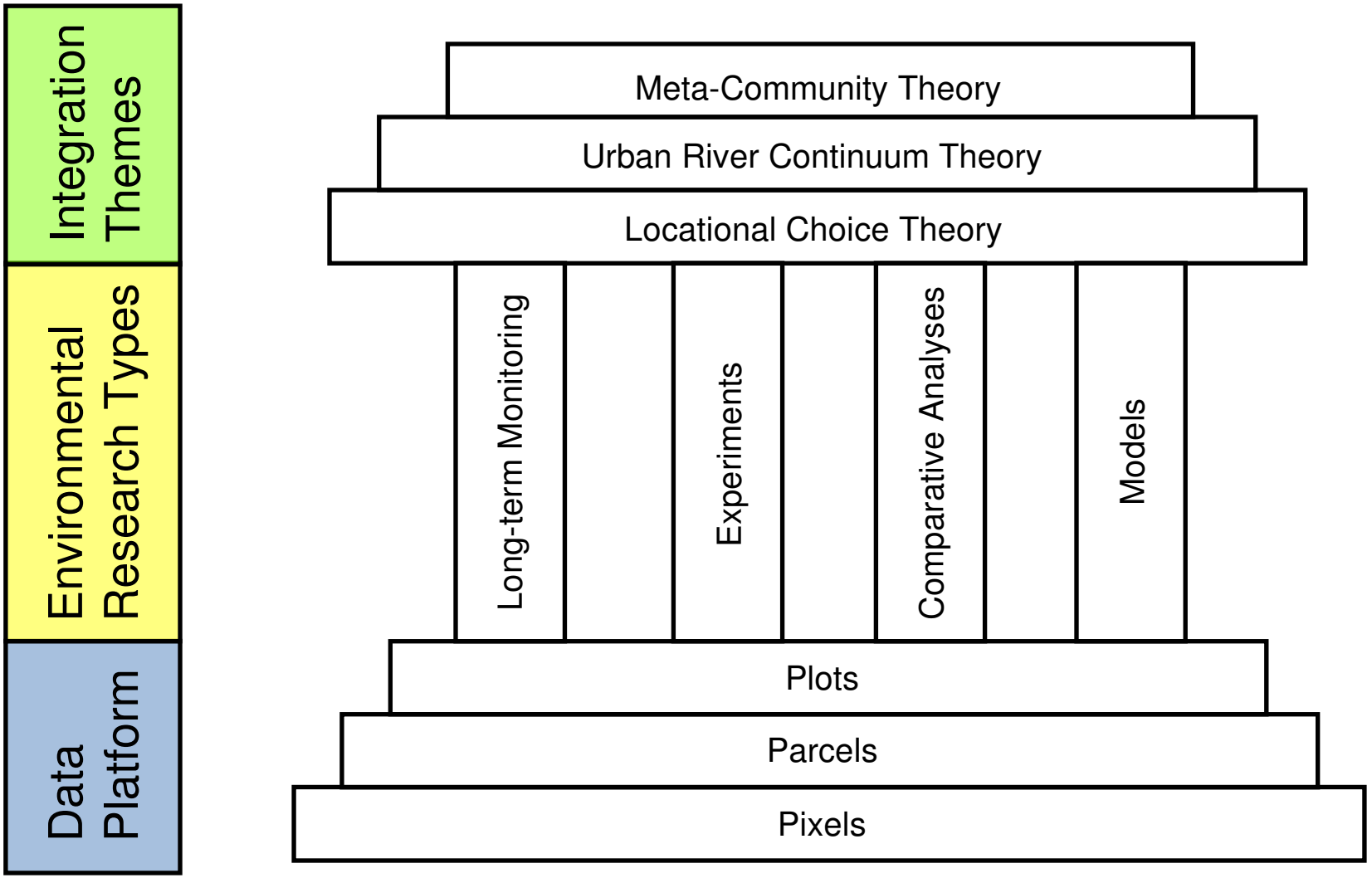
Biotic Metacommunity

C.1: What metacommunity processes affect species coexistence in urban ecosystems? Do social processes constrained or reinforced these?

C.2: How do perceptions of the environment influence decision making at different scales and does this mediate metacommunity structure?

C.2: To what extent does the urban stream dis/continuum govern aquatic metacommunity dynamics compared to direct human effects?

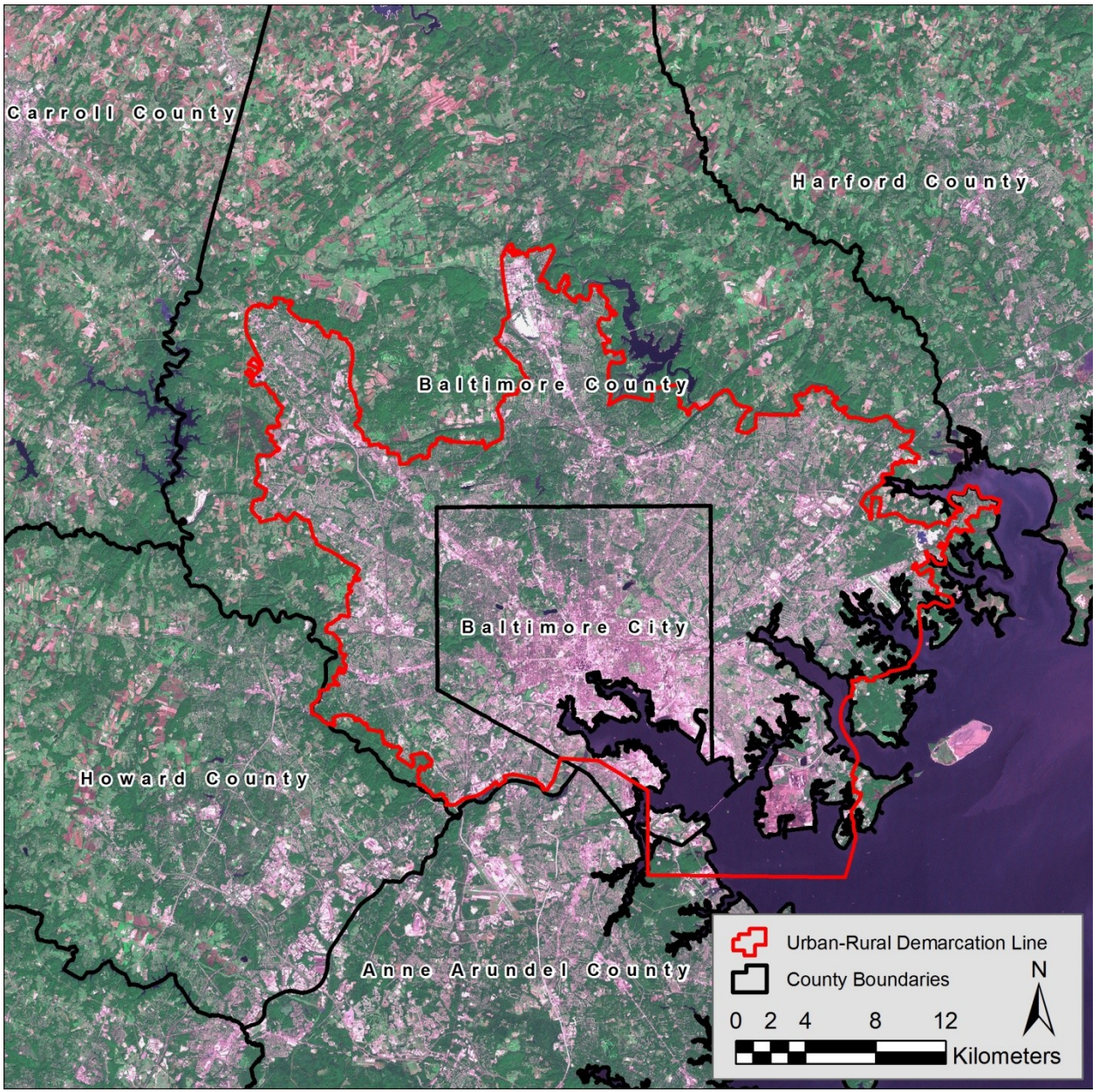
BES III Research Approaches



New research strategies

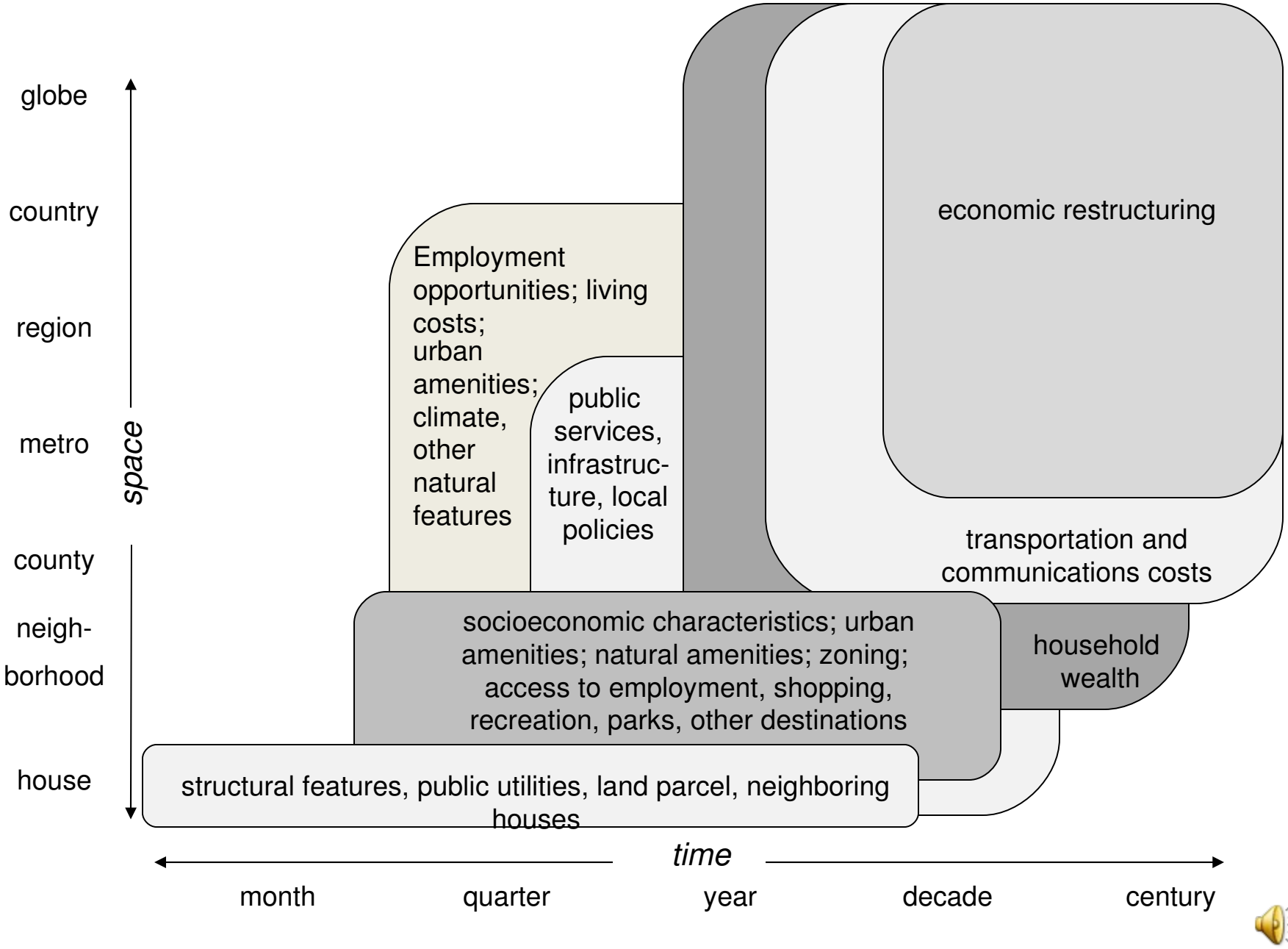
- Extend to exurban lands
- Add locational choice models
- Link among models

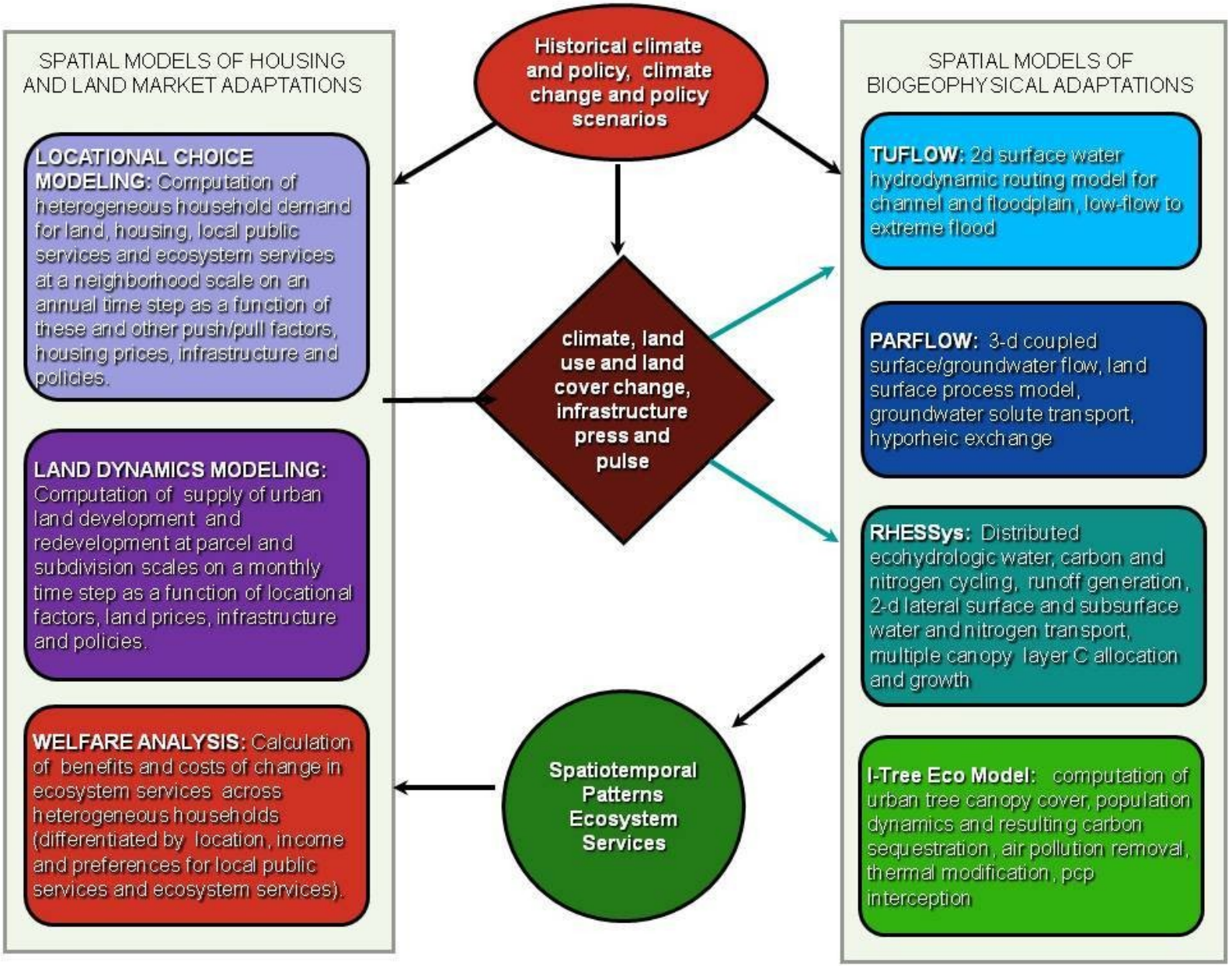
Beyond the URDL



Nature Precedings : doi:10.1038/npre.2011.6499.1 : Posted 5 Oct 2011

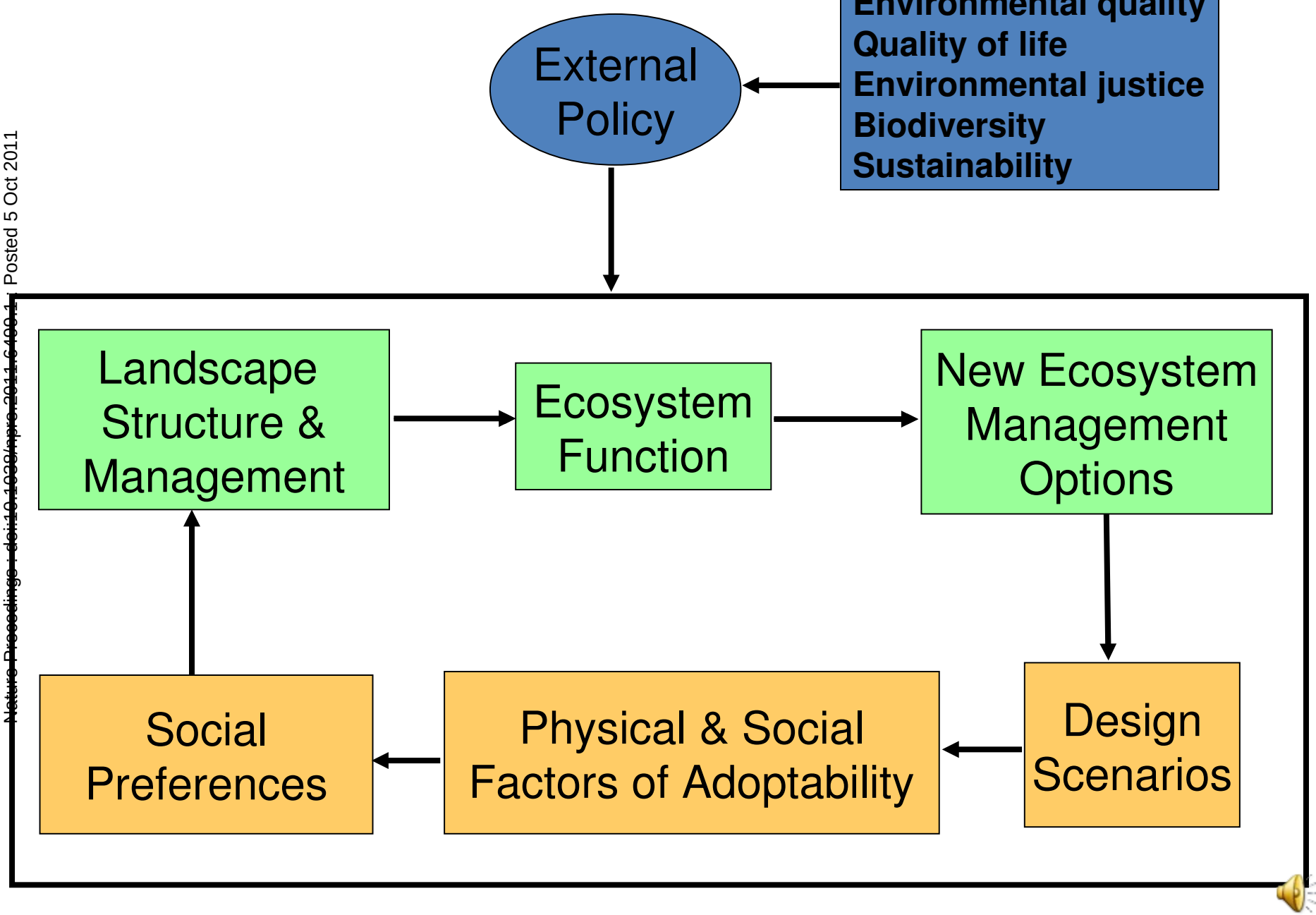
Scale and household decisions:



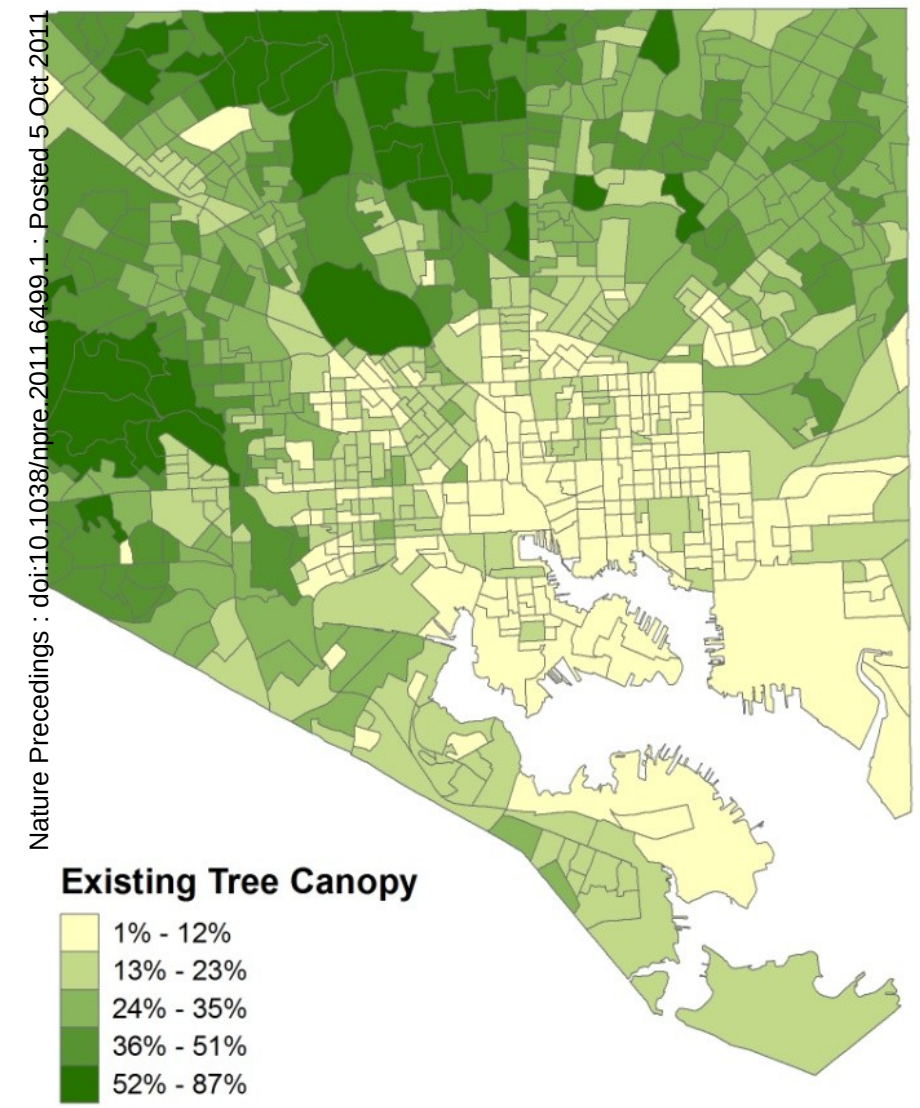


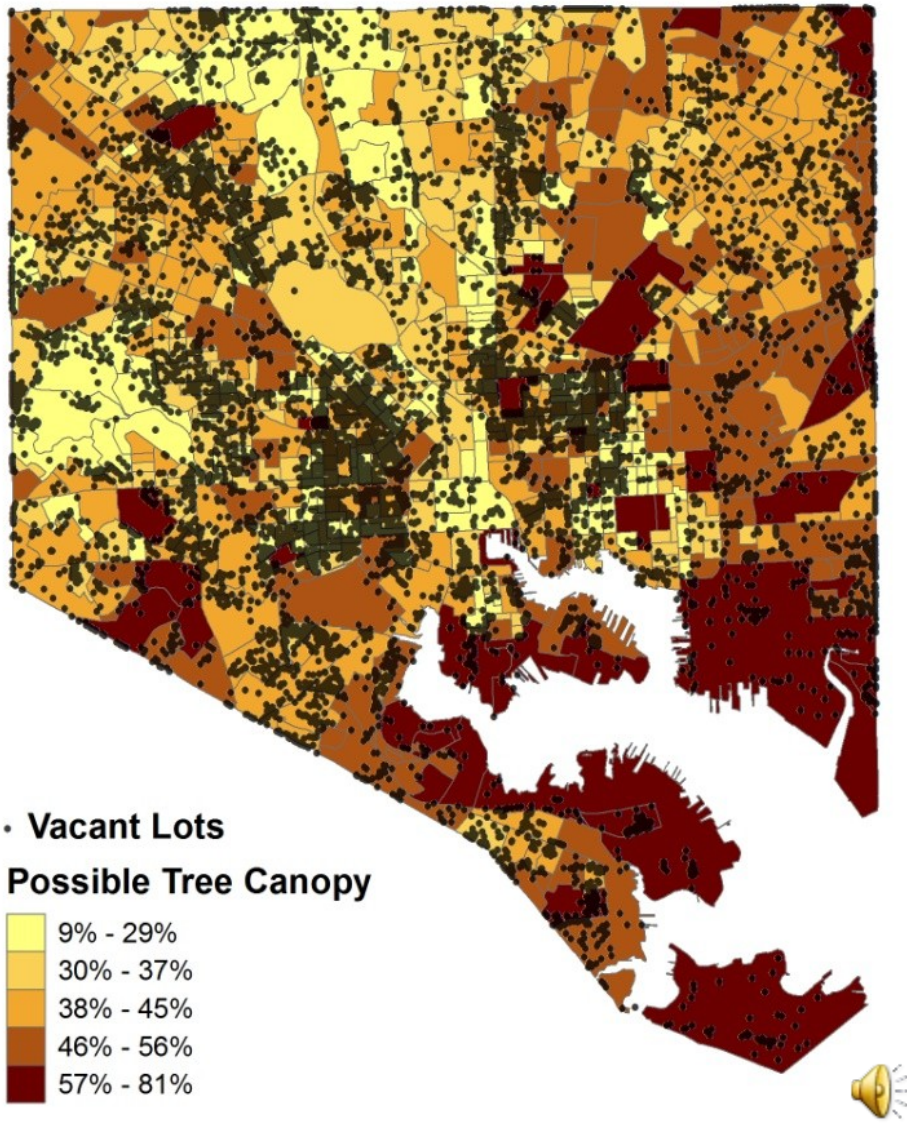
New Application Strategies

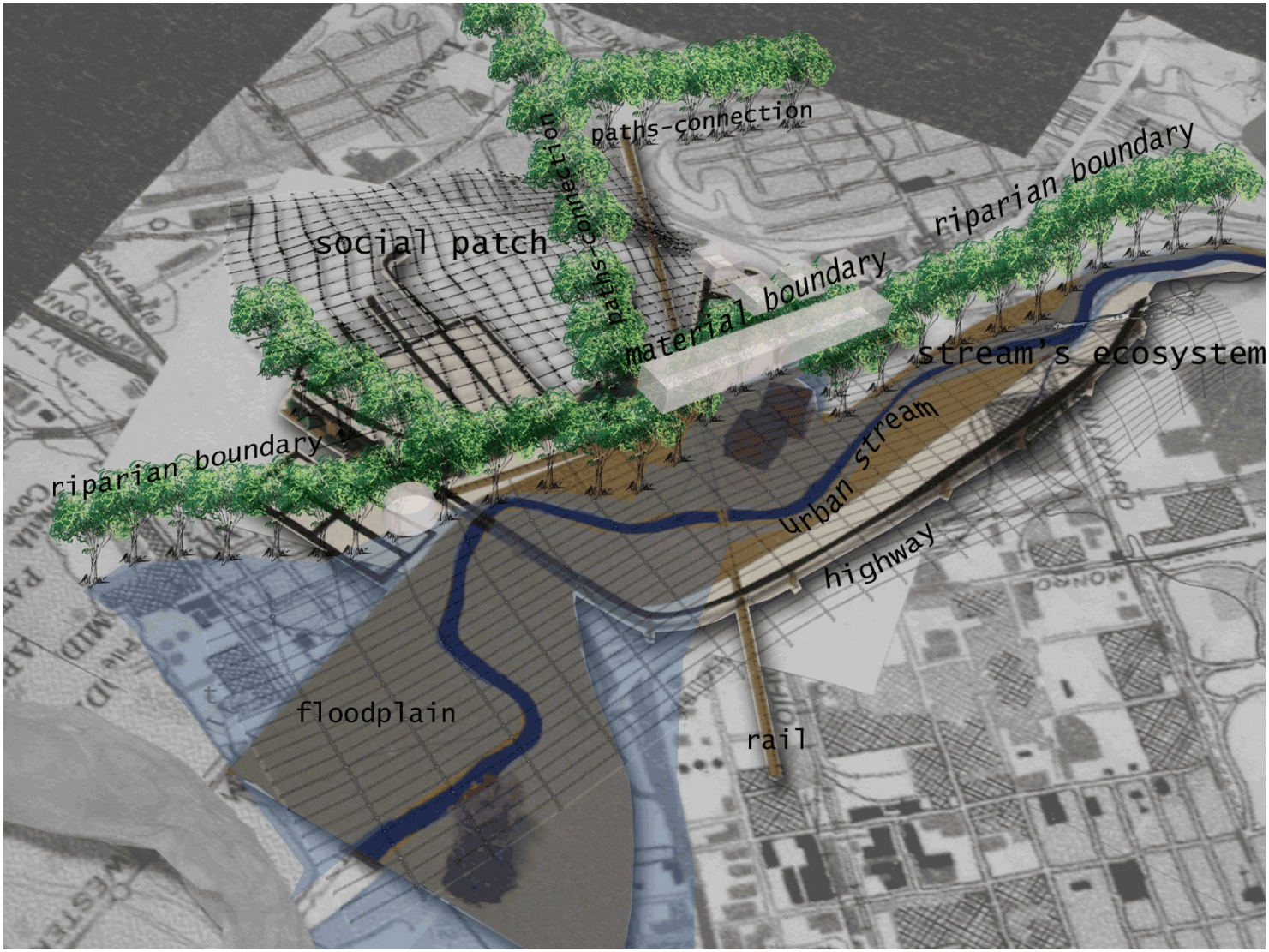
- Scenarios



Tree canopy and vacancy







Pavithra Sriprakash

BES III – Improve:

- Integration of biophysical-human
- Clarify theoretical structure
- Link theory to research questions
- Address climate change and scenarios
- Management and policy interaction

Seeyalaterbye, Hon!

www.beslter.org