Principles of Urban Ecology

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What’s a principle?

Components of Theory

- Domain
- Assumptions
- Concepts
- Definitions
- Facts
- Confirmed generalizations
- Laws
- Models
- Translation modes
- Hypotheses
- Framework

Pickett et al. 2007

Senses of “urban”

- Broad – inclusive
- Narrow – specific

Goal

- Framework
- Model building

Themes

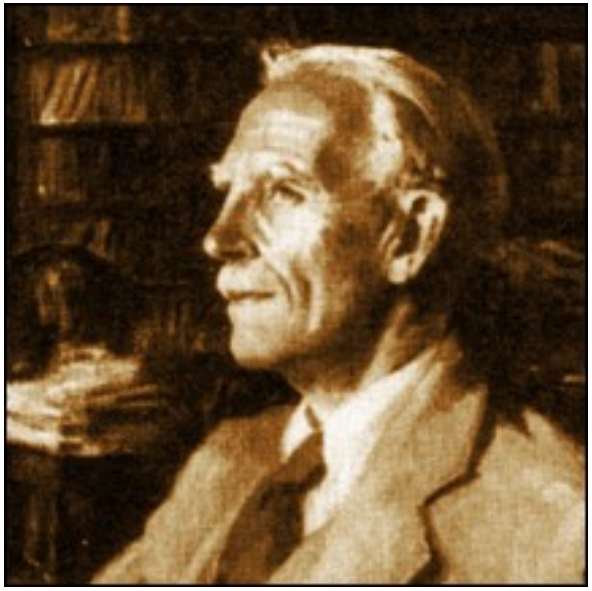
- Components
- Form
- Change
- Functioning

Components of the system

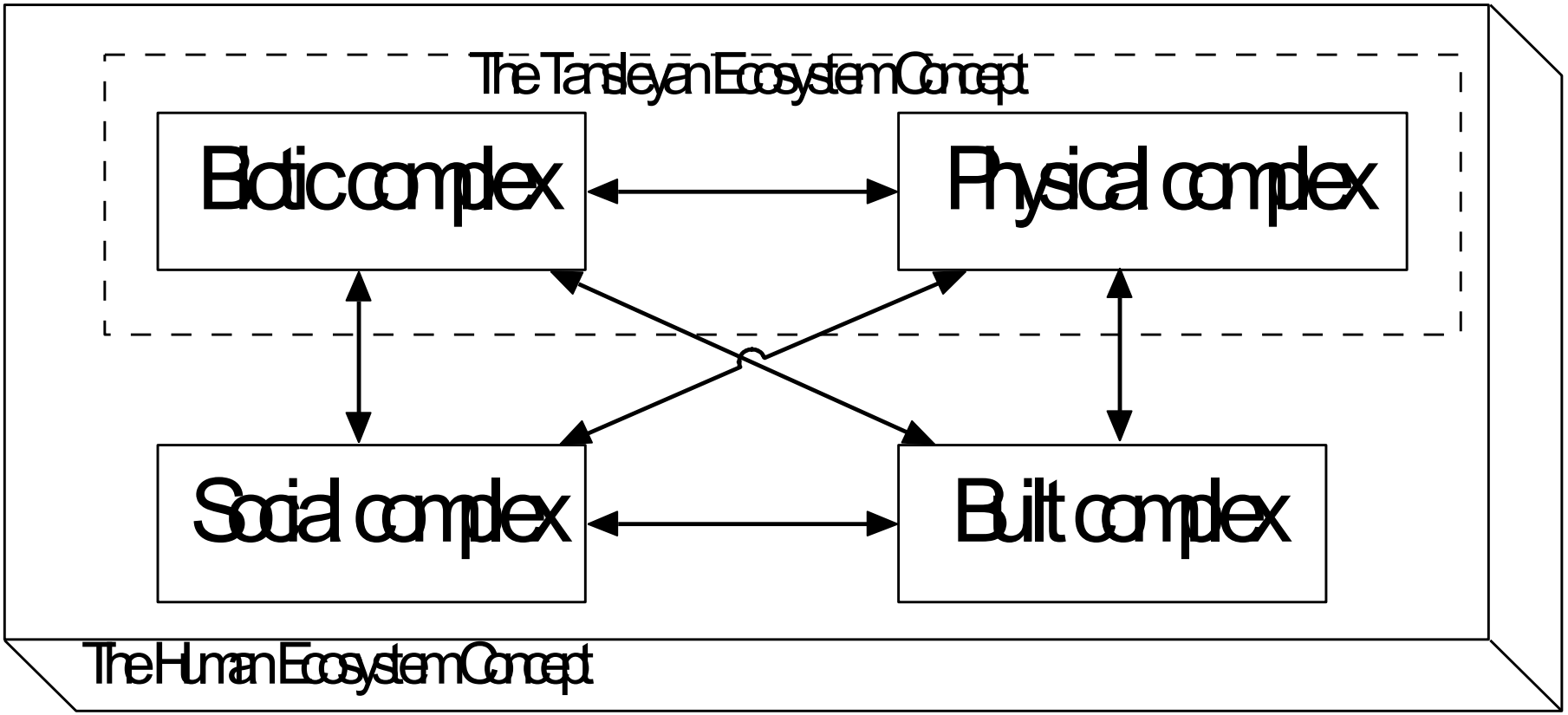
P1

- Cities are about people *and* ecosystems.
  - Human ecosystems

The Ecosystem Concept

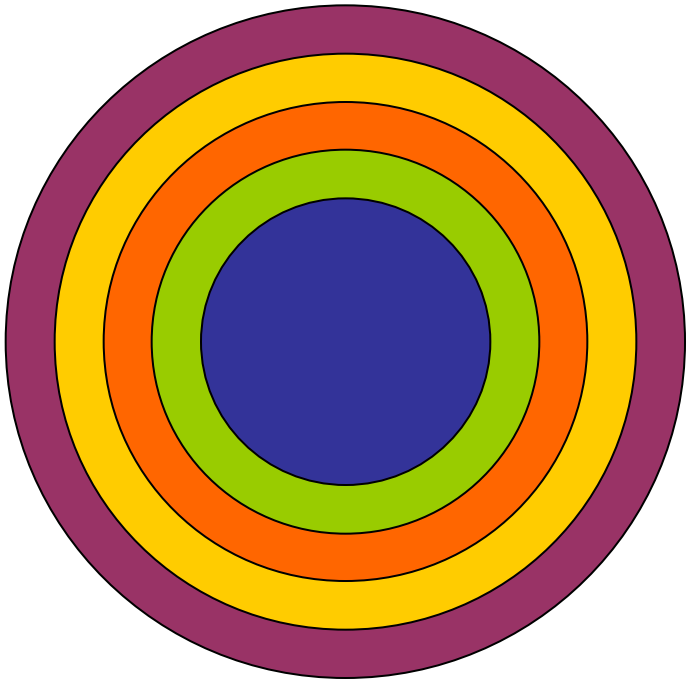


Sir Arthur G. Tansley (1871-1955)


The Tansleyan Ecosystem Concept
Biotic complex
Physical complex
Social complex
Built complex
The Human Ecosystem Concept

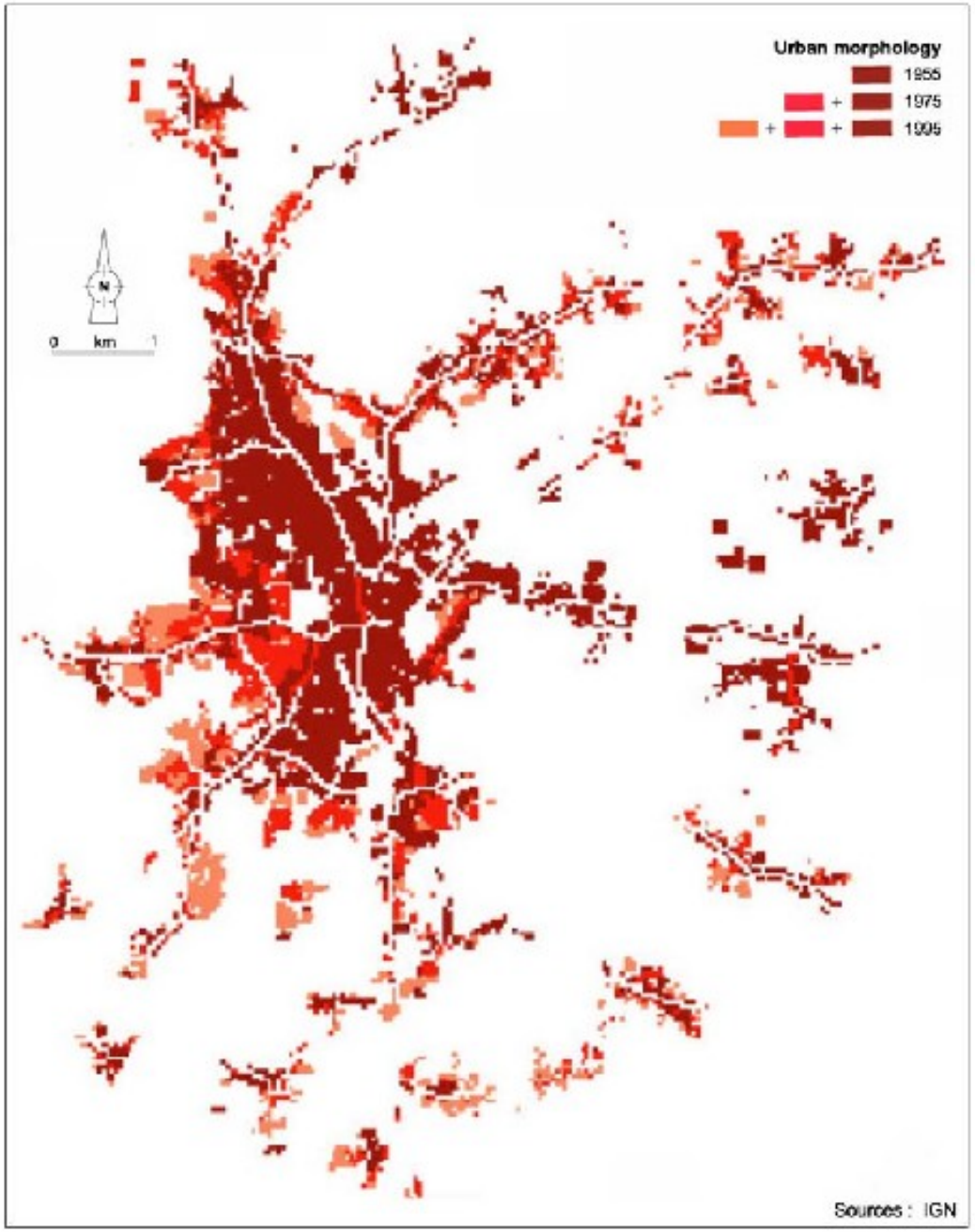
P2

- Cities have multiple and changing forms.



Burgess Model

- Central Business District
- Transitional zone: recent immigrants, deteriorating housing, factories, abandonment
- Working class zone: single family tenements
- Residential zone: single family homes with yards and garages
- Commuter zone: suburbs

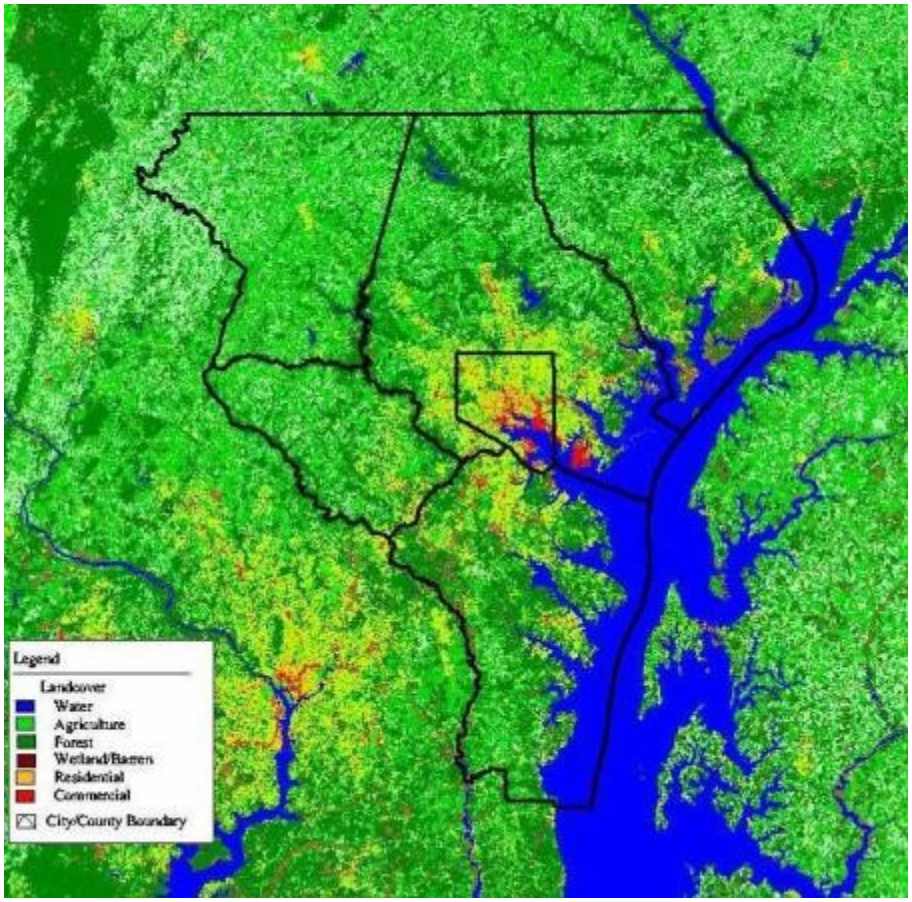


Antoni 2001


Nokulunga
Cash Store

P3

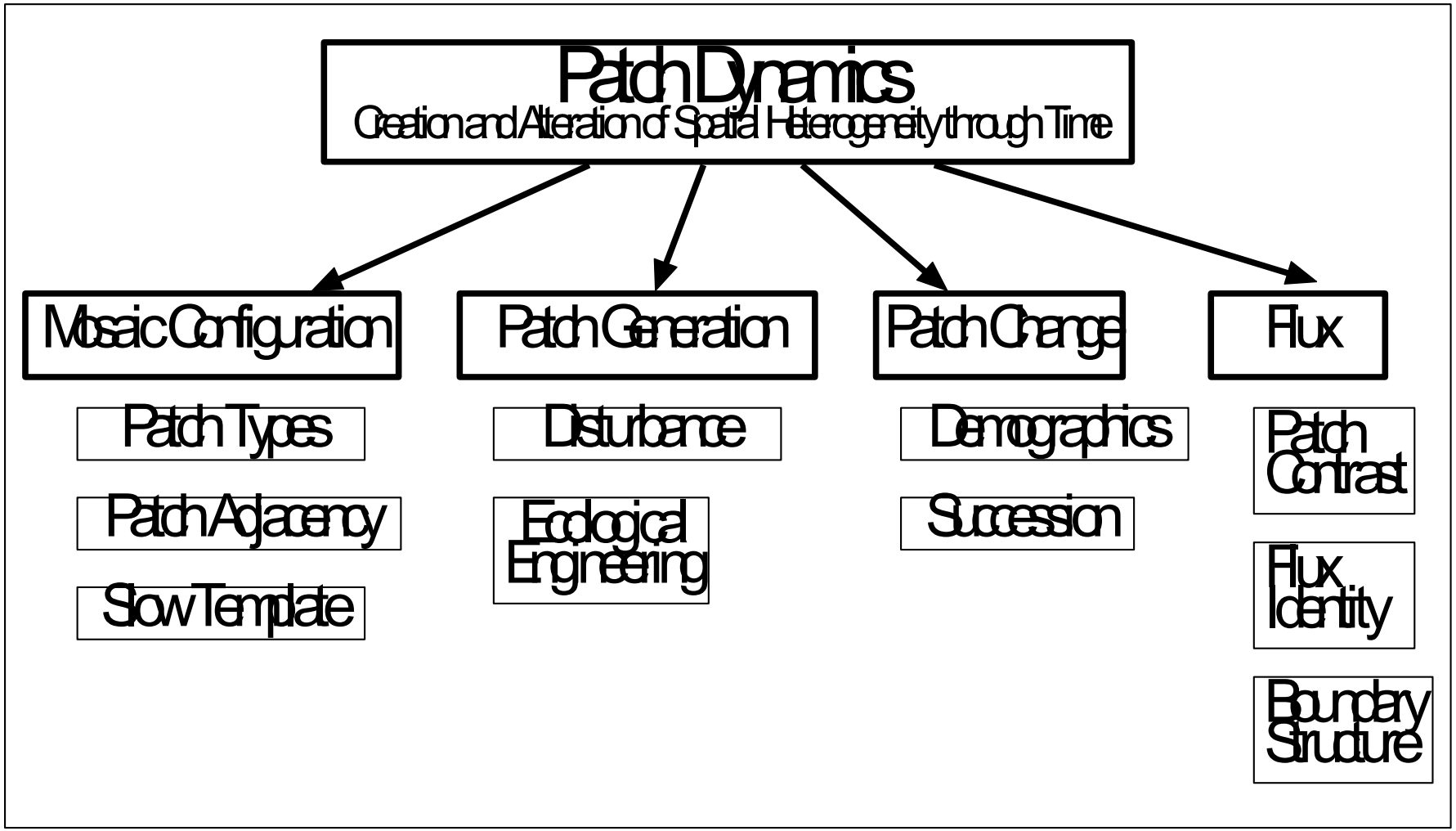
- Cities are mosaics extending into surroundings.



Cadenasso

Patch dynamics

- Applies to cities
- Hierarchical
- Gradients and fields



Pickett, Cadenasso

Social processes

P4

- Planned, opportunistic, incremental, incidental.

Components of change

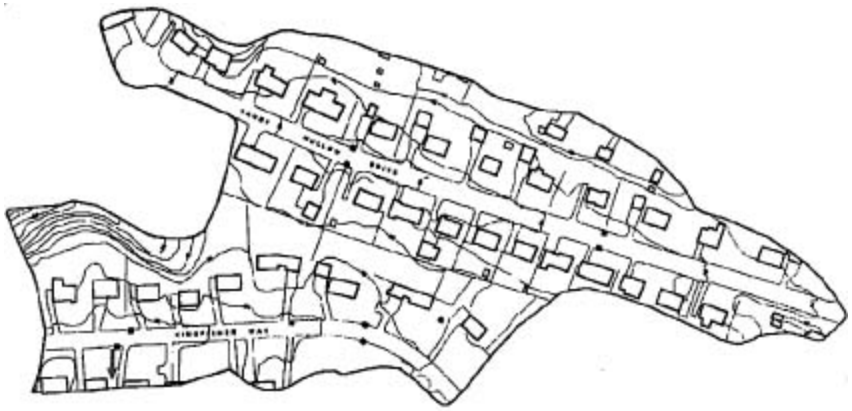
- Urban design
- Urban planning
- Topography
- Ecology
- Social-cultural
- Economic

P5

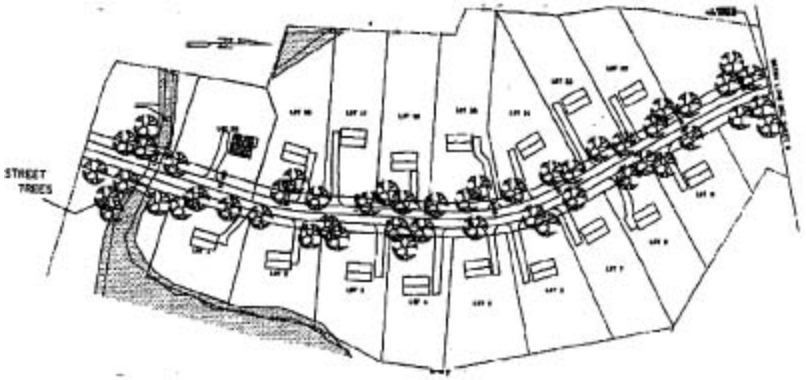
- Urban designs as experiments.

Felson, Pickett (2005)

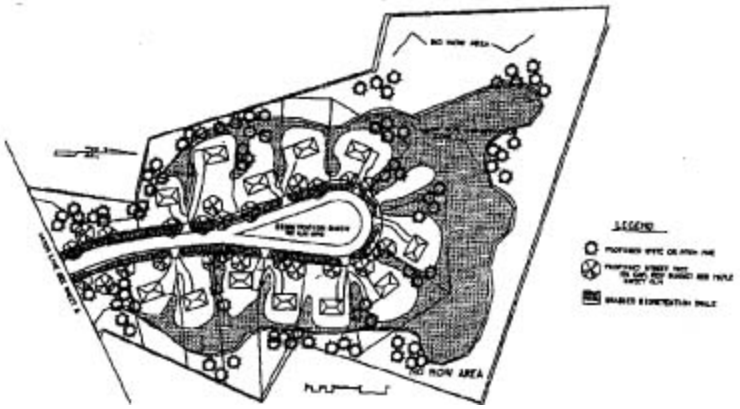
Jordan Cove, CT



Control development



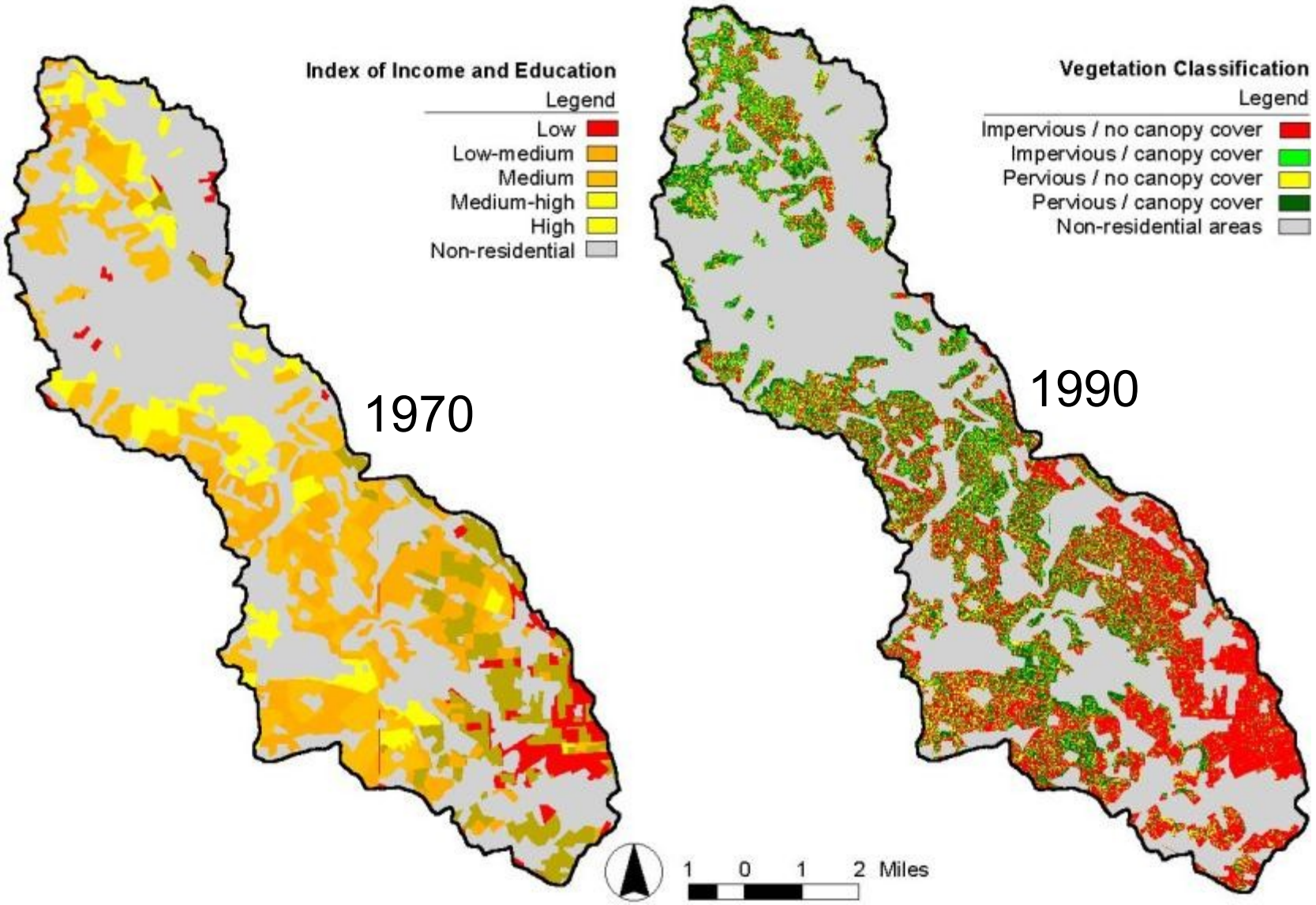
Traditional



BMP

P6

- Social, economic, cultural processes influence biophysical processes.


Index of Income and Education
Legend
Low
Low-medium
Medium
Medium-high
High
Non-residential
1970
Vegetation Classification
Legend
Impervious / no canopy cover
Impervious / canopy cover
Pervious / no canopy cover
Pervious / canopy cover
Non-residential areas
1990
1 0 1 2 Miles

Grove, Burch

P7

- Social, cultural, economic complexity.

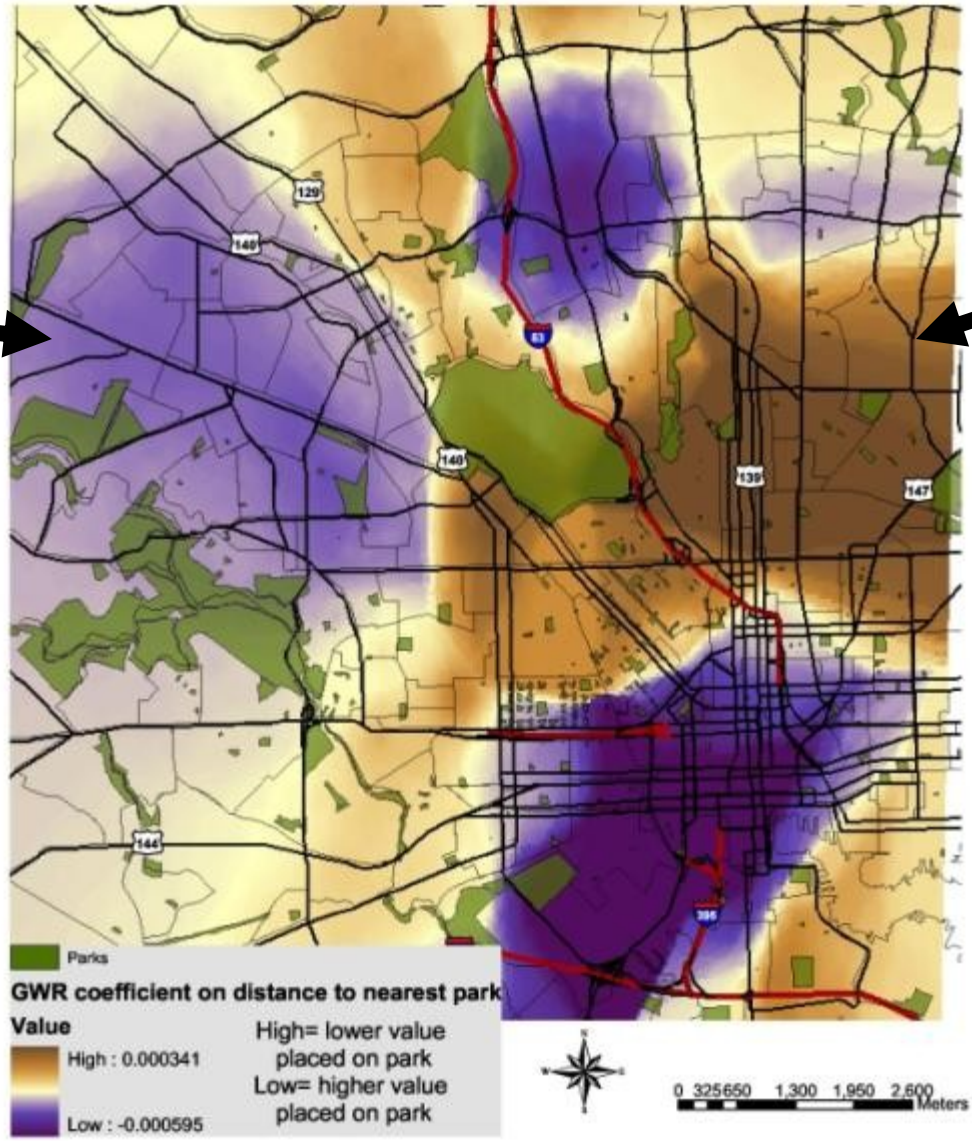
Components of social complexity

- Property regimes
- Households and individuals
- Social status
- Economic status
- Lifestyle grouping
- Social identity
- etc.

Interpolated Map showing how proximity to parks is reflected in West Baltimore property values, created with Geographically Weighted Regression

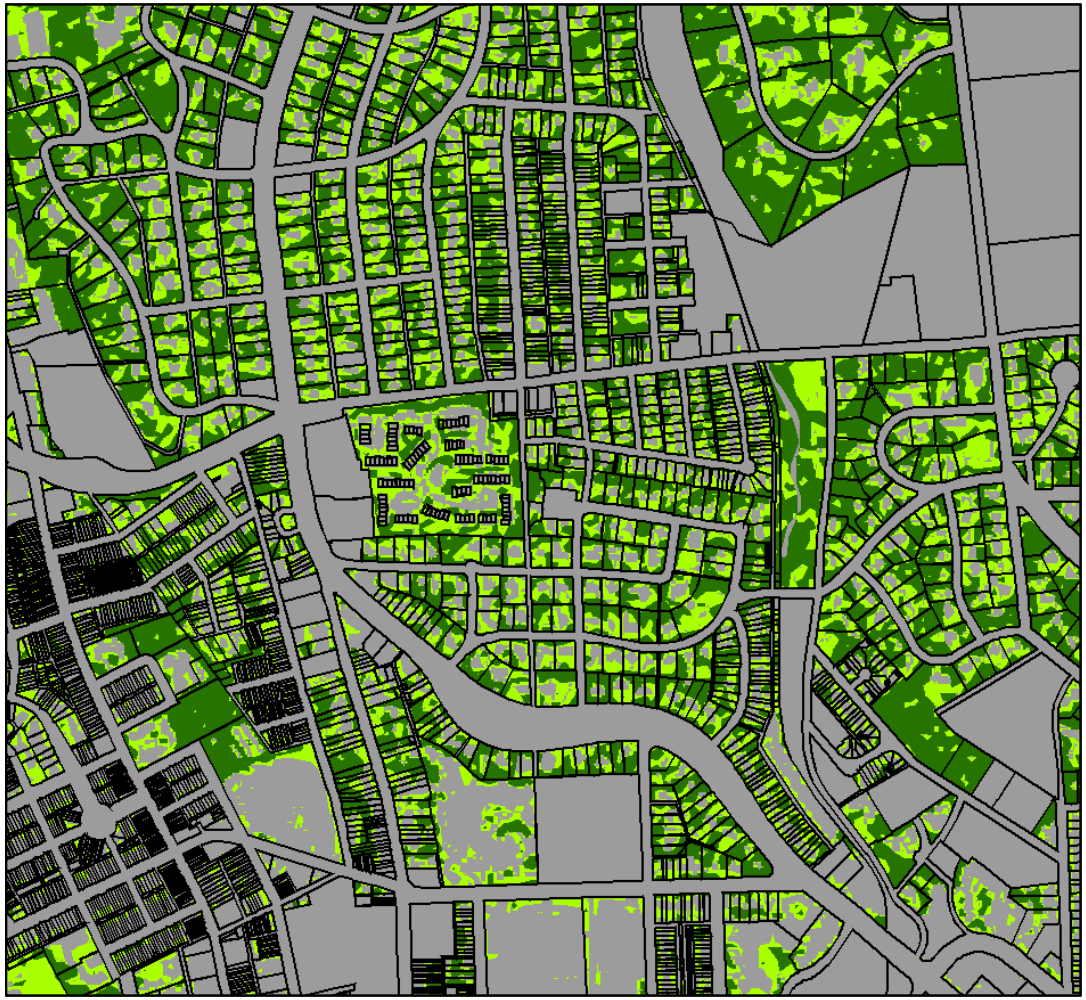
Perceive high value of parks

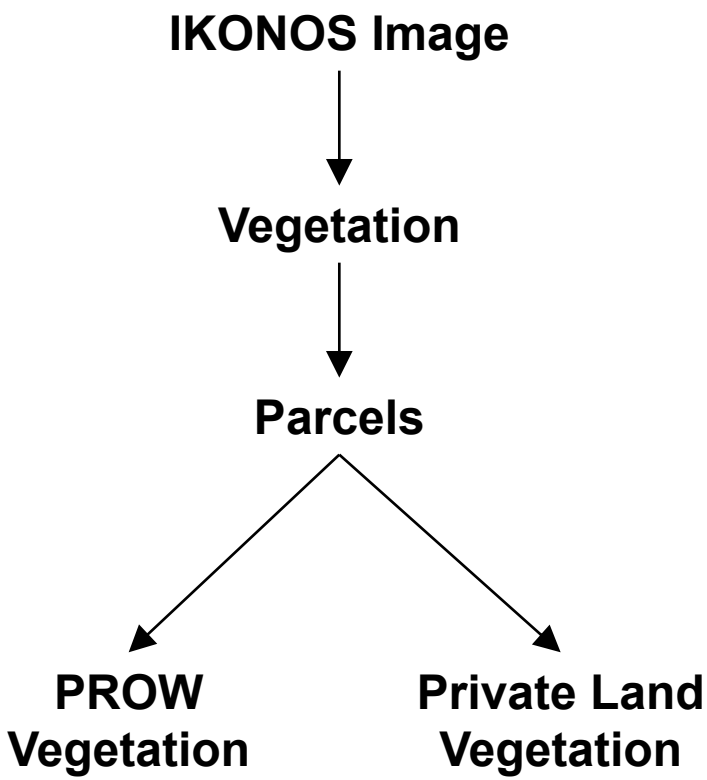
Perceive low value of parks



Troy et al.

Fine Scale Analysis





Grove, Troy, O'Neil-Dunne

Biophysical functions

P8

- Remnant soils, waters, vegetation.

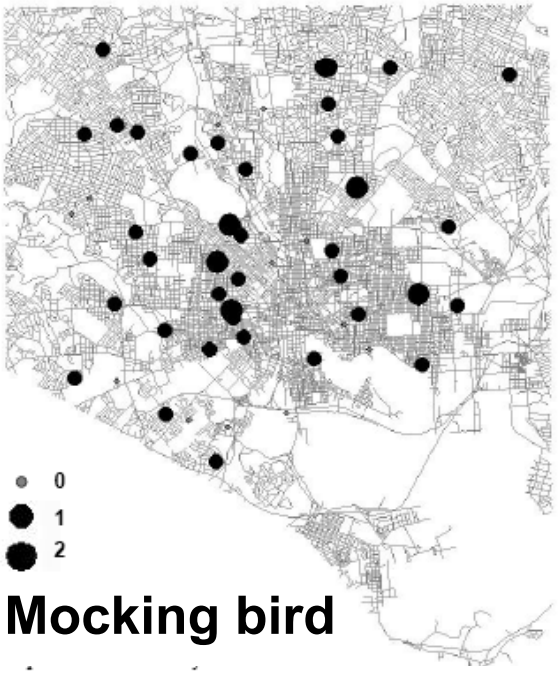
Nitrogen retention

	Suburban	Forested	Agriculture
	---------- kg N ha^{-1} y^{-1} ----------		
Inputs			
Atmosphere	8.7	8.7	8.7
Fertilizer	13.9	0	100
TOTAL	22.6	8.7	108.7
Outputs			
Streamflow	6.5	0.52	16.4
Retention			
Mass	16.1	8.2	92.3
Percent	71	94	85

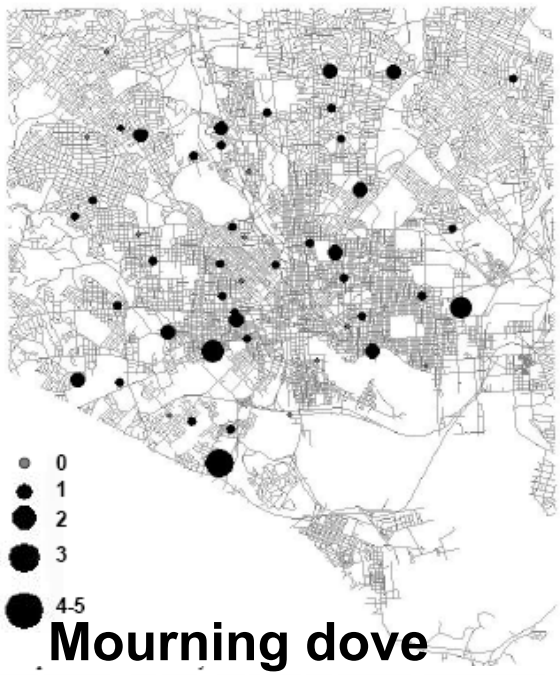
Groffman, Belt, Fisher

P9

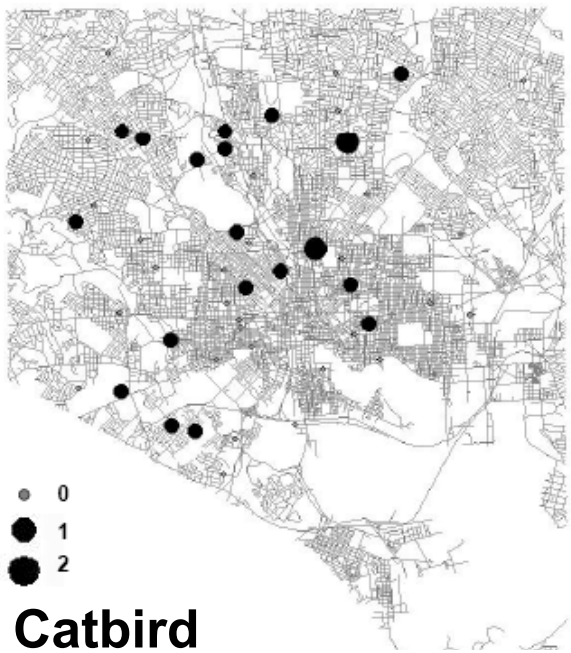
- Biodiversity multifaceted and present.



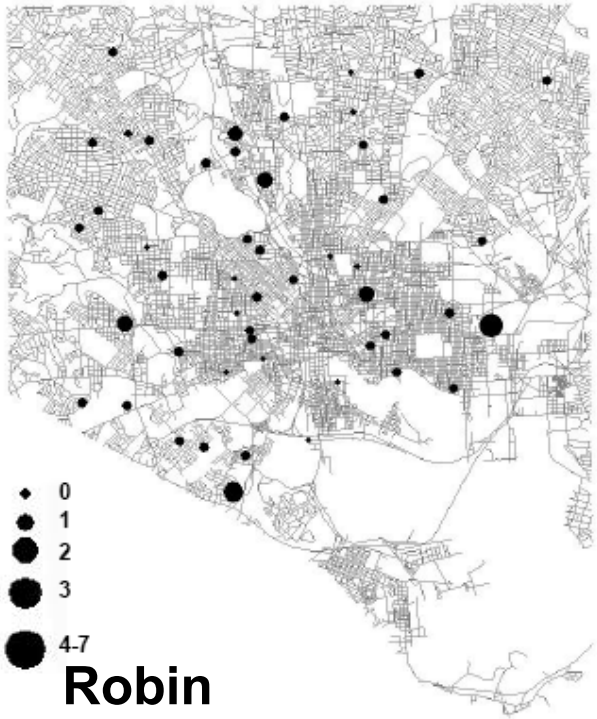
Mocking bird



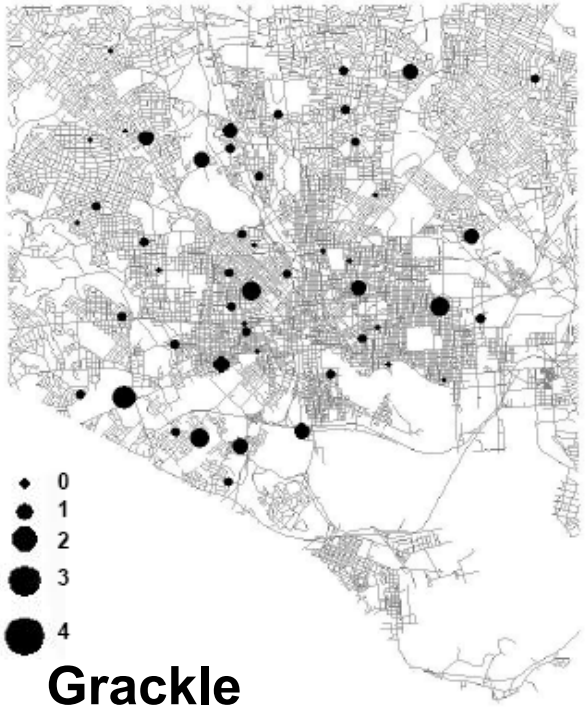
Mourning dove



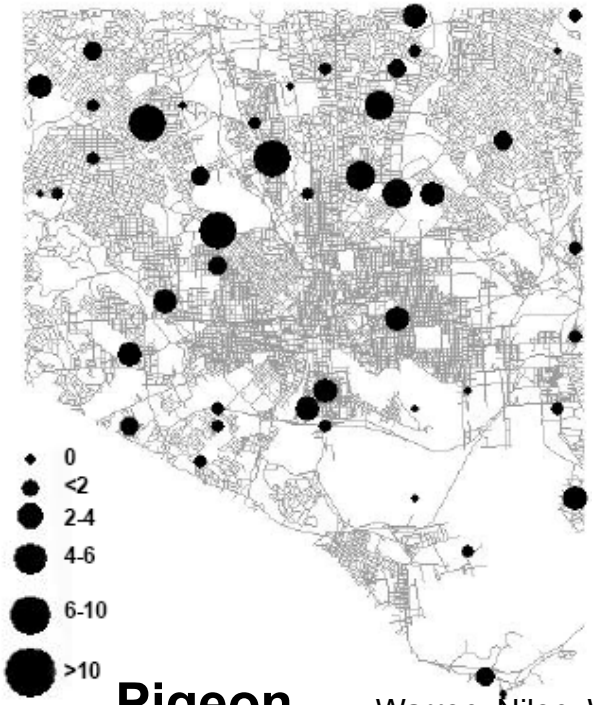
Catbird



Robin



Grackle



Pigeon

Warren, Nilon, Wolf

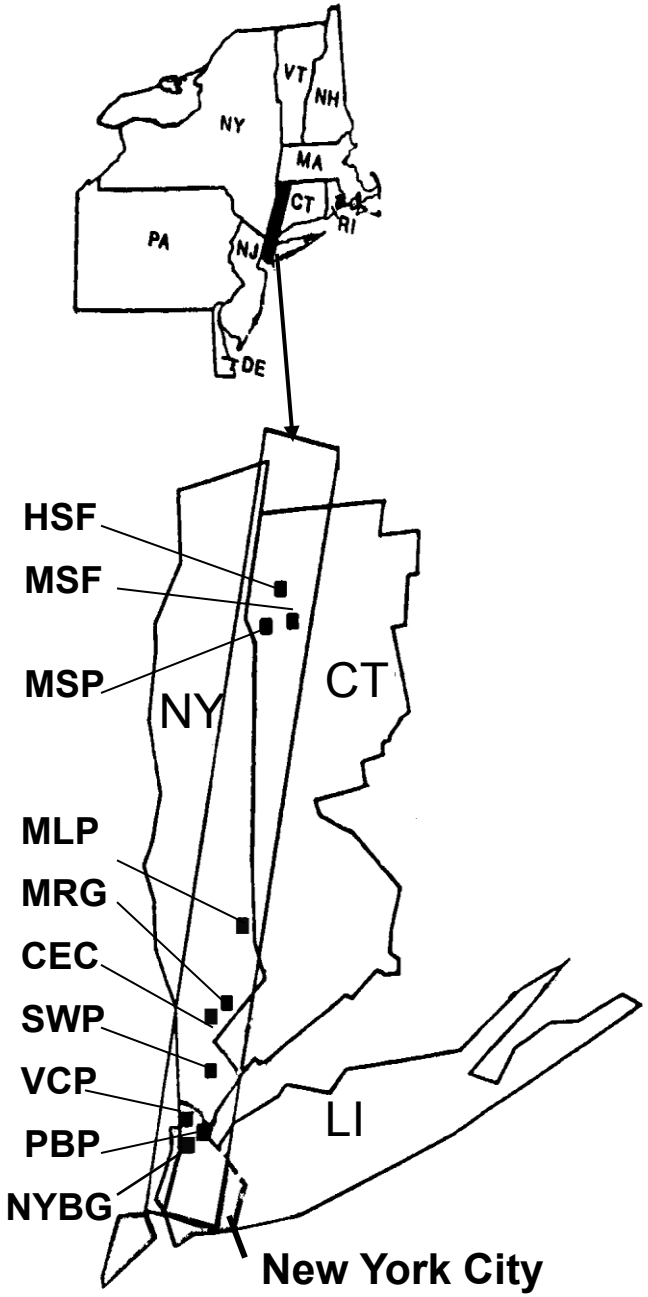
Methodological principles

P10

- Study-specific definition of urban.

P11

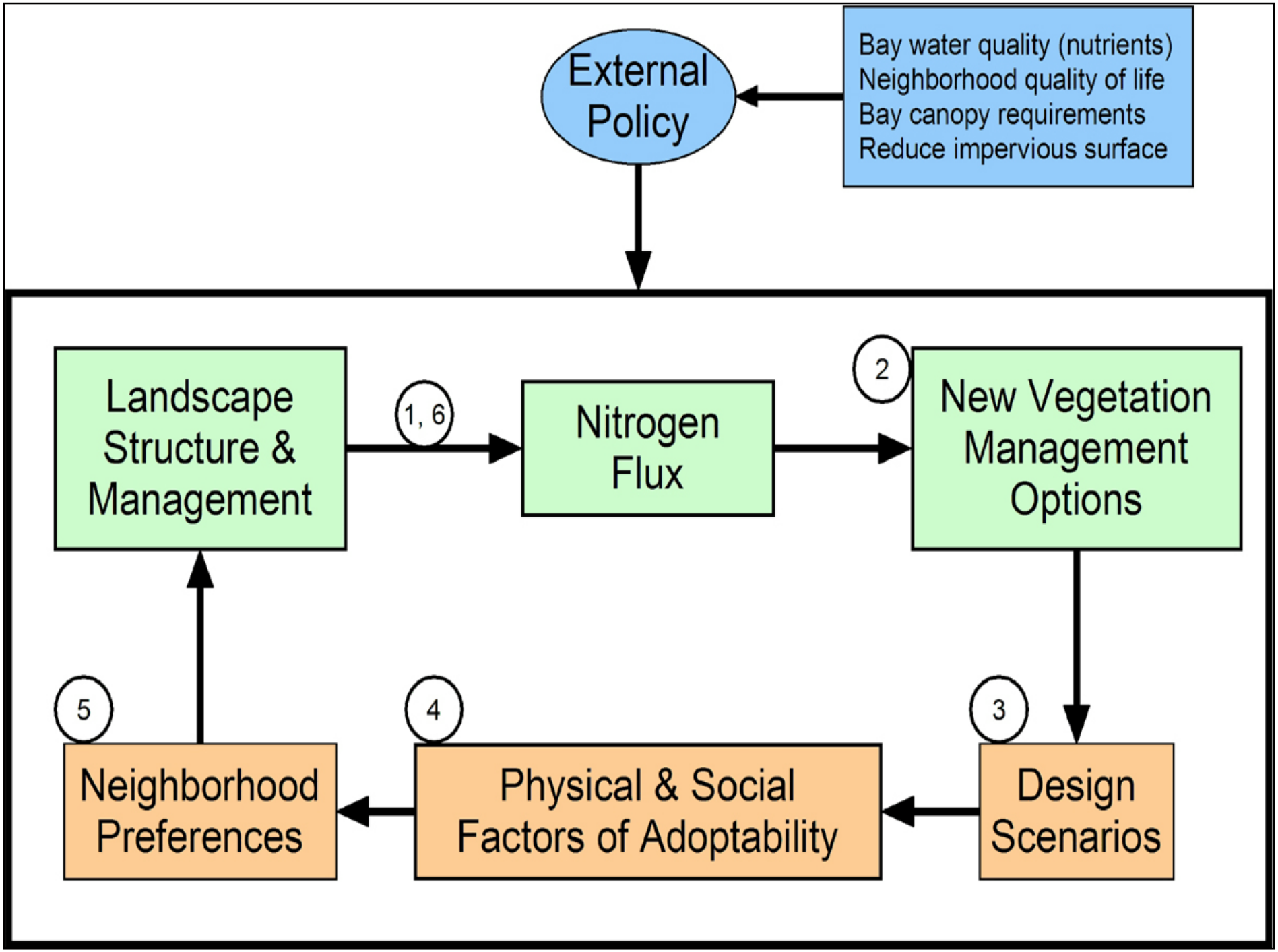
- Abstract urban gradients.



McDonnell et al 1990

P12

- Human perception as links.

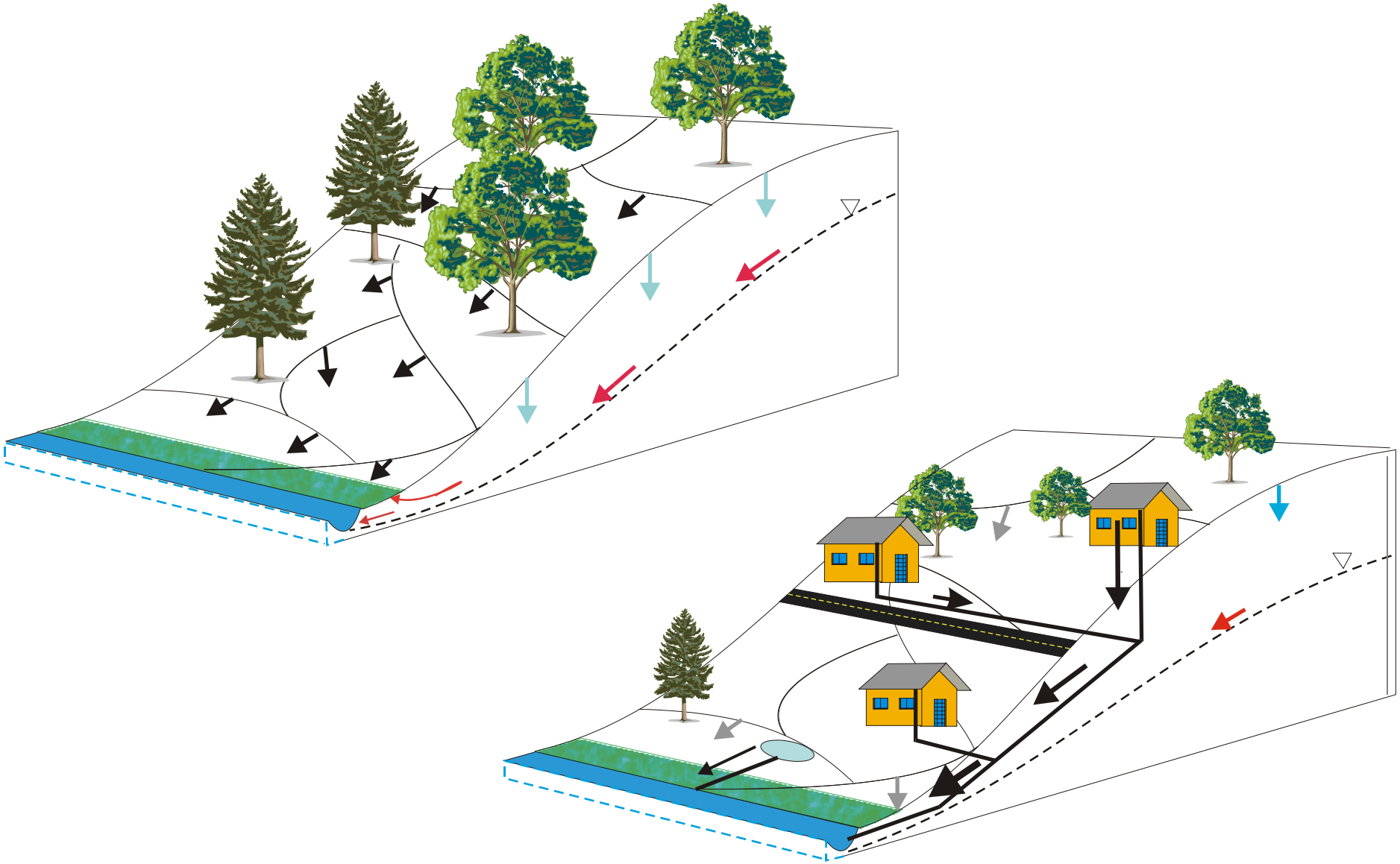


Pickett, Cadenasso (2008)

Practical principles

P13

- Flux of water, and water infrastructure.



N. Law and L. Band

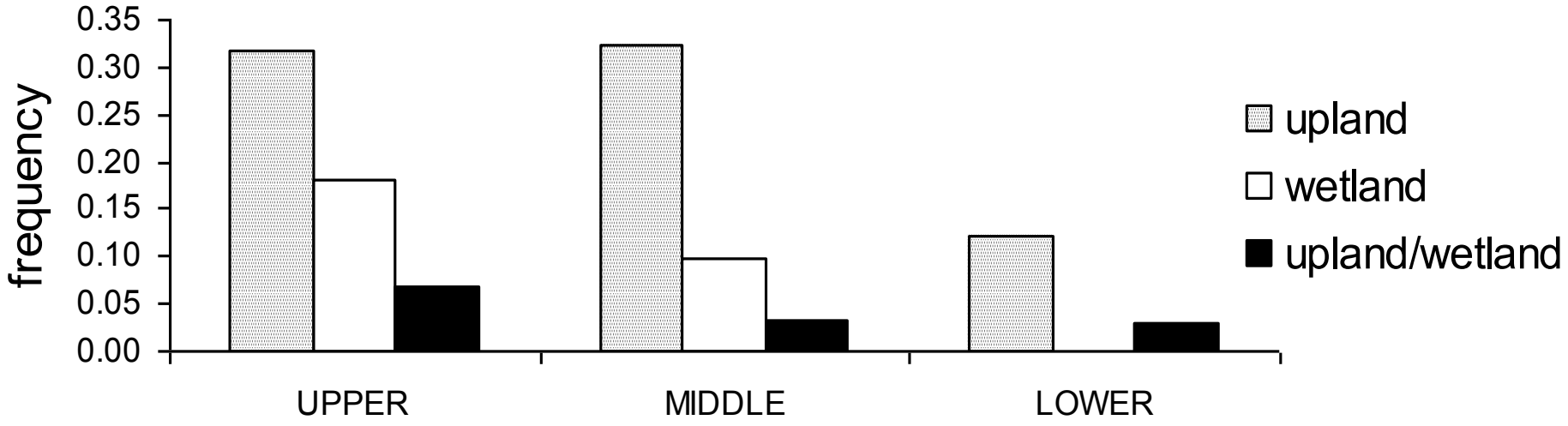
Water principle

- Sites of cities
- Urban design
- Future demands.

P14

- Exotic species functions.

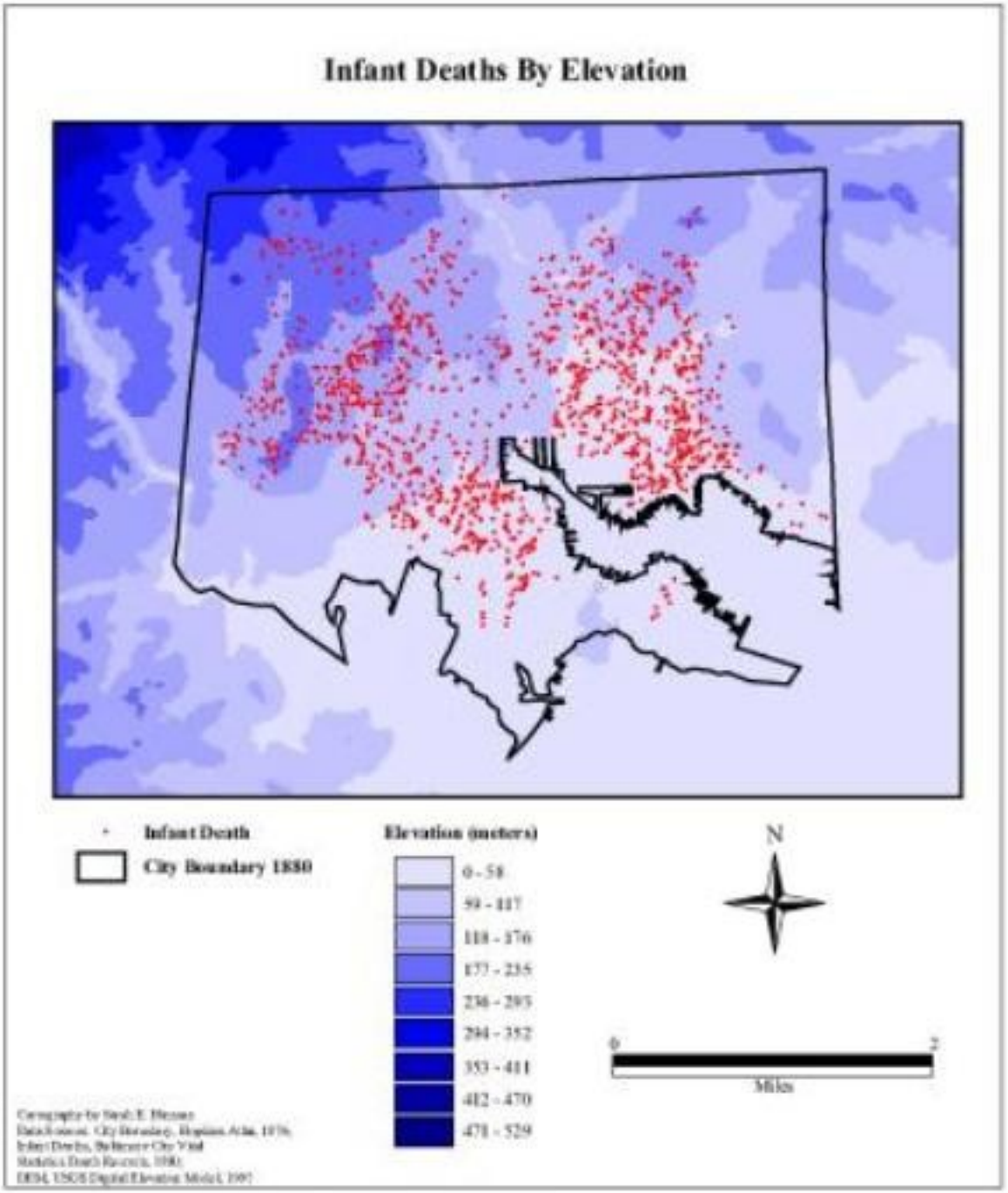
Distributions of exotic herbs in riparian zones



G. Brush et al. *in prep*

P15

- City form and shared needs
  - Role of elites
  - Non-stationary roles
  - Non-overlapping agency
  - Environmental injustice.

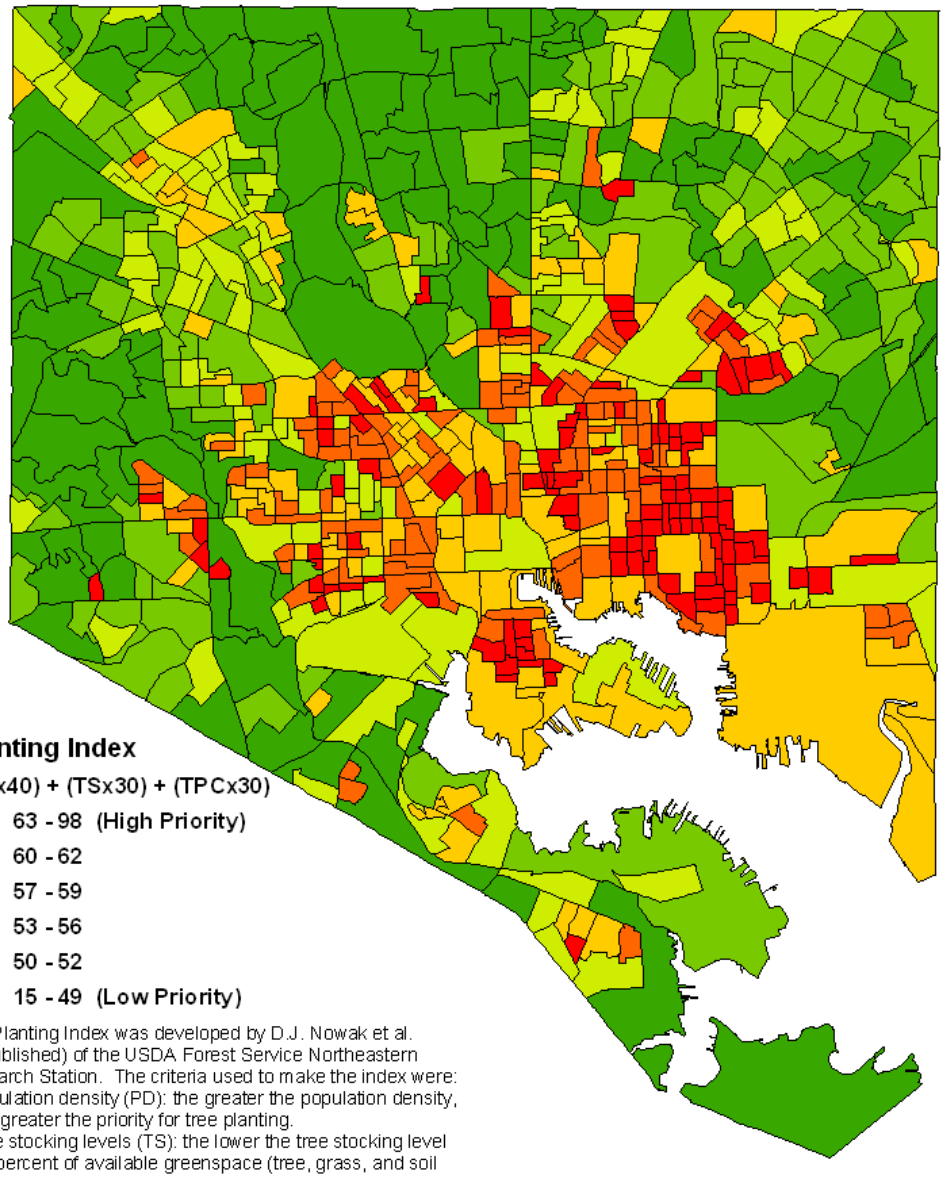

Infant Deaths By Elevation
Infant Death
City Boundary 1880
Elevation (meters)
0 - 58
59 - 117
118 - 176
177 - 235
236 - 293
294 - 352
353 - 411
412 - 470
471 - 529
N
0
2
Miles

Boone

P16

- Utility of data requires continual dialog.

Prioritization of Planting Locations



Planting Index

(PDx40) + (TSx30) + (TPCx30)

- **63 - 98 (High Priority)**
- **60 - 62**
- **57 - 59**
- **53 - 56**
- **50 - 52**
- **15 - 49 (Low Priority)**

The Planting Index was developed by D.J. Nowak et al. (unpublished) of the USDA Forest Service Northeastern Research Station. The criteria used to make the index were:

- Population density (PD): the greater the population density, the greater the priority for tree planting.
- Tree stocking levels (TS): the lower the tree stocking level the percent of available greenspace (tree, grass, and soil cover areas) that is occupied by tree canopies), the greater the priority for tree planting.
- Tree cover per capita (TPC): the lower the amount of tree canopy cover per capita, the greater the priority for tree planting.

BES Use Only

Analysis and map production:

Jarlath O'Neil-Dunne
UVM Spatial Analysis Lab
June 1, 2004
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802-656-3324

Review of the principles

- Human ecosystem
- Multiple forms
- Extensive spatial mosaics
- Intention, opportunity, incidental, constraint
- Design as experiment
- Role of social pattern and process
- Social complexity …

- Retain remnant soils, waters, vegetation
- Biodiversity multifaceted, value
- Urban definitions various
- Abstract gradients of urbanization
- Human perceptions and actions
- Flux of water, water infrastructure
- Exotics and function
- City form: equity and control
- Application through dialog.

Conclusions

- Transdiciplinary concern
- Heterogeneous, changing subject
- Suggests emerging framework
- Open to new insights
- Context for specific tests.