Ecohydrological Principles: Green Infrastructure Meets Stormwater Engineering

Ecohydrology Science and Practice Roundtable
Drexel University, Philadelphia, PA
July 24, 2012

Kenneth Belt, P.E.
US Forest Service
Hydrologist/Aquatic Ecologist

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Center for Watershed Protection
Deputy Director of Programs

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University of Maryland
Assistant Professor

And many more…

BALTIMORE CITY DPW

LTER Long Term Ecological Research

Baltimore Ecosystem Study

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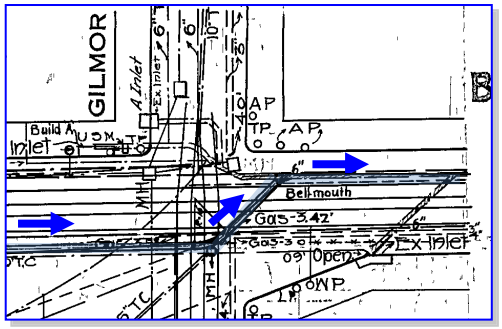

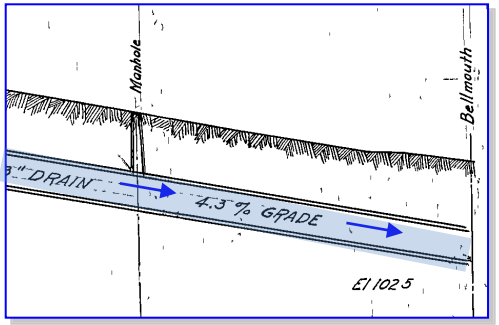

Ecohydrology & Stormwater Mgt

1. Ecohydrology: USFS Science Synthesis

2. The Urban Watershed Continuum

3. New Visions for Stormwater Mgt

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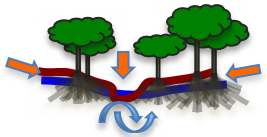
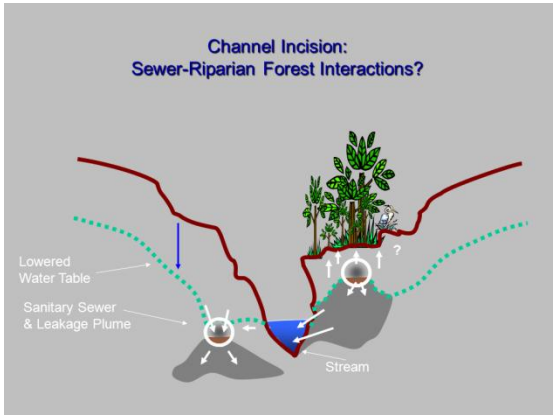
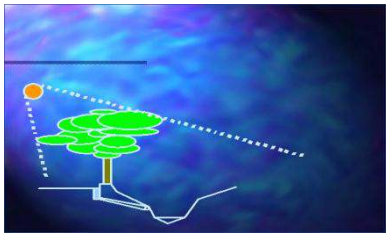
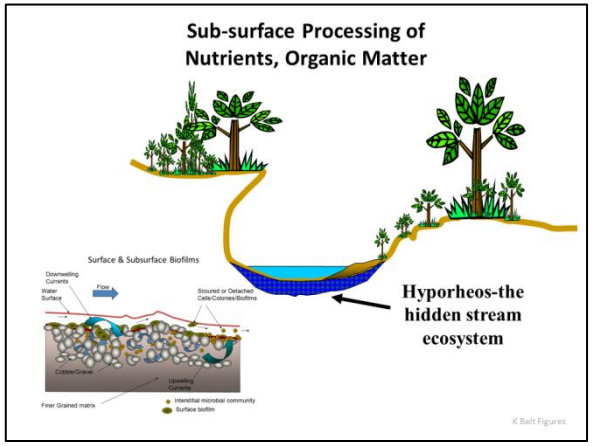


Many Ecohydrological Questions

- Carbon
- Thermal
- Biogeochemistry
- Waste Wood
- Transpiration
- Interception







K Belt Photos, Figures;
BioRet Photo, PG Co DEP

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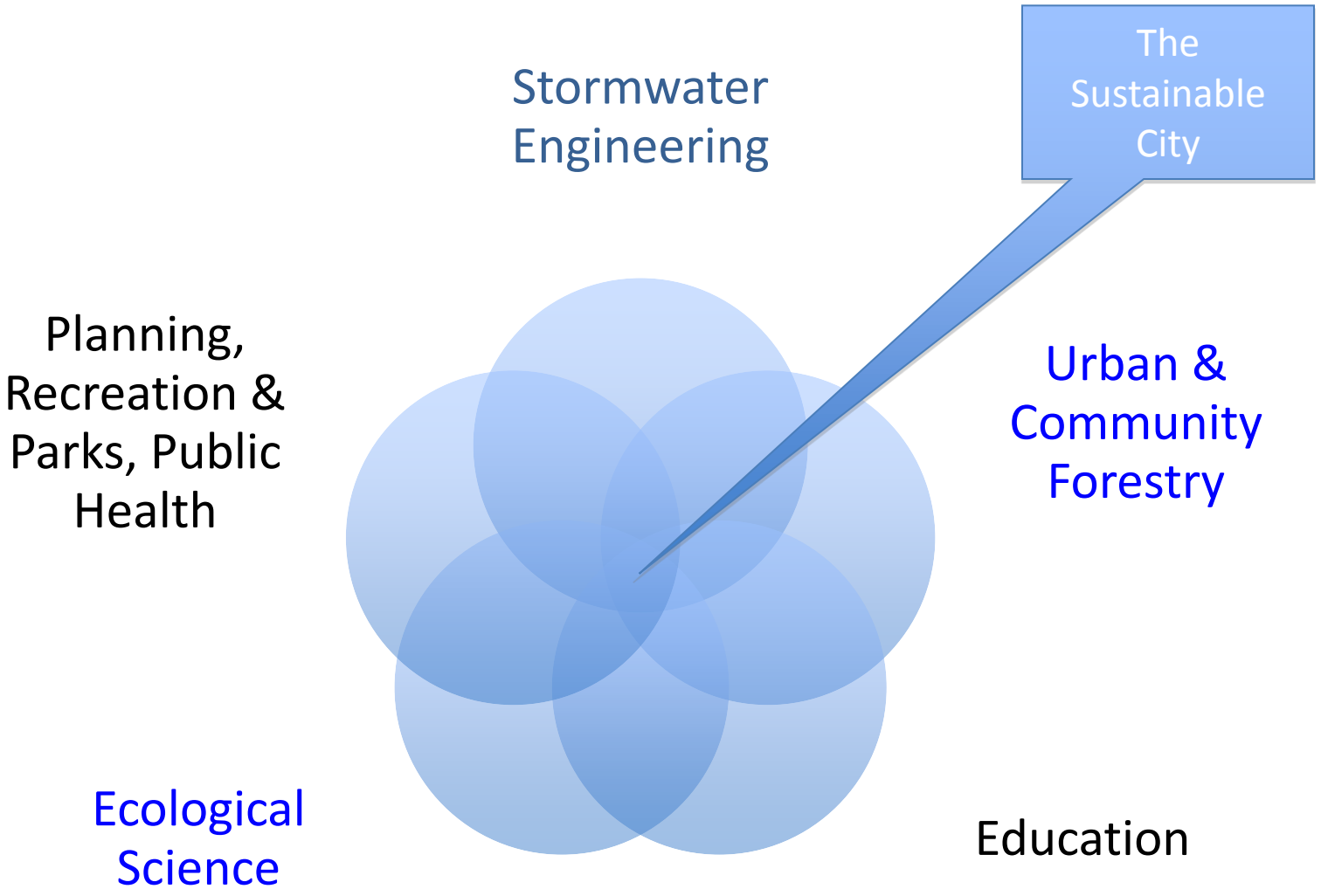
How can Ecological Science and Forestry Contribute to an integrated path to the Sustainable City ?



Forest Service Science Synthesis Project:
We're looking for cross-thinking team members

… disciplines from microbes to systems ecology, urban foresters to engineers, etc.

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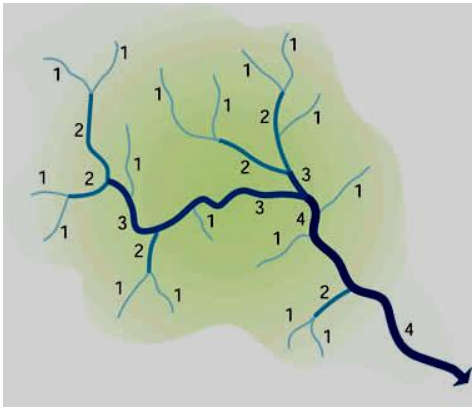
Pearls of wisdom… questions actually



Storm drains are streams

Micro-BMPs have micro drainage areas (but high cost)… and we'll need many of them

We need to maximize performance & sustainability… use biology effectively

GI needs to be the community

GI needs to be multi-objective

We need a new "systems" vision/approach

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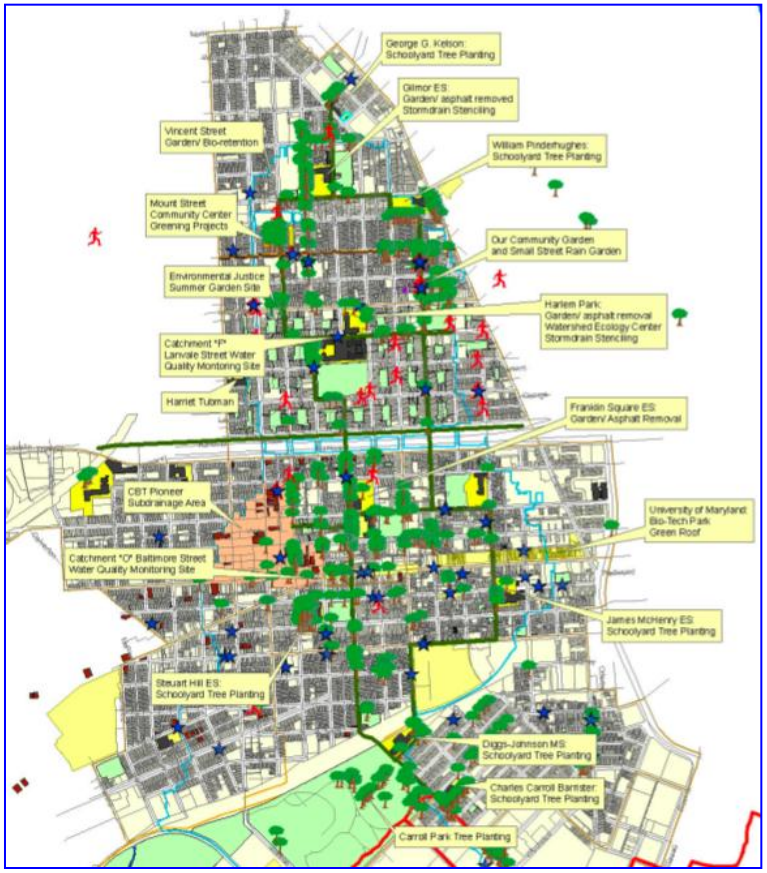
Watershed 263 Long-term Restoration…

FS non-research funds to WS263 since 2001*:

- USFS: $461 K
- Local Match: $335 K



* Courtesy Guy Hager, P&P Foundation

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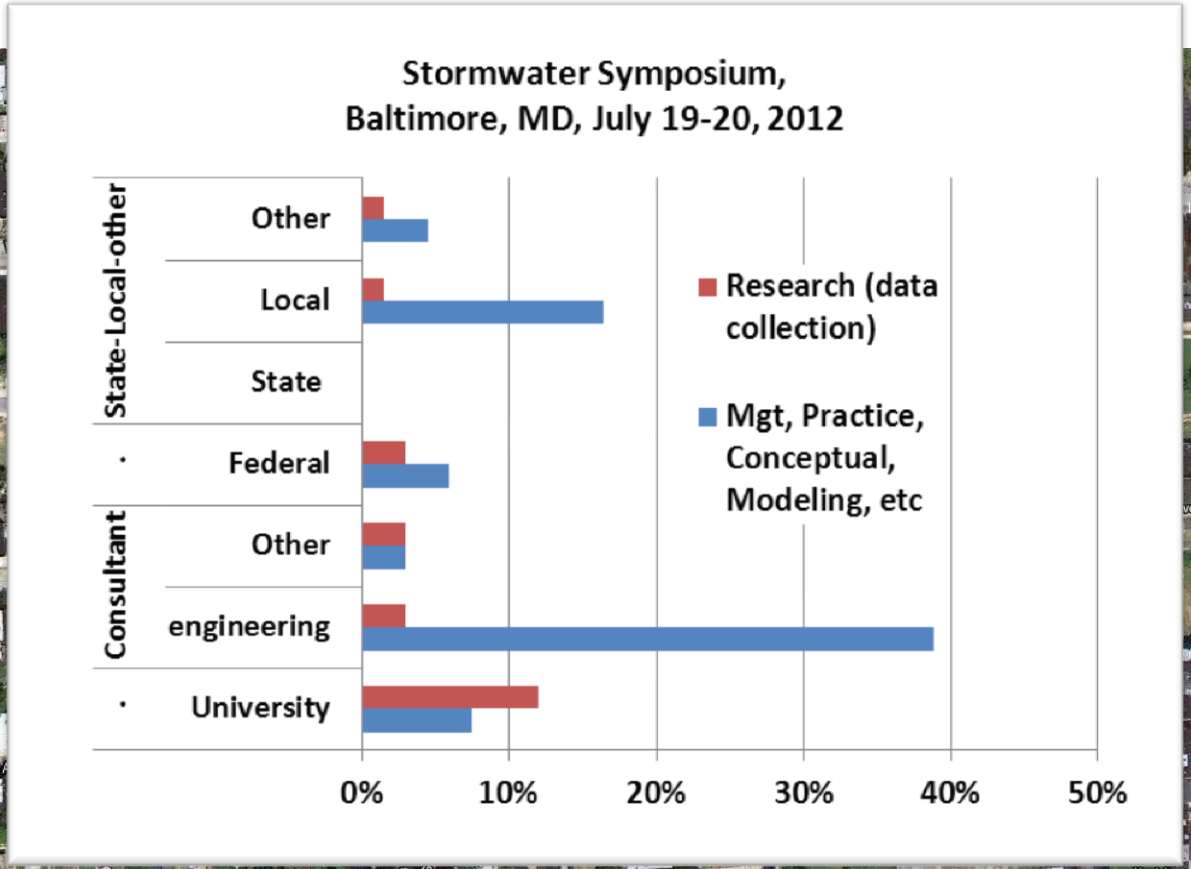
Current Stormwater Mgt…



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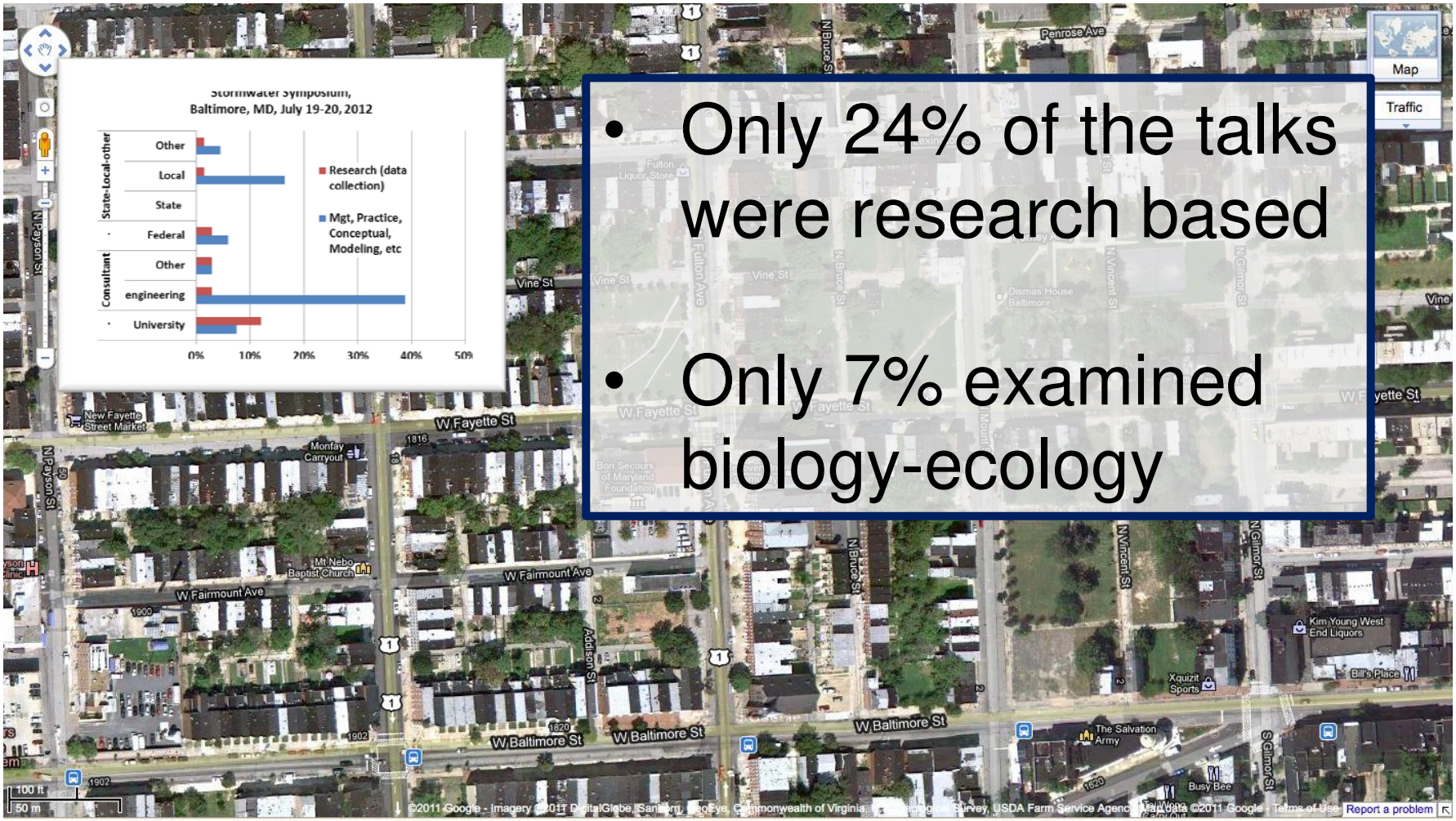
We need more research/monitoring



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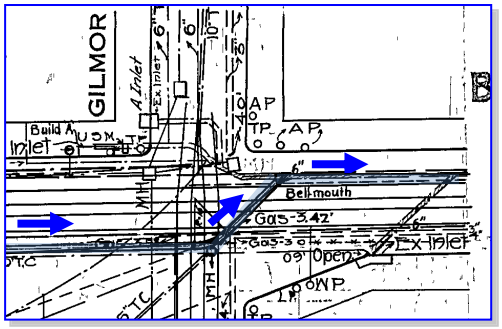
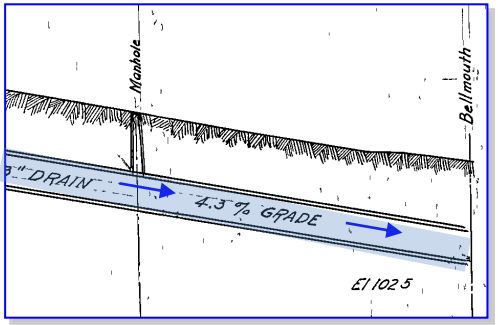
Reflections on NURP (ca. 1980s)

JFURP (Baltimore):
Local Training & Instilling a Culture of Monitoring





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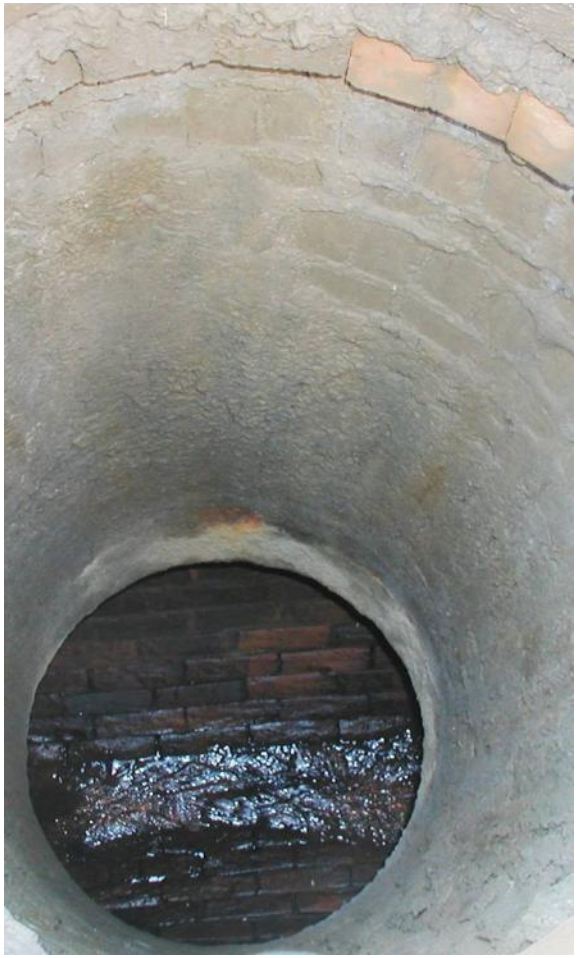
Watershed 263: Ultra Urban, with Groundwater Matrix Issues?



Balt Baseflow

Lanv Baseflow

Baltimore City DPW Photos

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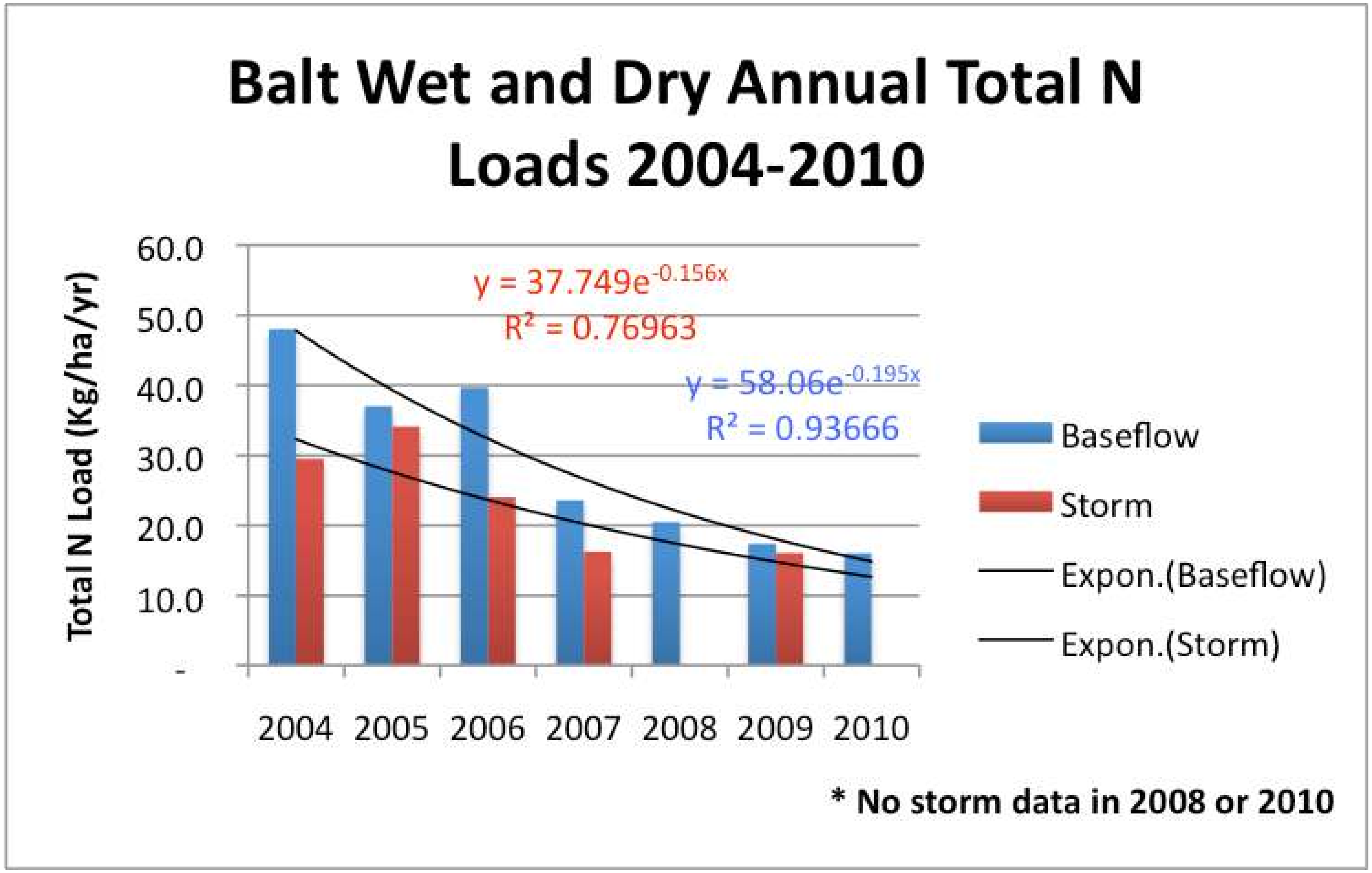
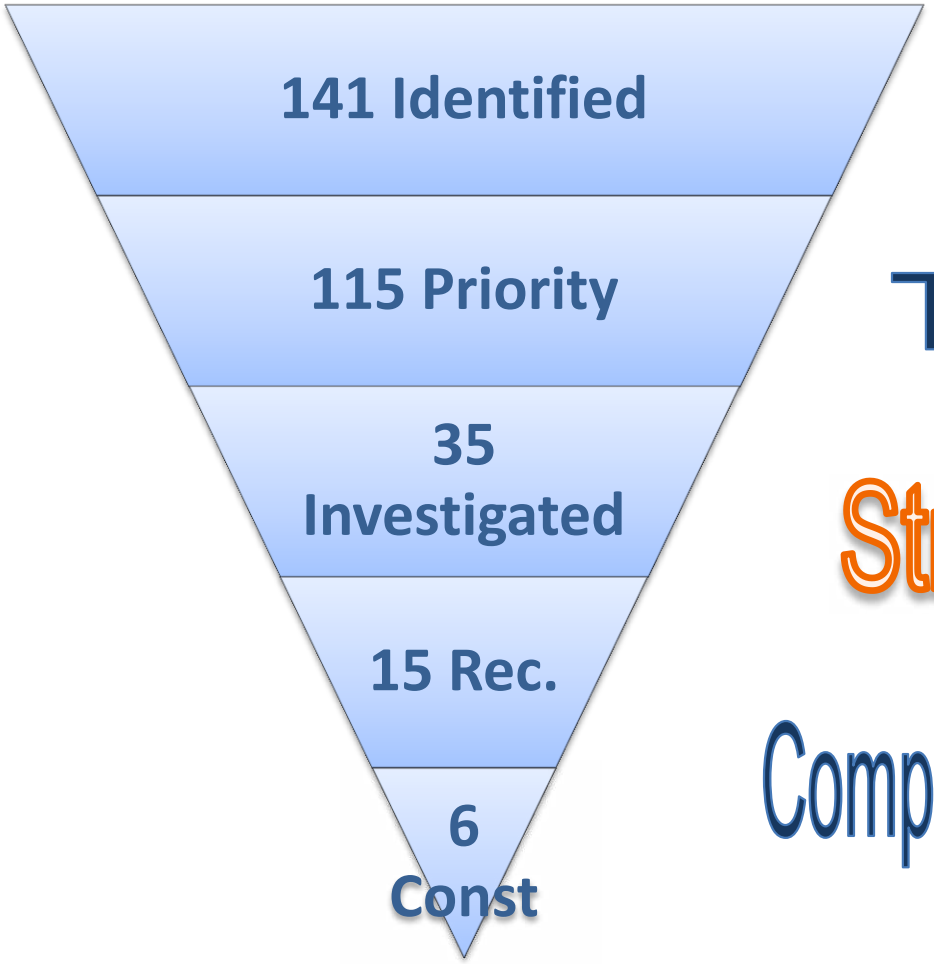
Nitrogen Baseflow and Stormflow Loads: …Decreasing Over Time



Project Selection Process…
only the chosen few remain



Limited

Construction Area

Right of Entry

Utilities

Trees

Structures

Compacted Soils

Slide fr K Burgess, BCity DPW

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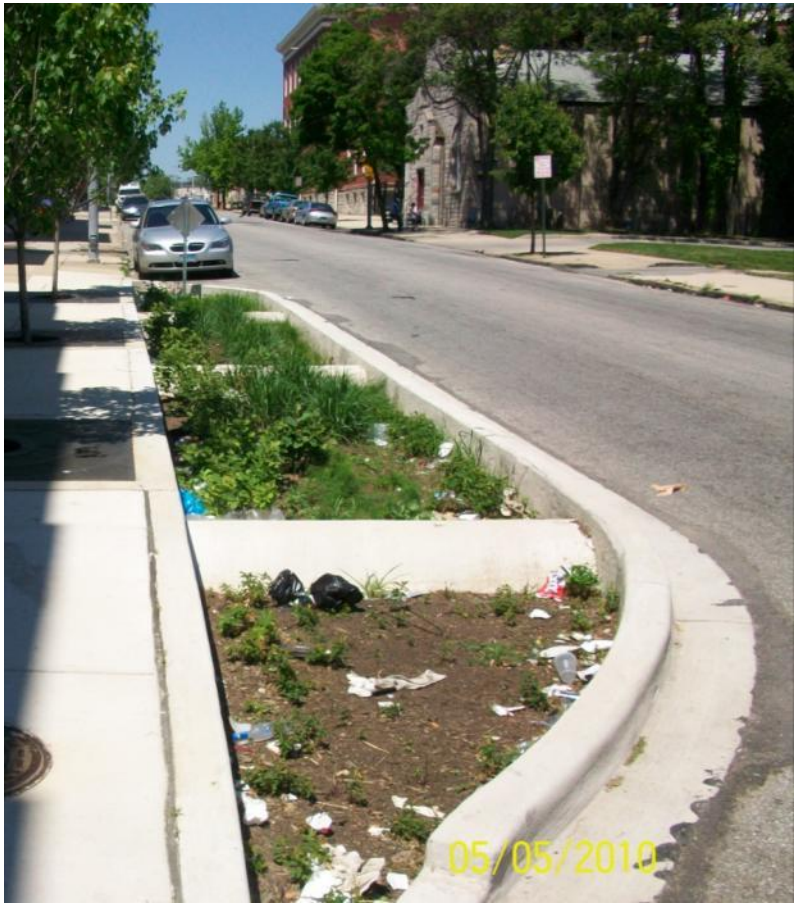
Sustainable… means attractive and with operation, maintenance and replacement costs included…



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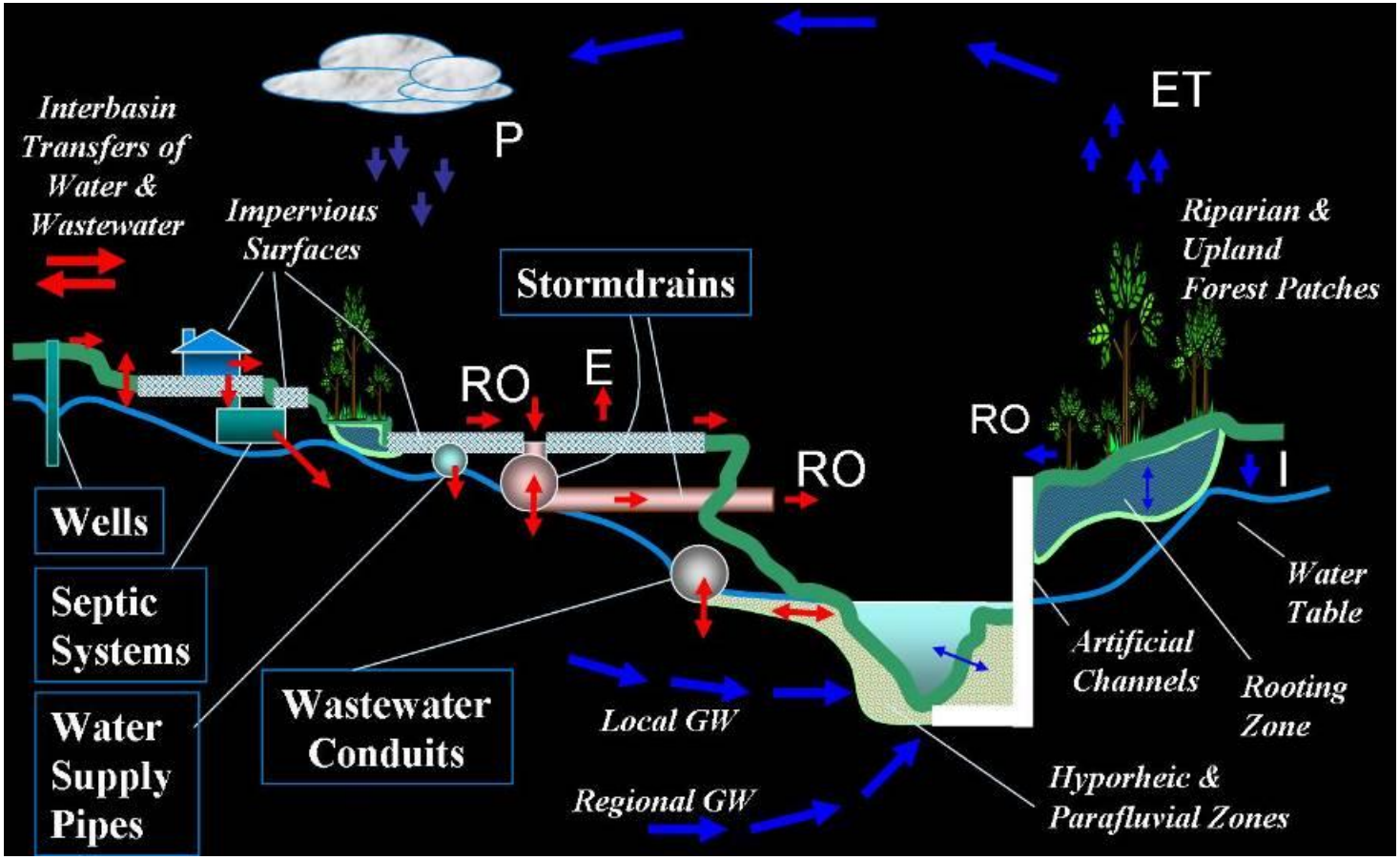
The Urban Hydrologic System

infrastructure driven pathways



K Belt Figure

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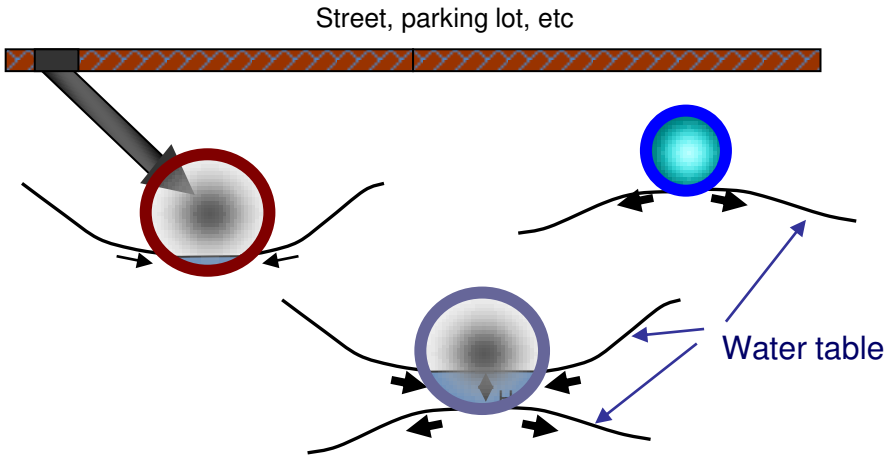
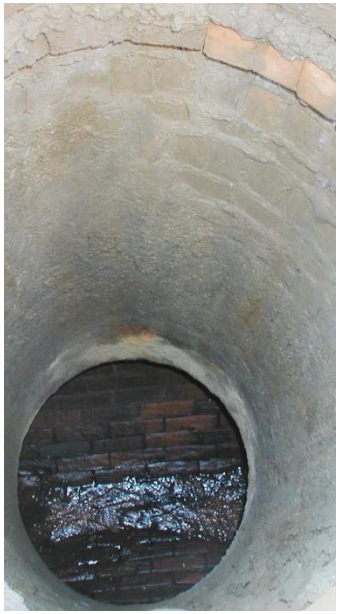
The *Real Unseen* Urban Stream Riparian System…

Urban "Karst"





K Belt Photos, figure

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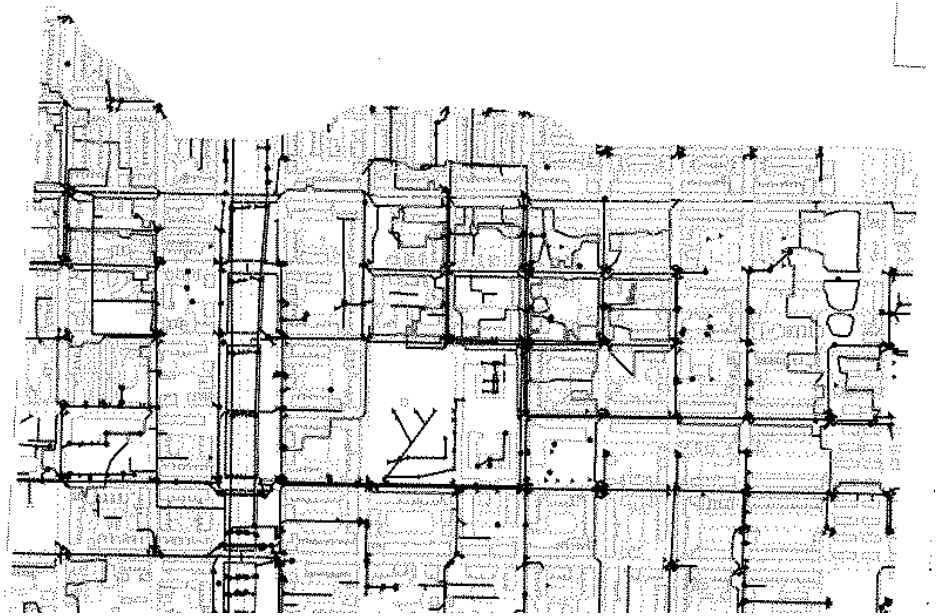
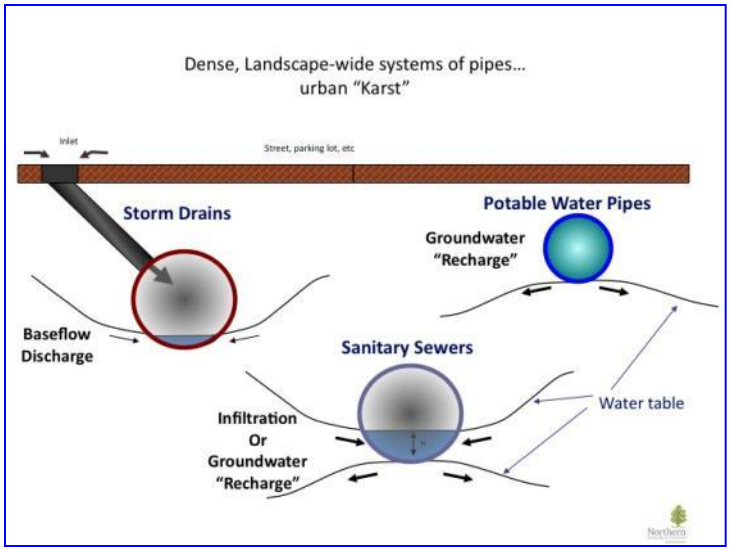
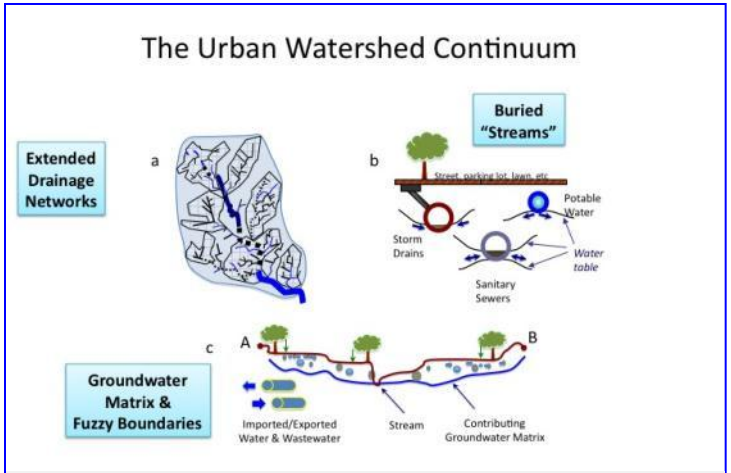
Dense, landscape-wide systems of pipes…
The “Watershed Continuum”

… storm drains carry more than stormwater



Balt Catchment Storm Drains





Kaushal, S. & Belt, K. 2012 The Urban Watershed Continuum: Evolving Spatial and Temporal Dimensions.

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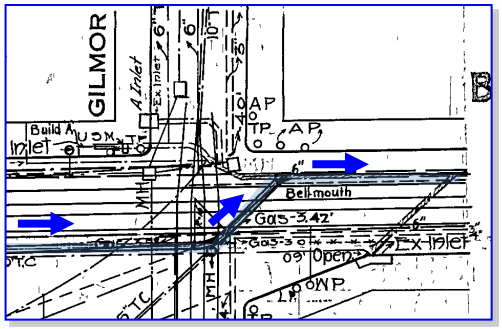

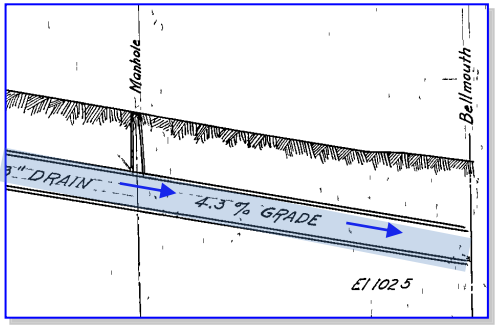

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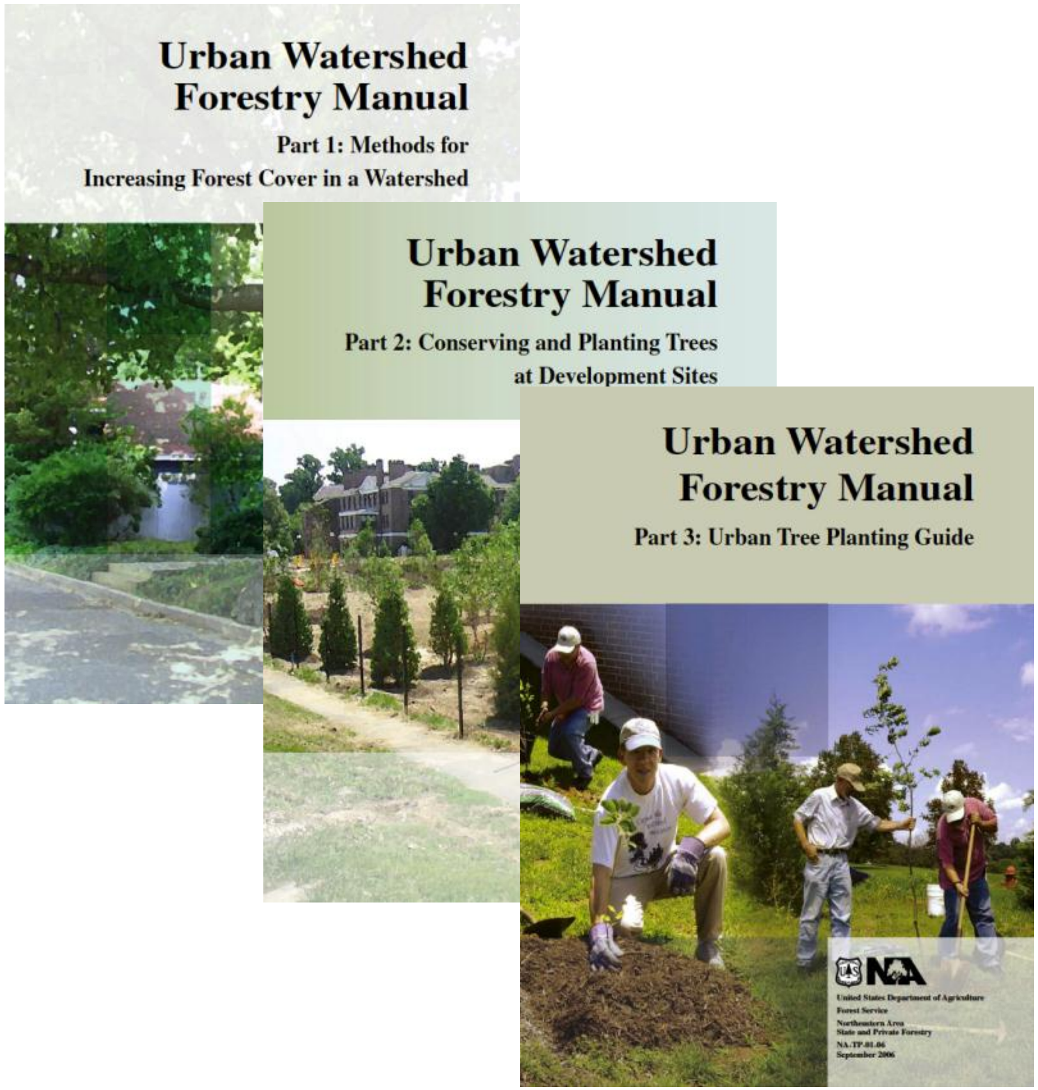
GI: We need to get beyond tree-planting…



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We need to consider integrated, cross-disciplinary systems that function at multiple levels

COUPLED BIOGEOCHEMICAL CYCLES

Coupling biogeochemical cycles in urban environments: ecosystem services, green solutions, and misconceptions

27

Diane E Pataki[1,2*], Margaret M Carreiro[3], Jennifer Cherrier[4], Nancy E Grulke[5], Viniece Jennings[6], Stephanie Pincetl[7], Richard V Pouyat[8], Thomas H Whitlow[9], and Wayne C Zipperer[6]

Urban green space is purported to offset greenhouse-gas (GHG) emi
cool local climate, and improve public health. To use these service
designing and implementing ecosystem-services-based "green infrast
cases the environmental benefits of this infrastructure have been wel
unquantified, and/or outweighed by potential costs. Quantifying b
infrastructure can improve our understanding of urban ecosystem s
tended consequences) resulting from designed urban green spaces. H
biogeochemical processes into designing, implementing, and evalua
structure, and provide examples for GHG mitigation, stormwater ru
quality and health.

Front Ecol Environ 2011; 9(1): 27–36, doi:10.1890/090220

Environmental Management (2010) 45:227–238
DOI 10.1007/s00267-009-9412-7

RESEARCH

Implementing Municipal Tree Planting: Los Angeles Million-Tree Initiative

Stephanie Pincetl

Received: 13 January 2009 / Accepted: 22 November 2009 / Published online: 17 December 2009

Abstract Urban forests are increasingly being seen as an important infrastructure that can help cities remediate their environmental impacts. This work reports on the first steps in implementing a million tree program in Los Angeles and the ways such a biogenic—living—infrastructure has been approached. Numbers of studies have been done to quantify the benefits of urban forests, but little has been written on the process of implementing urban tree planting programs. The investigative methods were primarily qualitative, involving interviews, attending meetings and conducting literature reviews. Results indicate that multiple nonprofit and city administration is determined by who initiates the program.

Keywords Urban forestry · Implementation · Biogenic Infrastructure · Governance · Urban environment

Introduction

For the first time in human history, more than half the world's population is residing in cities (Cohen 2003). Most

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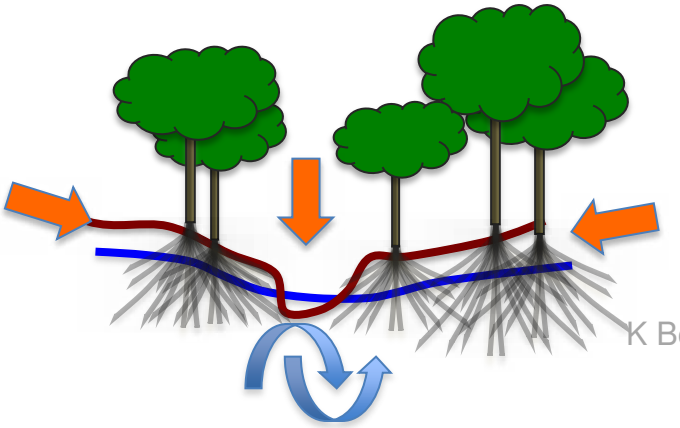
What Can We Apply from Ecohydrological Science?



K Belt Photo, Figure

K. Kallaugher

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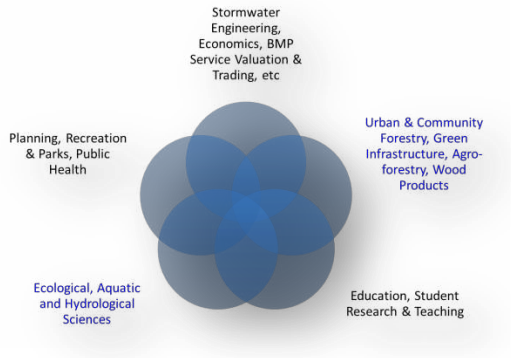

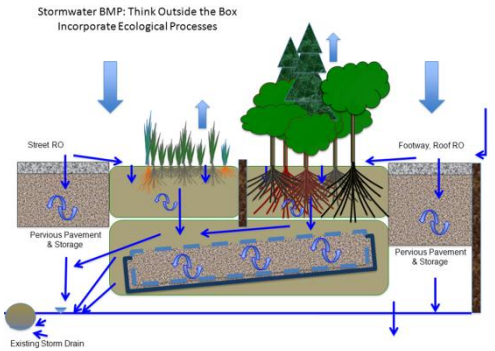

Eco-hydr-forestry… quest for knowledge

Help !

- **Papers Photos & Ideas**
- **Contacts**
- **Contributors**
- **Co-authors**
- **Full Partners…**

- **Ken Belt, USFS**
  kbelt@fs.fed.us

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