Roundtable on Urban Ecohydrology Science and Practice

July 24th, 2012

Drexel University
Philadelphia, PA

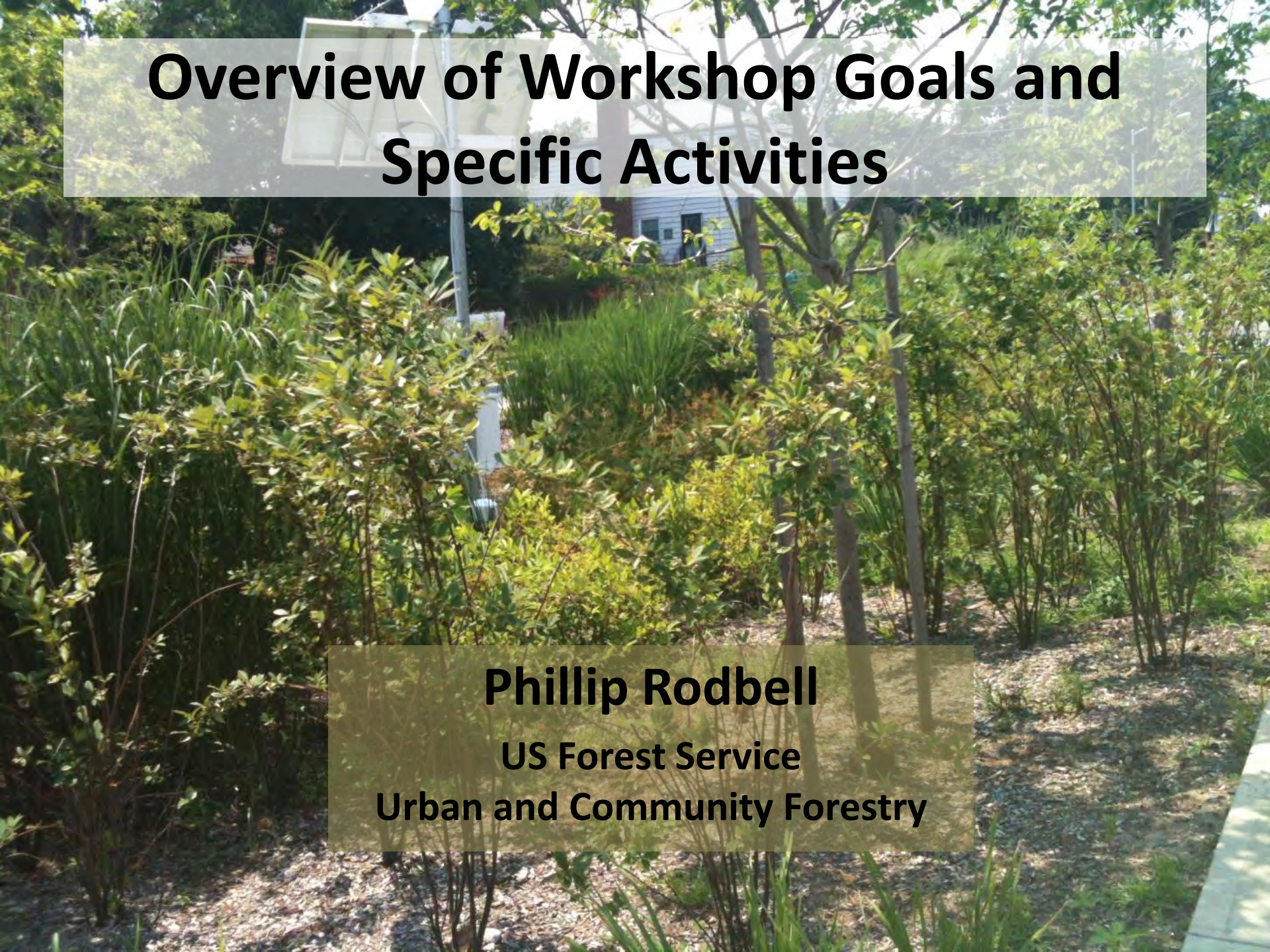
Welcome to Drexel University!

Charles N Haas, PhD, BCEEM, F ASCE, F AAAS, F AAM, F IWA, F SRA

LD Betz Professor of Environmental Engineering

Head - Dept. of Civil, Architectural & Environmental Engineering, Drexel University

Overview of Workshop Goals and Specific Activities



Phillip Rodbell

US Forest Service

Urban and Community Forestry

Workshop Goals

- Explore applied research opportunities in the specialized field of urban ecohydrology
- Engage stakeholders in dialogue regarding the use of green infrastructure for stormwater management & climate change adaptation
- Foster dialogue between researchers and practitioners
- Generate urban ecohydrology research priorities list

Agenda for the day

- 9:30 – 10:10 Introductory presentations
- 10:10 – 11:50 Technical presentations
- 12:00 – 1:00 Lunch a-”roundtables”
- 1:00 – 1:20 Strawperson presentation
- 1:20 – 1:30 Roundtable instructions
- 1:20 – 3:00 Roundtable activities
- 3:00 – 3:30 Report back
- 3:30 – 4:00 Next Steps, Survey

Welcome from CCRUN!

Linda E. Sohl

CCSR/GISS at Columbia University

Consortium for Climate Risk in the Urban Northeast (CCRUN)

A NOAA Regional Integrated Sciences and Assessments (RISA) Project

Boston

New York

Philadelphia

Urban Eco-Hydrology Roundtable

July 24, 2012
Drexel University
Philadelphia, Pennsylvania

Mission

CCRUN conducts stakeholder-driven research that reduces climate-related vulnerability and advances opportunities for adaptation in the urban Northeast

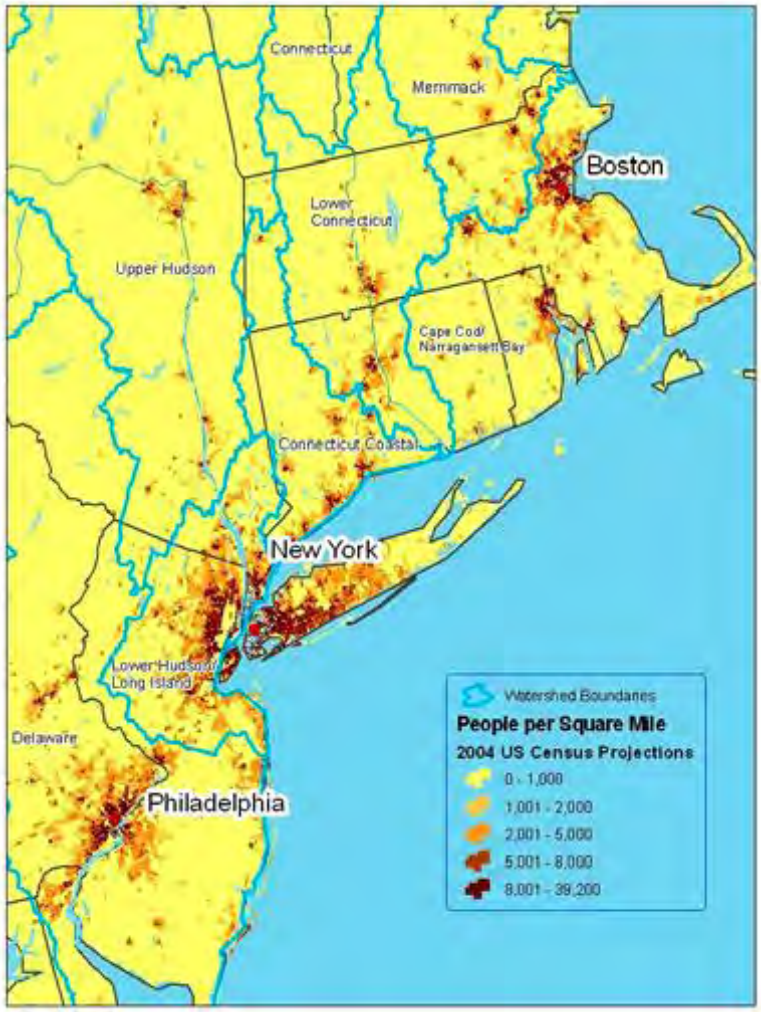
Storm damage in Westchester County, NY, March 12-15, 2010.
Source: James Estrin / *The New York Times*

Striped bass fishing in Boston Harbor.
Source: Capt. Bill Smith / FishBoston.com

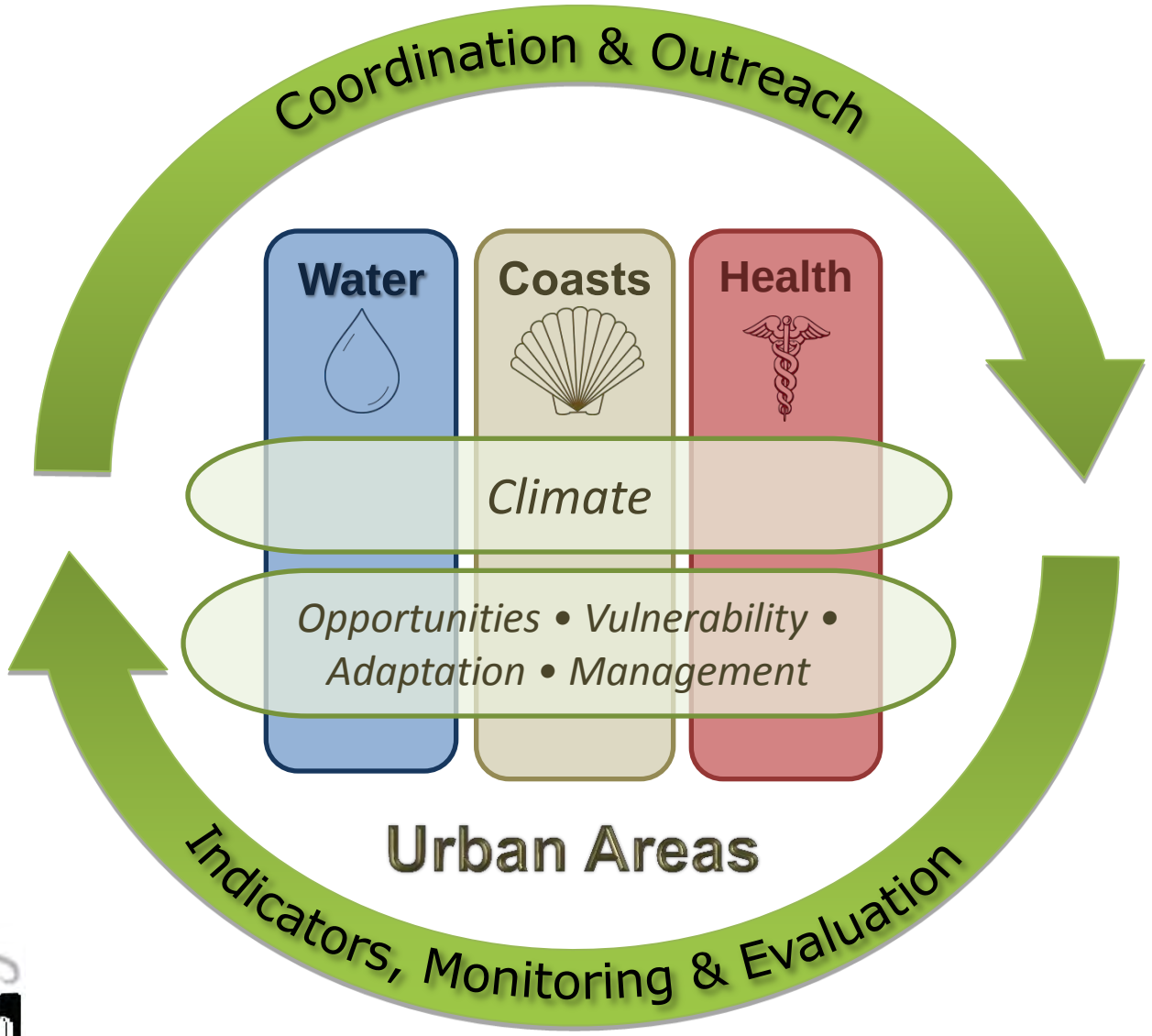
CCRUN

Overview

- Five year project (2010-2015)
- Geographic scope includes the Boston – New York – Philadelphia urban corridor
- Focus on vulnerable populations and infrastructure
- Watersheds, Coastal Zones, and Health sectors



Project Sphere



CCRUN

Objectives

- Develop risk assessments of weather, climate variability, and climate change tailored to urban stakeholder needs
- Integrate interdisciplinary research with stakeholder management of climate risks in the areas of water, health, and coastal zones
- Create and evaluate tools, training activities, and outreach efforts to support enhanced stakeholder capacity to understand climate risks and develop adaptation strategies

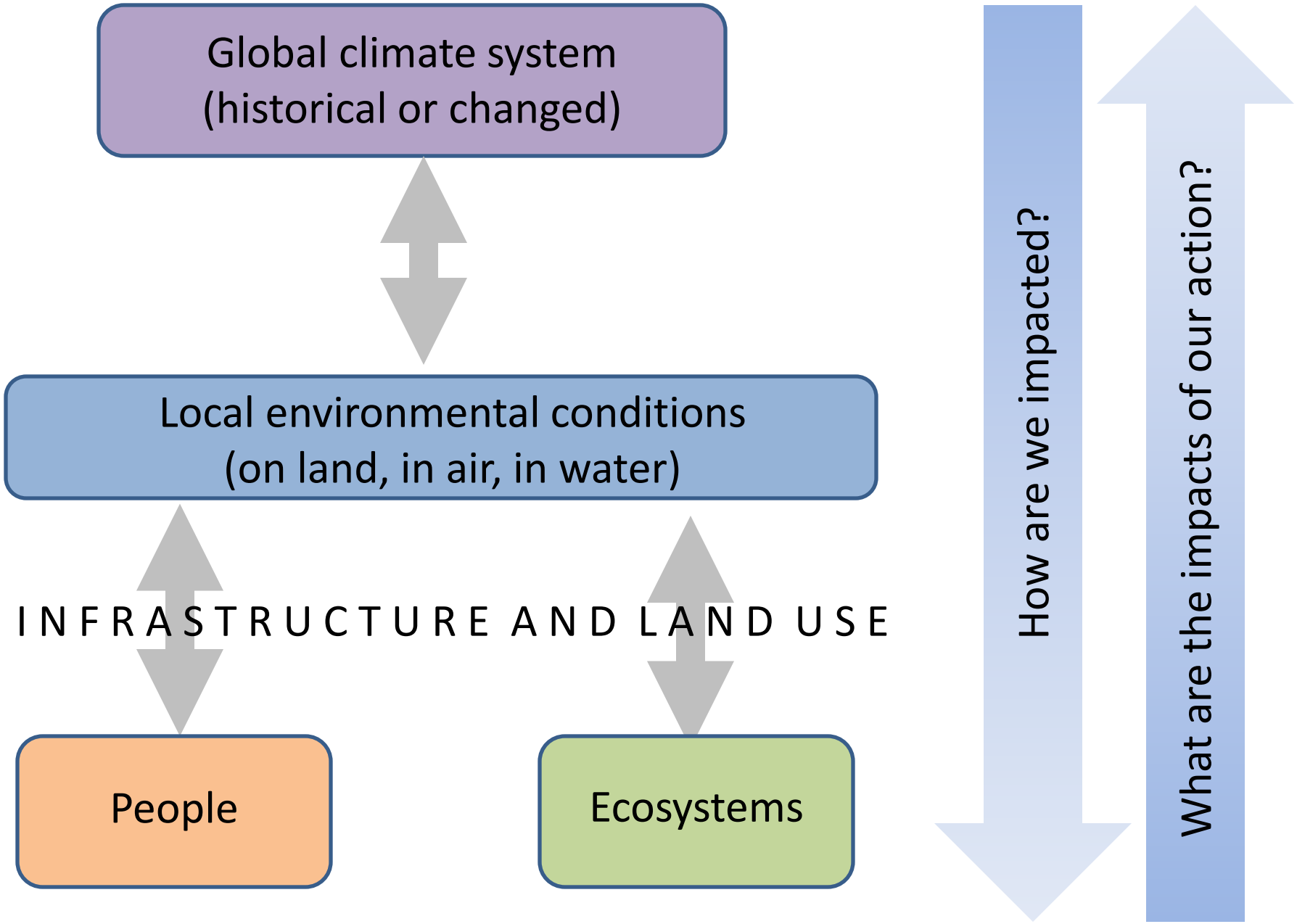
CCRUN

Green Infrastructure as a Climate Adaptation Strategy

Franco Montalto

Dept. of Civil, Architectural, & Environmental Engineering

Drexel Engineering Cities Initiative (DECI)


Global climate system
(historical or changed)
Local environmental conditions
(on land, in air, in water)
INFRASTRUCTURE AND LAND USE
People
Ecosystems
How are we impacted?
What are the impacts of our action?

What is Green Infrastructure?

Strategically placed:

- Impervious surface removal efforts
- Stormwater diversion, storage, & use projects
- Urban natural landscape restoration efforts

Stakeholder interest:

- Cost-effective means to manage urban watersheds and meet water-related infrastructure needs
- Contribution to urban sustainability goals

Relevant Research Questions

- How will infrastructure and land use changes brought about by GI management plans alter environmental conditions (under all possible climatic conditions)?
- How more or less vulnerable to climatic variability will people and ecosystems be with GI in place?
- What scale issues are relevant (space and time)?

Ecohydrology

- Peter Eagleson – seminal papers, 1970s
- The functional interrelationships between hydrology and biota at the catchment scale (Zalewski 2000)
- The hydrologic mechanisms that underlie ecological patterns and processes (Rodriquez-Iturbe 2000)

Urban Ecohydrology

- How relevant/transferable are traditional ecohydrology research results to engineered urban environments?

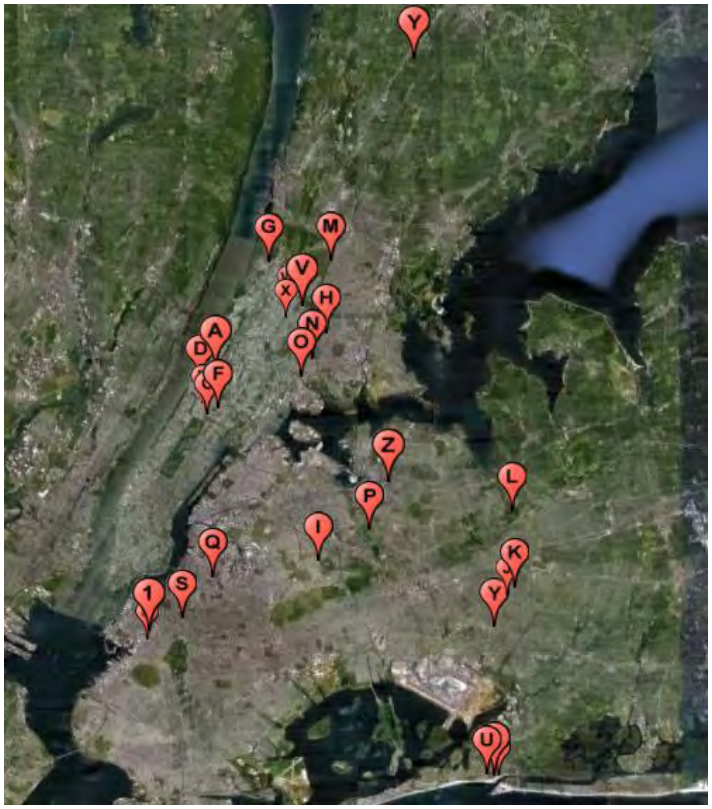
Urban ecosystems characterized by:

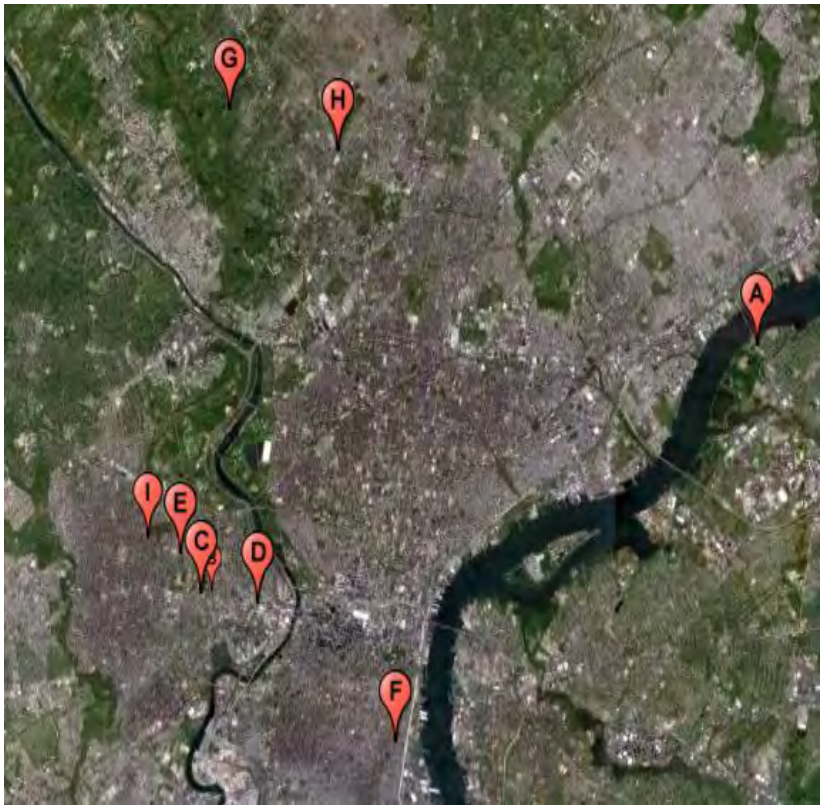
- Habitat patches
- Hard physical boundaries
- Disturbed, imported soils
- Installed plants
- Urban climates

SWRE Lab

GI Monitoring Network

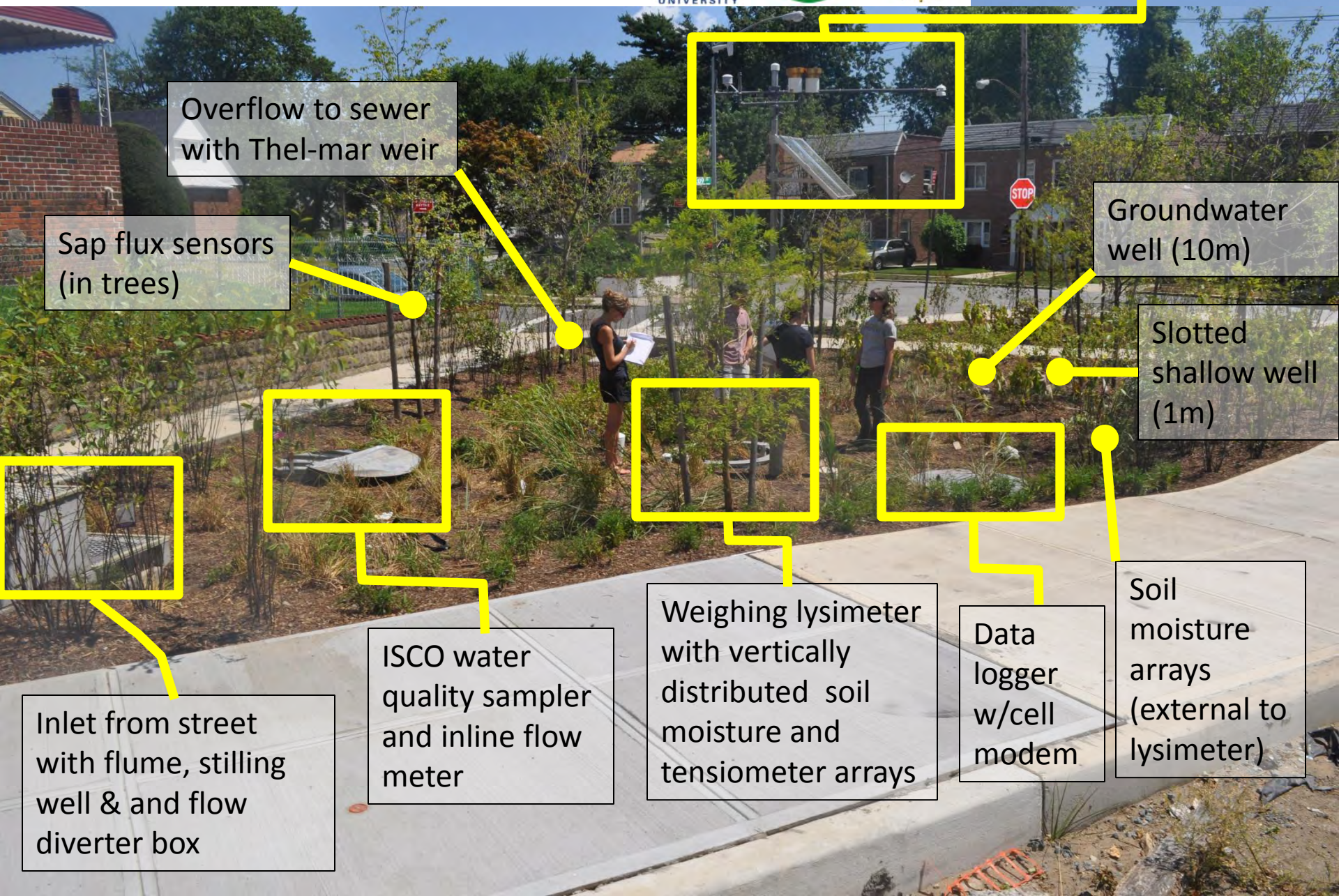
The Sustainable Water Resource Engineering Lab at Drexel University

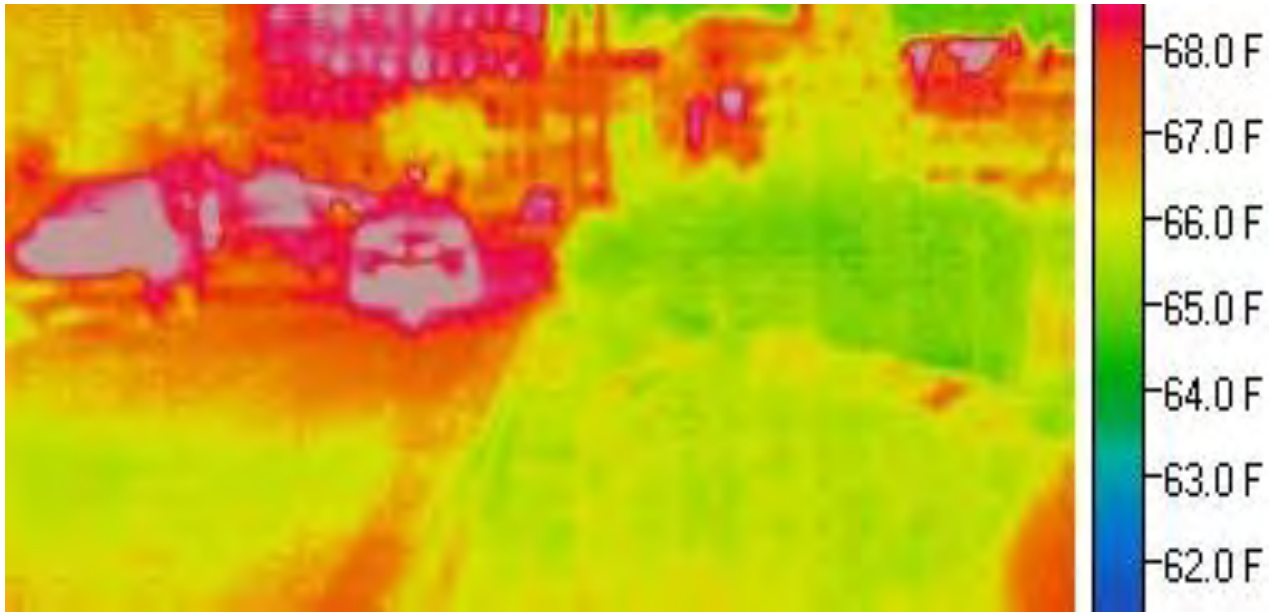




Bioretention "Greenstreet" Monitoring Setup

Nashville & 116th Street, Queens, NY

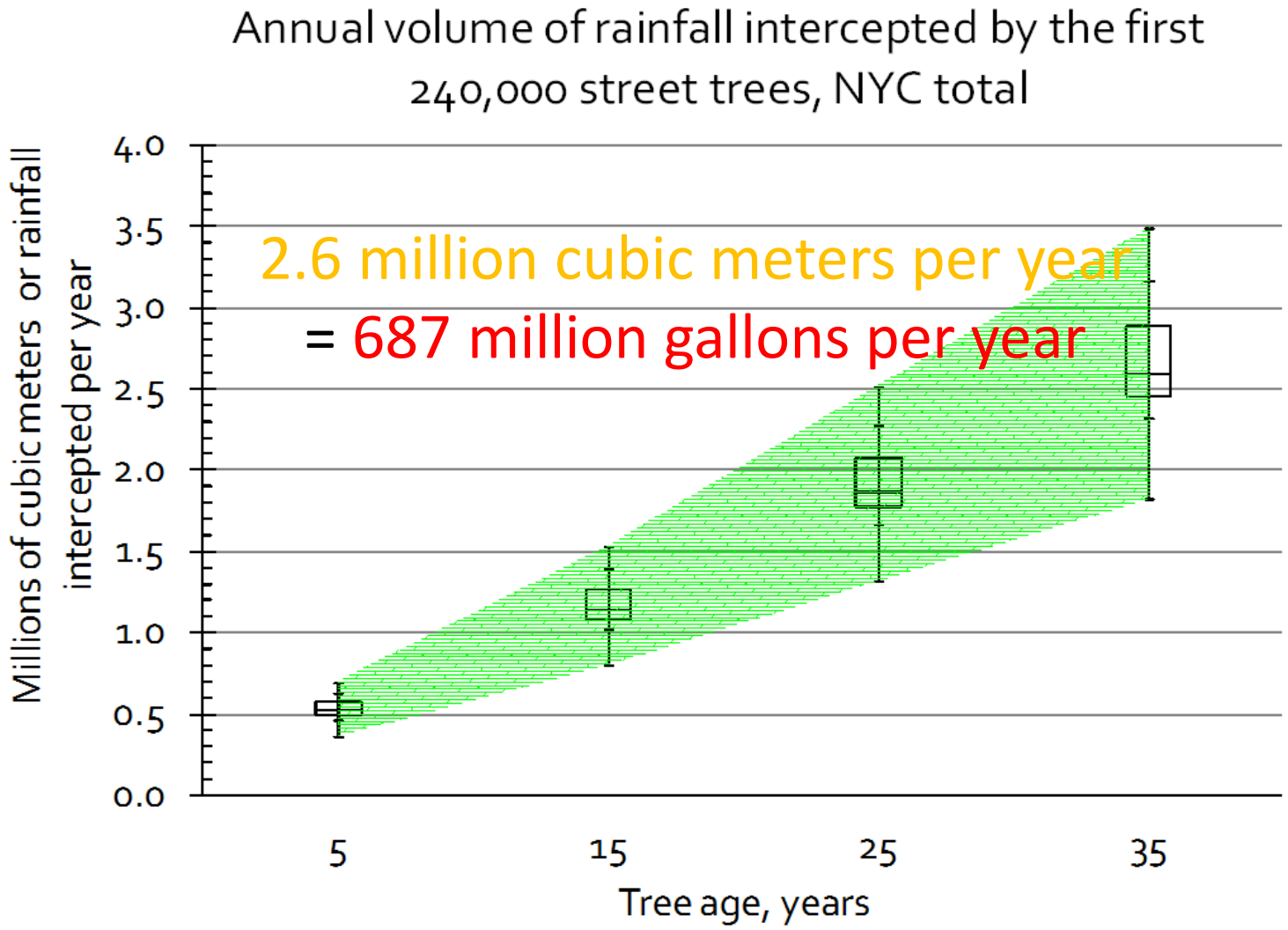


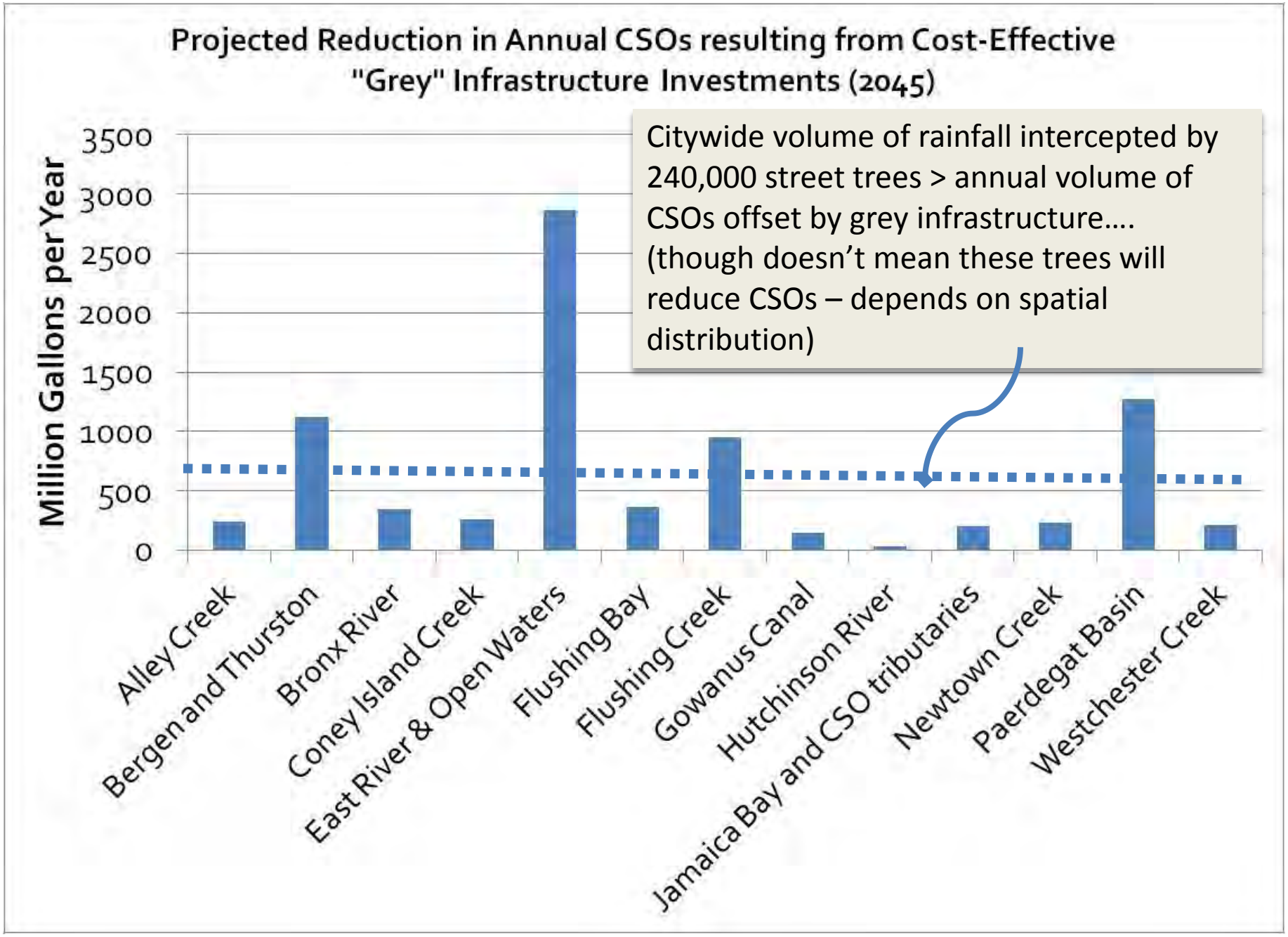


How might GI modify the microclimate of the urban spaces that surround it?

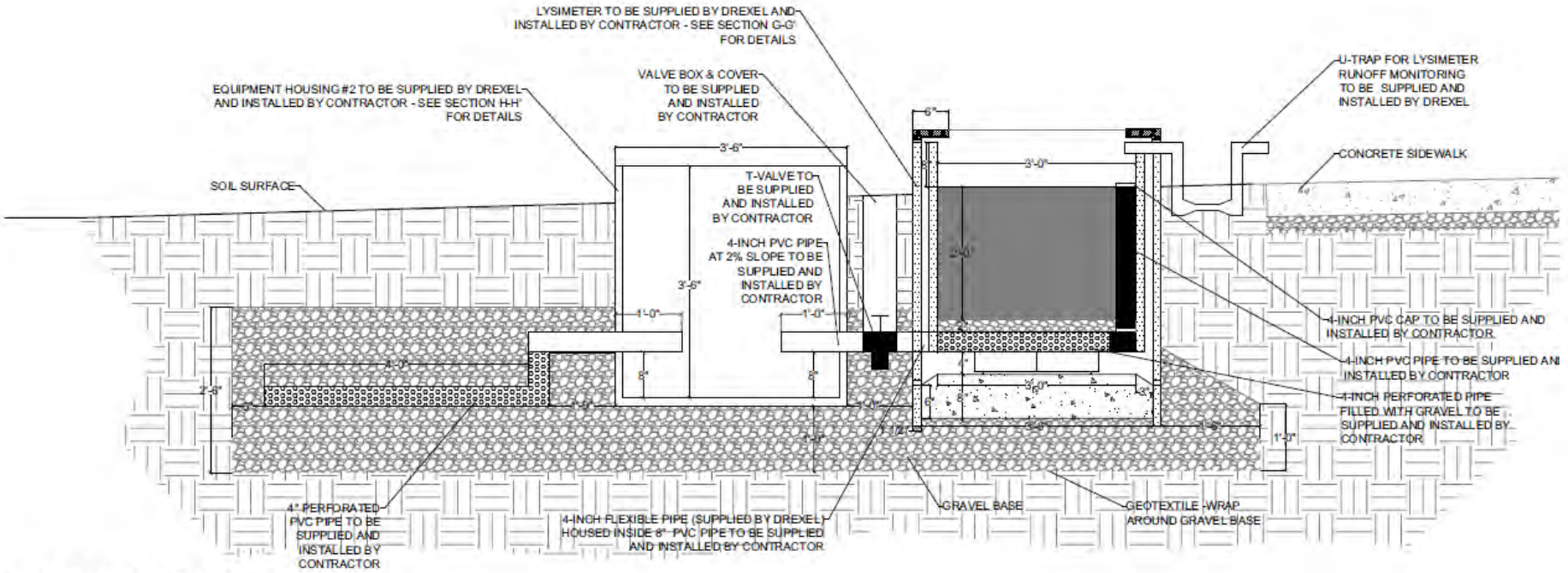
Image: Scott Jeffers

How much precipitation can be attenuated in new urban canopies?




Projected Reduction in Annual CSOs resulting from Cost-Effective "Grey" Infrastructure Investments (2045)
Million Gallons per Year
3500
3000
2500
2000
1500
1000
500
0
Citywide volume of rainfall intercepted by 240,000 street trees > annual volume of CSOs offset by grey infrastructure…. (though doesn't mean these trees will reduce CSOs – depends on spatial distribution)
Alley Creek
Bergen and Thurston
Bronx River
Coney Island Creek
East River & Open Waters
Flushing Bay
Flushing Creek
Gowanus Canal
Hutchinson River
Jamaica Bay and CSO tributaries
Newtown Creek
Paerdegat Basin
Westchester Creek

Weighing Lysimeters
(evapotranspirometers)



SECTION B-B' 1/2" = 1'
COLFAX AND MURDOCK

Weighing Lysimeters
(evapotranspirometers)

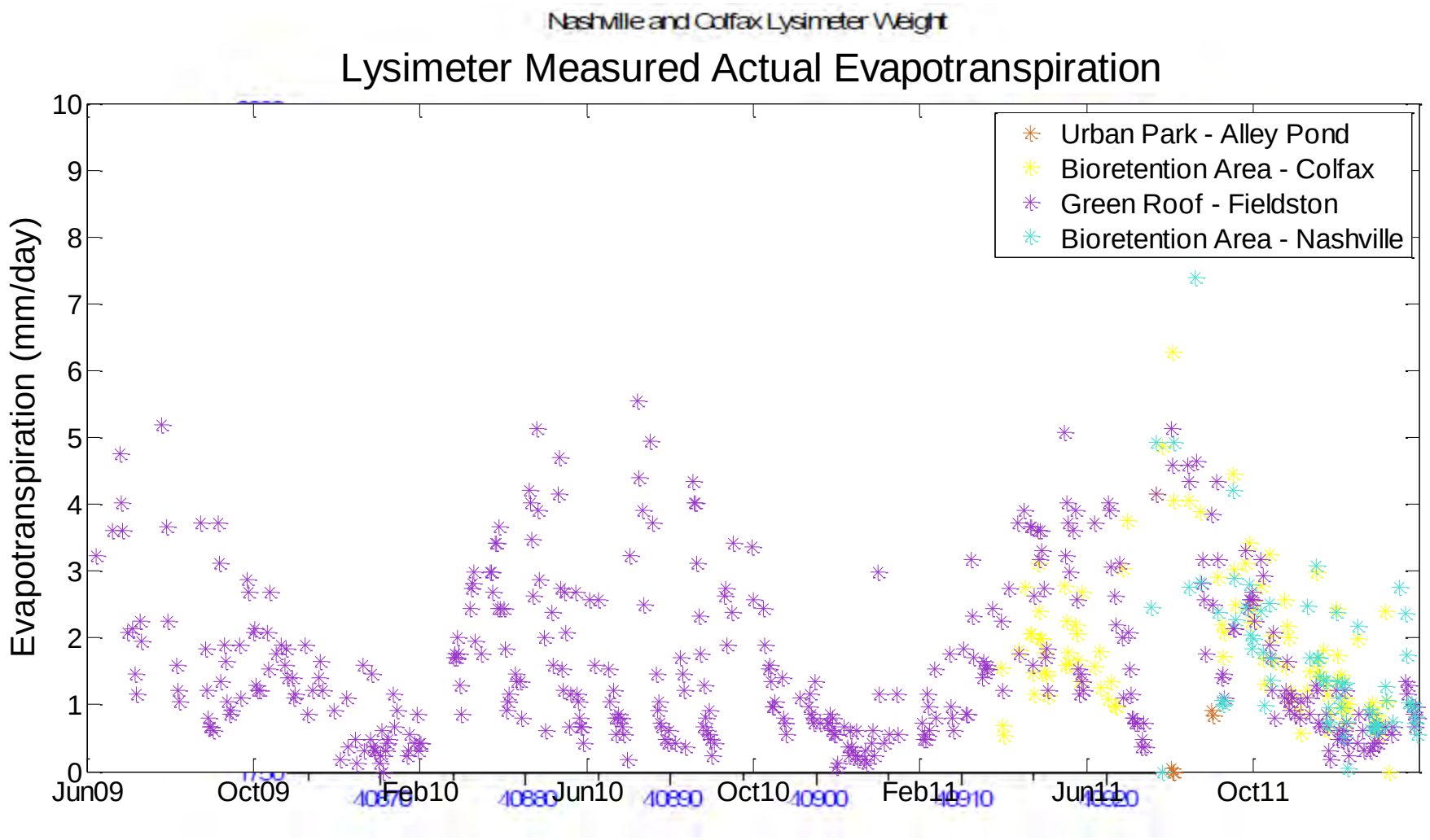
Green Roof – Fieldston
Sedum species

Bioretention Area (un-irrigated) – Colfax (left)
Aster dumosus

Bioretention Area (irrigated) – Nashville (right)
Juncus effusus

Urban Park – Alley Pond (left)
Mixed natives

How different is ET in different urban green spaces?



DiGiovanni et al (in preparation)

How different are soil moisture patterns in GI systems from natural landscapes?

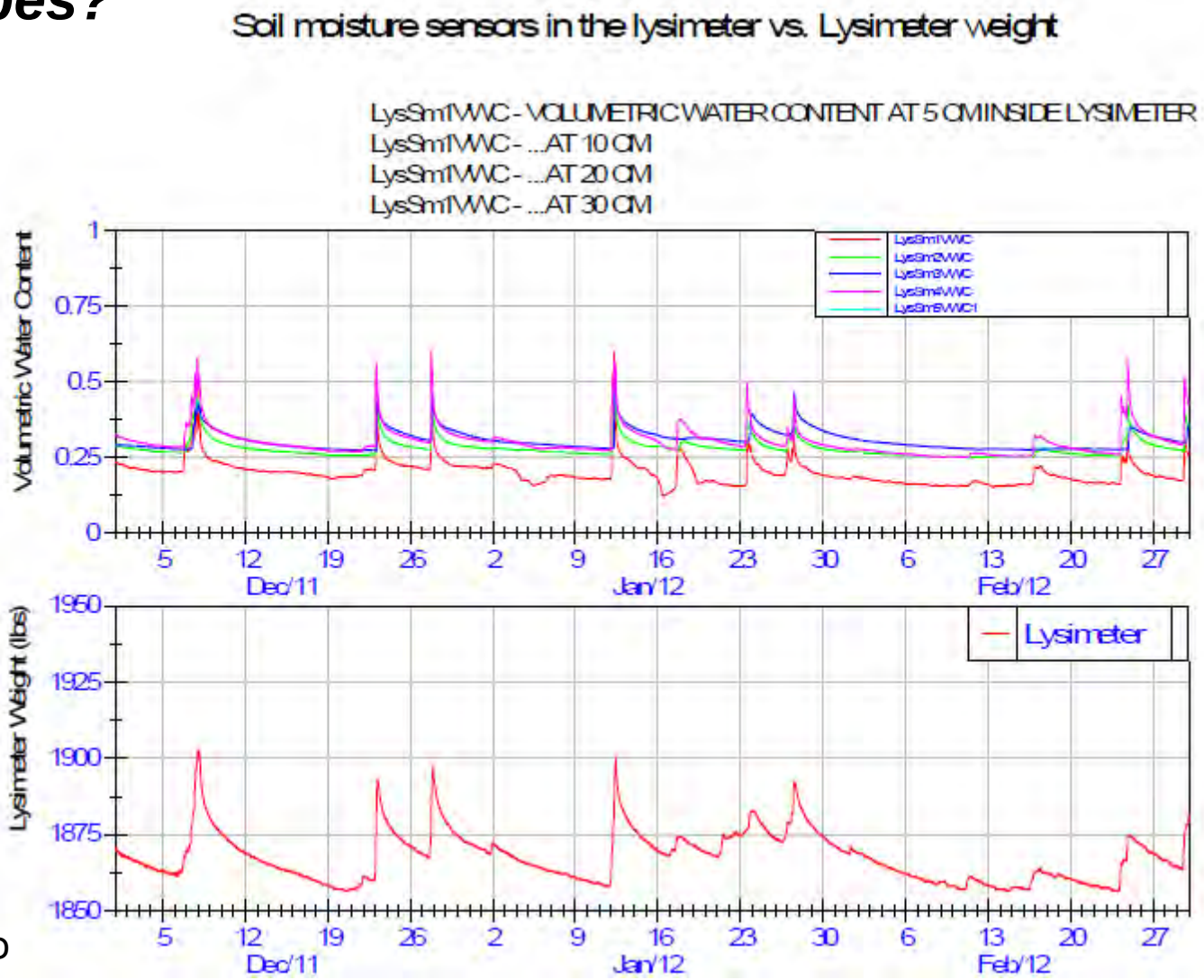
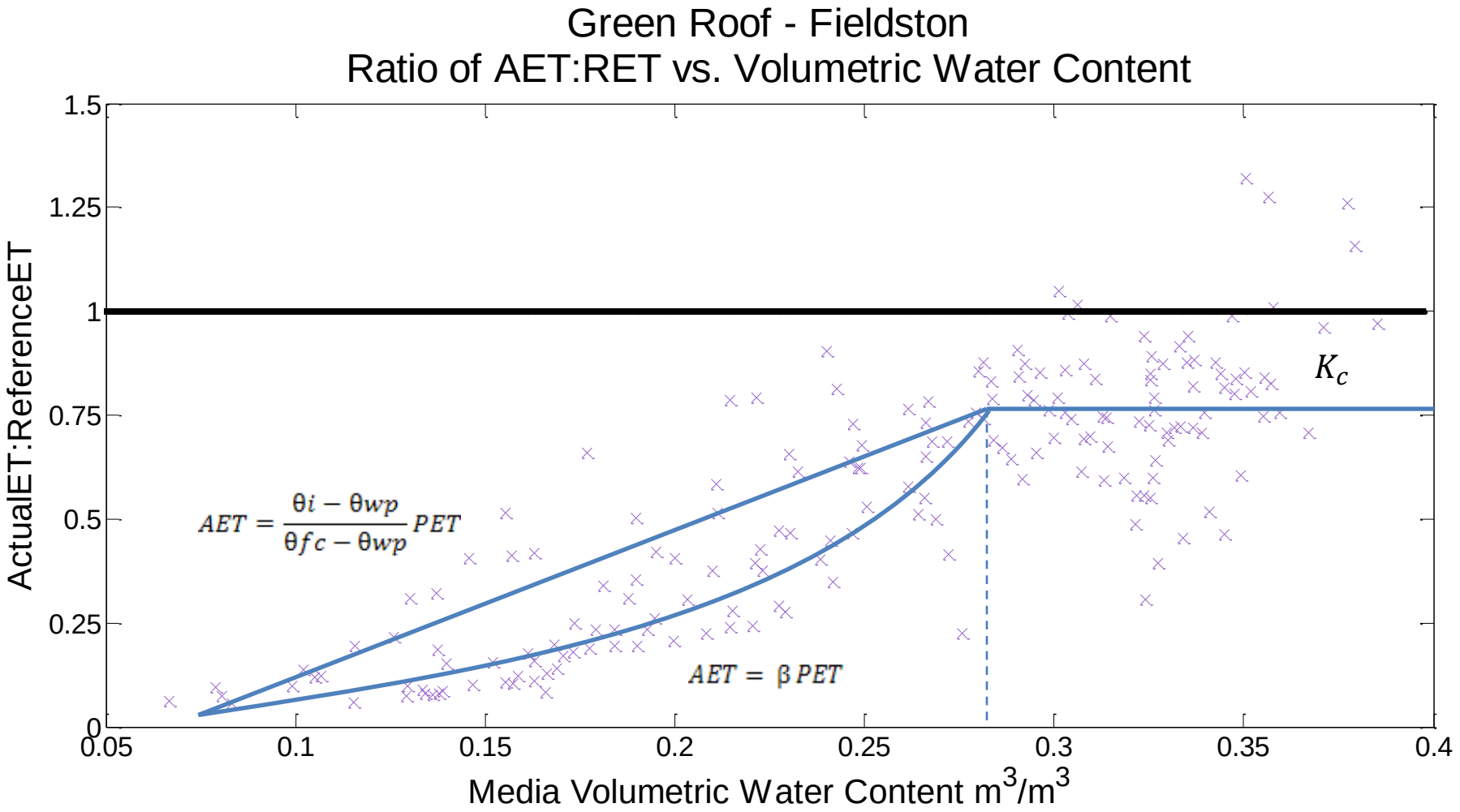


Image: Ryan Asensio

Are classical equations used to predict ET valid in the urban environment?



DiGiovanni et al (in preparation)

How different are infiltration rates from different urban green spaces? How do these compare to rainfall intensities?

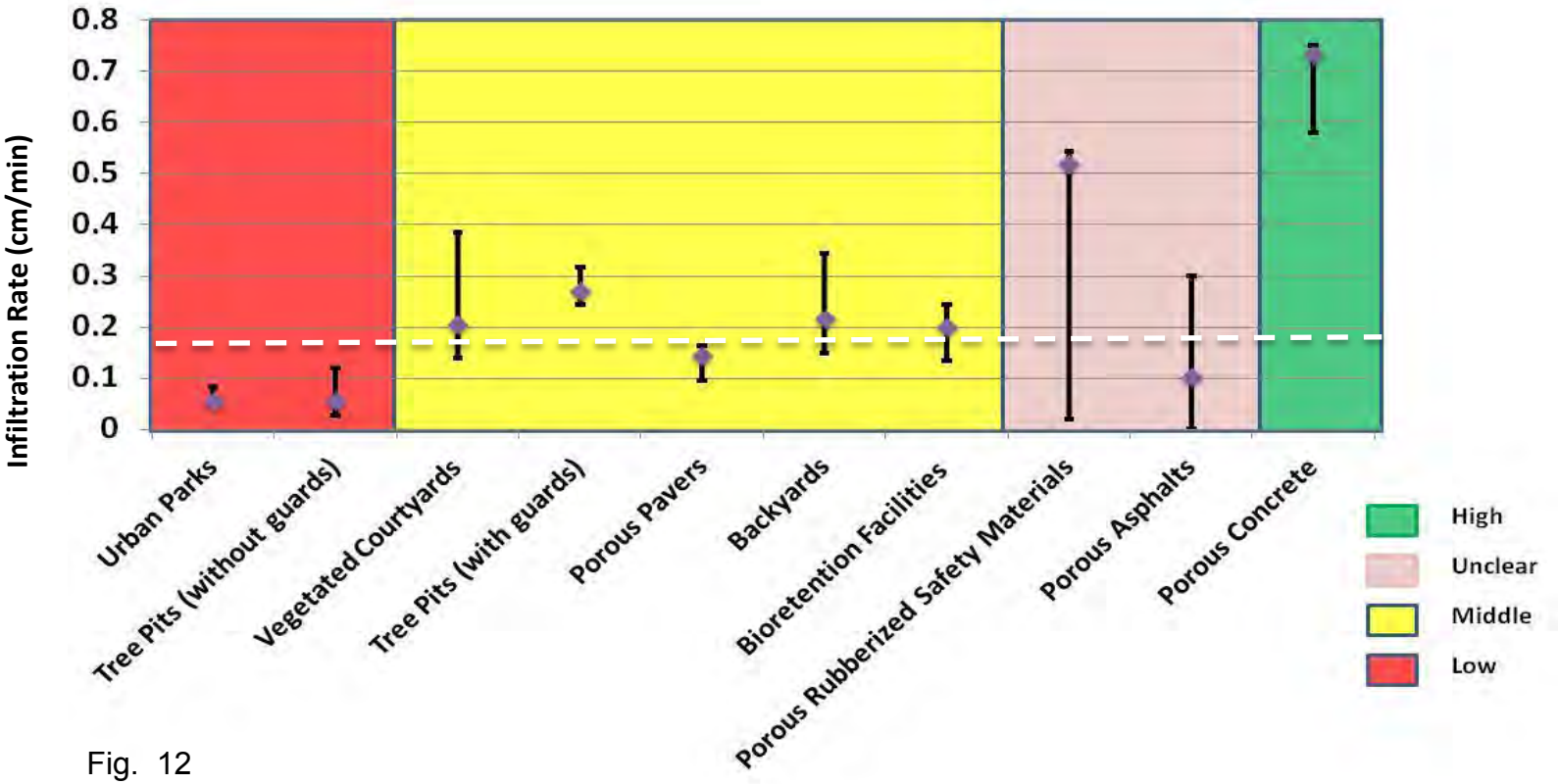
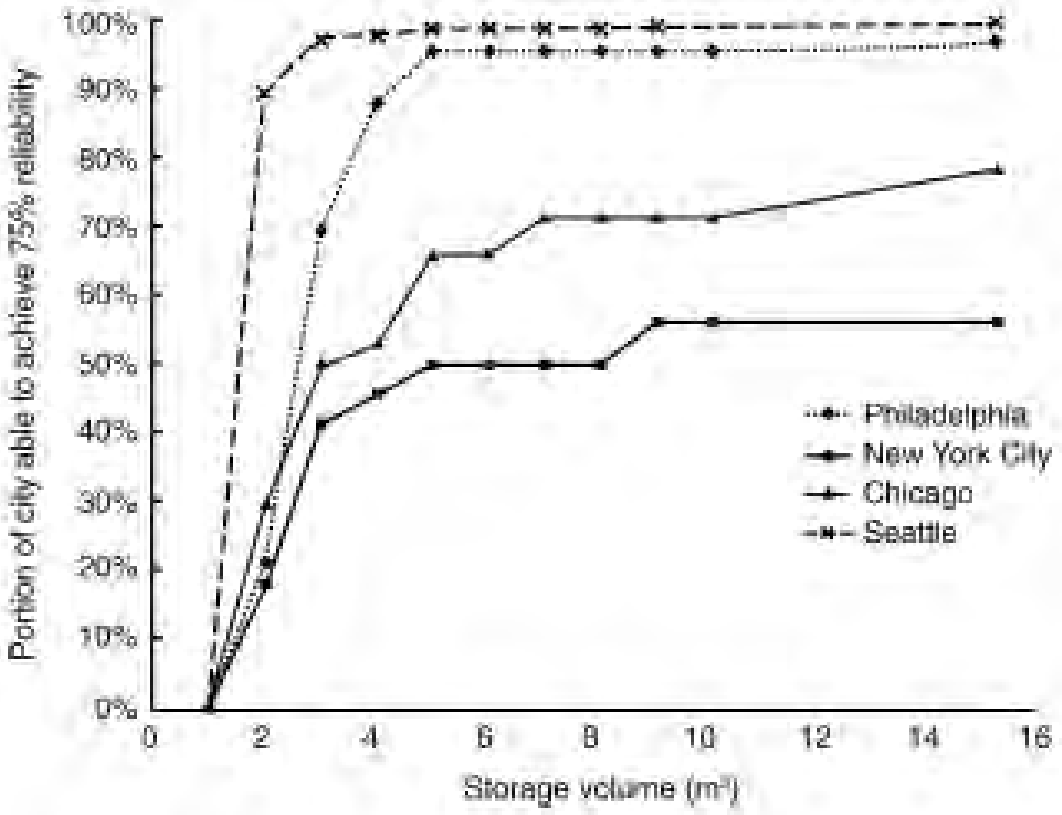


Fig. 12

Alizadehtazi et al (2012, forthcoming)

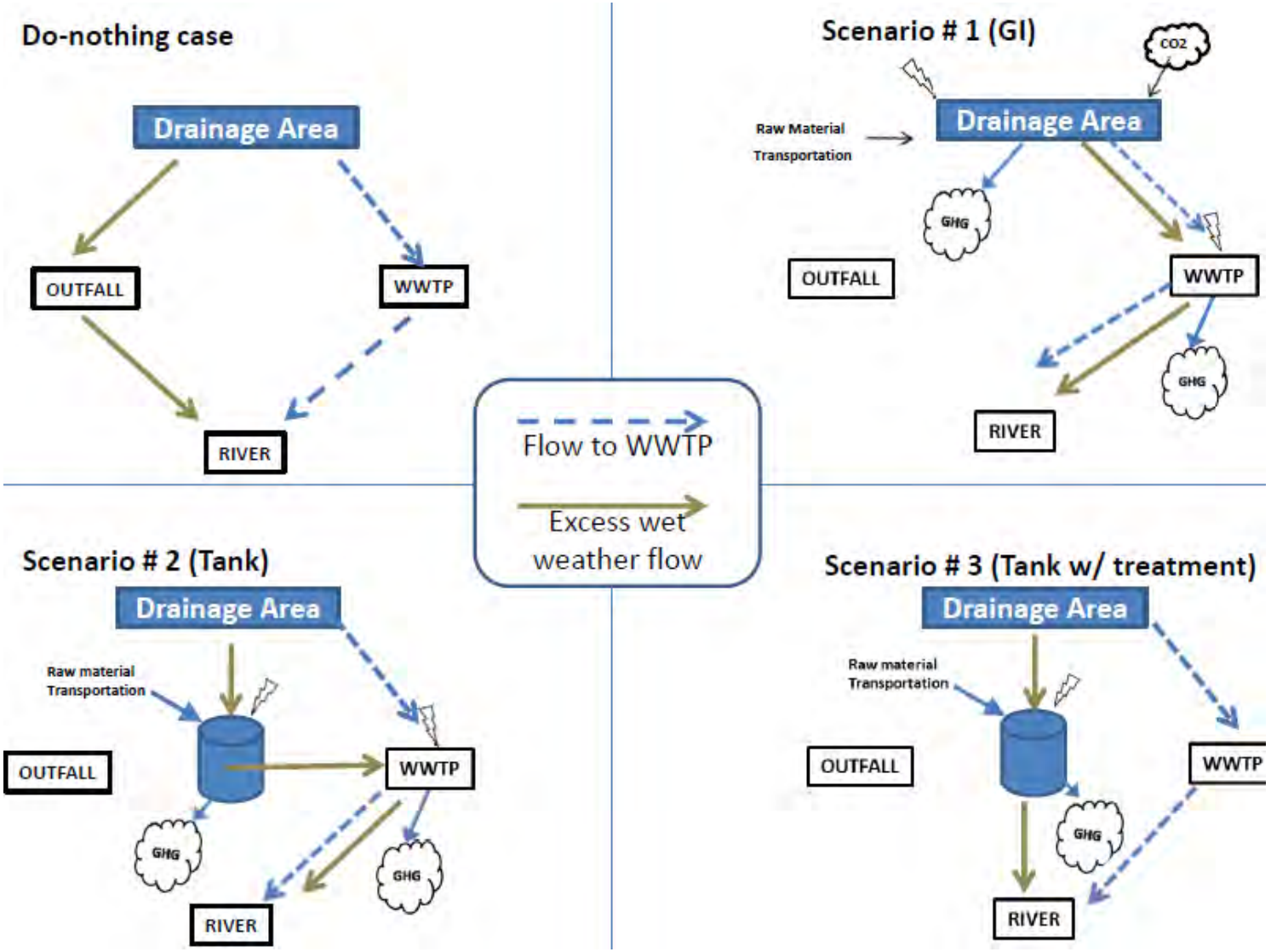
How much more resilient to drought can we become if we use urban stormwater productively?



15.10 Estimation of the portion of residential buildings achieving 75% reliability with different storage volumes.

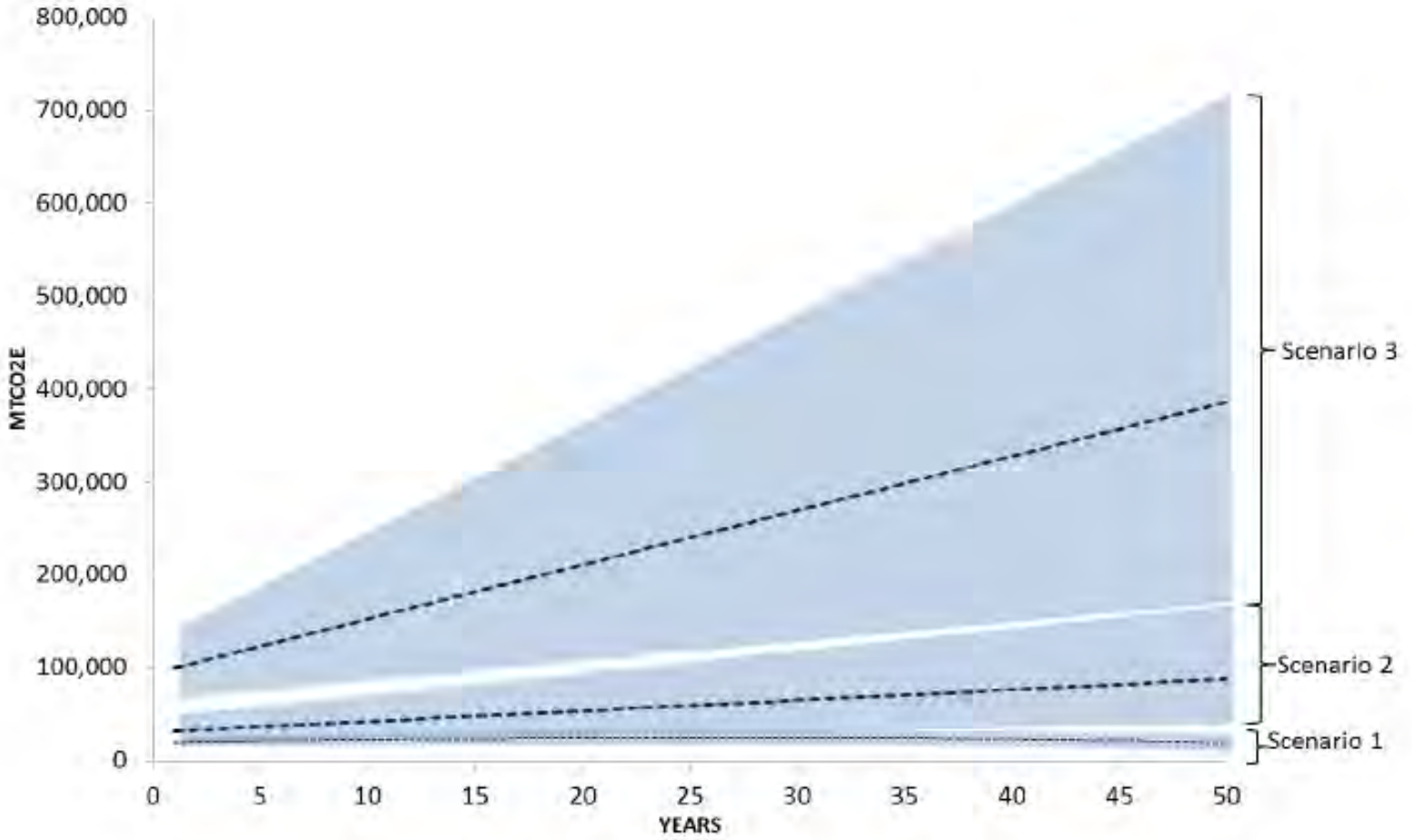
Rostad and Montalto (2012)

Can GI offset CO2 emissions?



Catalano de sousa et al (accepted)

Can GI offset CO2 emissions?

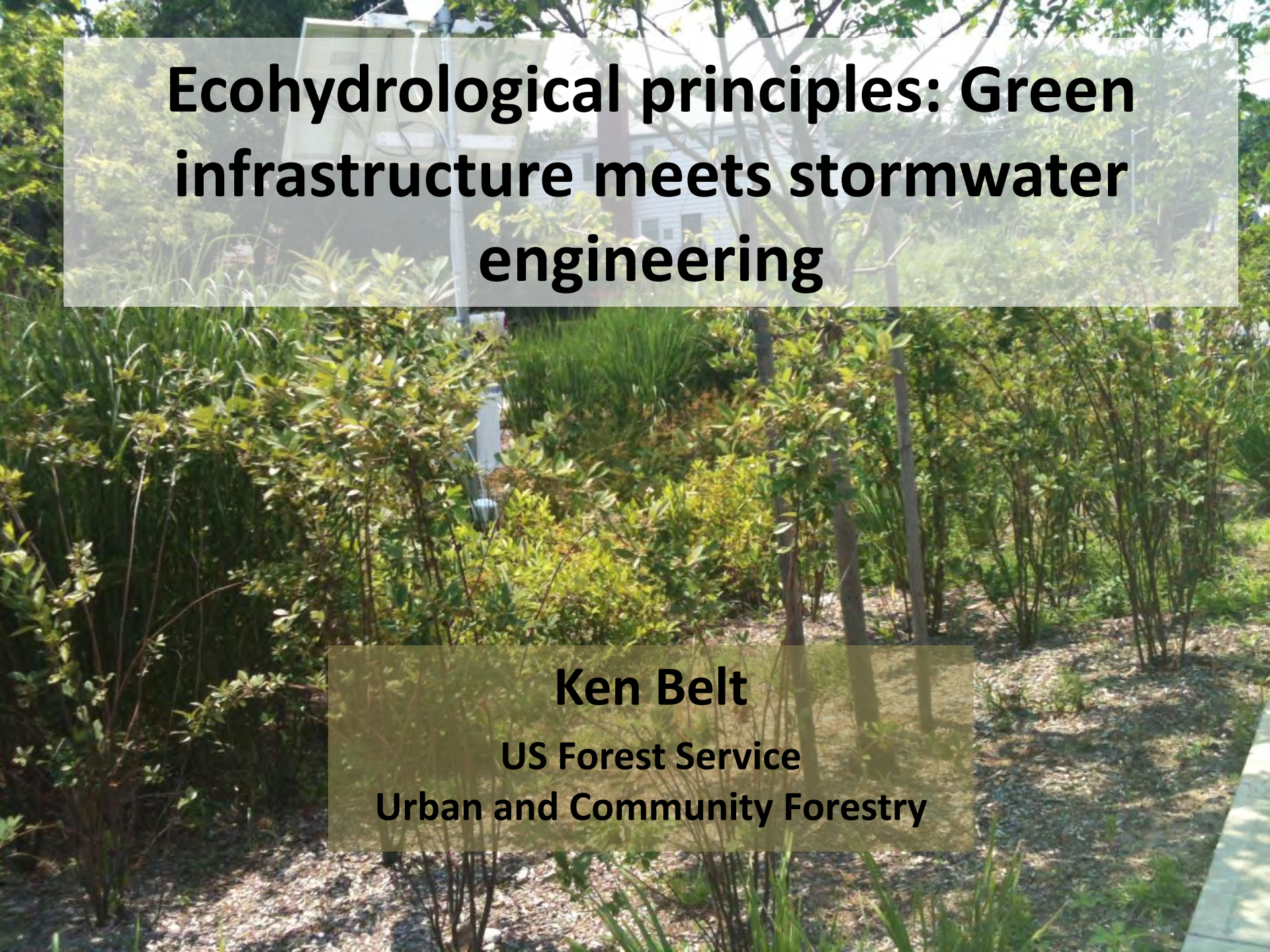


Catalano de sousa et al (accepted)

Concluding remarks

- We are currently changing urban ecosystems in unprecedented new ways
- The flow of water through urban ecosystems determines urban environmental quality and resilience to stressors (like climate change)
- Adaptive management is only possible if we are systematically documenting the effects of what we are doing and developing improved predictive capabilities.

Ecohydrological principles: Green infrastructure meets stormwater engineering



Ken Belt

US Forest Service

Urban and Community Forestry

Technical presentations

What decisions are practitioners making and what research is needed?

Lunch & Afternoon logistics