Green Infrastructure in Context: Public Health and Ecosystem Services

www.epa.gov/research

[1]Laura Schifman, [1]Alessandro Ossola, [2]Christopher Nytch, [3]William Shuster, [4]Danny Wiegand, [3]Matthew Hopton

[1]NRC Postdoctoral Research Associate, National Risk Management Research Lab, U.S. Environmental Protection Agency, Cincinnati, OH, [2]Environmental Sciences Dept., University of Puerto-Río Piedras Campus, San Juan, PR, [3]National Risk Management Research Lab, U.S. Environmental Protection Agency, Cincinnati, OH, [4]Gulf of Mexico Program, U.S. Environmental Protection Agency, New Orleans, LA.

Laura Schifman I Schifman.Laura@epa.gov I +1 513-569-7424

Background

- **Green infrastructure** (GI) in urban systems primarily acts as a stormwater control measure, however additional ecosystem services (ES) can be generated [1].
- ES depend upon **hydro-ecological processes** and directly interact with **socio-economic characteristics** of urban systems.
- Public health, as related to mosquito-borne diseases (e.g., Zika, Chikungunya, West Nile and Dengue viruses), is generally not considered in ES assessment.
- Public health priorities elicit **tradeoffs** between stormwater management through runoff retention/detention and suitable mosquito breeding habitat for *Aedes aegypti* and *A. albopictus*.

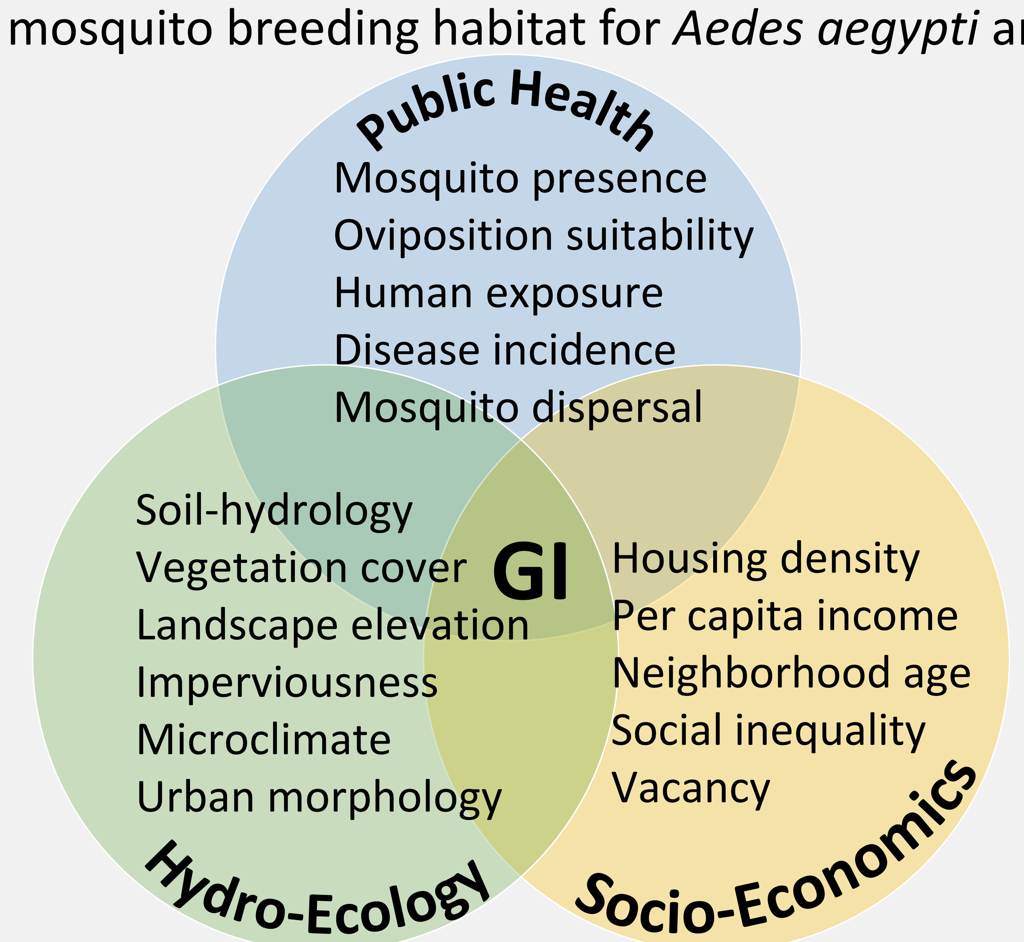


Figure 1. *Interplay between Hydro-Ecology, Socio-Economics, and Public Health that influence the tradeoffs faced when designing GI for stormwater management in subtropical urban areas.*

Methods

Field Sampling. Mosquito abundance data will be acquired from datasets collected by Centers for Disease Control and Prevention (Caguas, PR) and the New Orleans Mosquito, Termite and Rodent Control Board (New Orleans, LA) from 2013 – 2016.

Geospatial Data. Remotely sensed data (e.g., LiDAR, multispectral imagery) and census block socio-economic data will be acquired to calculate metrics related to vegetation structure, imperviousness, urban morphology and socio-economic settings of neighborhoods. Mosquito abundance data will be related to geospatial metrics and GI structure.

Lay of the Land: New Orleans, LA and Caguas, PR

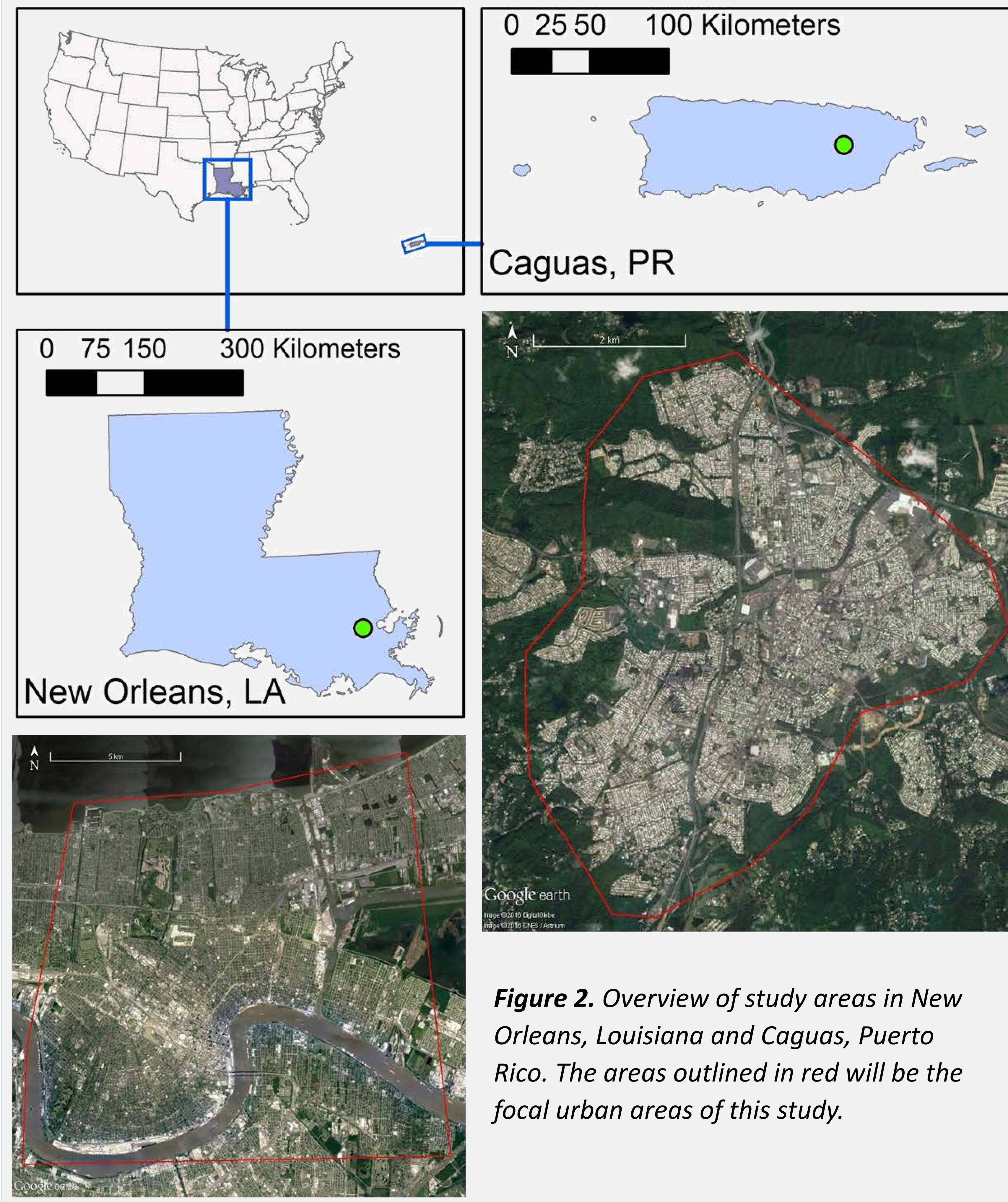


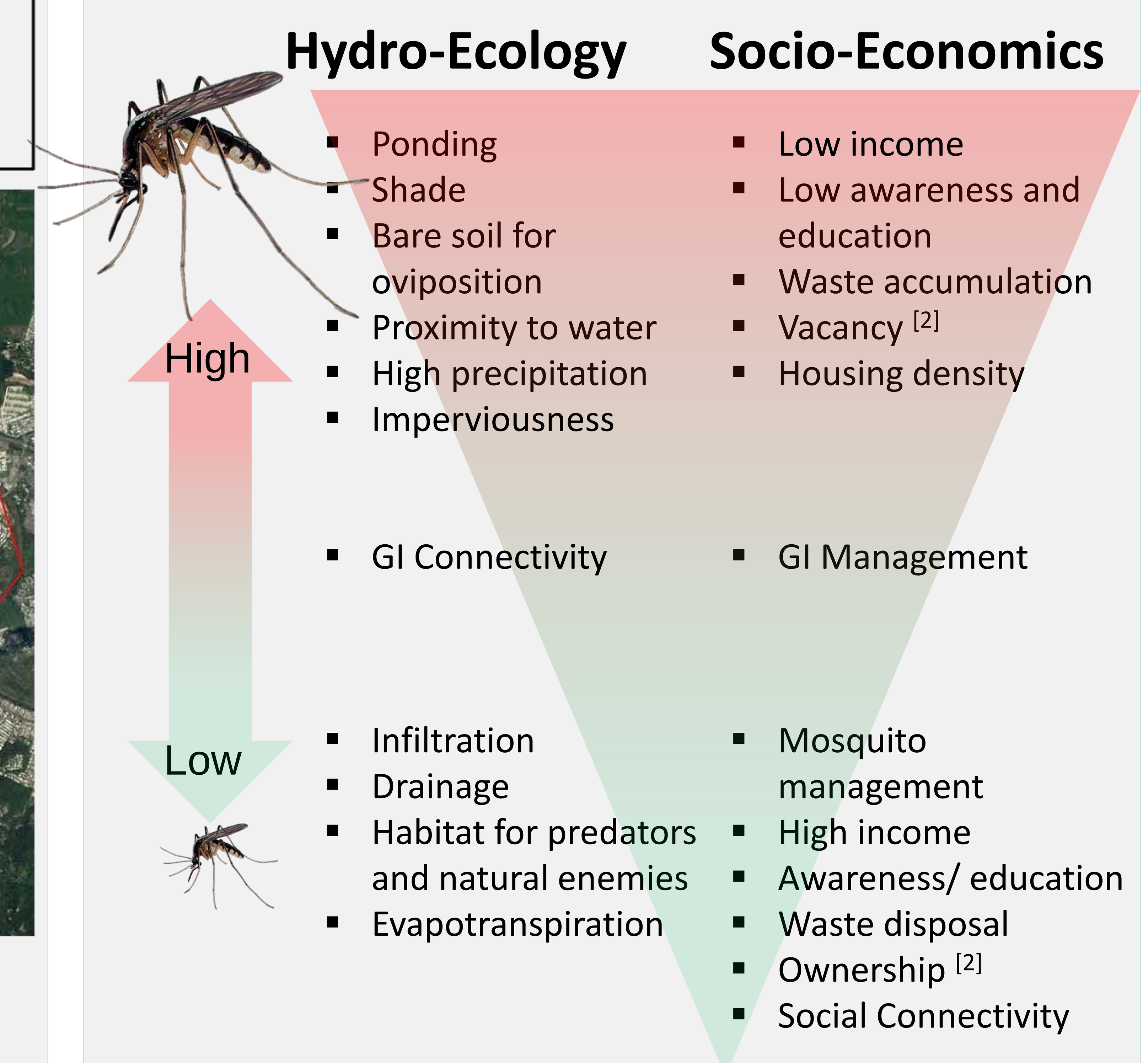
Figure 2. *Overview of study areas in New Orleans, Louisiana and Caguas, Puerto Rico. The areas outlined in red will be the focal urban areas of this study.*

Descriptive qualities applicable to both cities:

- High mosquito presence year-round due to **subtropical climate**.
- **Urban areas** in subtropical climates with different GI characteristics.
- High concern for public health threats related to a number of **mosquito borne diseases**.
- Even though GI is critical in **stormwater management**, there are potential tradeoffs with ecosystems related to public health.

Working Hypothesis

Figure 3. *Expected outcomes of mosquito abundance in relation to the hydro-ecological and socio-economic drivers.*



Ways forward

- With social-environmental change and increasing urbanization GI could enhance hydrological services, but also contribute to public health benefits (e.g., pest management and control of mosquito breeding habitat).
- Integrating sustainability and resilience into planning and (re-) design of GI can enhance the livability of cities.
- Incorporating socio-hydrologic principles into water management can advance our understanding of ecosystem services in terms of public health.

Acknowledgements. LAS and AO held NRC Research Associateship appointments at U.S. EPA while this research was carried out. The authors would like to thank Roberto Barrera (CDC), Sarah Michaels and Brendan Carter (New Orleans Mosquito Control Board) for providing input so far. The views expressed are those of the author[s] and do not necessarily represent the views or policies of the U.S. EPA.

References. [1] Schifman, L.A., D.L. Herrmann, W.D. Shuster, A. Ossola, A. Garmestani, M.E. Hopton. (under review). Situating Green Infrastructure in Context: A Framework for Adaptive Socio-Hydrology in Cities.
[2] Ossola A., D.L. Herrmann, L.A. Schifman, A. Garmestani, K. Schwarz, M.E. Hopton. (under review) The provision of urban ecosystem services throughout the private-social-public domain : A conceptual framework.