Urban aquatic ecosystems: a synthesis working group proposal

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Other members of steering committee: Sujay Kaushal (BES), Bill McDowell (LUQ), John Melack (SBC), Emily Stanley (NTL), and Wil Wollheim (PIE).

Background and Rationale

Aquatic ecosystems in urban environments are highly modified by human activity, engineering, and design. These systems are critical in delivering ecosystem services to urban residents, who comprise over 80% of the US population. This synthesis working group builds upon two impromptu meetings of interested persons held at the 2012 ASM[1]. Based upon our discussions, we propose to initiate comparative analyses of modifications of urban aquatic ecosystems in different parts of the U.S., exploring both the drivers/motivations for those modifications as well as the consequences for ecosystem function and for people, and potential feedbacks between drivers and consequences.

Urban aquatic ecosystems are varied: from streams draining small, suburban watersheds to buried streams in pipes; from retention basins and ponds to bioretention cells; from natural lakes and wetlands surrounded by urban development to constructed lakes and wetlands (including wastewater treatment wetlands), among many others. Many urban areas develop along rivers or estuaries. Hydrologic modification associated with urbanization is often extensive, involving hard engineering or "soft" design. We intend to focus on these modified aquatic ecosystems to assess their prevalence, distribution, and function across several LTER sites that have an urban research focus. We ask, *what are the primary drivers or motivations for urban water infrastructure design, and how do different infrastructure designs affect hydrologic connectivity, aquatic ecosystem function, and the delivery of ecosystem services?*

A large group participated in our initial ASM meetings, and many potential research questions and hypotheses emerged that illustrate the richness of the discussion. With available data resources as well as work already completed at several sites, we have a strong foundation for this working group's activities.

Examples of questions and hypotheses to be explored by the urban aquatics working group
Does urbanization homogenize aquatic ecosystems like it does terrestrial ones?
How do we define streams in the urban environment? – update of the urban stream syndrome
How does design for drainage, water supply, or wastewater enhance or lessen resilience to climate variability and change?
How does hydrological connectivity differ among different cities, on urban-rural gradients within cities or regions?
What is the historical trajectory of change in hydrologic infrastructure, and are there legacy effects of past hydrologic modifications on current hydrologic landscapes?
Hypothesis: Urban aquatic ecosystems differ according to motivations or intents of hydrologic modification: delivery, stormwater, wastewater, and aesthetics.
Hypothesis: Drivers and motivations vary with geographic location due to a) climatic/biophysical constraints and b) sociopolitical/ historical constraints on design.
Hypothesis: Infrastructure design promotes hydrologic connectivity in older and more humid regions, and restricts hydrologic connectivity in newer and drier regions.

[1] One of these meetings was held in conjunction with the "ClimHydro" working group organized by Julia Jones

Goals

The goals of this synthesis working group are to 1) coordinate organization of data on spatial distribution, numbers, and kinds of aquatic ecosystems in urban areas associated with participating LTER sites (high-resolution data available for many sites); 2) build a database of explanatory variables for urban aquatic ecosystem design, including such factors as development age, primary use of system (e.g., stormwater conveyance vs. aesthetic considerations, data available from infrastructure maps), climatic and hydrologic conditions (data from ClimDB and HydroDB), and socio-economic information (using census dataset assembled for EcoTrends); 3) build community of collaborators and enhance interaction among LTER graduate students working in urban ecosystems; 4) develop a comparative pilot project that will lead to a manuscript and provide a foundation for development of further cross-site research; and 5) develop a framework for ecosystem services in urban infrastructure.

Proposed activities and expected products[2]

We propose to hold two working-group meetings or workshops. The first meeting, involving the PIs and graduate students receiving stipends (see budget) will be held for three days early in 2013 at CAP, and will focus on data compilation, development of design and methods for the pilot project, and organization of communication, tasks, and scheduling for the ensuing four to six-month period. Prior to this workshop (in early December, 2012), we will hold a Web conference with students interested in participating in the working group from multiple sites. Although we will select four students to receive stipends and lead the pilot project, other students will be encouraged to participate remotely. The second, four-day meeting will be held in early-mid summer at BES or SESYNC (pending proposal acceptance), and will also include faculty and/or post-doctoral participants from sites that have committed to the project. At the second meeting, the graduate students will report on their pilot project, and will lead the outlining and initial writing of a manuscript. Other participants will spend the majority of the workshop time developing ideas for continued collaborations that might lead to future funding. The pilot project, data compilation, and manuscript will contribute to a strong foundation for continued collaborative research. All funds will be spent by August 1, 2012.

Participants

The table at right lists individuals who participated in the ASM meetings, with additional contacts listed in italics. The organizing committee is listed in bold and graduate students who have thus far indicated interest are denoted with an asterisk. Confirmed participating sites are indicated in bold.

LTER site	Participants
BES	**Neil Bettez,** Jon Duncan*, Peter Groffman, Dan Jones*, **Jen Morse,** Rose Smith*, *S Kaushal*
CAP	Dan Childers, **Nancy Grimm, Monica Palta**, Rebecca Hale*, Jorge Ramos*
LUQ	**Bill McDowell**, Alan Covich, *Alonso Ramirez*
NTL	**Emily Stanley**, *Steve Loheide*
PIE	***Wil Wolheim,*** Nat Morse*
SBC	**John Melack**, *Christina Tague*
AND	Julia Jones
CDR	*Jacques Finlay, Sarah Hobbie*
CWT	Robert Northington*, Laurence Lin
FCE	Evelyn Gaiser, Dan Childers
KNZ	Matt Trentman*

[2] Expected products underlined.

Budget

We are requesting the maximum allowable funding for workshop travel, $14,000, to be divided among the two workshops: $4,000 for the first workshop (6 traveling participants @600-700 each) and $10,000 for the second (10 traveling participants @$1,000 each). We intend to save on costs for workshop 1 by housing participants in our homes and supplying breakfasts and lunches.

PIs Nancy Grimm, Neil Bettez, and Jen Morse plus additional representatives from other LTER sites will serve as a steering committee to coordinate and organize meetings, and work with the graduate-student team on the pilot project.

For our graduate student collaboration, we would like to provide stipends to four to six students @$2,000-3,000 each (amount depending upon number of students selected) for their efforts in developing the pilot project and helping to organize the datasets. The graduate students will be full participants in all aspects of the project and both workshops. We plan to fund students from at least three LTER sites, but also to invite participation from students at other sites through the webinar and follow-up teleconferences, even if they are not receiving stipends.

We would appreciate network office assistance with our proposed webinars and web conferencing. These remote meetings will provide insurance that the project continues to move along.

Total = $26,000

Timeline

Activity	**Due by**
Advertise project to students across LTER	November 20, 2012
Hold preliminary webinar for all interested students plus steering committee	December 20, 2012
First workshop to develop student-led pilot project, held at CAP	January or February, 2013
Web-conference check-in on pilot project for students and steering committee	April, 2013
Web pre-meeting for workshop participants	May, 2013
Web-conference check-in on pilot project for students and steering committee	June, 2013
Second workshop to focus on manuscript writing, framework development, and plans for future collaboration	June or July, 2013