Media Relations

September 10, 2014

UNH Scientists Find Urban Ecosystems “Evolve,” Require Sustainable Management

This stream restoration project in Baltimore, Maryland is in an early stage of evolution towards sustainability. A concrete channel that enclosed the stream has been removed, and native tree seedlings have been planted along its banks. Credit: Tamara Newcomer Johnson.

DURHAM, N.H. –- Cities are generally thought of as highly engineered landscapes that are not as ecologically dynamic as naturally occurring forests and free-flowing streams. But in a series of studies published Sept. 10 in a special issue of the journal Biogeochemistry, scientists specializing in urban ecosystems, including two from the University of New Hampshire, show urban and suburban environments are dynamic biological, chemical, and even geological ecosystems that can change relatively quickly in response to human activities.

These changes can result in rapid losses of ecosystem functions like flood protection and pollution filtration but, when properly monitored and managed, can also lead to progress towards restoring damaged watersheds to ecological health and productivity.

“There is a lot of good urban restoration work underway in cities but it often has only a short-term effect because urban watersheds follow their own evolutionary paths,” says William McDowell of the UNH department of natural resources and the environment (NREN). McDowell and Wil Wollheim of NREN and the UNH Institute for the Study of Earth, Oceans, and Space are co-editors, as well as co-authors of several of the studies, of the Biogeochemistry special issue.

Adds McDowell, “For example, utility managers may build a stormwater retention pond to capture pollution, such as excess nitrogen from urban runoff. And it may work very well for a few years. But then it fills in with sediment, becomes a wetland, and no longer functions the way the engineers designed it to work.”

In 14 related studies, scientists from across the U.S. examined the impacts of human actions on the changing biogeochemical nature of urban and suburban ecosystems. The studies were carried out in a broad range of climates: from Boston and Baltimore to San Juan, Puerto Rico, Tucson, Arizona and Southern California. The study shows that from coast to coast these ecosystems can work in surprisingly similar ways regardless of local conditions.

Among the findings are that the streams, lakes, and surfaces that make up urban watersheds are becoming saltier due to road deicing as well as the excess salt in human diets, which is excreted and captured by sewer systems. Additionally, crumbling sewage pipes leak chloride-laden waste into groundwater, where it eventually mingles with surface water. Urban waters also carry the chemical signature of dissolving concrete, which contains powdered limestone that weathers easily when exposed to acidic rain or chemicals.

The authors say many cities now have their own human-made geology—concrete surfaces that mimic a type of limestone called karst. This “urban karst” is constantly breaking down into its constituent elements, including calcium and carbonate minerals, which flow into urban streams and affect their acidity or alkalinity, and therefore their ability to sustain aquatic life.

Notes Wollheim, “Urban streams are potentially valuable resources if managed properly because they’re near where people live and can be frequently visited. The studies in this issue help us to understand the current state of these resources and will inform better management of stream systems that flow through and from urban areas.”

Adds co-editor Sujay Kaushal of the University of Maryland, “We hope that scientists, managers and citizens will work together to make decisions that allow for what we call ‘urban evolution’—that is, changing the ecology of cities over time by selecting sustainable infrastructure and development. If we do that, we can find effective ways to understand and manage the trajectory of urban ecosystems, from decline towards sustainability.”

Copies of all 14 papers in the special issue on biogeochemical cycles in urban watersheds will be available free of charge for 30 days, beginning Sept. 10, 2014, at the Biogeochemistry website
http://link.springer.com/journal/10533/121/1/page/1

A portion of the research described in the special issue of Biogeochemistry was funded by the National Science Foundation’s Long Term Ecological Research (LTER) network, including LTER sites in Baltimore, MD, Plum Island, Mass., and Luquillo, Puerto Rico, the NSF Experimental Program to Stimulate Competitive Research (EPSCoR), the New Hampshire Agricultural Experiment Station, and others.

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Photographs to download:
http://www.eos.unh.edu/newsimage/urbanKarst_lg.jpg
http://www.eos.unh.edu/newsimage/evolvingstream3_lg.jpg
Image captions:
A concrete bridge in Baltimore, Maryland is weathering and dissolving due to acidic precipitation and contributing to the formation of "urban karst." Credit: Sujay Kaushal, University of Maryland
This stream restoration project in Baltimore, Maryland is in an early stage of evolution towards sustainability. A concrete channel that enclosed the stream has been removed, and native tree seedlings have been planted along its banks. Credit:
Tamara Newcomer Johnson.

Media Contact: David Sims | 603-862-5369 | Institute for the Study of Earth, Oceans, and Space