Study suggests expanded concept of 'urban watershed'

June 14 2012

Within two decades, 60 percent of the world's population will live in cities, and coping with the resulting urban drinking water and sanitation issues will be one of the greatest challenges of this century. A U.S. Forest Service study recently published in Urban Ecosystems proposes an expanded view of the complex world of urban water.

The study presents a new conceptual framework that addresses characteristics of watersheds that are affected by urban land uses, including:

- hydrologic connectivity between aquatic and terrestrial ecosystems that alters transport and transformation processes within watersheds at multiple spatial and temporal dimensions,
- unique characteristics and challenges of recognizing engineered headwaters as part of ecosystems and linkages to larger order streams and receiving waters,
- changes in the relationship between urban infrastructure and watershed material transport and transformation over time.

"Urban ecosystems are a critical part of the landscape and influence the environmental health of entire regions," according to Michael T. Rains, director of the Northern Research Station. "Forest Service research is contributing to meeting the needs of cities and the responsible stewardship of urban natural resources."

Co-authors Ken Belt, a hydrologist/aquatic ecologist with the Forest Service's Northern Research Station, and Sujay Kaushal, an assistant professor with the University of Maryland's Department of Geology and Earth System Science Interdisciplinary Center, describe urban watersheds as four dimensional eco-hydrologic entities that function in space and time. Much of that space is below ground, where thousands of miles of pipes, including storm, sewer and water pipes, are routing water in and out of buildings and ultimately between and across watersheds. How deep pipes are located, how much they leak and what they are leaking creates a complicated underground system that has great implications for above-ground stream ecosystems and the people who depend on them, according to Belt and Kaushal.

Time is also an important factor in a larger perspective on urban water. Urban watersheds experience tremendous change over time, both above ground and within their underground networks. Buildings and human activities change on the surface, and trees benefitting from leaked water grow and their root systems extend deep into the subsurface. Below ground, the huge network of pipes ages and changes as technologies and regulatory environments change. These watershed changes exert large effects on their receiving streams.

"The immense engineered urban water network has effectively expanded the natural drainage system of watersheds in ways that profoundly change the stream ecosystems they are connected to," Belt said.

Provided by USDA Forest Service