

# Streams show signs of degradation at earliest stages of urban development

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The loss of sensitive species in streams begins to occur at the initial stages of urban development, according to a new study by the USGS. The study found that streams are more sensitive to development than previously understood.

"We tend not to think of waterways as fragile organisms, and yet that is exactly what the results of this scientific investigation appear to be telling us," said USGS Director Marcia McNutt. "Streams are more than water, but rather communities of interdependent aquatic life, the most sensitive of which are easily disrupted by urbanization."

Contaminants, habitat destruction, and increasing streamflow flashiness resulting from [urban development](#) can degrade stream ecosystems and cause degradation downstream with adverse effects on biological communities and on economically valuable resources, such as fisheries and tourism.

For example, by the time urban development had approached 20 percent in watersheds in the New England area, the aquatic invertebrate community had undergone a change in species composition of about 25 percent.

The study also found that the health of highly-degraded streams can be improved by implementing management actions that are designed to reduce specific stressors.

"Biological communities were not resistant to even low levels of urban development. In the study sensitive invertebrate species were being lost over the initial stages of development in relatively undisturbed watersheds," said Dr. Gerard McMahon, lead scientist on the study.

"Understanding how stream ecosystems are impacted by urban development can assist in the development of management actions to protect and rehabilitate urban stream ecosystems."

Multiple streams in nine [metropolitan areas](#) ([water.usgs.gov/nawqa/urban/htm.../wherewestudied.html](http://water.usgs.gov/nawqa/urban/htm.../wherewestudied.html)) across the continental U.S. were sampled to assess the effects of urban development on stream ecosystems. Study areas include Atlanta, Ga., Birmingham, Ala., Boston, Mass., Dallas, Texas, Denver, Colo., Milwaukee, Wis., Portland, Ore., Raleigh, N.C., and Salt Lake City, Utah.

The study also found that the effects of urbanization on the biological community vary geographically depending on the predominant land cover and the health of the community prior to urban development. In the study, the greatest loss of sensitive species occurred in Boston, Portland, Salt Lake City, Birmingham, Atlanta, and Raleigh metropolitan areas, where the predominant land cover was forested prior to urban development. The smallest loss of sensitive species occurred in Denver, Dallas, and Milwaukee metropolitan areas where [land cover](#) was primarily agriculture before urban development.

"The reason for this difference was not because biological communities in the Denver, Dallas, and Milwaukee areas are more resilient to stressors from urban development, but because the [biological communities](#) had already lost sensitive species to stressors from pre-urban agricultural land use activities," said McMahon.

Although urban development creates multiple stressors, such as an

increase in concentrations of insecticides, chlorides, and nutrients, that can degrade stream health—no single factor was universally important in explaining the effects of urban development on stream ecosystems. The USGS developed an innovative modeling tool to predict how different combinations of urban-related stressors affect stream health. This tool, initially developed for the New England area, can provide insights on how watershed management actions to improve one or more of these stressors may increase the likelihood of obtaining a desired biological condition.

**More information:** The effects of urbanization on streams, including information about this and past studies, as well as graphics and maps, and videos can be [online](#).

Results of this nationwide study and details about the effects of urbanization on the nine metropolitan areas can be found in a new USGS publication titled, "[Effects of urban development on stream ecosystems in nine metropolitan study areas across the United States](#)."

Management strategies used throughout the U.S. to reduce the impacts of urban development on stream ecosystems are described in a new USGS report written in partnership with the Center for Watershed Protection in Maryland titled, "[Strategies for Managing the Effects of Urban Development on Streams](#)."

Provided by United States Geological Survey

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