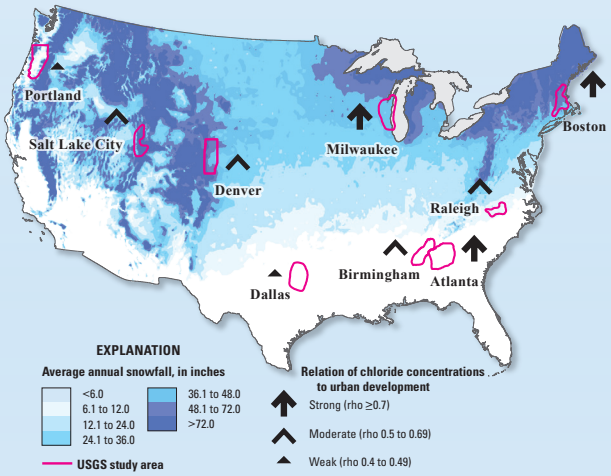
Raleigh and Durham Metropolitan Areas

This information sheet highlights selected findings of a comprehensive assessment by the National Water-Quality Assessment Program of the U.S. Geological Survey of the effects of urban development on stream ecosystems in nine metropolitan study areas. These are a few of the findings from the study in the Raleigh and Durham Metropolitan Areas.

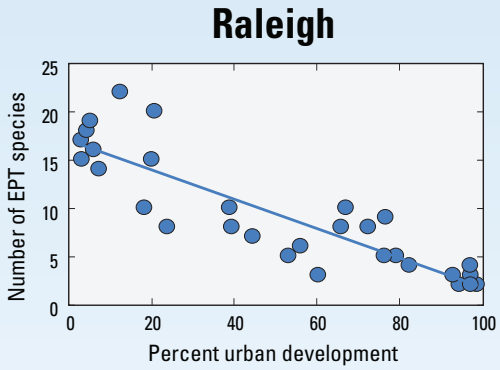
Concentrations of Contaminants in Water Increased With Urban Development



Concentrations of contaminants, including nitrogen, chloride, insecticides, and polycyclic aromatic hydrocarbons (PAHs), increased with urban development. The total concentration of insecticides increased with urban development in seven study areas; whereas, the relation between the numbers of individual insecticides detected and the amount of urban development varied across the study areas and appeared to coincide with regional pesticide-use patterns. For instance, higher concentrations of the insecticides chlorpyrifos and chlordane were detected in urban streams in the Atlanta, Dallas, and Raleigh study areas because of the historical use of these compounds for termite control.

An increase in chloride concentrations relative to urban development was also observed in the Raleigh and Durham Metropolitan Area where deicing chemicals are used infrequently, which suggests additional sources of chloride other than road salt such as leaking sewage pipes and septic tanks, fertilizer use, and the use of water softeners, bleach, and swimming pool chemicals.

Loss of Sensitive Species Was the Most Consistent Biological Response to Urban Development



Urban development generally results in a shift in the species composition of the algal, invertebrate, and fish communities. However, the most consistent change in any of the biological communities was the loss of sensitive invertebrate species and a shift to species that are more tolerant to physical and chemical stressors. A loss in the numbers (richness) of sensitive species, which is related to a decrease in Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) invertebrate species (typically abbreviated as EPT), was a common response in all study areas where urban development occurred in forested watersheds. The number of EPT species is a biological condition metric that is used in many biomonitoring programs across the country because it is sensitive to environmental degradation. A reduction of more than 50 percent of EPT species was observed in Raleigh as urban development increased in the watersheds.

Urban Development Leads to Increased Variability in Streamflow

Urban development typically increases the amount of water entering a stream after a storm and decreases the time that it takes for the water to travel over altered land surfaces before entering the stream. Efforts to reduce flooding by draining water quickly from roads and parking lots can result in increased amounts of water reaching a stream within a short period of time, which can lead to stream flashiness and altered stream channels. Additionally, rapid runoff reduces the amount of water available to infiltrate the soil and recharge the aquifers, which often results in lower sustained streamflows, especially during summer. Furthermore, when the hydrology of a stream is altered, the physical habitat of a stream often becomes degraded from channel erosion or lower summer flows that reduce spawning, feeding, and living spaces of the aquatic biota.

Increases in streamflow volume and frequency can lead to flooding and damage to infrastructure. The end of this culvert has fallen off into Pigeon House Branch near Raleigh, due to erosion during high flows.

Streams that were sampled in the Raleigh and Durham Metropolitan Areas

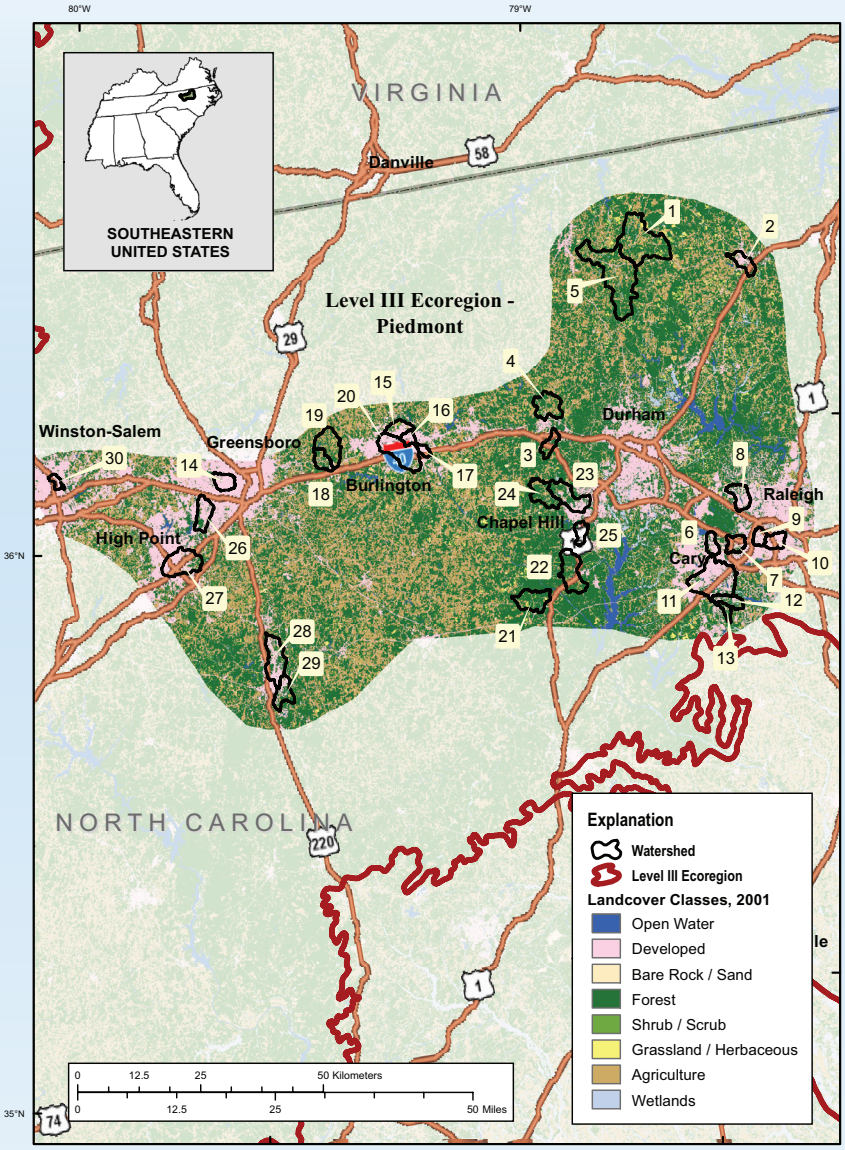


Figure Number	USGS Station Name
1	Tar River near Berea, N.C.
2	Foundry Branch at mouth near Oxford, N.C.
3	Cates Creek near Hillsborough, N.C.
4	Strouds Creek at St Marys Road near Hillsborough, N.C.
5	Deep Creek near Moriah, N.C.
6	Black Creek at Weston Parkway near Cary, N.C.
7	Richlands Creek at Schenk Forest near Cary, N.C.
8	Hare Snipe Creek at SR 1822 near Leesville, N.C.
9	Beaverdam Creek at Glenwood Aveue at Raleigh, N.C.
10	Pigeon House Branch at Crabtree Boulevard at Raleigh, N.C.
11	Swift Creek near Apex, N.C.
12	Dutchmans Branch at SR 1386 near Mccullers Crossrds, N.C.
13	Camp Branch above SR 1390 near Holly Springs, N.C.
14	North Buffalo Creek at Greensboro, N.C.
15	Service Creek above Dry Creek at Burlington, N.C.
16	Dry Creek above Service Creek at Burlington, N.C.
17	Branch Creek Below NC 54 near Graham, N.C.
18	Rock Creek Tributary at Stoney Creek Golf Course near Sedalia, N.C.
19	Rock Creek above Rock Creek Tributary near Whitsett, N.C.
20	Little Alamance Creek at SR 2309 near Graham, N.C.
21	Brooks Creek at Eddie Perry Road near Bynum, N.C.
22	Pokeberry Creek near Pittsboro, N.C.
23	Bolin Creek above Franklin Streetnear Chapel Hill N.C.
24	Morgan Creek near White Cross, N.C.
25	Wilson Creek at mouth near Chapel Hill, N.C.
26	Bull Run at NC 29/70 near Jamestown, N.C.
27	Richland Creek near Archdale, N.C.
28	Hasketts Creek Below SR 2149 near Central Falls, N.C.
29	Vestal Creek near Asheboro, N.C.
30	Bowen Branch near mouth at Winston-Salem, N.C.

Information on the effects of urban development on stream ecosystems is available in the following publications:

Coles, J.F., and others, 2012, Effects of urban development on stream ecosystems across the United States. (Available at *http://pubs.usgs.gov/circ/1373/*.)

Cappiella, Karen, and others, 2012, Strategies for managing the effects of urban development on stream. (Available at *http://pubs.usgs.gov/circ/1378/*.)

Videos, podcasts, articles, and fact sheets describing the USGS assessment of the effects of urban development on stream ecosystems in nine metropolitan areas of the United States are available at *http://water.usgs.gov/nawqa/urban/*.

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