# Characteristics of Urban Landscapes That Affect Aquatic Community Health

Data on fish, invertebrate, and algal communities in 36 NJ streams were integrated with about 400 environmental variables to assess the effects of the urban landscape on water quality. Watersheds were chosen to represent an urban land-use gradient, which ranged from 3 to 96% urban and from 15 to 180 mi^2 in drainage area.

NAWQA Synoptic Sampling Network
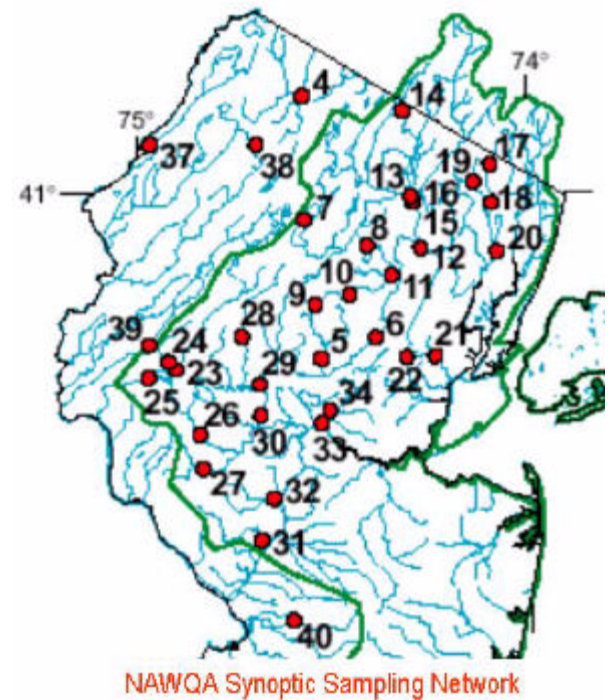
Changes in aquatic community structure were statistically related to environmental variables along the urban gradient (table 3 bottom of next column).

Changes in streamflow, impervious road area, and population density were related to impairment in all 3 aquatic communities (negative in table 3). Specifically, changes in hydrologic factors (such as decreases in base flow and increases in peak discharge and flow variabiltiy) were found to influence the types and condition of aquatic communities present in a stream, in large part, by the way these changes in flow affect stream habitat.

The presence of a cobble substrate was a factor contributing to healthier fish and invertebrate communities (positive in table 3). Changes in the substrate characteristics of urban streams are related to increases in flow, channel erosion, and sedimentation common to minimally controlled urban storm runoff.
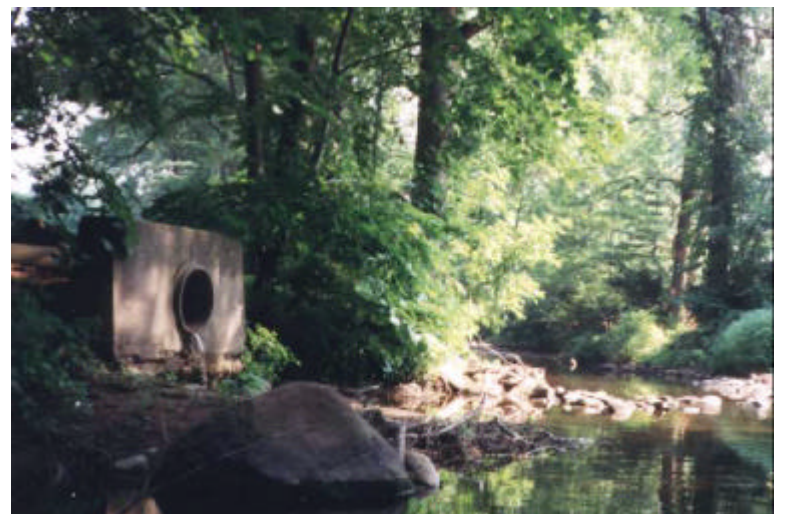
Point-source flow, urban growth 1986-95, and impervious nonroad area were related to invertebrate impairment only (negative in table 3).

Changes in water-use and wastewater distribution practices can lead to reductions in base flow and greatly influence the suitability of a stream for many types of organisms (Klein 1979), especially aquatic invertebrates. For example, the difference in wetted habitat for median-flow conditions (upper photo) and low-flow conditions (bottom photo) at Neshanic River at Reaville, NJ, is substantial, although not solely related to human activities.

The area of forest and wetlands was positively related to invertebrate community health (table 3). Forests and wetlands play a major role in maintaining a healthy supply of water, food, and habitat for disturbance-intolerant and highly desired species. Forest and wetlands can help mitigate the undesirable effects of urban development. Proximity of forest (for example, riparian areas) to the sampling site was also an important factor.

Table 3. Environmental factors that were highly related to impairment of fish, aquatic-invertebrate, and algal communities along an urban land-use gradient. Green shading indicates factors that were more favorable to healthy aquatic communities and red shading indicates factors that were less favorable. [NS, No statistically significant effect on aquatic community]

	Response of aquatic community		
Watershed characteristic	**Fish**	**Aquatic invertebrates**	**Algae**
Area of forest and wetlands	NS	Positive	NS
Ability to maintain base flow	NS	Positive	NS
Percentage of cobble substrate	Positive	Positive	NS
Median sulfate concentration	NS	Positive	Positive
Median total phosphorus concentration	Negative	NS	Positive
Mean annual flood	Negative	Negative	Negative
Flashiness of streamflow	Negative	NS	NS
Impervious area, road area only	Negative	Negative	Negative
Impervious area, nonroad area only	NS	Negative	NS
Population density	Negative	Negative	Negative
Total urban area in 1986	Negative	NS	NS
Urban area growth from 1986 to 1995	NS	Negative	NS
Commercial and industrial area in 1986	NS	Negative	Negative
Total point-source flow	NS	Negative	NS