Housing Density and Urban Land Use as Indicators of Stream Quality

A large number of indicators exist to measure the amount of urbanization in a watershed, and in turn, predict stream quality. Impervious cover has traditionally been the primary indicator of watershed urbanization, but two recent studies from Ohio and Illinois focus on housing density, urban land use, and population density as indicators. These studies provide some of the first real data on relationships between urbanization and stream quality in the Midwest.

Midwestern streams have many attributes unique to the area. Most Midwestern streams flow across the gently sloping till and outwash plains created after the last great ice sheets receded from North America 10,000 years ago. Typically, these streams are low gradient, shallowly entrenched, alluvial systems with extensive associated wetlands (McNab and Avers, 1994). In terms of aquatic diversity, the Midwest has historically had the highest diversity of freshwater mussels in North America. Prior to settlement, over 80 species of freshwater mussels were present in the state of Illinois alone (INHS, 1996).

Unfortunately, over half of the remaining mussel species existing in the Midwest are now classified as endangered, threatened, or of special state concern (USFWS, 1998). The formerly extensive wetlands of the Midwest have been reduced by over 80% and intensive agricultural and land development practices have led to the straightening, channelization, and impoundment of many streams. These practices have resulted in high rates of sedimentation and nutrient enrichment in the region's streams and rivers.

Land development pressures are increasing in many Midwestern communities, rendering urbanization an even greater threat to the region's aquatic resources. For example, between 1970 and 1990, the northeastern Illinois area population grew by a modest 4%, yet the amount of land in urban/suburban use grew by more than 33% (NIPC, 1998). This pattern of growth appears to be continuing: Census Bureau estimates indicate that the region's population has grown as much since 1990 as it had in the previous two decades (NIPC, 1998).

Over the past decade, numerous studies have linked increasing urbanization with stream degradation. The research by Chris Yoder and Ed Rankin perhaps best illustrates this relationship. They report, "Few if any, ecologically healthy watersheds exist in the older most extensively urbanized areas of Ohio and no headwater streams (i.e., draining <20 mi^2) sampled by Ohio EPA during the past 18 years in these areas have exhibited full attainment of the Warmwater Habitat (WWH) use designation" (Yoder, 1995; Yoder and Rankin, 1996).

A recent study by Yoder, Dale White, and Bob Miltner (1999) of the Ohio EPA further explored the effects of urbanization on a large number of Ohio streams. This study team utilized bioassessment techniques to link land uses with stream quality in two Ohio ecoregions. Fish, benthic macroinvertebrates, stream habitat and water chemistry were sampled in urban/suburban watersheds in the Cuyahoga River basin in northeastern Ohio and smaller subwatersheds in the Columbus metropolitan area of central Ohio. The Cuyahoga watersheds are characterized by extensive development, including a mix of older residential, commercial, and industrial land uses, along with more recent suburban development. The Columbus watersheds are characterized by residential urban land use, much of which has developed within the last two decades. However, a significant difference between the Cuyahoga and Columbus study areas is that many of the sample points in the Cuyahoga drainage were located in larger

Table 1: Sampling Parameters for the Cuyahoga and Area Streams					
Sample Location	Drainage Areas (sq. mi.).	Macro-Invertebrate Samples	Fish Samples	Habitat Assessment	Water Chemistry Samples
Cuyahoga	2 - 700	80	82	82	103
Columbus	<35	0	80	80	0