ASSESSING THE RELATIONSHIP BETWEEN AQUATIC INDICATORS, LAND USE, AND WATER QUALITY IN FIVE METROPOLITAN AREAS

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ABSTRACT

Urbanization has been defined as an increase in human habitation, combined with increased per capita consumption and extensive modification of the landscape (McDonnell and Pickett, 1990). Changes in the landscape, especially urbanization, are known to affect aquatic communities (e.g., Wang et al., 1997; Scott et al., 1986; Klein, 1979). In this study, we relate the land use/cover classification data between decades for several metropolitan areas to extant species composition and water quality data.

The relationship among aquatic indicators, land use, and water quality data from the 1970s to 2000 is currently being assessed for five U.S. metropolitan areas: Phoenix, Raleigh-Durham, Chicago-Milwaukee, Detroit, and St. Paul-Minneapolis by the USEPA. For Phoenix and Raleigh-Durham, each study area is comprised of the contiguous metropolitan area plus a surrounding 20-mile buffer inclusive of the major drainage basins. The conservative 20-mile buffer was chosen to incorporate projected urban growth of these metropolitan areas beyond the year 2000 and to evaluate the effects of expanding urban development on aquatic communities. The remaining study areas are comprised of the total counties in which the metropolitan area resides. In this study, changes in land use/cover classification are compared between decades for each metropolitan area. Land use classification statistics were determined using the Analytical Tool Investigating Land Assessment (AtTILA) program which is a computer-based GIS (Geographic Information System) that uses geospatial data to calculate many common landscape metrics, such as proportion of land use/cover classes, human use index, percent imperviousness, population density, and sprawl index. Preliminary AtTILA results, when used in conjunction with census data and other data sources, for the Phoenix study area have shown a sustained increase in urban land use, population density, and annual automobile congestion costs per capita from the 1970s to the 1990s. Corresponding changes in water quality and aquatic community structure are expected, based on many recent studies linking increases in urban land use to degradation of water quality and changes aquatic community structure.

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