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Linking land use characteristics and water quality for targeted watershed management and restoration

Following a 1998 Ohio EPA TMDL study, the Sugar Creek watershed in north central Ohio was determined to be severely impaired due to sedimentation, habitat alteration, and nutrient enrichment. While there are industrial and urban point sources within the watershed, non point source pollution comprises much of the problem due to the rural, agricultural nature of the watershed. Shortly after the TMDL study, research and management to improve water quality and habitat began within the Sugar Creek watershed. Biweekly water quality sampling started in 2002 at twenty sites in two subwatersheds of the Sugar Creek, the North and South Forks, in order to monitor trends and hotspots for poor water quality. Using a geographic information system (GIS) and canonical correspondence analysis (CCA), land use characteristics, specifically percents of agriculture, urban, wooded, riparian buffer, and stream and road densities, were linked to mean concentrations of nitrate-nitrogen, ammonium-nitrogen, phosphate-phosphorus, and total solids over two years. To discern differences between land use and water quality seasonally, water quality was analyzed by season: growing season (May 1- October 15), dormant season (October 16- April 30), and year-round. In the North Fork subwatershed, ammonium, total solids, and phosphate were positively related to percent agriculture and urban and negatively related to percent wooded and riparian buffer. Nitrate concentrations were split between agriculture and wooded areas. Seasonal differences were minor, but during the dormant season, urban areas tended to have stronger positive relationships with ammonium and phosphate. In the South Fork subwatershed, total solids, phosphate, and ammonium were positively related to urban areas and higher stream densities. Nitrate was positively related to agriculture and negatively related to woodlots and riparian buffers. Similar relationships were found between the different seasonal analyses. Using the results of this study, hotspots can be further investigated and watershed management and restoration actions can target specific land use practices linked to poor water quality. Additional research is planned to further discern specific agricultural practices, such as row crops, pasture, and hay, leading to increased nitrate concentrations in the subwatersheds.

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