# Abstracts

Wednesday, April 30

## Session H7: Tracking Water Quality Trends

1:30 – 3:00 pm | Room 231

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***Survey Reference Watersheds, 1970-2010***

**Alisa Mast[1], Mark Nilles[1], Michael McHale[2] and David Clow[1]**
[1]*US Geological Survey, Denver, Colo.*, [2]*US Geological Survey, Troy, N.Y.*

**Abstract**
The Hydrologic Benchmark Network (HBN) is a long-term monitoring program established by the U.S. Geological Survey in the 1960s to track changes in the streamflow and stream chemistry in undeveloped watersheds across the US. Trends in stream chemistry were tested at 15 HBN stations over two periods (1970-2010 and 1990-2010) using the parametric LOADEST model and the nonparametric seasonal Kendall test. Trends in annual streamflow and precipitation chemistry also were tested to help identify likely drivers of changes in stream chemistry. At stations in the northeastern US, there were significant declines in stream sulfate, which were consistent with declines in sulfate deposition resulting from the reductions in SO2 emissions mandated under the Clean Air Act Amendments. Sulfate declines in stream water were smaller than declines in deposition suggesting sulfate may be accumulating in watershed soils and thereby delaying the stream response to improvements in deposition. Trends in stream chemistry at stations in other part of the country generally were attributed to climate variability or land disturbance. Despite declines in deposition, increasing stream sulfate was observed at several stations and appeared to be linked to periods of drought or declining streamflow. Falling water tables might have enhanced oxidation of organic matter in wetlands or pyrite in mineralized bedrock thereby increasing sulfate export in surface water. Increasing sulfate and nitrate at a station in the western US were attributed to release of soluble salts and nutrients from soils following a large wildfire in the watershed.

***The Triangle Area Water Supply Monitoring Project: Tracking Water-Quality Trends and Emerging Issues for 25 Years***

**Mary Giorgino**
*US Geological Survey, Raleigh, N.C.*

**Abstract**
The Triangle, a region in central North Carolina that is anchored by the cities of Raleigh, Durham, and Chapel Hill, is one of the fastest growing areas in the United States. Growth continues to increase demand for public drinking water, which primarily is supplied by local reservoirs. At the same time, urbanization is altering the landscape in ways that might alter loads of nutrients and other pollutants. In 1988, several local governments initiated the Triangle Area Water Supply Monitoring Project (TAWSMP) to systematically evaluate the quality of water-supply sources in the region. With assistance from the U.S. Geological Survey, the TAWSMP has collected and analyzed water-quality samples from reservoirs and streams and collected continuous records of streamflow in the study area for more than 25 years. Monitoring stations, sampling priorities, and partners have evolved over time. A core monitoring network of streamflow gages and water-quality sampling sites provides a stable dataset for analyzing long-term trends. Special investigations supplement the core monitoring by focusing on emerging issues such as pharmaceuticals, mercury, and cyanotoxins in area water supplies.

Analysis of land-cover change from the mid-1970s through the mid-2000s indicates that developed lands increased upstream from all sites in the monitoring network; however, the amount of increase varied considerably among sites, ranging from 2 to 34 percent. Likewise, population growth in project watersheds ranged from 27 to 915 percent during 1990 through 2010. Trends in streamflow, nitrogen, phosphorus, and selected major ions illustrate how water-quality has changed in response to water-management activities, climatological variations, and growth. Lessons learned for interpreting trends will be discussed, including how to identify false trends, when to analyze for step trends, and the importance of streamflow data for interpreting water-quality trends under varying hydrologic conditions.

### *Nitrogen and Phosphorus Concentrations and Loads in the Great Miami River Basin, Ohio*

**Michael Ekberg**
*Miami Conservancy District, Dayton, Oh.*

**Abstract**
To evaluate baseline water quality conditions in the Great Miami River Watershed the Miami Conservancy District conducted a six year study of nutrient concentrations, loads, and yields in surface water from 2006–2011. Nutrient monitoring stations were installed at four locations on the Great Miami River and its tributary rivers to collect data on nitrogen and phosphorus concentrations and loads. Each station was located near the mouth of a major subwatershed within the Great Miami River Basin such that nutrient concentrations, loads, and yields could be compared between the drainage areas.

The results from this study show that nutrient concentrations in the water column of the Great Miami River and its major tributaries are highly variable with flow and season. Concentrations of nitrate - nitrogen tend to be highest during winter and spring runoff events. Like nitrate - nitrogen, concentrations of total phosphorus and orthophosphate tend to be high during winter and spring runoff events at all monitoring stations. However, data collected at three of the four stations also show increases in total phosphorus and orthophosphate during summer low flow conditions suggesting that both point and nonpoint sources of phosphorus play important roles in controlling phosphorus concentration in the water column.

Winter and spring runoff events tend to deliver most of the annual nitrogen and phosphorus load to the Ohio River each year. Our data suggests nonpoint sources of nutrients as the dominant source of annual nutrient loads. Total nitrogen and phosphorus yields for the Great Miami River Basin in 2007, 2008, and 2011 exceeded published mean nutrient yields for the years 1980–1996. Our findings suggest that the Great Miami River Basin has some of the highest mean nutrient yields in the entire Mississippi River Basin and could be an excellent target area for future multi-state water quality credit trading programs designed to reduce export of nutrients to the Gulf of Mexico.

### *Long-term Trends in Concentrations of Selected Constituents in Indiana Streams*

**Martin Risch1, Skip Vecchia2 and Aubrey Bunch1**
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**Abstract**
The Indiana Fixed Station Monitoring Program (FSMP) has a long-term water-quality data record from monthly stream samples. Some sites have been in the program since 1957 and in 2012, 163 sites were monitored to support a variety of purposes. Compilation and analysis of all available water-quality data from the Indiana FSMP and all streamflow data from U.S. Geological Survey (USGS) gages in Indiana provided a data set for analysis of trends in concentrations of selected constituents.

For the time period 1999 to 2010, a total of 57 FSMP stream sites were found to have a complete annual record for at least 12 water-quality constituents and to have an associated USGS gage with a complete annual streamflow record. The model QWTRENDS was used for data analysis. This model accounts for variability of streamflow at different time scales to identify trends in constituent concentrations not caused by streamflow variability.

Statistically significant trends were identified for all 12 constituents during the study period. The number of sites with significant trends varied by constituent, and ranged from 13 of 57 sites for suspended solids to a maximum of 30 of 57 sites for chloride and sulfate. For all constituents, there were more significant decreases in concentrations than increases. The spatial distribution of the sites with significant trends was uneven. A total of 54 sites out of the

57 stream sites in the FSMP assessment had at least one constituent with a significant trend. Some watersheds showed groups of constituents with trends that may be explained with ancillary data such as nearby point sources or land use.

Some legacy FSMP sites have long-term water-quality and associated USGS gage streamflow records of more than 30 years. Analysis of these data indicated both similar and different trends in constituents than those from the more recent 1990 to 2010 time period. Annual constituent loads and watershed yields computed with these data provide additional information. The data analysis from this study underscores the value of maintaining complete, long-term monitoring data for understanding and managing water resources.