



**Title:** Measuring the Flux of Nitrogen from Watersheds: Errors and the Temporal Resolution Problem

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**Organization:** North Carolina State University

**State:** NC

**Region:** Southern

**Year of Funding:**

**Theme:** Nutrient and Pesticide Management

**Situation:** The Neuse River Basin was declared a nutrient sensitive watershed in 1998, and has been included in the list of impaired waters under the 303(d) section of the Clean Water Act. In response, the NC State Legislature has mandated a 30% reduction in nitrogen flux from the basin by 2004. The Neuse TMDL process was initiated in 1998 as part of a settlement of a lawsuit filed against EPA by an environmental group. In 1999 NC DWQ proposed a TMDL based on the 30% nitrogen reduction previously proposed. In 2000 a Neuse TMDL stakeholder group was formed including industrial and municipal point source permit holders, non-point source contributors (agriculture, golf course, forestry, military), urban, environmental, recreation and fishing groups. This whole process has been based on being accurately able to accurately measure nitrate flux within the river basin. The RiverNet monitoring program measures nitrate fluxes on an hourly basis. Large flux estimate errors are found when these hourly fluxes are compared to the traditional flux estimates (daily or weekly fluxes) that have been used for monitoring and regulation purposes. This work demonstrates that current estimates of nitrogen flux in watersheds have over estimated the importance of non-point sources, and under estimated the importance of point sources.

**Objectives:** The objectives of this project are to accurately measure nitrogen fluxes on a watershed scale in basins with different land uses and from point and non-point sources. Previous studies have done a good job with spatial scale variability, but done a poor job on temporal scale variability. While this problem is not as important for non-point sources such as agricultural basins, this is a serious problem in urban areas associated with large point sources such as municipal sewage treatment plants. The large temporal variability associated with this large point source indicates that the flux from these sources has been seriously underestimated.

**Methods:** This project employs a new technology of in situ nutrient analyzers that make measurements in the river on an hourly basis and then sends the data back to a research server that puts the data on an internet web site for data distribution to the stakeholder groups. Reports are given to the state legislature and are available on the Rivernet web site.

**Partnerships:** Partnerships have been formed with the City of Raleigh Public Utilities Division, the NC Dept of the Environment and Natural Resource, the NC Dept. of Public Health, and the Governor Emergency Management Operations Center, North Carolina Pork Producers, and the NC State Animal Waste Management Center.

**Research:** The Rivernet project in one of three research programs that is being integrated into a five year NSF funded program entitled Enhancing Diversity in Geosciences in North Carolina. This program is combining geoscience programs between NCSU and NCCU. In addition several middle schools and high schools are using the Rivernet data to enhance their environmental science programs.

**Resources:** Funding for the Rivernet program and it's associated activities come from NC DENR, WRRI, the City of Raleigh, and US EPA. The College of Physical and Mathematical Sciences at NCSU contributes technician time and some expendable supplies support.

**Results:** **OUTPUTS** - Reports to State Legislature, Stakeholder groups, City of Raleigh Public Utilities Division, web based reports. Participation in national, state and local conferences, development of new monitoring techniques and protocols. **OUTCOMES** - The most important outcome of this work will be reassessment of how nitrogen fluxes are done with implication for state legislation and policies, TMDL evaluation programs, and ultimate regulations and legislation that control nutrient discharges from industrial and municipal point source permit holders as well as non-point source contributors (agriculture, golf course, forestry, military).



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