Water Resources Research Institute of The University of North Carolina

Who We Are

WRRI is a unit of The University of North Carolina system established in 1965 by executive action of UNC President William C. Friday. Headquartered at North Carolina State University, it is one of 54 state water institutes that were authorized by the Water Resources Research Act of 1964 to administer and promote federal/state partnerships in research and information transfer on water-related issues.

WRRI receives federally appropriated funds through the U.S. Geological Survey's State Water Research Institute Program and state funding through The University of North Carolina system. The Institute also arranges research partnerships and competes for federal, state, and foundation grants and contracts.

What We Offer

- To **federal and state agencies** we offer assistance in promoting and facilitating the research and technology transfer they need to carry out their missions to protect human health, environmental resources, and economic sustainability.
- To **local governments** we offer a link with the research community that they can use to find solutions to problems related to water supply protection and management, wastewater treatment and disposal, stormwater management, regulatory compliance, and infrastructure financing.
- To **industry** we offer a research link for investigating economically efficient ways of minimizing the impact of activities on water resources.
- To the **general public** we provide workshops and publications through which they may become better informed about our state's water resources, problems threatening our resources, and ways in which they can be involved in helping to solve those problems
- To the **research community** in North Carolina we offer a funding resource and a resource they can use to stay in touch with current issues and problems of concern to federal, state, and local governments, industry, and the public.

Director: David H. Moreau
1131 Jordan Hall
Box 7912
North Carolina State University
Raleigh, NC 27695-7912
Telephone: (919) 515-2815 Fax: (919) 515-2839
Email: water_resources@ncsu.edu
Web: http://www.ncsu.edu/wrri/

Significant Accomplishments

Endocrine And Reproductive Effects Of The Pharmaceutical Fluoxetine On Native Freshwater Mussels: Proximity To Measured Environmental Concentrations, W. Gregory Cope, Robert B. Bringolf, Rebecca M. Heltsley, and Damian Shea, NC State University

The results of this research description listed below were featured in a Press Release stemming from a presentation of this information at the 232nd Annual Meeting of the American Chemical Society held September 10–14, 2006 in San Francisco, CA. As such, this research garnered national and international attention, being picked up by thousands of media outlets worldwide (as can be evidenced by a Google search on the terms prozac and mussels).

Toxicity tests with gravid female adult eastern elliptio (*Elliptio complanata*) mussels and a range of fluoxetine concentrations evaluated the potential for fluoxetine to cause pre–mature release (spontaneous parturition) of glochidia and the viability of the glochidia that were released. The investigators found that fluoxetine does indeed cause the pre–mature release of non–viable and viable larvae (glochidia) in native freshwater mussels in less than 48 hours of exposure.

The ecological effects of an ill–timed release of larval mussels or gametes caused by environmental fluoxetine exposure could be potentially devastating to localized mussel populations. Likewise, the inability of a female mussel to attract her obligate fish host through reduced or non–existent mantle flap (fish lure) display behavior such that she would not be able to successfully infest a fish with glochidia could also result in total reproductive failure and devastate local mussel populations. Because the mode of action of fluoxetine is to alter behavior through neuroendrocrine pathways, this scenario is biologically plausible and warrants further investigation.

Sampling sediment in Crabtree Creek, Raleigh, NC, for pharmaceutical compounds from treated wastewater effluent. Photo credit: Dr. Greg Cope, NC State University.

Significant Accomplishments *continued*

Reduced Cost Strategies for Regional Integration of Surface and Ground Water Use, Brian R. Kirsch, and Gregory W. Characklis, School of Public Health, UNC Chapel Hill

Published as: Kirsch, Brian R., and Gregory W. Characklis. (2006). Equilibrium Approach to Integrating Regional Surface Water Treatment and Limited Groundwater Pumping Capacity. Journal of Water Resources Planning and Management, 132, 443-453.

The inexpensive nature of groundwater, combined with population growth, has resulted in many aquifers being pumped at unsustainable levels. Consequently, regulators in many states have acted to limit water withdrawals from affected formations. Communities subject to such restrictions must seek alternatives and will often choose to develop surface waters, a process involving substantial expenditures on treatment and conveyance infrastructure, costs that will be particularly burdensome for smaller communities. Regional treatment plants can take advantage of the economies of scale inherent in these facilities and will lower treatment costs, but these savings must be weighed against increased conveyance costs associated with a larger distribution area. Regional strategies must also consider how to integrate the development of surface water with use of the remaining groundwater pumping capacity.

This work describes an equilibrium approach that balances the two antagonistic forces affecting surface water development, while simultaneously considering the efficient allocation of post-reduction groundwater capacity through tradable pumping permits. Unlike earlier regionalization work, this approach has each individual community select its least cost supply alternative, rather than the alternative that results in the lowest aggregate regional cost. The model is applied to a 15-county region of North Carolina facing substantial groundwater pumping restrictions. Results indicate that the inclusion of regional surface water systems and tradable groundwater permits can reduce the estimated cost of meeting the new restrictions in the region by as much as 35 percent in present value cost terms.

Interbasin Transfer

WRRI played a significant role in interbasin transfer (IBT) issues in North Carolina in 2007. First, we contributed in a very significant manner to the debate over a IBT certificate eventually granted to the cities of Concord and Kannapolis to take 10 MGD from the Catawba River. We provided an analysis of relative quantities of water available from the Catawba and the Yadkin Basin. The Director of WRRI also serves as Chairman of the commission that made the final decision. The controversy regarding this certificate triggered a rewrite of the NC IBT statute. The Director of WRRI was one of the principal advisors to the legislature.

During that debate, the Bi−State Commission on the Catawba River held several meetings to explore ways NC and SC could cooperate on managing the river. The Director of WRRI made a presentation to that group on organization options for cooperation, including a history of federal and state river basin planning that has taken place previously in the Catawba and neighboring basins.

Drought

Like a number of other Southeastern states, NC continues to suffer through a very severe drought that threatens our public water supplies. WRRI has played a significant role is providing risk analyses to state government and advising the governor's office about strategy. The Director of WRRI asked the governor's office to convene a group of urban water managers to discuss approaches to demand reductions that go beyond the usual curtailment of outdoor uses of water. The group was confronted with the question: how would get to a 50 percent reduction if you had to? Options that go beyond public appeals for doing so are not readily apparent, and at the suggestion of the Director, the governor's office is developing a public information/public appeal to be ready in case of worsening conditions. WRRI has prepared papers on risk assessment, a history of droughts affecting water supplies, and estimates of when droughts have ended.

What we do

WRRI **leverages** federally appropriated funds with state and local funds to identify and support research needed to help solve water quality and water resources problems in North Carolina and the region. The Institute identifies needed research by tracking water issues and by seeking input from an Advisory Committee representing state and federal agencies, industry, agriculture, local government, and the public at large. We then issue requests for proposals from researchers with water-related expertise at all senior colleges and universities in North Carolina. When proposals are submitted we coordinate review by members of our Technical Committee, award research funds based on the committee's recommendations, and provide administrative support for the contracts.

WRRI **identifies** possible partnership arrangements for addressing more narrow research needs. The NC Urban Water Consortium, a group of some of North Carolina's larger municipal providers of water and sewer services. The Consortium funds research to provide information and solve problems related to individual facilities or to local and regional environmental and regulatory circumstances.

WRRI **publishes** technical reports on completed research projects and arranges for technology transfer from researchers to state agency personnel and others who can put the research results to work. The Institute helps keep the public informed about water issues and research results by publishing a newsletter, *WRRI News*, and maintaining a web site, http://www.ncsu.edu/wrri/.

WRRI **informs** and **educates** water resources professionals, researchers, and undergraduate and graduate students through electronic lists, seminars, workshops, and conferences. Each year the annual conference addresses the state's ever-changing water research needs and provides a forum of learning and networking for participants concerning the most current water resources research issues in North Carolina.

WRRI **promotes** U.S. Geological Survey and other organizations internship opportunities to college students.

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