



North Dakota Water Resources Research Institute

North Dakota State University
University of North Dakota



Website: www.ce.ndsu.nodak.edu/wrri

January 2003

From the Director

Welcome to the 2003-issue of the Institute newsletter. The 2002 fellowship research of the Institute is highlighted in this issue. I encourage you to visit the Institute website, www.ce.ndsu.nodak.edu/wrri, for details.



As in the past few years, again this year, we decided to continue to meet the mission of the Institute by dedicating most of our Federal allotment funds toward competitive graduate student research fellowships, each of which is also a research project that will result in a masters thesis or doctoral dissertation. The faculty advisors find matching or co-funding for the research through the university, or grants from local, county, state or federal agencies, foundations, or industry. We also co-sponsored a regional conference on groundwater and a biotic resources seminar program.

The North Dakota Water Resources Research Institute is located in the NDSU Department of Civil Engineering and Construction. We can be reached at Box 5285, University Station, Fargo, North Dakota 58105-5285 or at (701) 231-7244.

G. Padmanabhan, Director
Chair and Professor, Department of Civil Engineering and Construction
North Dakota State University

Highlights of 2002 Institute Fellowship Research

Rahul Bajpai is working on his M.S. degree research in Environmental Engineering at NDSU. His advisor is Wei Lin, Assistant Professor of Civil Engineering. Rahul is doing a comparative analysis of ozonation systems in Fargo and Moorhead water treatment plants. Both the plants use the Red River water as the primary source. Both employ ozonation followed by biofiltration. The ozonation systems at the MWTP and the FWTP are not only different in design and operation, but also in the purpose they serve at the respective WTP. The Moorhead WTP uses ozone not only for disinfection, but also, for the taste and odor control of the raw water supplies coming in, from the Red River. The Fargo WTP uses ozone only for the purpose of disinfection. Moreover the operating pH at the respective WTPs is different as well. The research is conducted to assess the presence of disinfection by-products and to quantify the amounts of total aldehyde concentration in the treated water. The results will be used to draw conclusions on how the influent water quality and the operational conditions affect the formation of ozone DBPs. Also, the aldehyde removal across the filters will be studied.



Megan Jaskowiak continued her Ph.D. botany research at NDSU on the impact of Lake Ashtabula on Sheyenne River algal communities. Her dissertation has been accepted. Working with Marvin Fawley, Professor of Botany, and Research Associate Karen Phillips, Megan continued her studies of the Sheyenne river's periphyton, and examined the effects of man-made lake Ashtabula. First, the distribution of the periphytic algae was examined. Second, the distribution of the periphytic algae was correlated to changes the environmental conditions. Third, two species of diatoms that could not be identified to species were described as new species. Also, the differences between natural substrates and artificial substrates were compared using canonical correspondence analysis (CCA). The relative abundance data from these studies were compared to presence/absence data using multiple dimensional scaling (MDS).



Unal Kizil expects to complete his Ph.D. program in Agricultural and Bio-system Engineering at NDSU by May 2003. His research focus is in feedlot runoff and manure management modeling. His advisor is James Lindley, Associate Professor in Agricultural and Bio-systems Engineering. The overall goal of the research is to develop a complete feedlot runoff and manure management model to predict runoff and its concentrations generated from feedlots, and develop an online GIS database. The model has three modules written in Visual Basic programming language. Hydrology/nutrient module calculates runoff quality and quantity. Amount of nutrient loading to a water body (if there is no runoff containment structure, or in case of a failure of the containment structure) is estimated in this module. Also, runoff quality and quantity data is used in the second module to make a manure management budget. Manure management module is used in the program to predict the nutrient fate of the manure. Manure and/or runoff application rate, required commercial fertilizer amount, and commercial value of the produced manure are some of the outputs of this module. Over application of manure and/or runoff might create water pollution due to the excess amount of nutrient build up in the soil followed by surface runoff or leaching. This module can be used as a tool that provides environmentally sound waste management plans. Storage or treatment system design module provides a tool to design waste storage and treatment systems.



Murthy Kasi is working on his Ph.D degree research in Environmental Engineering at NDSU. His advisor is Wei Lin, Assistant Professor of Civil Engineering. His research, in early stage, is on phosphorus transport through a wetland ecosystem. Three wetland/lakes located in the Hamden Slough National Wildlife Refuge in western Minnesota near the Lake Bisson are selected for study. To quantify the impact on phosphorus levels soil sampling has been done at three different locations in the study area. Testing of samples has been done for total phosphorus, available phosphorus, pH, electrical conductivity and also for some metal ions that are expected to have some influence on phosphorus availability. There is a shallow aquifer system beneath the wetland area and considerable leakage from this aquifer into the wetlands takes place. Flow monitoring has been done using piezometer monitoring system and measurements were taken each month starting from May 2002 to October 2002. The monitoring data will be analyzed to determine surface water and groundwater flow rates. Preliminary water sampling has been completed and analyzed for basic water quality parameters including phosphorus. The area was surveyed using GPS and level for preparing topographic map, which will be used to assess the non-point source flow to these wetlands.



Fred Ossman completed his M.S. degree in zoology at NDSU. He is currently pursuing a Ph.D. degree. His advisor is Malcolm Butler, Professor of Zoology, NDSU. His research topic is Northern Forest Wetlands: Characteristics and Influences on Invertebrate and Amphibian Community Structure. Characterization of the macroinvertebrate communities and their analyses in light of the physical properties of wetland sites was the focus of this study. Phase II is currently underway with data for the fourth year still being sorted and analyzed. Data from this portion of the study tends to support that clear-cutting activities increase hydroperiod in those wetlands adjacent to the clear-cut. Trends also suggest that water depth in the spring increases in association with the clear-cut areas. This result is surprising given that the past two winters in northern Minnesota experienced below average snowfall amounts. Taken together, increased depth and hydroperiod, may result in a change in the legal definition of which classification these wetlands fall under. However, if those physical changes are indeed taking place, it may be a short term effect. Water depth and hydroperiod may return to their normal levels and periodicity as the forest regenerates.

Anthony Potthoff expects to complete his M.S. degree in Zoology at NDSU in May 2003. His advisor was Malcolm Butler, Professor of Zoology. Anthony's research is Evaluation of Walleye to Suppress Fathead Minnow Populations in Type IV & V Wetlands. In the first year of the study Anthony observed a higher density of cladocerans in the walleye fry treatment by mid June, with a 17.5-fold increase over reference wetlands by mid August. Walleye fry stocking appeared to have little effect on most macroinvertebrate populations. The trend of increased zooplankton in the fry treatment, particularly the cladocerans, corroborated their observations that walleye fry were successful in suppressing fathead minnows. This released zooplankton from predation, which led to water clarity improvements in some walleye fry treatment ponds. The results from the first year of the study indicate that the biomanipulation in the fry treatment wetlands responded positively. The positive response can be seen in the decrease in fathead minnow biomass and the increase in cladoceran abundance in the fry treatment wetlands. The response in the advance treatment wetlands was negative, with decreased abundance of most invertebrate groups. The positive results in the fry treatment have potentially set the stage for those wetlands to shift from being in a turbid water state to a clear water state during the second year of the study.





Shannon Torrence completed her M.S. thesis in Zoology at NDSU in December 2002. His advisor was Malcolm Butler, Professor of Zoology. Shannon investigated the variables influencing habitat use by diving waterbirds foraging in the prairie-pothole region. I studied the guild structure of foraging diving ducks on the pothole scale in southwestern Manitoba. The goals of my study were to uncover patterns of habitat use by diving ducks foraging within potholes in relationship to water depth, submergent vegetation, benthic invertebrate biomass, abundance, and size, and benthic substrate compactness and particle size and, I also sought to explain observed patterns in habitat use by comparing habitat variables to morphological features of diving waterfowl species. I found that benthic particle size and compactness decrease with depth, and submergent plants tend to grow within certain depth zones. I found that while diving ducks forage at specific depths within potholes, most divers foraged shallowly. Because most divers forage shallowly, variation in dive locations cannot be explained by habitat variables measured, nor by invertebrate biomass, abundance, or size. However, depths where divers forage within potholes can change between years. When food resources are limiting, competition may be high at shallower depths, but diving ducks most likely forage opportunistically on patchily distributed invertebrate prey.

2003 Graduate Research Fellows Announced

Seven 2003-Graduate Research Fellowships were approved for award by the State Advisory Committee, of which two fellowships – one M.S. and one Ph.D. – of respectively Anthony Pothoff and Sreerama Murthy were renewed. The following are the fellowships awarded:

- **Anthony Pothoff** (M.S. program, Zoology, NDSU). **Evaluation of Walleye to Suppress Fathead Minnow Populations in Type IV & V Wetlands**; advisor, Malcolm Butler, Zoology, NDSU.
- **Chris Laveau** (M.S. program, Geology, UND). **Hydrological Modeling of the Spatial and Temporal Variation of Prairie Potholes at the Basin Level**; advisor, Phil Gerla, Geology and Geological Engineering, UND.
- **Jennifer Newbrey** (Ph.D. program, Zoology, NDSU). **Effects of West Nile Virus Infection, Immune Function, and Age on Female Yellow-headed Blackbird**; advisor, Wendy Reed, Biology, NDSU.
- **Michael Newbrey** (Ph.D. program, Geology, NDSU). **Comparative Study of Fossil and Extant Fish Growth: Including Analyses of Mean Annual Temperature in the Geologic Record**; advisor, Allan Ashworth, Geology, NDSU.
- **Sreerama Murthy** (Ph.D. program, Civil Engineering, NDSU). **Phosphorus Transport through a Wetland Ecosystem**; advisor, Wei Lin, Civil Engineering, NDSU.
- **Tedros Tesfay** (Ph.D. program, Geology, UND). **Modeling Groundwater Denitrification by Ferrous Iron Using PHREEQC**; advisor, Scott Korom, Geology, UND.
- **Trent Museus** (B.S. program, prospective M.S student, Civil Engineering, NDSU). **A Study of Microbial Regrowth Potential of Water in Fargo, North Dakota and Moorhead, Minnesota**; advisor, Eakalak Khan, Civil Engineering, NDSU.

47th Annual Midwest Groundwater Conference co-sponsored by the Institute

Several graduate and undergraduate students and faculty interested in and working on groundwater problems from the University of North Dakota and North Dakota State University attended the conference.

About 100 groundwater practitioners, students and faculty met at the 47th Annual Midwest Groundwater Conference held in Fargo, ND, on October 2nd to 4th, 2002. The NDWRRI co-sponsored the conference along with the North Dakota State Water Commission, the North Dakota Geological Survey, the Water Resources Division of the United States Geological Survey, and the Department of Geology and Geological Engineering of University of North Dakota. It is an annual conference hosted by one of the 14 member Midwest states each fall. It is believed to be the longest-running conference dedicated to ground water. The conference, which was held in Madison, Wisconsin in 2001 will be held in Kalamazoo, Michigan in 2003. The attendees came from 12 different states and 2 Canadian provinces. Attendees were groundwater practitioners in private enterprise, federal, state, and local government, as well as universities. The conference provided an opportunity for hydrologists, geologists, engineers, planners, students and others studying the groundwater resources of their respective states to meet and exchange ideas, discuss mutual problems, and summarize results of field and laboratory studies. Thirty-eight oral and poster presentations were made in a total of one poster and six podium sessions. Participants also had the benefit of enjoying a pre-conference field trip to the Sheyenne National Grasslands. Dr Allan Ashworth, Professor and Chair of Department of Geosciences, NDSU, presented a dinner talk , “A Warmer Antarctica”.

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NDSU's Biotic Resources Seminar Program

NDWRRI continues to help support the NDSU Biotic Resources Seminar program, which has brought 66 biologically-oriented speakers to campus since 1987. Under this multi-disciplinary program, visiting scientists are invited and hosted by faculty and graduate students from several departments in the Colleges of Agriculture and Science and Mathematics. Seminar topics range widely, with the common thread being organismal/environmental biology in the broadest sense. Of the 15 visitors hosted by this program during the past three academic years, 75% spoke on topics related to the ecology, evolution, and conservation of aquatic organisms and their habitats. Examples include the genetics and conservation of rare and endangered fish and aquatic invertebrates, human impacts on the biota of lakes, and wetland ecology. NDWRRI seed money had helped to leverage other support for this program from the NDSU Cooperative Sponsorship Committee, ND EPSCoR, and the colleges and departments of the hosts. Students, staff, and faculty from across campus attend these seminars and the associated informal gatherings. The program thus stimulates networking within campus in addition to informing NDSU researchers about studies conducted by colleagues from other institutions.

National Competitive Grant Program

The Request for Proposals for the FY 2003 National Competitive Grants Program authorized by section 104G of the Water Resources Research Act of 1984 has been released. The RFP may be obtained either by going to <https://niwr.org/NIWR> and clicking on "View the RFP" under "National Competitive Grants Program" or by going directly to https://niwr.org/2003_104G_RFP. An abstract of the RFP has also been posted at <http://water.usgs.gov/wrri/news.html>. Funds have not been appropriated for this program. If an appropriation is received, the RFP will be revised accordingly. The closing date for proposals to be filed on the web site by principal investigators is 5:00 PM, Eastern Standard Time, March 21, 2003. The closing date for approvals of the applications by Institute Directors is 5:00 PM, Eastern Standard Time, March 28, 2003. It is highly competitive and the research should be of regional or national significance. As you know the proposals for this program need to be approved by the state Water Resources Research Institute. If you plan to submit one, please consult the director of the Institute.

North Dakota Water Resources Research Institute

The Institute was founded in 1965 by authority of Congress as one of the 54 Institutes throughout the nation and is administered through the United States Geological Survey. The NDWRRI receives funding through section 104 of the *Water Resources Research Act of 1984* and it applies its Federal allotment funds to research that fosters: (A) the entry of new research scientists into the water resources field, (B) training and education of future water resources scientists, engineers, and technicians; (C) the preliminary exploration of new ideas that address water problems or expand understanding of water and water-related phenomena; and (D) the dissemination of research results to water managers and the public. The NDWRRI continues to meet its mission by dedicating most of the Federal allotment funds toward competitive graduate student research fellowships. Each of the Fellowship is also a research project that will result in a master's thesis or doctoral dissertation. The faculty advisors find matching or co-funding for the research through the university, or grants from local, county, state or federal agencies, foundations, or industry. Also, the Institute co-sponsors seminars and conferences on water themes.