SPEAKER ABSTRACTS/BIOGRAPHIES

The Effect of Agriculture on Groundwater Resources

November 15, 2017

Minnesota Ground Water Association Fall Conference

Kevin Kuehner

Minnesota Department of Agriculture

From Field to Stream: Measuring Nitrate-Nitrogen Loss in Southeast Minnesota

Summary

The Root River Field to Stream Partnership is a multi-scale, multi-organizational effort to evaluate relationships between water quality and agricultural practices across till and karst dominated landscapes in southeast Minnesota. Results from phase I of the study will be shared, and will focus on the range and timing of nitrate-nitrogen loss measured in overland runoff, springs and streams

Biography

Kevin Kuehner is a soil scientist for the Minnesota Department of Agriculture (MDA) based in Preston. Kevin serves in the Clean Water Technical Unit and provides educational and technical assistance to farmers, ag professionals and resource managers in southeast Minnesota. Kevin has degrees in Water Resources Management and Soil Science from the University of Wisconsin-Stevens Point and is a Certified Crop Advisor.

B.S., Soil Science and Water Resources Management, University of Wisconsin-Stevens Point, 2008

Kimberly Kaiser and Jeff Paddock
Minnesota Department of Agriculture

Nitrate and Pesticides in Private Wells at the Township Scale

Summary

The Minnesota Department of Agriculture (MDA) determines current nitrate-nitrogen concentrations in private wells, on a township scale, through the Township Testing Program. The MDA has identified townships throughout the state that are vulnerable to groundwater contamination and have significant row crop production. More than 70,000 private well owners will be offered nitrate testing in over 300 townships by 2019.

Each selected township is offered testing in two steps, the "initial" sampling and the "follow-up" sampling. In the initial sampling, all township homeowners using private wells are sent a nitrate test kit. If nitrate is detected in their initial sample, the homeowner is offered a follow-up nitrate test, pesticide test and well site visit. As of January 2017, 167 vulnerable townships from 19 counties participated in the TTP from 2013 to 2016. Overall, 9.5% (1,912) of the 20,042 wells exceeded the HRL for Nitrate-N.

Homeowners who had a Nitrate-N detection in their initial sample are offered the opportunity to have their well sampled again for nitrate-N and approximately 125 pesticides as part of the Private Well Pesticide Sampling Project (PWPS). The MDA has sampled approximately 3,765 wells in nineteen counties for nitrate-N and pesticides from 2014-2017. Pesticides and/or pesticide degradates were detected in 76% of the wells sampled in 2016. The MDA anticipates that approximately 5,800 wells in 52 counties will be sampled by the time the PWPS Project is complete in 2020.

Biographies

Kim Kaiser

Although a native of western Wisconsin, Kim spent over 10 years working on surface water and groundwater quality issues in Central and Southeast Idaho. Kim and her family thoroughly enjoyed living and playing in the Northern Rockies, but are happy to be back in the mid-west, near their families and more water! Kim has been with the MDA as a hydrologist since 2010 working on nitrate in groundwater.

M.S., Environmental Science, University of Idaho, 2004
B.S., Environmental Geology, Hydrogeology Emphasis, University of Wisconsin, Eau-Claire, 1996

Jeff Paddock

Jeff Paddock is a Hydrologist with the Monitoring & Assessment Unit at the Minnesota Department of Agriculture. He has been with the MDA since 2010 and his work at the MDA focuses primarily on coordinating the Private Well Pesticide Sampling Project. Jeff has previously worked as a Groundwater Specialist with the Montana Department of Agriculture, an Environmental Consultant and as an Environmental Driller. Outside of work Jeff and his wife Jill enjoy traveling and spending time at their cabin in Northern Wisconsin.

B.S., Geology, University of Wisconsin-Eau Claire, 1997

David Rindal
Minnesota Department of Health

MDA-MDH Community Public Water System Well Pesticide Reconnaissance Study

Summary

The Minnesota Departments of Agriculture and Health conducted a reconnaissance study of 135 pesticides and their degradates at 108 community public water system wells during February and March 2015. The untreated source samples were also analyzed for a small set of water chemistry indicators. Pesticide compounds were detected in 72 of 108 samples, but not at levels of known public health risk. Samples were analyzed for neonicotinoids, and none were detected. A cumulative assessment of detected chemicals found that concentrations did not pose a health risk of concern when combining relevant chemical health endpoints and exposure durations.

Biography

David has been with the Minnesota Department of Health since 2000 working as a Safe Drinking Water Act compliance engineer. He specializes in surface-water treatment, nutrients, organic contaminants, and community fluoridation.

M.S., Civil Engineering, University of Minnesota

B.S., Engineering, Harvey Mudd College

William W. Simpkins
Department of Geological and Atmospheric Sciences,
Iowa State University

The "Bootprint" of Intensive Agriculture in Iowa: Groundwater, Drainage, and Litigation

Summary

- Iowa leads the nation in corn ethanol production – and uses groundwater to do it
- Drinking water vs. traditional and emerging contaminants
- Relationship of glacial history, till fractures, redox geochemistry, and tile drainage
- Impact of the Des Moines Water Works lawsuit on water quality
- Solutions for improving (ground)water quality in Iowa

Biography

Bill is in his 29th year of teaching hydrogeology-related courses at ISU and recently survived a three-year term as department chair. His interests include aquitard hydrogeology, aquifer recharge and sustainability, impacts of agriculture on groundwater quality and hydrology, isotope hydrology, virus transport, and public health. He is a Fellow of the Geological Society of America (GSA), a former GSA Council member (2012-16), 2015 awardee of GSA's George Burke Maxey Distinguished Service Award, and Chair of the 2018 GSA North-Central Section Meeting in Ames. Bill and his wife Cathy, a native of Lindstrom, have a son and a daughter pursuing graduate degrees (Scott at the U; Kelsey at CU-Boulder). They sing with Minnesotans in a professional choir, play tennis frequently, and ride Iowa's (and Minnesota's) bike trails.

Ph.D., Geology, University of Wisconsin-Madison, 1989
M.S., Geology and Water Resources Management, University of Wisconsin-Madison, 1979
B.A., Geology, Augustana College (Rock Island, IL), 1976

Yusong Li
Department of Civil Engineering, University of Nebraska-Lincoln

Impacts of Climate Change on Nitrate Transport Beneath a Center-Pivot Irrigated Corn Field

Summary

- Background on impacts of climate change on groundwater and water quality
- Nebraska Management System Evaluation Area (MSEA) Site
- Numerical model development
- Modeling historical data
- Model prediction under future climate scenarios

Biography

Yusong Li is currently an associate professor in the department of Civil Engineering. The goal of her research is to protect and restore environment and water resources based on a fundamental investigation of the complex physical, chemical and biological processes that govern flow and transport of contaminants in the environmental systems across multiple systems. Her research is funded by NSF, USDA, DOE and USGS. She teaches classes on introduction to water resources engineering, groundwater engineering, and fate and transport of contaminants in porous media.

Ph.D., Environmental Engineering, Vanderbilt University, 2005
M.S., Environmental Engineering, Tsinghua University, China, 1997
B.S., Environmental Engineering, Tsinghua University, China, 1995

David A. Legvold and Claire Hinthe

Legvold Farms and St. Olaf College

Functionality of Saturated Buffers in Nitrogen Abatement in Agricultural Tile Water

Summary

- What is a saturated buffer?
- What are the anticipated benefits of a saturated buffer/
- Methodologies for water sampling within the buffer
- Three treatment regimes utilizing various native plantings
- Keeping Nitrogen out of tile water in the first place: how do we do this?

Nitrogen fertilizer is a widely used nutrient in Minnesota's row-crop production. This nutrient is regarded as a necessity for efficient grain production. However, the tendency of this nutrient to combine with groundwater and surface runoff causes many environmental liabilities as it is expressed in tile drainage. Several strategies to limit groundwater contributions of Nitrogen from agriculture have been explored with limited acceptance from the agricultural community. This presentation will explore some promising strategies that focus on the re-direction of tile drain water into grassed buffers that are required along protected waterways. In addition, methods to keep Nitrogen out of tile drainage in the first place will be discussed. Research protocols have been developed in collaboration with St. Olaf College, Carleton College, University of Minnesota, Minnesota Department of Agriculture, Ecosystem Services Exchange, and Ellingson Drainage.

Biographies

David has farmed for 40 years in Southern Dakota County using restorative farming practices. Legvold has done numerous presentations on water quality in agriculture and soil health as well as being featured in several publications. His farm is a Minnesota Agricultural Water Quality Certified operation. Legvold was named by Governor Dayton as one of three Minnesota Water Heroes.
Legvold Farms has been the site of several conferences including the 2016 Conservation Technology Information Center (CTIC) national tour, International Drainage Symposium tour, Minnesota Buffer Legislation Symposium with Governor Dayton and staff. Legvold was named one of five 4R Nutrient Stewardship Advocates in the U.S. by the National Fertilizer Institute. Legvold and his wife Ruth have two sons who share in the farming operation.

B.A. Education, Minnesota State University Mankato, 1963
M.A. Administration and Policy, University of Minnesota, 1982

Claire hails from Missoula, Montana. She is an Environmental Studies and Political Science Major at St. Olaf College. In addition she has areas of concentration in Natural Sciences, Women and Gender Studies. Claire is principal trumpet in the St. Olaf Band and principal trumpet in the St. Olaf Orchestra as well as being an accomplished pianist. She has worked extensively with Mark Dittrich of Minnesota Department of Agriculture to develop the research protocols in saturated buffer technology. She was a lead organizer for the 4R Nutrient Stewardship Field Day in July of 2017. It is her plan to continue saturated buffer research in 2018.

B.A. Environmental Studies and Political Science, St. Olaf College (expected, spring 2019)

Jeffrey M. Peterson
Water Resources Center, University of Minnesota

Economics of Irrigation and Groundwater Depletion

Summary

- Groundwater use and depletion trends in a global context
- Impacts of groundwater depletion, local and global
- Economic drivers of groundwater use
- Roles for policy and new technologies

Biography

Jeffrey M. Peterson is the Director of the University of Minnesota's Water Resources Center, a unit of University of Minnesota Extension and the College of Food, Agricultural, and Natural Resource Sciences. As Director, he provides overall leadership for the center's outreach, teaching, and research activities involving faculty and students across the university. He also holds a faculty appointment as a professor in the Department of Applied Economics. Prior to coming to Minnesota he held a faculty position in the Department of Agricultural Economics at Kansas State University for 15 years, including service as Director of Graduate Studies from 2014 to 2015. He is the recipient of national awards for his research on environmental policy analysis, focusing on water use and water quality impacts from agriculture. He currently serves as an editor of the Journal of Agricultural and Resource Economics.

Ph.D., Agricultural and Resource Economics, Cornell University, 2000
M.S., Agricultural and Resource Economics, Cornell University, 1997
B.S., Agricultural Economics, University of Wisconsin-River Falls, 1994

Tim Cowdery
U.S. Geological Survey, Upper Midwest Water-Science Center

The Hydrologic Benefits of Wetland and Prairie Restoration in Western Minnesota: Lessons Learned at the Glacial Ridge National Wildlife Refuge, 2002–2015.

Summary

- Quantifying hydrologic benefits from land restorations
- Measuring flows in components of the water cycle
- Glacial Lake Agassiz beach-ridge hydrology
- Restoration implications in western Minnesota

A comparison between the hydrology of the Glacial Ridge National Wildlife Refuge before and after wetland and prairie restoration shows substantial changes in flows of water through the hydrologic cycle, in behavior of overland runoff and ditch flow during storms, and in water quality. Within the 6 basins measured for this study, the area of cropland decreased by 14 percent, the area of wetlands increased by 6 percent, and the area of native prairie increased by 19 percent between 2002 and 2015 due to restorations. During the same period, hydrologic changes had the benefits of decreasing runoff rate (33 percent, as a proportion of precipitation) and ditch flow rate (23 percent) and improving water quality as measured by a decrease in nitrate concentration (surficial groundwater median: 79 percent, ditchwater median: 53 percent) and suspended sediment in ditchwater (64 percent) within the study area. Peak ditch flow from storms decreased, ditch flow recessions lengthened, and base flow from groundwater discharge increased, though only a small amount in some basins. These changes reduce the amount of water leaving the study area through ditches, reducing flows that contribute to flooding.

Neither the density of restorations nor the beneficial changes in hydrology were evenly distributed throughout the study area. Amount of hydrologic benefits within an individual ditch basin did not correlate directly with amount of restoration in that basin. This is likely because of complicating factors within each basin like the kind of land restored, the amount of surficial aquifer, the amount of remaining ditches, and the density of closed wetland and lake basins.
An analysis of landscape characteristics that correlated with hydrologic benefits in the study area showed that area of surficial aquifer and area of drained wetlands are most important. Restored prairie slows overland runoff promoting recharge to aquifers and restored wetlands provides surface storage for some of the runoff that remains. Some recharge to aquifers is slowly release water as base flow to streams, while runoff stored in wetlands is returned to the atmosphere as evapotranspiration. Areas with the highest density of surficial aquifers and drained wetlands have the highest potential for hydrologic benefits from wetland and prairie restoration. In western Minnesota, these areas are the uplands the Alexandria Moraine Complex and the beaches of Glacial Lake Agassiz in parts of western third of Minnesota.

(continued on the next page)

Biography

Tim is a hydrogeologist with the U.S. Geological Survey in Mounds View, Minnesota. He currently serves as chief for several projects and is the Minnesota Water-Science Center's Groundwater and Database Specialist. His research interests include groundwater sustainability, groundwater/surface-water interactions, numerical groundwater modeling, glacial geology, and groundwater recharge analysis.

M.S., Department of Geology and Geophysics, University of Minnesota, 2007

B.A., Geology Department, Carleton College, 1983