Emerging Contaminants in the Aquatic Environment Conference
June 5 & 6, 2018 • Champaign, IL
I Hotel & Conference Center
Emerging Contaminants in the Aquatic Environment Conference

June 5-6, 2018

Chancellor Ballroom
I Hotel & Conference Center
Champaign, Illinois

Sponsors
Illinois Sustainable Technology Center
Illinois-Indiana Sea Grant
Department of Civil and Environmental Engineering

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University of Illinois Extension
National Science Foundation
Illinois Hazardous Waste Research Fund

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Conference At-A-Glance

Monday, June 4 – Houlihan’s

5:00 – 7:00 p.m.  Networking Mixer

Tuesday, June 5 – Chancellor Ballroom

7:30 a.m.  Check In and Breakfast
8:30 a.m.  Welcome
8:45 a.m.  Keynote
9:30 a.m.  Break
9:45 a.m.  Oral Presentations
10:00 a.m.  Break
10:20 a.m.  Oral Presentations
11:40 p.m.  Lunch and Networking
1:00 p.m.  Keynote
1:45 p.m.  Invited Speaker
2:15 p.m.  Break
2:30 p.m.  Oral Presentations
3:30 p.m.  Break
3:50 p.m.  Oral Presentations
4:30 - 6:00 p.m.  Poster Session and Reception

Wednesday, June 6 – Chancellor Ballroom

7:30 a.m.  Breakfast and Structured Discussions
8:30 a.m.  Keynote
9:15 a.m.  Invited Speaker
9:45 a.m.  Break
10:00 a.m.  Oral Presentations
11:40 a.m.  Lunch and Networking
12:30 p.m.  Oral Presentations
1:50 p.m.  Closing Remarks and Student Awards Presentation
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## EXPANDED AGENDA

### Monday, June 4

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<tr>
<td>5:00 - 7:00 p.m.</td>
<td>Networking Mixer</td>
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<td></td>
<td>Join us for a pre-conference networking mixer at Houlihan's restaurant in the I Hotel and Conference Center. This event will be a chance to meet many conference attendees and presenters in an informal setting. Appetizers will be provided and a cash bar will be available.</td>
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### Tuesday, June 5

<table>
<thead>
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<th>Time</th>
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<tr>
<td>7:30 a.m.</td>
<td>Check in and Continental Breakfast</td>
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<tr>
<td>8:30 a.m.</td>
<td>Welcome: Sarah Zack - Pollution Prevention Extension Specialist, Illinois-Indiana Sea Grant; Yu-Feng Lin - Associate Director, Illinois-Indiana Sea Grant</td>
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<td></td>
<td>Morning Moderator</td>
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<td></td>
<td>Sarah Zack - Illinois-Indiana Sea Grant</td>
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<tr>
<td>8:45 a.m.</td>
<td>Keynote: Stefan Krause - Professor and Chair of Ecohydrology and Biogeochemistry, University of Birmingham, UK; Multi-contaminant interactions at aquifer-river interfaces</td>
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<tr>
<td>9:30 a.m.</td>
<td>Break</td>
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<tr>
<td>9:45 a.m.</td>
<td>Jody Shoemaker</td>
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<td></td>
<td>Development of U.S. EPA standardized methods for chemicals of emerging concern in drinking water</td>
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<tr>
<td>10:05 a.m.</td>
<td>Abhilasha Krishnamurthy</td>
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<td>Drain to where? Engineered nanoparticles in urban streams</td>
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<td>10:25 a.m.</td>
<td>Alison Franklin</td>
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<td>Soil as a natural filter: Can soil mitigate emerging contaminants in the environment?</td>
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<tr>
<td>10:45 a.m.</td>
<td>Break</td>
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<tr>
<td>11:00 a.m.</td>
<td>Yaochun Yu</td>
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<td>Biotransformation of carbendazim exclusively by a complete ammonia oxidizer <em>Nitrospira inopinata</em> among three ammonia-oxidizers</td>
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<td>11:20 a.m.</td>
<td>Hui Zhi</td>
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<tr>
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<td>Longitudinal pharmaceutical exposures in a temperate stream dominated by wastewater effluent</td>
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<td>Time</td>
<td>Speaker</td>
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<tr>
<td>11:40 a.m.</td>
<td>Jill Bartolotta</td>
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<tr>
<td>12:00 p.m.</td>
<td>Lunch</td>
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<tr>
<td>Afternoon</td>
<td>Yujie Men - Civil and Environmental Engineering, University of Illinois</td>
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<td>Moderator</td>
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<tr>
<td>1:00 p.m.</td>
<td>Keynote: Rainer Lohmann, Ph.D. - Professor of Oceanography and Director of the Superfund Research Program on PFASs, University of Rhode Island; <em>From PCBs to PFASs – A global cruise in persistence, long-range transport and novel detection tools</em></td>
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<tr>
<td>1:45 p.m.</td>
<td>Break</td>
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<tr>
<td>2:00 p.m.</td>
<td>Invited Speaker: Mei Sun</td>
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<td>2:30 p.m.</td>
<td>Graham Peaslee</td>
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<td>2:50 p.m.</td>
<td>Jinyong Liu</td>
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<td>3:10 p.m.</td>
<td>Break</td>
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<td>3:30 p.m.</td>
<td>Matt Taylor</td>
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<td>3:50 p.m.</td>
<td>Simona Bălan</td>
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<tr>
<td>4:10 p.m.</td>
<td>Yousof Aly</td>
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<tr>
<td>4:30 - 6:00 p.m.</td>
<td>Poster Session and Reception in the Chancellor Ballroom</td>
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# Wednesday, June 6

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<tr>
<td>7:30 a.m.</td>
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<td>Moderator: Nancy Holm - Illinois Sustainable Technology Center</td>
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<tr>
<td>8:30 a.m.</td>
<td><strong>Keynote: Xuefei Zhou</strong> - Professor at State Key Laboratory of Pollution Control and Resource Reuse in the College of Environmental Science and Engineering at Tongji University, China; <em>An overview of the challenges with PPCPs in China and advanced technologies for typical pharmaceuticals removal</em></td>
</tr>
<tr>
<td>9:15 a.m.</td>
<td>Invited Speaker: Peter Lenaker - From rivers to lake - Variability in the vertical distribution of microplastics in the water column and surficial sediment in Milwaukee, WI</td>
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<td>9:45 a.m.</td>
<td>Break</td>
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<td>10:00 a.m.</td>
<td>Jonathan Ali - Surveillance for emerging bugs and drugs in agriculturally-dominated stream systems: Findings from the Elkhorn River, Nebraska</td>
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<td>10:20 a.m.</td>
<td>Ravneet Kaur - Incidence of pharmaceuticals in surface water of an urbanizing watershed</td>
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<td>10:40 a.m.</td>
<td>Ukoha Emekwo - Solar Light-BiOCl/BiOI nanoparticles enabled degradation of pharmaceuticals and tartrazine</td>
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<td>11:00 a.m.</td>
<td>Khang Huynh - Phytometabolism of pharmaceuticals and personal care products – A critical point for comprehensively addressing human exposure to emerging contaminants through food chains</td>
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<tr>
<td>11:20 a.m.</td>
<td>Stephanie Berg - The impact of dissolved organic matter on the photodegradation of atorvastatin, carbamazepine, DEET, and venlafaxine in the St. Louis River Estuary</td>
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<tr>
<td>11:40 a.m.</td>
<td>Lunch</td>
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<td>Moderator: Elizabeth Meschewski - Illinois Sustainable Technology Center</td>
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</table>
12:30 p.m. Lara Milligan Florida Microplastics Awareness Project - An outreach, behavior change & citizen science effort

12:50 p.m. Sam Panno Microplastics and PPCPs occurrence in karst groundwaters of Illinois

1:10 p.m. Cory Suski Physiological status of silver carp in the Illinois River: An assessment of fish at the leading edge of the invasion front

1:30 p.m. Pamela Dugan Re-emergence or have they emerged? Same old contaminants but new tricks

1:50 p.m. Closing Remarks and Student Awards Presentation
Keynote Speakers

Multi-contaminant interactions at aquifer-river interfaces
Stefan Krause - Professor and Chair of Ecohydrology and Biogeochemistry, University of Birmingham, UK; S.Krause@bham.ac.uk

Abstract: Hyporheic zones at the interfaces between aquifers and rivers are characterized by the spatially and temporally dynamic mixing of groundwater and surface water resources. The mixing of these diverse water sources creates streambed hotspots where different types of legacy and emerging contaminants meet, potentially react or compete for reaction partners. This demands the development of integrated management strategies for groundwater and surface water resources.

This talk investigates the organizational principles of drivers and controls of multiple contaminant interactions in hyporheic zones, including examples of different diffuse and point source legacy pollutants as well as emerging contaminants such as engineered nanoparticles and microplastics. The environmental impacts of multiple pollutants on ecosystem functioning (whole stream metabolism, biofilm primary production) are furthermore analyzed in relation to other stressors, such as increasing water temperatures, flood or drought conditions.

Biography: Stefan is also the director of the Birmingham Water Council and leads the Physical Geography Research Theme. He has more than 15 years of experience in international research leadership in the fields of contaminant hydrology, ecohydrology, and biogeochemistry, with a particular focus on groundwater-surface water interfaces. His labs’ current research portfolio of UK research councils NERC and EPSRC, EU-H2020, EU- FP7 and EIT Climate-KIC, Leverhulme Trust, and Environment Agency exceeds a funding volume of £10M (~$13.3M US), including close collaborations with UK and international industry and public sector partners. Main research activities in his lab currently focus on:

- Multi-component reactive transport of diffuse and point source pollutants in freshwater ecosystems
- Integrated carbon and nutrient cycles in hyporheic and riparian zones and consequences of excess nutrient loads in agricultural systems for enhanced stream bed respiration and greenhouse gas production
- Fate and transport of emerging contaminants (specifically microplastics and engineered nanoparticles) at freshwater-sediment interfaces
- Non-linear process dynamics at ecohydrological interfaces with a particular focus on dynamic source zone contributions of urban and rural pollutants
- Ecohydrological impacts of multi-stressor interactions and prediction of resulting threshold, hotspot and hot moment ecosystem behavior
From PCBs to PFASs – A global cruise in persistence, long-range transport and novel detection tools
Rainer Lohmann - Professor of Oceanography, University of Rhode Island; rloehmann@uri.edu

Abstract: Some of the most notorious organic contaminants are persistent, bioaccumulative and hydrophobic, including PCBs and organochlorine pesticides, such as DDT. Yet many emerging contaminants in water possess very different physico-chemical properties and pathways. Per- and polyfluorinated alkyl substances in particular are at least as persistent as PCBs, also bioaccumulate but are much more soluble in water. Both are of concern to humans near contaminated sites, but also pose risks in the remote Arctic environment. By relying on passive sampling, we have been studying the transport, fate, and bioaccumulation of persistent contaminants at scales ranging from the heavily contaminated Passaic River (NJ) to the remote Arctic region. In the Passaic River, food-web dynamics of legacy contaminants were strongly influences by contaminants residing in sediment and porewater. By and large, these legacy pollutants scale with population density. The perfluorinated compounds, in contrast, have distinct point sources that are not (yet) scaling with population, implying that abatement and remediation are distinct options.

Biography: Rainer obtained a Ph.D. in Environmental Science from Lancaster University (UK) in 1999, and a BSc in Chemical Engineering from EHICS (Strasbourg, France) in 1996. With funding from NSF, NIH, SERDP and private foundations, his group conducts research into the sources, transport, and bioaccumulation of anthropogenic pollutants. He is Director of the new Superfund Research Center at URI: Sources, Transport, Exposure and Effects of PFASs (STEEP). Dr. Lohmann has published over 100 peer-reviewed publications and serves as Editor for Environmental Toxicology and Chemistry. He is on the Editorial Boards for Environmental Science and Technology, Environmental Pollution and Environmental Science and Technology Letters, among others.
An overview of the challenges with PPCPs in China and advanced technologies for typical pharmaceuticals removal

Xuefei Zhou - Professor at State Key Laboratory of Pollution Control and Resource Reuse, College of Environmental Science and Engineering, Tongji University, China; zhouxuefei@tongji.edu.cn

Abstract: Currently, with economic development and population growth, China is a large country with high production and consumption of pharmaceuticals and personal care products (PPCPs). Consequently, multiple micropollutants, especially PPCP residues due to their universal consumption, low human metabolic capability, and improper disposal, have been widely detected in aquatic environment including wastewater, surface water, groundwater and drinking water in China. This work reports the current contamination status and environmental behavior of six PPCPs, namely, fluoroquinolones (FQs), non-steroidal anti-inflammatory drugs (NSAIDs), blood lipid regulators (BLRs), carbamazepine (CBZ), triclosan (TCS), and galaxolide (HHCB) in the aquatic environment in China by chromatographic methods. The emerging control technologies, such as advanced oxidation processes (AOP), molecularly imprinted polymer (MIP), nanoscale zerovalent iron (NZVI), carbon nanotubes (CNTs), oxygen releasing compound (ORC), electro-catalysis, and photocatalytic oxidation under visible light, have been applied to remove these PPCPs for achieving higher and more consistent removal. The evaluation of PPCPs removal from a municipal in the aquatic environment covers a series of aspects from sources to end-uses. After the release of micropollutants, a better understanding and modeling of their fate in the water is essential for effectively predicting their impacts on the receiving environment. The purpose of our work is to provide a comprehensive summary of the occurrence, analysis system and removal of these PPCPs in corresponding treatment facilities as well as the optimum methods for their elimination by these advanced treatment processes.

Biography: Xuefei's research has focused on environmental fate of emerging contaminants and novel materials and techniques for water and wastewater treatment. Current research areas include occurrence, fate and removal of pharmaceuticals and personal care products (PPCPs) in aquatic environments; modeling and simulation of biological wastewater treatment (by ASMs, ADMs, CFD, etc.); ecosystem restoration of the urban water environment. Environmental problems are now regional and global ones, Dr. Zhou’s group also focuses on sustainable technologies for the reduction of CO2 emission and adaptation to climate change. Her scholarly activities and professional services include the professional membership of International Water Association (IWA); the proposal reviewer for National Natural Science Foundation of China (NSFC); and the manuscript reviewer for Chemical Engineering Journal, Water Research, Bioresource Technology, Journal of Hazardous Materials, Electrophoresis, Journal of Molecular Recognition. Dr. Zhou has published to date more than 80 peer-reviewed articles in professional journals and 4 books. Additionally, she holds more than thirty patents for the water and wastewater treatment techniques.
Invited Speakers

From rivers to lake – Variability in the vertical distribution of microplastics in the water column and surficial sediment in Milwaukee, WI

Peter Lenaker - Physical Scientist, United States Geological Survey - Upper Midwest Water Science Center; plenaker@usgs.gov
Co-authors: Steven R. Corsi, Austin K. Baldwin, Sherri A. Mason

Abstract: Microplastics – plastic particles less than 5mm in diameter–have become a contaminant of concern in freshwater systems. Potential pathways which introduce various microplastic sources to freshwater systems include, but are not limited to, the breakdown of larger plastic litter in urban runoff (e.g., Styrofoam, plastic bags, bottles, wrappers, cigarette butts) and wastewater treatment plant effluent (e.g., synthetic fibers from clothing and textiles, fragments of larger debris, microbeads from personal care products).

To date, previous research on microplastics focused on the surface of a water-body to quantify occurrence and abundance. Little, if any, research has been done to characterize microplastic prevalence at different depths within the water column. In 2016, the U.S. Geological Survey, Milwaukee Metropolitan Sewage District, and State University of New York at Fredonia collaborated to characterize the vertical distribution of microplastics in the water column across ten sampling locations ranging from rivers to nearshore Lake Michigan. Surface-water samples from the top 15-30cm were collected using a 3 foot by 1.3 foot 0.335 mm mesh neuston net. One surface sediment (top 20cm) sample was composited from multiple subsamples at nine of the sampling locations. At six of the ten sampling locations additional water samples were collected at certain depth intervals within the water column using a 6 inch diameter 0.335 mm mesh net.

Mean total particle concentration in water samples from all sites and depths was 1.78 particles/m³, with a maximum concentration of 19.1 particles/m³, and a median of 0.85 particles/m³. Site-specific mean concentrations ranged from 0.5 to 11.6 particles/m³. Fibers/lines were the dominant particle type in water samples, making up 80 percent of the 15,545 microplastic particles collected. A comparison of surface and depth-weighted microplastic concentrations suggest water velocity and particle buoyancy could be potential factors governing estimates of the distribution of microplastic concentrations within the water column. At upstream river sampling locations with higher unidirectional water velocities, particle buoyancy appears less important, compared to the more tranquil downstream harbor and lake locations with less unidirectional water velocities. Our results suggest inclusion of multiple sampling points within the water column improved accuracy of overall microplastic assessment compared to sampling only the surface of the water body.

Biography: Pete is a Physical Scientist with the USGS in Middleton, WI. He obtained a M.S. in Oceanography and Coastal Science from Louisiana State University in 2009, and a B.S. in Environmental Science from Western Washington University in 2006. He started at the USGS in 2010 and has been involved in numerous water quality investigations at the local and regional level with a focus on emerging and legacy contaminants and the adverse impacts to aquatic systems and human health.
Emerging perfluoroalkyl substances in North Carolina drinking water sources and finished drinking water

Mei Sun - Assistant Professor, University of North Carolina at Charlotte; msun8@uncc.edu
Co-authors: Elisa Arevalo, Mark Strynar, Andrew Lindstrom, Detlef Knappe

Abstract: Per- and polyfluoroalkyl substances (PFAS) are persistent pollutants of emerging concern. In the Cape Fear River watershed of North Carolina, an emerging PFAS known as GenX was detected at an average concentration of 631 ng/L. Three other perfluoroalkyl ether carboxylic acids exhibited chromatographic peak areas up to 15 times that of GenX. None of these compounds were removed by conventional or advanced drinking water treatment. This research received attention from state regulators, local utilities, local officials, and the public. State regulators issued a provisional drinking water health goal for GenX at 140 ng/L, and ordered a fluorochemical manufacturer, which was identified as the source, to stop discharging GenX. Monitoring results in downstream drinking water plants showed dramatic decrease of PFAS levels since the discharge was stopped. However, after a recent spill at the manufacturer site, high levels of PFECA were found and two new perfluoroalkyl ether sulfonic acids were detected in the river. Comparisons between total PFAS quantified by combustion ion chromatography and individual PFAS by targeted mass spectrometry suggest unidentified PFAS exist in the drinking water from the impacted communities.

Biography: Mei Sun is an assistant professor in UNC Charlotte. She got her bachelor’s degree in Environmental Science and Engineering from Tsinghua University, China, and M.S./Ph.D. in Civil and Environmental Engineering from Carnegie Mellon University. Dr. Sun’s research focuses on innovative treatment technologies to remove emerging contaminants from water and wastewater; fate, transport and degradation of contaminants in various environmental matrices; and contaminated subsurface remediation.
Oral Presentations

Surveillance for emerging bugs and drugs in agriculturally-dominated stream systems: Findings from the Elkhorn River, Nebraska
Jonathan Ali - Postdoctoral Associate, University of Nebraska-Lincoln; jonathan.ali@unl.edu
Co-authors: Linsey M. Donner, Wayne A. Mathews, Daniel D. Snow, Shannon L. Bartelt-Hunt

Abstract: Modern agricultural practices use of a variety of veterinary pharmaceuticals that, as emerging agricultural contaminants (EACs), lack regulatory limits with respect to environmental concentrations and enter surface waters through point- and non-point sources. Additionally, antibiotic resistance microorganisms are associated with the use of these EACs, presenting a public health threat. Here, we present findings from a survey for the occurrence of elevated nutrient concentrations (i.e., PO₄ and NO₃), pharmaceuticals and pathogenic microorganisms from point- and non-point sources in the agriculturally-dominated Elkhorn River in Eastern Nebraska. Surveillance comprised of grab samples for nutrient concentrations and the isolation of microorganisms, as well as passive sampling for EACs using polar organic chemical integrative samplers. Along with spatial variation in nutrients, we detected 12 antibiotics and several steroids associated with livestock production. Furthermore, potential pathogens and antibiotic resistant microorganisms were isolated and screened for their antibiotic susceptibility. The findings from this study highlight the role of non-point sources of EACs in surface waters, and its public health implications.

Biography: Jonathan obtained his bachelor’s degree in Biological Science from Wright State University, and his doctorate in Environmental Toxicology from the University of Nebraska Medical Center. His primary research focus is on the occurrence and adverse impacts of waterborne agricultural pollutants, with an emphasis on the application of novel field methods. At UNL, he is working with a multi-disciplinary team seeking to understand linkages between land-use, agriculture and emerging public health threats.

Enhanced PFAS adsorption as a method on in-situ groundwater remediation
Yousof Aly - Geochemist, Arcadis; alyxx010@umn.edu
Co-authors: Erika Houtz, Ian Ross, Matt Simcik

Abstract: Per- and poly-fluoro alkyl substances (PFASs) are a class of highly persistent compounds that have been broadly detected in the environment. They are commonly detected in groundwater where aqueous film forming foam has been released. PFASs are capable of long range transport through the environment due to their inability to naturally attenuate, their relatively low retention to soil organic carbon, and their high aqueous solubility. Due to PFAS resistance to conventional treatment, in-situ treatment is sought after as an alternate cost-effective treatment technology. An injectable adsorption enhancer that can sequester plumes and reduce the mobility of PFAS could increase efficiency of remediation efforts. PFAS adsorption enhancement two cationic onto natural soil of was investigated in this research. In column and batch tests, partitioning of UCMR3 PFASs increased by factors of 2.0-6.1 relative to unamended soils. Long term PFAS retention is necessary for this technology to be considered viable in a field application. By flushing columns with background electrolyte, this binding interaction was found to persist for at least 2 months. 19F-NMR results will also be presented, giving insight into PFAS-coagulant interaction mechanism.

Biography: Yousof Aly is a recent Ph.D. graduate from the University of Minnesota and currently works as a geochemist at Arcadis. His research in Dr. Matt Simcik's Lab centered around fate and transport of PFAS and developing a new remediation method.
California’s proposal to regulate perfluoroalkyl and polyfluoroalkyl substances (PFASs) in certain consumer products to protect public and environmental health

Simona Bălan - Senior Environmental Scientist, California Department of Toxic Substances Control; simona.balan@dtsc.ca.gov

Co-authors: Ky Gress, Dennis F. Guo, Vivek Mathrani, Jeff Wong, Andre Algazi, Karl Palmer, Meredith Williams

Abstract: Perfluoroalkyl and polyfluoroalkyl substances (PFASs) have become ubiquitous in the environment, leading to chronic, lifelong human and ecological exposures. Since early 2016, the California Department of Toxic Substances Control (DTSC), which runs the innovative Safer Consumer Products (SCP) program, has been researching and engaging with stakeholders regarding the use of PFASs in consumer products. Finding that carpets and rugs contribute to the widespread PFAS environmental contamination and exposures, in February 2018 DTSC proposed to list PFASs in carpets and rugs as a Priority Product under the SCP regulations. Priority Products are product-chemical combinations of concern for public or environmental health. If DTSC lists a Priority Product under the SCP regulations, product manufacturers (or retailers, importers, etc.) must perform an Alternatives Analysis, comparing the chemical of concern with potential alternatives to determine if there is a safer way to make the product.

We will present an overview of the SCP regulatory framework, summarize DTSC’s findings that have led to the selection of PFASs in carpets and rugs as a potential Priority Product, and discuss DTSC’s next steps regarding PFASs in consumer products.

Biography: Simona Andreea Bălan is a Senior Environmental Scientist at California’s Department of Toxic Substances Control (DTSC), where she leads the Safer Consumer Products team working on perfluoroalkyl and polyfluoroalkyl substances (PFASs). Before joining DTSC, she was Senior Scientist at the Green Science Policy Institute, managing international projects on the use of flame-retardants and PFASs in consumer products. She has a Ph.D. in Environmental Science, Policy and Management from UC Berkeley.

Barriers and benefits to desired behaviors for single use plastic items in northeast Ohio’s Lake Erie basin

Jill Bartolotta - Extension Educator, Ohio Sea Grant; bartolotta.2@osu.edu

Co-author: Scott Hardy

Abstract: Given the growing saliency of plastic marine debris, and the impact of plastics on beaches and aquatic environments in the Laurentian Great Lakes, applied research is needed to support municipal and nongovernmental campaigns to prevent debris from reaching the water’s edge. This study addresses this need by examining the barriers and benefits to positive behavior for two plastic debris items in northeast Ohio's Lake Erie basin: plastic bags and plastic water bottles. An online survey is employed to gather data on the use and disposal of these plastic items and to solicit recommendations on how to positively change behavior to reduce improper disposal. Results support a ban on plastic bags and plastic water bottles, with more enthusiasm for a bag ban. Financial incentives are also seen as an effective way to influence behavior change, as are location-specific solutions focused on education and outreach.

Biography: Jill Bartolotta is the Ohio Sea Grant College Program Extension Educator for Lake and Ashtabula Counties. She works with communities to conduct outreach and education about Lake Erie, identify community needs in regards to research, funding, or scientific expertise, develop partnerships to foster a collaborative approach to management of natural resource issues, and bring science into the decision-making process at the individual and community level.
The impact of dissolved organic matter on the photodegradation of atorvastatin, carbamazepine, DEET, and venlafaxine in the St. Louis River Estuary

Stephanie Berg - Graduate Student, University of Wisconsin-Madison; stephanie.berg@wisc.edu

Co-authors: Quinn T. Whiting, Joseph A. Herrli, Kathryn C. Breuckman, Kristine H. Wammer, Christina K. Remucal

Abstract: Reactions driven by sunlight control the fate of many organic chemicals in sunlit surface waters. Dissolved organic matter (DOM) can absorb light and generate photochemically-produced reactive intermediates (PPRIs) like triplet state DOM, singlet oxygen, and hydroxyl radical which can degrade chemicals in surface waters. Photoreactivity of DOM is dependent upon composition, which varies widely among natural waters. To understand how composition of DOM affects chemical fate, we collected water samples in the St. Louis River and studied the molecular composition of DOM in the system and photoreactivity. Analysis of DOM by ultraviolet-visible spectroscopy and Fourier transform-ion cyclotron resonance mass spectrometry demonstrates that more terrestrially-derived DOM is found upstream in the system, while more microbially-derived DOM is found downstream. Variation in photoreactivity is observed and is dependent on the PPRI in question. In addition, selected chemicals including atorvastatin, carbamazepine, DEET, and venlafaxine were spiked into the waters to measure their degradation rates under simulated sunlight. For each compound, degradation rates vary in the waters and trends in rates depend on the compound.

Biography: Stephanie Berg earned a B.S. in Chemistry and a minor in Biology at the University of St. Thomas in Minnesota in 2016. Currently, she is a graduate student in the Environmental Chemistry and Technology Program at the University of Wisconsin-Madison working in Christina Remucal’s aquatic chemistry laboratory. Stephanie’s thesis work currently focuses on linking molecular characterization of dissolved organic matter to its photochemical reactivity.

Re-emergence or have they emerged? Same old contaminants but new tricks

Pamela Dugan - Business Development Manager, Carus Corporation; pamela.dugan@caruscorporation.com

Abstract: A variety of batch and column experiments as well as a field effort were conducted to evaluate the removal efficiencies of the following organic compounds: 1,4 dioxane, perfluoroalkyl compounds, pharmaceutical, endocrine disruptors, and personal care products using advanced oxidation technologies combined with low-cost sorptive treatment approaches. Batch and column test results indicate 99% removal of micropollutants from water samples, as well as a field effort at a Department of Defense Military Base where 1,4 dioxane was successfully treated with a passive slow-release oxidant technology.

Biography: Pamela serves as the Business Development Manager for Carus Corporation and has a B.S. from Indiana University and a Ph.D. in Environmental Engineering from the Colorado School of Mines. She has over 15 years of experience in the fields of soil and groundwater remediation and particular expertise in the development and application of innovative technologies for inorganic and emerging contaminant removal.

Solar Light-BiOCl/BiOI nanoparticles enabled degradation of pharmaceuticals and tartrazine

Ukoha Emekwo - Research Assistant, Purdue Water Institute/Purdue University Northwest; uemekwo@pnw.edu

Co-authors: A. G. Agwu Nnanna, John D. Vargo, Nicholas Baumhover
Abstract: In this study, BiOCl/BiOI(x) was rapidly prepared at room temperature and dried under microwave irradiation. The prepared photo-catalysts morphology were observed using SEM. Photo-catalyst experiment performed in degrading tartrazine reveals that BiOCl/BiOI composite with molar ratio of 0.85 to 0.15 exhibited the highest photo-activity and achieved 100% degradation of 20mg/l of tartrazine in 60 mins and 140 mins under simulated solar light and visible LED light irradiation respectively. Results also show that the photocatalysis followed pseudo first order reaction mechanism with kinetic rate constants of 0.097min⁻¹ and 0.048 min⁻¹ for BiOCl₀.₈₅/BiOI₀.₁₅ under simulated solar light and visible LED light irradiation respectively. BiOCl₀.₈₅/BiOI₀.₁₅ was also found to be 5 times better than TiO₂ (P25) and 14 times better than BiOI. The high catalyst activity experienced by BiOCl₀.₈₅/BiOI₀.₁₅ is attributed to reduction in electron-hole recombination rate, high surface area for adsorption and harnessing of visible light photons by BiOI in the composite.

Biography: Emekwo is a graduate student in Mechanical Engineering at Purdue University Northwest, Hammond, Indiana. He is presently employed by Purdue Water Institute as a Graduate Research Assistant. He obtained his bachelor’s degree in Chemical Engineering and finished with consistent and excellent academic record.

Soil as a natural filter: Can soil mitigate emerging contaminants in the environment?
Alison Franklin - Graduate Research Assistant, Pennsylvania State University; amy125@psu.edu
Co-authors: Clinton Williams, Danielle Andrews, John (Jack) Watson

Abstract: With low-levels of antibiotics in the environment due to wastewater treatment plant (WWTP) effluent, concern exists for human health. Application of effluent on soil may help mitigate these emerging contaminants. This study analyzed three antibiotics (sulfamethoxazole - SMX, ofloxacin - OFL, and trimethoprim - TMP) at a wastewater reuse site. Soil samples were collected (i) at a site not receiving effluent irrigation for 8 months and at the same site following (ii) one irrigation and (iii) 10-weeks of irrigation. In effluent, SMX was typically at the highest concentrations (22±3.7 µg L⁻¹) with OFL and TMP at 2.2±0.6 µg L⁻¹ and 1.0±0.02 µg L⁻¹, respectively. In soil, OFL had the highest background concentrations (650±204 ng kg⁻¹), while after 10 weeks of irrigation, SMX had the highest concentrations (730±360 ng kg⁻¹), and TMP was finally quantified (190±71 ng kg⁻¹). Groundwater concentrations were typically <25 ng L⁻¹ with highs of 660±20 ng L⁻¹ and 67±7.0 ng L⁻¹ for SMX and OFL, respectively. Since groundwater concentrations were frequently 1,000 fold lower than effluent, soil may be an adequate tertiary treatment for WWTP effluent for improved water quality and protection of human health.

Biography: Alison is a Ph.D. candidate in Soil Science and Biogeochemistry at Penn State University. Her research focuses on emerging contaminants in the environment due to the reuse of wastewater treatment plant effluent. She is currently looking at antibiotics and antibiotic-resistant bacteria in agricultural systems impacted by irrigation with wastewater treatment plant effluent. Alison is specifically interested in the possible toxicological impacts and ecological issues with reusing wastewater.

Phytometabolism of pharmaceuticals and personal care products – A critical point for comprehensively addressing human exposure to emerging contaminants through food chains
Khang Huynh - Ph.D. student, Michigan State University; huynhkha@msu.edu
Co-author: Dawn Reinhold

Abstract: Understandings of metabolism of pharmaceuticals and personal care products in planted systems are important for human health risk assessments through consumption of contaminated crop plants. Our studies revealed that antimicrobials and sulfonamide antibiotics were intensively metabolized in plant tissues
following uptake, with hydroxylated and glycosylated metabolites accounted for predominant proportions of the identified metabolites. For example, significant metabolism of triclocarban in various tissues of pepper plants (66.2, 95.5, 97.1 and 95.6% of uptaken triclocarban in roots, stems, leaves and fruits, respectively) was observed after 12 weeks of exposure. Hydroxylated triclocarban metabolites were identified as major phase I transformation products, followed by O-glycosylation in phase II. For sulfonamide antibiotics, approximately 99% of the accumulated sulfamethazine and sulfamethoxazole was present in metabolized forms in Arabidopsis thaliana plants upon 10 days of exposure. N4-glycosylation and subsequent O-glycosylation with two glucose units bound to one another via glycosidic linkage appeared to be the major metabolic pathways of sulfamethazine and sulfamethoxazole in A. thaliana.

Biography: Khang is currently a fifth-year Ph.D. student in Biosystems Engineering at Michigan State University. His research focuses on accumulation and metabolism of antimicrobial and antibiotic compounds, such as triclocarban, triclosan, sulfonamides and tetracyclines, by food crops. Human exposure to these emerging pollutants and their metabolites through consumption of contaminated food crops is also his research interest.

Incidence of pharmaceuticals in surface water of an urbanizing watershed
Ravneet Kaur - Graduate Student (Ph.D.), Tennessee State University; sidhuravneet7@gmail.com
Co-authors: Anonya Amenyenu, Karnita Garner, Paul Okweye, Sam Dennis

Abstract: Pharmaceuticals have been detected nationwide in different environmental matrices including wastewater effluents and surface water. The objective of this monitoring study was to detect the presence of pharmaceuticals in the surface water (Stones River) of an urbanizing watershed. Stones River is a fifth order river that drains a large portion of Rutherford County including Murfreesboro, Tennessee. Water samples were collected from the river for three seasons that spanned from the summer of 2014 through the winter of 2016. Simultaneously, water quality parameters were also determined in situ using multi-parameter sondes. The water samples were analyzed for the presence of pharmaceuticals using GC-MS. Chemical Abstract Service Registry Numbers (CASRN or CAS) for detected pharmaceuticals were identified. The pharmaceuticals detected included those used for the treatment of chronic alcoholism (Disulfiram; CAS# 97-77-8); antibiotic drug (Trimethoprim; CAS# 738-38-5); anti-diabetic drug (Thiazolidine; CAS# 504-78-9); and anti-inflammatory conditions drug (Methyl palmitate; CAS# 112-39-0). While the quantitative concentrations of these drugs were not determined in this study, their qualitative presence in surface water is noteworthy.

Biography: Ravneet is a Ph.D. student and Graduate Assistant under the supervision of Dr. Sam O. Dennis, at Tennessee State University (Nashville, TN). Her dissertation research focuses on quantification of pharmaceuticals in the surface water of Middle Tennessee and North Alabama. The research is funded by USDA-NIFA Evans Allen Program and College of Agriculture at Tennessee State University, as well as a joint USDA Capacity Building Grant between Alabama A&M University and Tennessee State University.

Drain to where? Engineered nanoparticles in urban streams
Abhilasha Krishnamurthy - Student, University of Illinois at Chicago; arajes2@uic.edu
Co-authors: Ben O'Connor, Karl Rockne

Abstract: With wide applications in consumer goods, textiles, pharmaceuticals and personal care products, engineered nanoparticles (ENPs) are introduced into the environment at faster rates. ENPs are released to urban streams through treated effluent from sewage treatment facilities. Although substantial quantities of ENPs are removed through sewage sludge, large volumes of effluents containing low concentrations of ENPs still pose a threat to receiving streams.
In 2015, part of an effluent-dominated stream (EDS) in Wheaton, Illinois, was restored to mitigate flooding and improve the aquatic habitat. The objective of this study is to estimate the concentration of ENPs introduced into the EDS through the treated effluent and assess the impact of the eco-restoration on the fate of ENPs in the restored transect. An Inductively Coupled Plasma Mass Spectrometer (ICP-MS) with advanced particle size detection capabilities was used in our preliminary analysis to differentiate dissolved concentrations from particle concentrations. Our initial estimates show a near complete removal of titanium nanoparticles and a substantial reduction in zinc nanoparticles along the restored stream reach.

Biography: Abhilasha is a Ph.D. candidate in the Department of Civil and Materials Engineering at the University of Illinois at Chicago. She holds a Master’s degree in Chemical Engineering from the Indian Institute of Technology Madras, India. Abhilasha insists she is an avid hiker, although her pedometer counts are from walking in effluent-dominated streams and pacing drug store aisles in pursuit of nanoparticle-free products in recyclable packages.

B12-catalyzed defluorination of branched per- and poly-fluoroalkyl substances: Structure-reactivity relationship and environmental implications

Jinyong Liu - Assistant Professor, University of California, Riverside; jyliu@engr.ucr.edu
Co-authors: Daniel J. Van Hoomissen, Tianchi Liu, Andrew Maizel, Xiangchen Huo, Seth R. Fernández, Changxu Ren, Xin Xiao, Charles Schaefer, Christopher P. Higgins, Shubham Vyas, Timothy Strathmann

Abstract: This presentation will report on the structure-reactivity relationship for B12-catalyzed defluorination of branched per- and poly-fluoroalkyl substances (PFASs). Branched PFASs have been made for various applications, such as textile production, surfactant formulation, and aircraft anti-erosion. Different from linear PFASs (e.g., PFOA and PFOS) that are believed to be highly recalcitrant in biological systems, branched PFASs could potentially undergo defluorination reactions by the B12 catalyst. Our experimental results and theoretical calculations reveal correlations between the extent of defluorination and the local C–F bonding environment of a series of branched PFAS structures. No defluorination was observed in linear PFOA or from perfluoralkyl ether carboxylic acids. The results suggest the importance of evaluating potential impacts of branched PFASs in biological systems where B12 is present, and provide a guide for designing novel PFAS structures and catalysts for easy defluorination in natural and engineered systems.

Biography: Dr. Jinyong Liu is an Assistant Professor at UCR Department of Chemical and Environmental Engineering. He earned his Ph.D. degree in Environmental Engineering from UIUC. His current research interests include (1) destruction of per- and polyfluorinated alkyl substances in contaminated environmental water, (2) heterogeneous catalysts for the reduction of toxic oxyanions such as perchlorate and nitrate, and (3) new methods for the cost-effective degradation of nitro-containing explosive chemicals.

Florida Microplastics Awareness Project - An outreach, behavior change & citizen science effort

Lara Milligan - Natural Resources Agent, UF/IFAS Extension; lara317@ufl.edu
Co-author: Maia McGuire

Abstract: The Florida Microplastic Awareness Project (FMAP) combines outreach and citizen science. The citizen science component involves the collection, filtering and analysis of water samples to determine the presence or absence of microplastics. To date over 1,300 samples have been collected. The majority of the microplastics found have been fibers, followed by fragments, films and microbeads.
The FMAP website contains a wealth of microplastics information including an annotated PowerPoint Presentation. Over 4,900 people have been reached by regional coordinators with direct education about microplastics. Posts on the FMAP Facebook page and group had a reach of almost 60,000 in 2016 and 2017. Website hits and file downloads during this same period totaled over 38,000.

Another component of FMAP is a pledge that lists different actions people can do to limit their contribution to microplastic waste. This pledge has been completed by over 1,650 people. On average, people have pledged to make 3.7 behavior changes. In follow-up surveys received from 151 pledge-takers, 91% indicated that they had made at least one behavior change to reduce their plastic waste production. On average, people reported having made 3.27 behavior changes.

**Biography:** Lara Milligan is the Natural Resources Agent for UF/IFAS Extension Pinellas County and has served in this role since 2012. Her work focuses on wildlife, water, and general environmental education. Lara earned her bachelor’s and master’s degrees in Natural Resource Conservation from the University of Florida and is a graduate of the Natural Resources Leadership Institute.

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**Microplastics and PPCPs occurrence in karst groundwaters of Illinois**

Samuel Panno - Senior Geochemist, Illinois State Geological Survey;
s-panno@illinois.edu

**Co-author:** Walt Kelly, John Scott, Wei Zheng, Rachel McNeish, Nancy Holm, Tim Hoellein, Elizabeth Baranski

**Abstract:** Groundwater in karst aquifers throughout the world constitutes about one quarter of all drinking water sources. The carbonate aquifers of northwestern and southwestern Illinois are fractured, creviced and contain open conduits and caves. Loess, ranging in thickness up to 4 m in northwestern Illinois and up to 10 m in southwestern Illinois, overlie much of the bedrock, and cover-collapse sinkholes are found in both regions. Because of these features and the open nature of the bedrock, the karst aquifers are particularly susceptible to the introduction and rapid transport of both dissolved and particulate pollutants.

In order to assess the susceptibility of karst aquifers to surface-borne contaminants, 8 springs and 3 shallow wells in Illinois’ Driftless Area in northwestern Illinois were sampled for groundwater chemistry, a suite of pharmaceuticals and personal care products (PPCPs), and microplastics in November 2017. In addition, 6 springs in Illinois’ sinkhole plain in southwestern Illinois that were previously sampled for chemistry and PPCPs (Dodgen et al. 2017) were sampled for microplastics. Springs and wells in these areas commonly contain contaminants from various sources, including road salt runoff, septic effluent (including enteric bacteria), and N-fertilizers. The results of the most recent sampling of springs and wells in these areas indicated the presence of both PPCPs and microplastics within the karst aquifers. PPCPs found in 15 of 17 sites included caffeine, carbamazepine, sulfamethoxazole and triclosan. All but one of the 17 groundwater samples contained microplastics with a maximum concentration of 15.2 pieces per liter or 15,217 pieces per m³. Based on this and previous investigations, the most likely source of PPCPs and microplastics in the karst aquifers is septic effluent. This is the first time we are aware of that microplastics have been detected in groundwater.

**Biography:** Samuel V. Panno is a Senior Geochemist and has been with the Illinois State Geological Survey since 1988. Mr. Panno has B.S. degrees in Biology and Geology, an M.S. degree in Geology, with post-graduate work in Hydrogeology and Groundwater Chemistry. Currently, Mr. Panno is leading research on the geology, hydrogeology and groundwater quality of karst aquifers of Illinois, the origin of saline springs throughout the Illinois Basin, the evolution of Illinois Basin brines, and the use of speleothems in identifying paleoeartquakes in the Midwestern U.S.
PIGE: A rapid screening method for PFAS contamination
Graham Peaslee - Professor, University of Notre Dame; gpeaslee@nd.edu
Co-authors: Sean McGuinness, John Wilkinson, Ashabari Majumdar, David Lunderberg, Alix Robel, Jennifer Field

Abstract: Particle-induced gamma-ray emission (PIGE) spectroscopy is a well-established method for total fluorine measurement in any solid surface. As a spectroscopic technique, we can determine total fluorine in any sample non-destructively within minutes. For example, we have used PIGE as a rapid screening tool for intentional PFAS treatments of consumer products, such as food packaging materials, textiles, disposable plates and personal care products. While specific PFAS congener identification requires liquid chromatography tandem mass spectrometry, total organic fluorine is an accurate surrogate for PFAS use in most cases.

PFAS contamination of groundwater and drinking water is an emerging environmental problem that can benefit from a rapid screening technique. To characterize and monitor PFAS contamination in groundwater we have developed a solid-phase extraction technique followed by PIGE to rapidly measure total organic fluorine content in aqueous samples. We compare our results to laboratory standards and two different field surveys of aqueous-film-forming foam (AFFF)-impacted sites. We are extending the method to meet drinking water standards as well with higher volume solid-phase extraction.

Biography: Graham Peaslee is a Professor of Physics at the University of Notre Dame, and leads the applied nuclear physics group there. His research interests include developing nuclear science techniques that can adapted to environmental, medical, public health, energy and defense issues. He has more than 187 peer-reviewed publications, most with student co-authors.

Development of U.S. EPA standardized methods for chemicals of emerging concern in drinking water
Jody Shoemaker - Research Chemist, U.S. Environmental Protection Agency; shoemaker.jody@epa.gov
Co-authors: Daniel Tettenhorst, Arman de la Cruz

Abstract: Multi-laboratory verified standardized methods that are rugged, selective and sensitive are needed for chemicals of emerging concern in drinking waters. EPA’s Office of Research and Development has developed standardized methods for future use in EPA’s Unregulated Contaminant Monitoring Regulations to gather nationwide occurrence data in drinking water for some of these chemicals. This presentation will describe the method development process and issues specific to analyzing compounds in water, such as preservatives, internal and surrogate standards, and aqueous sample and extract holding times.

The focus of the presentation will be methods to determine cyanotoxins and nonylphenol as EPA’s Office of Water has identified these as chemicals in drinking water that may require future nationwide monitoring. Method 544 has been recently developed to quantitate six microcystins and nodularin and a new method is currently being developed for nonylphenol. The solid phase extraction and LC/MS/MS techniques employed in these methods will be presented, along with demonstration data, detection limits and quality control measures.

Biography: Dr. Shoemaker is a research chemist at the U.S. EPA and a principal investigator for projects involving the development of analytical methods for potential drinking water contaminants. She has been involved in the development of seven drinking water methods, including Method 537 for perfluorinated alkyl acids and Method 544 for cyanotoxins. Dr. Shoemaker has a B.S. in Chemistry from Notre Dame College of Ohio and a Ph.D. from the University of Florida.
Physiological status of silver carp in the Illinois River: An assessment of fish at the leading edge of the invasion front

Cory Suski - Associate Professor, University of Illinois; suski@illinois.edu
Co-authors: Jennifer Jeffrey, Ken Jeffries

Abstract: Invasive carp in the Illinois River are of major concern due to their potential access into Lake Michigan via the Chicago Area Waterway System. Interestingly, the leading edge of the invasion front has not moved substantially closer to Lake Michigan over the past few decades, which begs the question as to what could be preventing upstream movement within the CAWS. One hypothesis to explain the static nature of the invasion front relates to the potential for aquatic contaminants to deter movement. The goal of the current study was to use physiological tools to define external factors that may be preventing movement of bigheaded carp within the Illinois River. To accomplish this, we compared liver transcriptomic profiles of silver carp at and away from the leading edge of the invasion front. Silver carp near the leading edge showed up-regulation of processes associated with active transport (e.g., drug transport), lipid metabolism, and autophagy, and down-regulation of processes involved in DNA repair and cell division. Results suggest that fish near the leading edge may be exposed to environmental contaminants increasing the need for detoxification in the liver, potentially limiting upstream movement.

Biography: Dr. Cory Suski is an Associate Professor in the Department of Natural Resources and Environmental Sciences at the University of Illinois. His research group combines physiological and behavioral tools to address issues of conservation and management in aquatic ecosystems.

Impacts of PFAS contamination on exploited estuarine species: An emerging picture

Matt Taylor - Principal Research Scientist and Associate Professor, Port Stephens Fisheries Institute; matt.taylor@dpi.nsw.gov.au

Abstract: While detection and quantification of PFAS in aquatic organisms is increasing, much remains to be resolved for estuarine and marine species. In Australia, multiple sources of PFAS have been identified adjacent to important estuarine fisheries over the last three years. The pervasive lack of a fundamental understanding of these unusual contaminants in estuarine systems has created an impetus for extensive sampling work and core research on fish, crustacean and mollusc species. Here, we present a synopsis of key findings in Australia to date, aimed at both defining the human health risks posed through consumption of contaminated seafood, and examining other areas including factors affecting bioaccumulation, depuration, spatial patterns in contamination, and sub-lethal effects of the contaminant. Substantial variation among species has been detected, which cannot be explained from a conventional toxicokinetic perspective. Certain species are able to rapidly depurate the contaminants, and spatial patterns relative to point sources vary among taxa, and in relation to trophic factors. These findings shed light on PFAS contamination in aquatic species in Australia and elsewhere, and segue into further research in this area.

Biography: Matt leads the Estuarine Fisheries group at Port Stephens Fisheries Institute, New South Wales, Australia. He is principally a fisheries ecologist with a focus on prawn fisheries, but has worked on contamination in exploited (fisheries) species on behalf of the New South Wales Government for a number of years, most recently on PFAS contamination. He sits on a range of high-level government committees dealing with aquatic contamination, and has over 95 publications in the scientific literature.
**Biotransformation of carbendazim exclusively by a complete ammonia oxidizer**

*Nitrospira inopinata* among three ammonia-oxidizers

Yaochun Yu - Ph.D. student, University of Illinois at Urbana-Champaign; yyu54@illinois.edu

*Co-authors: Ping Han, Li-Jun Zhou, Qinglong Wu, Yujie Men, Michael Wagner*

**Abstract:** The discovery of previously overlooked complete ammonia oxidizers (comammox) raised research interests of their ecological roles in natural and engineered environments. In this study, we investigated biotransformation capability of the only available comammox isolate so far, *Nitrospira inopinata*, for sixteen micropollutants. *N. inopinata* was able to biotransform five out of the 16 compounds, four of which were also biotransformed by two other ammonia oxidizers, i.e., ammonia-oxidizing bacteria (AOB): *Nitrosomonas nitrosa Nm90*, and ammonia-oxidizing archaea (AOA): *Nitrososphaera gargensis*. The fifth compound, carbendazim, a benzimidazole fungicide, was exclusively biotransformed by *N. inopinata* with ~50% removal after 10-day, whereas the removals by the other two ammonia oxidizers were less than 5%. Moreover, both the ammonia limitation experiment and TPs analysis indicated that the ammonia monooxygenase (AMO) was the responsible enzyme during carbendazim biotransformation. This study, for the first time explored the distinct environmental services of comammox bacteria in terms of micropollutant biotransformation. The findings expand our knowledge of micropollutant biotransformation mediated by different groups of ammonia oxidizers.

**Biography:** Yaochun Yu got his master’s degree in Environmental Engineering and Science at the University of Illinois at Urbana-Champaign. He is now continuing his Ph.D. study.

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**Longitudinal pharmaceutical exposures in a temperate stream dominated by wastewater effluent**

Hui Zhi - Ph.D. Student, University of Iowa; hui-zhi@uiowa.edu

*Co-authors: Dana Kolpin, Edward T. Furlong, Luke R. Iwanowicz, Rebecca D. Klapier, Shannon Meppelink, Michael T. Meyer, Gregory H. LeFevre*

**Abstract:** The increasing use of pharmaceuticals has translated to their documented presence in streams worldwide. To better understand the potential environmental exposures to pharmaceuticals, a small effluent-impacted stream (Muddy Creek) in Iowa was selected as a field laboratory for this study. To determine spatial and temporal trends in pharmaceutical exposures, four strategically located sampling sites along a 5 km stretch Muddy Creek were selected for this study. Water samples are being collected on a monthly basis at these sites for a 12 month period and measured for 111 pharmaceutical compounds. Initial results have documented a strong pharmaceutical gradient along this surface water flow path. The pharmaceuticals with the highest stream exposures were: metformin, gabapentin, 1,7-dimethylxanthine, and fexofenadine. In-stream attenuation varied dramatically between pharmaceuticals. Muddy Creek below the WWTP outfall was 93% effluent at the time of the initial sampling. Companion efforts will compare the monthly pharmaceutical results to whole organism molecular response assays to better understand potential environmental effects from such chemical exposures.

**Biography:** Hui Zhi is a 3rd year Ph.D. student in the Department of Civil and Environmental Engineering at University of Iowa. She received her master of sciences degree in the Department of Civil and Environmental Engineering at Cornell University, and her bachelor of sciences degree in Environmental Sciences program at China Pharmaceutical University. Her current research interests include the behavior of contaminants of emerging concern (CECs) in the aquatic environment and engineered natural water treatment systems. Her research goals are to better understand the biotransformation of CECs in the environment, and improve the efficacy of engineered natural treatment systems for beneficial water reuse.
6. Making sense of data from large-scale contaminants of emerging concern monitoring efforts: Screening-level assessment and water quality criteria derivation in Michigan
Sarah Bowman - Toxicologist, Michigan Department of Environmental Quality; BowmanS4@michigan.gov
Co-author: Dennis Bush

Abstract: A study of surface water monitoring data for contaminants of emerging concern (CECs) throughout the Great Lakes (Baldwin et al. 2016) concluded that some streams in Michigan have concentrations of contaminants that may impact aquatic life. We conducted a screening-level assessment of 69 chemicals sampled by Baldwin et al. (2016) in Michigan surface waters. Michigan has water quality criteria for 21 of the 69 chemicals. For the other chemicals, we developed estimated criteria or screening values and compared these to water concentrations in the study. We found that 7 chemicals (4-nonylphenol, HHCB, triclosan, carbaryl, dichlorvos, fluoranthene, and pyrene) exceeded criteria, estimated criteria, or screening values in water samples from at least one Michigan site in the study. We derived final aquatic life values for carbaryl, triclosan, and dichlorvos and conducted limited follow-up sampling in the Huron River for these chemicals in 2017. In contrast to the urban Clinton and Rouge Rivers that were sampled in the USGS study, our sampling returned non-detectable concentrations in the Huron. This study is an example of how states can use large-scale monitoring efforts to screen CECs using state-specific criteria or screening values.

Biography: Sarah Bowman is a toxicologist with the Michigan Department of Environmental Quality. She earned her Ph.D. from Ohio State University and her M.S. from the University of Georgia.

9. Physicochemical processes affecting the fate and transport of perfluoroalkyl substances in clay-rich sediments and groundwater
Rebecca Greenberg - Graduate Teaching Assistant, University of Alabama; rrgreenberg@crimson.ua.edu
Co-author: Geoffrey R. Tick

Abstract: Perfluoroalkyl substances (PFASs) are a class of emerging contaminants that pose a threat to the human health and the quality of groundwater, surface water, and drinking water supplies. This study elucidates the primary physicochemical factors controlling the fate and transport of the PFAS contaminants perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) in groundwater. Physicochemical processes of intercalation, adsorption, and desorption were investigated for the retention of PFAS in clay-rich sediment. Diffusional mass-transfer limitations were evaluated based on initial PFAS concentration, resulting contaminant intercalation (d-spacing changes) and clay mineralogy. A series of short- (48 hr) and long-term (9 mo) batch reactor experiments were conducted to determine effects of contaminant contact-time, compound chemistry, sediment geochemistry and sorbent crystalline structure. Sediment characterization and physicochemical concentrations were conducted using X-ray diffraction (XRD) and high performance liquid chromatography (HPLC). The results from this research allow for a better understanding of the fate and transport of PFASs, specifically PFOA and PFOS, in clay-rich sediments and groundwater.
10. Characterizing the fate and transport of chemicals of emerging concern (CECs) from animal manures during waste-to-energy processes

Kyu Hur - Undergraduate Student, University of Illinois at Urbana-Champaign; schidema@illinois.edu*

Co-authors: Young-Hwan Shin, Lance Schideman (*contact), Peng Zhang, John Scott, Michael Plewa, Yuanhui Zhang

Abstract: Animal manure and domestic wastewater contain hormones and other bioactive chemicals of emerging concern (CECs) that pose ecosystems and human health at very low concentrations (Irwin et al. 2001; Routledge et al., 1998; Schuh et al., 2011). This study investigates the effects of novel integrated manure management systems that can produce bioenergy and reduce the discharge of CECs, which simultaneously improves energy security and water quality. The novel system included a mixed algal-bacterial bioreactor (MABB) and hydrothermal conversion of the mixed biomass to bioenergy products. The percent removal of soluble COD, TN, TP, NH3-N in a mixed algal-bacterial bioreactor (MABB) were 75%, 30%, 40%, and 97%, respectively. Additional water quality data was collected on cytotoxicity, estrogenic effects and antibiotic resistance generation before and after the different system treatments. This research showed that this approach could remove more than 96% of total estrogenic hormones, while converting biomass into biocrude oil with up to a 40% yield (dry mass basis). Alternatively, catalytic hydrothermal conversion to syn-gas had a higher yield of up to 55% (dry basis). The most favorable process conditions for both bioenergy production and hormones removal were 300°C/60 min for hydrothermal liquefaction and 500°C/60 min with a Ruthenium catalyst for catalytic hydrothermal gasification.

Biography: Kyu is an undergraduate student in Chemistry at the University of Illinois at Urbana-Champaign. He has research experience from several university laboratories and is currently working as an academic hourly under the supervision of Dr. Michael Plewa and Dr. Lance Schideman. He is involved in toxicology and bioenvironmental engineering research projects and plans to continue research as a graduate student.

3. What do child care providers know about their role in protecting children’s environmental health?

Brenda Koester - Assistant Director, Family Resiliency Center, University of Illinois; bkoester@illinois.edu

Co-authors: Barbara H. Fiese, Ashley Neef

Abstract: The goal of the Illinois Children's Environmental Health Research Center is to study the effect of ubiquitous chemicals found in the environment and personal care products on children's neurological and reproductive development and function. The Center’s Community Outreach and Translation Core focuses on communicating findings to stakeholders including parents, childcare providers and others. Childcare providers are particularly important to target as most children under age 5 in the United States spend a significant number of waking hours in non-parental care. Recent analysis have indicated that endocrine-disrupting chemicals are present in childcare settings but providers’ knowledge of their risks may be non-existent or nascent. Other than lead exposure, the focus on children’s health in childcare settings has been on more immediate safety issues. We surveyed and interviewed childcare providers in rural, urban, and micro-urban settings regarding their current childcare routines relevant to endocrine disruptor exposures and their
understanding of the role these chemicals play in children's environmental health. Findings were used to develop messaging targeted to care providers illustrating strategies for reducing exposures.

Biography: Brenda Davis Koester serves as the Assistant Director of the Family Resiliency Center at the University of Illinois at Urbana-Champaign. She has expertise and experience in community collaborations, outreach, research translation and dissemination. Her research work centers on early care and education policy, family health and wellbeing, and food insecurity. Her work has been funded by NIEHS, USEPA, USDA, Christopher Family Foundation Food & Family Program, Feeding America, and the Walmart Foundation.

4. Evaluation of organosilica sorbent media as an adsorbent for the removal of perfluoroalkyl substances from contaminated groundwater
Michaela Lawrence - Recent Graduate, The College of Wooster;
mlawrence18@wooster.edu
Co-author: Paul L. Edmiston

Abstract: Perfluoroalkyl substances (PFASs) are a class of persistent contaminants that have become an emerging concern due to their widespread environmental presence and potential adverse health effects to humans and wildlife. Recently, PFASs have been detected in drinking water sources derived from wastewater treatment plants, industrial sites, military training facilities, and civilian airports, exceeding the Environmental Protection Agency’s (EPA) lifetime exposure limit of 70 ppt. Porous hydrophobic coated-silicas (PHC-Silicas), which are comprised of an organosilica adsorbent film deposited on an inert silica support, were recently developed. Three types of porous silica—PHC-Silica, PHC-F-Silica-CF3 and PHC-F-Silica-(CF2)7CF3—were evaluated for the removal of perfluorooctane sulfonic acid (PFOS) from drinking water. It was hypothesized that the addition of fluoroalkyl groups would improve the affinity of PHC-Silica to adsorb PFOS. The adsorption capacity and affinity of PFOS for the organosilica adsorbents was measured using column breakthrough measurements. Adsorption capacities were greater for PHC-F-Silica-CF3, and PHC-F-Silica-(CF2)7CF3 than PHC-Silica, which supports the hypothesis.

Biography: Michaela Lawrence is a recent graduate of the College of Wooster in Wooster, Ohio, where she earned her bachelor’s degree in chemistry. Her research focuses on perfluoroalkyl substances and their presence in groundwater and drinking water. Her past experiences involve detection of free iron in glacial meltwater at Mount Rainier National Park and the detection of carbon dioxide in a coastal ocean observing system at the University of South Florida.

1. Copper concentrations at Lake Erie marinas
Sarah Orlando - Ohio Clean Marinas Program Manager, Ohio Sea Grant;
orlando.42@osu.edu
Co-authors: J.R. Farver, C.J. Winslow, J.J. Davis, V.L. Igoe, H.M. Duff

Abstract: One of the challenging topics in the marina industry is managing wastewater from boat bottom washing. After the ban of tributyltin in the 1980s, copper became the primary biocide used in antifouling paints on the bottom of boats. During washing, copper oxide leaches from the boat bottom, entering the water as a free copper ion and adsorbing suspended particulate matter as it settles and accumulates in the sediment. As a result, copper concentrations in sediment are often two to three orders of magnitude greater than in the water column. Ohio Sea Grant collaborated with Bowling Green State University and Lake Erie marinas to establish preliminary data on copper accumulation in sediment over the course of one boating season, and to quantify the amount of copper contributed by boat bottom washing during that season. Sediment samples were taken at eight Lake Erie marinas, at three targeted locations: the boat haul-out area, permanent dockage, and at the mouth of the marina. The project aided scientists, agencies, marina
owners, and boaters in obtaining a better picture of the contribution of boat bottom wash wastewater to copper concentrations in Lake Erie nearshore sediments, and in finding sustainable solutions for boat bottom washing.

**Biography:** Sarah Orlando is the Program Manager for the Ohio Clean Marinas and Clean Boaters programs – voluntary, incentive-based programs to help maintain and improve coastal and Lake Erie water quality while preserving the economic activity and viability of the marine trades industry. Her primary responsibilities include conducting applied research and education programs regarding Clean Marinas, Clean Boaters, non-point source Lake Erie water quality, and other Lake Erie issues.

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**2. Quantifying the number of microplastics in the waterways of Northwest Indiana**

Brandon Stieve - Recent Graduate, Purdue University Northwest;
brandonestieve@icloud.com

*Co-authors: Kay Rowberg, Joshua Miranda*

**Abstract:** Microplastics are small pieces of plastic, <5 mm in length, that can form from the breakdown of larger pieces of plastic or synthetic textiles. Copious research has been done in the world’s oceans and oceanic beaches, but little work has been done in Northwest Indiana, and Lake Michigan. Microplastics are of concern because of the adverse effects they can have on birds and aquatic organisms. This study aims to quantify the concentration of microplastics in the waterways of northwest Indiana.

**Biography:** Brandon is a recent graduate from Purdue University Northwest where he earned a Bachelors degree in chemistry with a minor in environmental science. At Purdue, he was a tutor and Supplemental Instruction Leader for the Dept. of Student Academic Support for three years, and he was a supervisor for the department for a year and a half. Brandon has completed two research projects, one with Hoosier Riverwatch and one with Illinois-Indiana Sea Grant, involving water quality and water pollution.

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**8. Biodegradable nano-carbon-based smart filters for efficient remediation of pharmaceutical contaminants**

Indu Tripathi - Post-doc Research Associate, University of Illinois at Urbana-Champaign; indutrip@illinois.edu

*Co-authors: Laurel K. Dodgen, Fatemeh Ostadasseh, Santosh K. Misra, Enrique Daza, Brajendra K. Sharma, Wei Zheng, Dipanjan Pan*

**Abstract:** We have developed a ‘smart-filter’ comprised of tunable, biodegradable, and commercially-amenable pharmaceutical-nano-carbo-scavengers (PNCS) to efficiently and safely remediate pharmaceutical residues. Scavenging ability of PNCS for commonly used pharmaceuticals was verified following optimized protocols by using LC-MS/MS. It was found that the removal of 63.5 ± 0.4 % of Carbamazepine, 99.76 ± 0.01 % of Gemfibrozil and >99.9% of Triclocarban from a mixture containing 0.2 µg/L of each of Carbamazepine, Gemfibrozil and Triclocarban could be achieved by merely using 0.5 mg/mL of PNCS. Added to this, PNCS could be used for more than five repeated cycles of scavenging with ability of more than 30%. Furthermore, a smart filter multi-layer set-up was designed using PNCS in tertiary layer underneath sand and activated charcoal. Our results suggest that disposition of these hybrid nanocomposites, could aid in environmental remediation efforts, including as an additional unit in hospital waste control unit to send a more cleaner and safer effluent to general hospital sewage system.

**Biography:** Indu received her B.S. degree in Veterinary Sciences from Karnataka University, and her M.S. in Pharmacology & Toxicology and Ph.D. from Bangalore Veterinary College on the residual effects of growth promoters and anti-microbial agents in poultry chicken. Currently, she has been working in Prof. Pan’s lab at
the University of Illinois at Urbana-Champaign on the use of carbon-based engineered nanomaterials to remediate large bodies of water from oil spills, and for developing smart filters to remove pharmaceuticals and personal care products.

**5. Occurrence and fate of emerging organic contaminants in wastewater treatment plants with an enhanced nitrification step**

Yue Xing - Ph.D. Student, University of Illinois at Urbana-Champaign; yuexing2@illinois.edu

Co-authors: Yaochun Yu, Yujie Men

**Abstract:** The goal of this study is to investigate occurrence and removal of emerging organic contaminants (EOCs) during wastewater treatment processes and understand the role of enhanced nitrification treatment in removing EOCs. Influent and effluent of each treatment step at two local wastewater treatment plants (WWTPs) were analyzed by high-performance liquid chromatography coupled with high-resolution mass spectrometry. A suspect screening method was applied with a self-compiled suspect list comprised of 1225 EOCs in 5 categories. A total of 292-341 suspect hits were retrieved. Structures of 56 out of 86 suspect hits were further validated. Influent concentrations of different EOCs varied from several ng/L to less than a hundred µg/L. Many EOCs, such as fexofenadine, citalopram, flecainide, had low removal efficiencies. The secondary biological treatment played the most crucial role in EOCs removal, whereas other steps except the enhanced nitrification step had minor contribution. The enhanced nitrification step could partially remove EOCs and exhibited substantial removal for a small number of EOC suspects. This study provides first important insights into the roles of the enhanced nitrification step in wastewater treatment.

**Biography:** Yue Xing is a Ph.D. student from University of Illinois at Urbana-Champaign. Her research focuses on the biotransformation and fate of emerging contaminants, especially antimicrobial agents, and their impacts on antibiotic resistance. She has obtained a Bachelor's degree and a Master's degree in Environmental Engineering from China Agricultural University.

**7. Reduction of perfluorooctanesulfonate (PFOS) by synthesized activated carbon-supported bimetals: Identification of intermediates**

Jenny Zenobio - Research Assistant, Purdue University; jzenobio@purdue.edu

Co-authors: J. E. Zenobio, Chad D. Vecitis, Linda S. Lee

**Abstract:** Perfluoroalkyl acids (PFAAs) are bio-accumulative and globally distributed in the environment due to their hydrophobicity, oleophobicity and oxidative stability making them recalcitrant towards most conventional water treatment process. PFOS defluorination has been observed previously using vitamin B12 and Ti(III)-citrate at 70°C under alkaline conditions, but only branched PFOS isomers were transformed. Our investigation attempts to examine an alternate reductant that can be able to reduce not only the branched but the linear PFOS (L-PFOS). Thus, we synthesized Ni0Fe0 nanoparticles (NPs) supported on activated carbon (AC) to degrade L-PFOS and the branched isomers. Transformation of the linear and isomers were observed over time with ~50% PFOS transformed within 5 days with the majority being L-PFOS. Several poly/per-fluorinated intermediates were identified with MS/MS fragmentation confirmation that suggests one pathway starts with one F/H replacement followed by further defluoro-hydrogenation and an alternate pathway leads to double bond formation. Generation of sulfite was observed and indicates an additional pathway involving C-S cleavage. Kinetics, mechanisms, and pathways will be presented.

**Biography:** Jenny Zenobio is a Ph.D. student at Purdue University working on the remediation of sites polluted by perfluorinated compounds (PFCs). She synthesizes nanoparticles for in situ application. Currently, she is a visiting student at Harvard University.
About the Illinois Sustainable Technology Center

The Illinois Sustainable Technology Center (ISTC) is a division of the Prairie Research Institute on the University of Illinois at Urbana-Champaign campus. Its mission is to encourage and assist citizens, businesses, and government agencies to prevent pollution, conserve natural resources, and reduce waste to protect human health and the environment of Illinois and beyond.

To learn more, visit istc.illinois.edu.

About the Illinois-Indiana Sea Grant

Illinois-Indiana Sea Grant (IISG), with its unique mandate to bring the latest science to those who can best use the information, serves a critical role in empowering people to solve problems in sustainable ways. One of more than 30 Sea Grant Programs in the United States, IISG is focused on the southern Lake Michigan region – 104 miles of heavily urbanized and industrialized shoreline in Illinois and Indiana. The program is funded through the National Oceanic and Atmospheric Administration (NOAA), the University of Illinois, and Purdue University, but IISG also works in partnerships with key organizations, institutions, and agencies in the region to reach more audiences and multiply opportunities for success, bringing together a wide variety of stakeholders to work towards a healthy environment and economy.

To learn more, visit iiseagrant.org.

About the Department of Civil and Environmental Engineering

The Department of Civil and Environmental Engineering is part of the College of Engineering at the University of Illinois at Urbana-Champaign. It is ranked within the top 5 undergraduate and graduate programs in the United States. There are 700+ undergraduate and 300+ graduate students enrolled in any given academic year. Faculty research includes energy-water nexus, environmental contaminants, structural and geotechnical engineering, sustainable and resilient infrastructure, and other topics.

To learn more, visit cee.illinois.edu.

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University of Illinois Extension is the flagship outreach effort of the University of Illinois at Urbana-Champaign, offering educational programs to residents of all of Illinois’ 102 counties — and far beyond.

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Planning Committee

Elizabeth Meschewski  
Senior Scientific Specialist  
Illinois Sustainable Technology Center  
Prairie Research Institute  
University of Illinois at Urbana-Champaign  
elm2@illinois.edu

Nancy Holm  
Assistant Director  
Illinois Sustainable Technology Center  
Prairie Researcher Institute  
University of Illinois at Urbana-Champaign  
naholm@illinois.edu

Sarah Zack  
Pollution Prevention Extension Specialist  
Illinois-Indiana Sea Grant  
University of Illinois Extension  
University of Illinois at Urbana-Champaign  
szack@illinois.edu

Yujie Men  
Assistant Professor  
Department of Civil and Environmental Engineering  
College of Engineering  
University of Illinois at Urbana-Champaign  
ymen2@illinois.edu