Indiana Water Resources Research Center
Purdue University

Annual Technical Report
2019

Products

Dey, Sayan, V. Merwade, and S. Saksena, Incorporating river geometry in large scale hydrologic and hydrodynamic models, presentation at CUAHSI Conference on Hydroinformatics, Provo, UT, 29-31 July, 2019.

Saksena, Siddharth, V. Merwade, P. Singhofen, S. Dey, Hyper-resolution flood modeling and mapping using a computationally-efficient distributed modeling approach, presentation at CUAHSI Conference on Hydroinformatics, Provo, UT, 29-31 July, 2019.

Dey, Sayan, S. Saksena, S. Arra, V. Merwade and P. Singhofen, Quantifying the effect of river channel geometry on fluvial interactions across multiple spatial scales, Abstract EP53G-2266 presented at 2019 Fall Meeting, AGU, San Francisco, CA, 9-13 Dec. 2019.

Saksena, S., Zeng, L., Salvi, NA, Dey, S., Merwade, V., Ramaswami, A. and Singhofen, P. (2020) "Comparing simplistic versus complex modeling approaches for simulating localized urban flooding" American Geophysical Union Annual Fall Meeting, Online, December 2020.

Dey, S., Saksena, S., and Merwade, V. (2020) "Quantifying the effect of river channel geometry on fluvial interactions across multiple spatial scales", American Geophysical Union Annual Fall Meeting, Online, December 2020.

Dey, S., Saksena, S., Merwade, V. and Arra, S. (2020) "Improving large-scale riverine flood modeling through automated incorporation of accurate geospatial descriptors", Virtual

Rodríguez González, M. I. Distribution and accessibility of ecosystem services in the Chicago metropolitan region. Doctoral dissertation

Rodríguez González, M. I., Pijanowski, B. C., Fahey, R. T., & Hardiman B. S. Distribution and access of top-ranked ecosystem services in the Chicago metropolitan region. Submitted for review to *Landscape and Urban Planning*

Rodríguez González, M. I., Francomano, D., Getson, J., Ma, Z., & Hardiman, B.S. How do urban residents valuate and use ecosystem services and local greenspaces? In preparation for *Ecosystem Services*

D Deifenbaugh, Alam S, B. Han. Reassessment of Water Quality of the Prairie Creek Reservoir in Eastern Indiana. Indiana Academy of Sciences Annual Conference 2021. March 2021.Virtual. (Abstract Accepted)

Alam S, D Deifenbaugh, B. Han. Reassessment of Water Quality of the Prairie Creek Reservoir in Eastern Indiana. Indiana Academy of Sciences Annual Conference 2020. March 2020. Indianapolis, IN.

Silowsky A., B. Han. Modeling the effectiveness of wetland restoration in mitigating extreme

streamflows under future climate change in the Ohio River watershed. Indiana Academy of Sciences Annual Conference 2020. March 2020. Indianapolis, IN.

B. Han. Exploring the Water Quality-Quantity Nexus under Climate and Landuse Change. AGU Fall Meeting 2019. San Francisco, CA.

B. Han, S. Alam. Exploring the Water Quality-Quantity Nexus under Changing Climate and Land Use. *Indiana Water Resources Association Symposium 2019*. Syracuse, IN.

S. Alam, B. Han. Water Quality Change in the Past Two Decades of the White River. *Indiana Water Resources Association Symposium 2019*. Syracuse, IN.

Han, B., et al. (2021). "Modeling nutrient release with compiled data in a typical Midwest watershed." Ecological indicators 121: 107213.

Alam, M. S., et al. (2020). "Nitrate and biochemical oxygen demand change in a typical Midwest stream in the past two decades." H2Open Journal 3(1): 519-537.

Conard, W.M., Tighe, M.E., Peaslee, G.F., Lamberti, G.A. 2019. Lake Michigan Sport Fish as Recipients of PFAS – An Emerging Contaminant in the Great Lakes. Society for Freshwater Science Annual Meeting. Salt Lake City, UT. May 2019. Poster presentation.

Lu, Junyu, Ajay Singh, Vikram Koundinya, Pranay Ranjan, Tonya Haigh, Jackie Getson, Jenna Klink, Linda Prokopy. In Press. Explaining the Use of Online Agricultural Decision Support Tools with Weather or Climate Information in the Midwestern United States. Journal of Environmental Management

Getson, Jackie M., Anders, Sjöstrand, Sarah Church, Roberta Weiner, Jerry Hatfield, Linda Prokopy. In Press. Do Scientists Have a Responsibility to Provide Climate Change Expertise to Mitigation and Adaptation Strategies? Perspectives from Climate Professionals. Public Understanding of Science.

Singh, Ajay, Francis Eanes, Linda S. Prokopy. 2020. Climate Change Uncertainty Among American Farmers: An Examination of Multi-Dimensional Uncertainty and Attitudes towards Agricultural Adaptation to Climate Change. Climatic Change. 162(3): 1047-1064.

Singh, Ajay S., Sarah Church, Layla Dang, Erin Hennes, Linda S. Prokopy. 2020. Does Climate Change Framing Matter? Evidence from a Field Experiment of Crop Advisors in the Midwestern United States. Climatic Change. 162: 1031-1044.

Ranjan, Pranay, Ajay S. Singh, Mark Tomer, Ann Lewandowski, Linda S. Prokopy. 2020. Farmer Engagement Using a Precision Approach to Watershed-Scale Conservation Planning: What Do We Know? Journal of Soil and Water Conservation. 75(4): 444-452.

Church, Sarah, Belyna Bentlage, Roberta Weiner*, Nick Babin, Brian Bulla, Katie Fagan**, Tonya

Haigh, J. Stuart Carlton, Linda S. Prokopy. 2020. National print media vs. agricultural trade publications: communicating the 2012 Midwestern US drought. Climatic Change.161: 43-63.
Church, Sarah P., Nicholas Babin, Belyna Bentlage, Michael Dunn, Jessica D. Ulrich-Schad, Pranay Ranjan, Joe Magner, Eileen McLellan, Susi Stephan, Mark D. Tomer, Linda S. Prokopy. 2019. The Beargrass Story: Utilizing Social Science to Evaluate and Learn from the "Watershed" Approach. Journal of Contemporary Water Research and Education. 167: 78-96.

Bentlage, Belyna M., Laura A. Esman, Brant Fisher, and Linda S. Prokopy. 2019. Using Social Science to Improve Outreach to Protect Endangered Aquatic Animals: The Case of Freshwater Mussels in Indiana. Journal of Contemporary Water Research and Education. 167: 68-77.

Fleckenstein, Michelle, Ashley Lythgoe, Junyu Lu, Nathan Thompson, Otto Doering, Seth Harden, Jackie M. Getson, Linda Prokopy. In Press. Crop Insurance: A Barrier to Conservation Adoption? Journal of Environmental Management.

Church, Sarah, Junyu Lu, Pranay Ranjan, Adam Reimer, Linda S. Prokopy. 2020. The role of systems thinking in cover crop adoption: Implications for conservation communication. Land Use Policy. 94

Prokopy, Linda S., Kristin Floress, J.Gordon Arbuckle, Sarah P. Church, Francis R. Eanes, Yuling Gao*, Benjamin M. Gramig, Pranay Ranjan, Ajay S. Singh. 2019. Adoption of Agricultural Conservation Practices in the United States: Evidence from 35 Years of Quantitative Literature. Journal of Soil and Water Conservation. 74(5): 520-534.

Church, Sarah P., Nicholas Babin, Belyna Bentlage, Michael Dunn, Jessica D. Ulrich-Schad, Pranay Ranjan, Joe Magner, Eileen McLellan, Susi Stephan, Mark D. Tomer, Linda S. Prokopy. 2019. The Beargrass Story: Utilizing Social Science to Evaluate and Learn from the "Watershed" Approach. Journal of Contemporary Water Research and Education. 167: 78-96.

Ranjan, Pranay, Ajay S. Singh, Mark Tomer, Ann Lewandowski, Linda S. Prokopy. 2019. Lessons Learned from Using a Decision-Support Tool for Precision Placement of Conservation Practices in Six Agricultural Watersheds in the US Midwest Journal of Environmental Management. Journal of Environmental Management, 239: 57-65.

Eanes, Francis R., Ajay S. Singh, Brian R. Bulla, Pranay Ranjan, Mary Fales, Benjamin Wickerham, Patrick J. Doran, Linda S. Prokopy. 2019. Crop advisers as conservation intermediaries: Perceptions and policy implications for relying on nontraditional partners to increase U.S. farmers' adoption of soil and water conservation practices. Land Use Policy, 81: 360- 370.

Church, Sarah, Lindsey Payne, Sara Peel, Linda Prokopy. 2019. Beyond Water Data: Benefits to Volunteers and to Local Water from a Citizen Science Program. Journal of Environmental Planning and Management. 62(2): 306-326.

Usher, Emily. 2019. Exploring Stakeholder Priorities for Successful Watershed Management. Indiana Water Resources Association Annual Symposium, Syracuse, IN. June 2019. Oral

presentation.

Conrad, Whitney. 2019. Effects of Land Use Type on Abundance and Type of Microplastic Pollution – A Contaminant of Emerging Concern in Indiana Rivers? Indiana Water Resources Association Annual Symposium, Syracuse, IN. June 2019. Oral presentation.

Ward, Jessica. 2019. Short- and Long-term Effects of Neurodegenerative Algal Metabolites on Predator-Prey Interactions in a Larval Freshwater Fish. Indiana Water Resources Association Annual Symposium, Syracuse, IN. June 2019. Oral presentation.

Prokopy, Linda. December 2020. "What Drives Decision-Making in the Field? Evidence from Research on Farmers." Field to Market Cross-Sector Dialogue on The Human Element: What Social Science Can Teach Us About Building Effective Sustainability Strategies for U.S. Agriculture, virtual.

Prokopy, Linda. October 2020. "Challenges in Agricultural Conservation: The Farmer, The Land Owner, and the Agricultural Supply Chain." Iowa State University, Natural Resources and Environmental Management graduate seminar, virtual.

Prokopy, Linda. September 2020. "The Social Dimension of Agricultural Conservation." Indiana Natural Resources Conservation Service training, virtual.

Prokopy, Linda. September 2020. "Understanding Adoption of Agricultural Conservation Practices." Water Resources Foundation webinar.

Prokopy, Linda. August 2020. "Understanding Adoption of Agricultural Conservation Practices." Tri-State Advanced Soil Health Training Workshop, virtual.

Arbuckle J. and Linda Prokopy. August 2020, "Understanding and Accelerating Adoption of Cover Crops." Midwest Cover Crops Council webinar.

Prokopy, Linda. July 2020, "Understanding Adoption of Agricultural Conservation Practices." Pritchard Panel, Soil and Water Conservation Society annual meeting, virtual.

Prokopy, Linda. July 2020. "Leveraging Crop Advisers to Deliver Agricultural Conservation Advice and Increase the Adoption of Conservation Practices." Agronomy Society of America webinar.

Prokopy, Linda. January 2020, "Off the Beaten Path: New Communication Avenues to Voluntary Conservation Ag Adoption." Bridges Over Barriers: Trust in Food Symposium, Chicago, IL.

Prokopy, Linda, January 2020, "Communicating Conservation." Alphabet Soup Group Meeting, Decatur, IL.

Prokopy, Linda. November 2019. “Latest Findings on Conservation Adoption.” Soil, Water, Cropping Systems Forum: How Purdue is Moving Ag Forward in Sustainable Ways. Hendricks County, IN.

Prokopy, Linda. November 2019: “Moving the Needle on Adoption of Agricultural Conservation Practices.” University of Montana.

Usher, Emily. 2020. Opportunities and Challenges of Integrating ACPF into NRCS’s Conservation Planning Toolkit. Soil and Water Conservation Society Annual Conference. Virtual.

Ranjan, P., Yu, D.J., Jeong, H., & Bhattarai, R. 2019. “Effects of institutional and infrastructure designs on collective-risk social dilemma: A case of agriculture drainage systems.” Presented in a pre-organized session: “Applying collective action theory to agricultural water management: Challenges and opportunities for protecting water quality,” at the Workshop on the Ostrom Workshop (WOW6), Bloomington, IN, June 19-22.

Information Transfer Program

The Indiana Water Resources Research Center (IWRRC) distributes funding opportunities, events, statewide legislative information, research awards and on-going research, requests for proposals, and other relevant water information through our listserv of water academics in Indiana, social media (Twitter: @INWaterCenter), and our website (iwrrc.org). In addition, we have developed project factsheets highlighting the research funded through the 104b program and the impact that research has on Indiana waterways. Factsheets are available at iwrrc.org.

The IWRRC participates in regional and statewide working groups; (1) the Algal Bloom Action Team (ABAT), a working group of representatives from extension and water institutes with the goal of making emergent Harmful Algal Bloom (HAB)research accessible to agriculture and natural resource educators across the Midwest region. During this reporting period, we produced a Frequently Asked Questions document and organized our first HABs Symposium that will occur in January 2021, and (2) the statewide advisory committee for Western Lake Erie Basin work.

In addition, the IWRRC partners with the Indiana Water Resources Association (IWRA) to host their Annual Symposium, Indiana’s predominant annual water conference. We strongly encourage our 104g small grant recipients and/or their students to present their research either through presentations or posters at this symposium. The IWRRC also supports the student poster competition. Several PIs and students presented at the 2019 Symposium but unfortunately, due to COVID-19, the 2020 Symposium was postponed to 2021.

Student Support

Number of students directly or indirectly supported:
11 Undergraduates
2 Masters graduate students
13 Ph.D. graduate students

Notable Achievements and Awards

Dr. Venkatesh Merwade's project (Purdue University) received subsequent support from the National Science Foundation. Title: River Morphology Data and Analysis Tools (RiverMorph): A Web Platform for Enabling River Morphology Research ($428,197).

Dr. Venkatesh Merwade's project (Purdue University) received subsequent support from the National Science Foundation. Title: The Urban Flooding Open Knowledge Network (UF-OKN): Delivering Flood Information to AnyOne, AnyTime, AnyWhere ($203,974)

Dr. Gary Lamberti (University of Notre Dame) received a 104g National Competitive Grant for his project, Per- and Polyfluoroalkyl Substances (PFAS) – An Emerging Environmental and Human Health Concern for the Great Lakes? ($250,000)

Dr. Paul Venturellli (Ball State University) received a 104g Aquatic Invasive Species National Competitive Grant for his project, Using data from a popular fishing app to predict the spread of aquatic invasives and identify characteristics of resistant/resilient lakes in the Upper Mississippi River Basin. ($79,195)

Dr. Linda Prokopy, Director, received funding from the Indiana Soybean Association for her project, Understanding Persistence of Cover Crop Use in the Big Pine Watershed. ($10,000)

Dr. Linda Prokopy, Director, received three grants from The Nature Conservancy for her projects, Understanding Persistence of Cover Crop Use in the Upper White, Lower Wabash, and St. Marys Watersheds. ($70,000)

Dr. Linda Prokopy, Director, received funding from The Nature Conservancy for her project, Understanding Social Capacity for Cover Crop Adoption. ($35,177)

Dr. Linda Prokopy, Director, received funding from the National Wildlife Federation for her project, Impacts of Cover Crop Champions Program on Non-Conservation Adopting Farmers. ($17,000)

Dr. Linda Prokopy, Director, received funding from USDA-NIFA as a Co-PI for the project, Readiness Assessment for NRCS to Use ACPF. ($183,986)

Dr. Linda Prokopy, Director, received funding from NRCS as a Co-PI for the project, Enhancing the Sustainability of US Cropping Systems through Cover Crops and an Innovative Information and Technology Network. ($715,863)

Dr. Linda Prokopy, Director, received funding from NRCS as a Co-PI for the project, Nutrient Stabilizer Adoption. ($79,457)

Dr. Linda Prokopy, Director, received funding from The Walton Family Foundation for her project, Assessing the Strengths and Limitations of Voluntary Conservation to Modify Agricultural Practices. ($100,000)

Dr. Linda Prokopy, Director, received the Unsung Diversity Hero Award, College of Agriculture, Purdue University, for her positive influence on programs and organizations from behind the scenes with a positive attitude, a willingness to help, and a commitment to excellence.

Effectiveness Of Wetland Restoration In Mitigating Extreme Streamflows Under Future Climate Change In The White River Watershed Of Indiana

Project Type: Annual Base Grant
Project ID: 2019IN095B

Project Impact:

The project has supported scenario-based hydrological modeling, and statistical analysis and modeling of water quality and streamflow changing trend of the White River watershed. Approaches employed in this project includes land use change scenarios, experimental data compiled from literature, climate data analysis, statistical modeling, and an easy-to-adopt nutrient simulation model. Primary findings 1) revealed sensitive areas in the White River watershed for nutrient release and projected the comparisons under various land use scenarios into the future, and 2) illustrated the increasing trend of BOD and nitrogen, and the decreasing trend of DO in the White River near Muncie over the past two decades. Approaches developed/adopted are helpful for watershed protection, to inform and guide conservation practices by revealing areas with the greatest effects on nutrients in streams under different land use scenarios. The experiment database that was compiled could serve as the basis of similar studies in the future. The long-term statistical analysis and modeling of the water quality also reveals the changing trend and potential pollution sources in the Upper White River watershed of Indiana. The approaches and outcomes will be beneficial to local community and may easily be applied to other agriculture dominate Midwest regions. The project also produced two peer-reviewed articles, six in-state and international conference presentations, involved/trained two undergraduate students, two master students and one Ph.D. student. A grant proposal to USGS 104 G National Competitive Grant program was submitted in 2020 as part of the product from this support.

Characterizing Aquifer Geometries In Northern Indiana By Profiling The Buried Bedrock Surface With Geophysical Techniques

Project Type: Annual Base Grant
Project ID: 2019IN096B

Project Impact:

Groundwater resource assessments in glaciated regions require buried bedrock elevation data to provide information related to the lower bounds of the unconsolidated aquifer geometry, which, in turn, determines water-resource availability. Bedrock data is relatively sparse in northern Indiana where glacial sediment thicknesses usually reach 300 ft or more. The goal of this project was to collect 100 to 200 new bedrock elevation data points in northeastern St. Joseph and northwestern Elkhart Counties; these data were estimated through a geophysical technique called microtremor Horizontal-Vertical Spectral Ratio (HVSR) analysis, using a microtremor seismograph or tromograph. A new bedrock surface model was prepared from this data and other available datasets. A student intern was hired to collect the data and develop field methods.

During the 2019 field season (May-October), 233 locations were surveyed using one or more tromographs. Problems with data collection were related to weather, which was wetter in the area than normal and, which, in turn, saturated the soils. For both field work and digital computations, methods were refined to aid in future work. Much of the data collected are within the accepted margin of error and add to the existing set of bedrock elevation data. Our new bedrock model derived from this data shows two bedrock valleys trending north south. This model improves our understanding of the bedrock morphology in the area but also directs attention to areas needing more data for future work.

Using Sedimentary Lipid Biomarkers To Track Historical Changes To Lake Michigan

Project Type: Annual Base Grant
Project ID: 2019IN097B

Project Impact:

We focused analytical efforts on two sediment cores, near Holland and Benton Harbor, MI, with similar sampled intervals for both between 1960-2008. We analyzed sterols, polycyclic aromatic hydrocarbons (PAHs), n-alkanes, and fatty acids. Overall, organic geochemical markers suggest sediments record site-specific information (not homogeneous), with more specific contaminants present in older sediments, but more recent increases in aquatic vegetation (potential blooms) at these sites. Eleven PAHs at both sites show significant increases (2-3 times greater) with depth. PAHs originate from the combustion of biomass and fossil fuels. PAH abundances suggest evidence of recent decreased air pollutant delivery to the lake, perhaps aligning with increased regulations. However, further analysis is needed to confirm and isolate the PAH source. We find seven sterols consistently ~5-10 times more abundant at the northern than the southern site. The northern site shows sterol increases with depth, not uniformly seen to the south. Sterol ratios indicative of human fecal contamination are more abundant in older samples of the northern site. FAMES and n-alkanes show good preservation (chain length distribution) and a mix of long and short chain lengths. FAMES are dominated by short chain lengths at all depths and show increases at both sites (especially in the north) increasing to present, suggesting microbial and aquatic bloom contributions are increasing through time, unrelated to PAH and sterol abundances or drivers. n-Alkanes show similar abundances in long and short chains across sites and through studied time intervals, suggesting terrestrial vegetation input of n-alkanes is equivalent to aquatic contributions.

Impacts Of Urban Ecosystem Services On Human Health And Water Quantity And Quality In Northwestern Indiana Communities: An Unexplored Opportunity To Study Service Accessibility

Project Type: Annual Base Grant
Project ID: 2019IN098B

Project Impact:

Urban greenspaces provide essential ecosystems services that regulate water quality. Our social survey of NW Indiana residents revealed income predicts resident valuation, preferences and delivery for most service types (Table 1). Involvement of survey respondents in environmental advocacy or an environmental profession (i.e., eco-involvement) was a good indicator for supporting and regulating ecosystem services (Table 1C, Figure 1C), which included hydrologic services. Eco-involved individuals frequented areas with rain gardens the most, potentially due to their environmental-centered purpose (could also be less known by other groups) (Table 2A, C). These insights support past research on service distribution disparities and nature valuation related to pro-environmental behavior. We also found that low-income residents are less likely to have vegetation on property (Table 2B), and that related expenses are their major concern when considering residing nearby areas with it (Table 2E). These results support previous findings that high-income individuals have more private greenspace (Table 2A), and emphasize that lack of access to private greenspaces by low-income residents could translate into relying on lower quality and poorly maintained public greenspaces (Figure 2)—overlooking these issues and sacrificing access to preventative benefits (e.g. flooding prevention, erosion control, etc.). This access to low-quality vegetation by low-income residents has been documented by our ecological mapping. Our approach allowed us to provide further insights into the heterogeneous and inequitable access to the benefits provided by urban greenspaces and the water quality benefits they provide.

Creating A High Resolution Hydrologic Model For Simulating And Forecasting Floods In The Wabash River Basin

Project Type: Annual Base Grant
Project ID: 2019IN099B

Project Impact:

The primary aim of this project was to create a large-scale hydrologic and hydraulic (H&H) model that can provide hydrologic fluxes and street level flooding information for any point in the entire Wabash River Basin spanning 85,000 km2 covering almost 65% of the state of Indiana. This aim is achieved by implementing a physically based distributed model, Integrated Channel and Pond Routing (ICPR), a FEMA approved H&H model which is capable of simulating physical processes such as routing, infiltration and pond storage across the entire watershed. This project also involved the development of automated tools for creating accurate geospatial descriptors such as river centerlines, banks and river geometry.

The overland flow was modeled by 2D flexible mesh with finer resolution near critical infrastructure and hydrologically important areas such as urban areas (example: city of Indianapolis), rivers, ridges, ponds, and levees. This leads to the creation of 4.75x106 nodes across the entire basin. Each of these nodes interacts with meteorological forcing such as precipitation and sub-surface module (vadose zone) to estimate hydrologic fluxes such as runoff, infiltration and recharge as well as hydraulic variables such as water surface elevation (WSE) and flow. The availability of WSE and flow estimates at every node enables the creation of dynamic floodmaps spanning the entire Wabash River Basin. The model is simulated for 2-month period (1st April 2013 – 1st June 2013) using High Performance Computing. Comparison with USGS gage measurements show that results are encouraging but can be further improved by improving bathymetric representation of river network. This project has enabled upscaling of a highly complex H&H model, that has led to more research funding to make the availability of its tools and results to the wider research and general community.

Per- and Polyfluoroalkyl Substances (PFAS) – An Emerging Environmental and Human Health Concern for the Great Lakes?

Project Type: Research
Project ID:

Project Impact:

In 2020, Covid-19 altered the original timeline of this project due to laboratory shutdowns and slowdowns at the University of Notre Dame and partner state and federal agencies. Still, our partner USGS Great Lakes Science Center was able to collect some of the prey fish samples from Lake Michigan that we required and will provide more fish in 2021. For predator fish, our USFWS partners with the Great Lakes Mass Marking Program were unable to sample in 2020 but look forward to providing predator fish samples in 2021. To acquire some predator fish in 2020, we reached out to individual fish biologists with the Indiana and Michigan Departments of Natural Resources whose programs sample fish weirs. In total, we obtained 40 Coho salmon, Chinook salmon, and Steelhead from Lake Michigan tributaries – Trail Creek in Indiana, and Little Manistee River and Boardman River in Michigan. We also obtained 25 fish samples from fishing tournaments provided by willing anglers. We will need to obtain additional predator fish in 2021 to ensure full coverage of Lake Michigan. However, our opportunistic sampling in 2020 was very fortuitous for this project, all of which was conducted under strict Covid-19 safeguards approved by the University of Notre Dame. To date, we have run 50 fish samples on our fluorine-detection instrument (PIGE) and 6 of those samples have also undergone preliminary PFAS compound identification with LC-MS/MS in our analytical laboratory.