

**Louisiana Water Resources Research Institute
Louisiana State University**

**Annual Technical Report
2019**

Products

Journal Articles

- Tan, G., S. Lu, N. Xu, D. Gao, and X. Zhu, Pseudocapacitive behaviors of polypyrrole grafted activated carbon and MnO₂ electrodes to enable fast and efficient membrane-free capacitive deionization, *Environmental Science & Technology*, 2020, 54, 9, 5843–5852
- Beigi, E., F. T.-C. Tsai, V. P. Singh, and S.-C. Kao. (2019). Bayesian Hierarchical Model Uncertainty Quantification for Future Hydroclimate Projections in Southern Hills-Gulf Region, USA. *Water*, 11(2), 268. <https://doi.org/10.3390/w11020268>
- Yin, J., H. V. Pham, and F. T.-C. Tsai. (2020). Multi-objective Spatial Pumping Optimization for Groundwater Management in a Multi-Aquifer System. *Journal of Water Resources Planning and Management*, 146(4). [https://doi.org/10.1061/\(ASCE\)WR.1943-5452.0001180](https://doi.org/10.1061/(ASCE)WR.1943-5452.0001180)
- Yang, S. and F.T.-C. Tsai (2020). Understanding impacts of groundwater dynamics on flooding and levees in Greater New Orleans. *Journal of Hydrology: Regional Studies*, 32, 100740. <https://doi.org/10.1016/j.ejrh.2020.100740>
- Jaegge, A., B. Lavergne, E. Pell, B.A. Stauffer (in preparation for submission to *Gulf and Caribbean Research* in Spring 2021) Combined effects of increased salinity and temperature on the growth of a non-toxic strain of *Microcystis aeruginosa*. (under preparation)
- Jaegge, A., J. Raabe, B.A. Stauffer. (in preparation for submission to *Estuaries and Coasts* in Summer 2021) Impacts of the 2019 Mississippi River flooding on estuarine phytoplankton communities. (under preparation)
- Xu, Y.J. and Xu, Z. Extreme floods increase continental carbon export – Results from the unprecedented 2019 Mississippi River mega flood. (to be submitted to *Water Research*)
- Xu, Y.J. and Xu, Z. Carbon transport and transformation in a 244-km reach of the lowermost Mississippi River. (to be submitted to *Journal of Hydrology*)
- Dhakal, R., K. P. Paudel, M. Fannin, N. Adusumilli, and D. Bhandari. Economic impact of water salinity in agriculture sector encompassing two aquifers of Louisiana. (in preparation for submission to *Sustainability*)

Conference Presentations

- Wang, P., and H. Zhang. Simulation of CO₂ over the Gulf Coast and the US using the CMAQ model. The 12th Annual Louisiana Groundwater, Surface Water, and Water Resources Symposium, Baton Rouge, LA, Mar 2018. Oral Presentation.
- Tan, G., X. Zhu. Activated Carbon Grafted Polypyrrole Anodes for Efficient Capacitive Deionization. Oral presentation at the “4th International conference on capacitive deionization and electrosorption”. May. 20-23. 2019. Beijing. China.
- Jaegge, A., J. Raabe, B.A. Stauffer. Floods and phytoplankton: Assessing impacts from the 2019 Mississippi River flooding. Oral presentation at the Gulf Estuarine Society (GERS) conference, Nov 2020 (virtual, student presentation winner).

- Jaegge, A., J. Raabe, B.A. Stauffer. Impacts of the 2019 Mississippi River flooding on estuarine phytoplankton communities. Oral presentation at UL Lafayette Biology Fall 2020 Colloquium, Sept 2020 (virtual).
- Jaegge, A., J. Raabe, B.A. Stauffer. Impacts of the 2019 Mississippi River flooding on estuarine phytoplankton communities. Poster presentation at the Ocean Sciences Meeting in San Diego, CA, Feb 2020.
- Pell, E., A. Jaegge, G. Kurtay, B. Lavergne, B.A. Stauffer. grow it like it's hot: how warming and freshening of estuaries support the growth of cyanobacteria. Poster presentation at the 2020 Midwest Fish & Wildlife Conference in Springfield, IL, Jan 2020.
- Lewis, T.L., A. Jaegge, J. Raabe, B.A. Stauffer. Effects of the 2019 Floods on Water Quality and Phytoplankton Communities in South. Louisiana Estuaries. 3rd Annual Symposium for Undergraduate Research Exploration (SURE), University of Texas at Austin, Austin, TX, Nov 2019
- Vahdat-Aboueshagh, Hamid, and Frank T.-C. Tsai, Building large-scale complex hydrostratigraphy model using big data of well logs: Subsurface characterization of the Capital Area, Louisiana, Abstract No. H21H-1831, 2019 American Geophysical Union Meeting, San Francisco, 9-13 December, 2019
- Chen, Y.-H., H. Vahdat-Aboueshagh, F. T.-C. Tsai, Assessment of Groundwater Depletion in Southern Hills Aquifer System, Southeastern Louisiana, 2020 American Geophysical Union Meeting (virtual), December 2020
- Bhatta, D., K.P. Paudel, and F.T.-C. Tsai. Impacts of Conservation Policy and Water Saving Technology on Irrigation Energy Cost in the Mississippi River Alluvial Aquifer (MRAA). Selected paper presented at the SAEA meeting in Kansas City, Missouri, August 10-11, 2020 (Virtual presentation).

Dissertations

- Wang, P., "Understanding Air Pollutants and Meteorology Interactions Using Chemical Transport Models" (2020). LSU Doctoral Dissertations. 5267.
https://digitalcommons.lsu.edu/gradschool_dissertations/5267
- Xu, Z., "Element Transport in A River-lake Continuum across Forest-dominated Landscapes: A Case Study in Central Louisiana" (2020). LSU Doctoral Dissertations. 5181.
https://digitalcommons.lsu.edu/gradschool_dissertations/5181
- Tan, G., "Water-energy Nexus: Studies On Salinity Gradient Energy Harvest And Desalination" (2020). LSU Doctoral Dissertations. 5400.
https://digitalcommons.lsu.edu/gradschool_dissertations/5400
- Yin, Jina, "Groundwater Management Optimization and Saltwater Intrusion Mitigation under Uncertainty" (2019). LSU Doctoral Dissertations. 5050.
https://digitalcommons.lsu.edu/gradschool_dissertations/5050
- Lemon, Mary Grace, "Characterization of Shallow Subsurface Hydrology in Large Fine-Grained Floodplains" (2020). LSU Doctoral Dissertations. 5328.
https://digitalcommons.lsu.edu/gradschool_dissertations/5328

- Bhatta, Dependra, "Sustainable Management of Groundwater in Louisiana" (2020). LSU Doctoral Dissertations. 5410.
https://digitalcommons.lsu.edu/gradschool_dissertations/5410

Information Transfer Program

The research results were disseminated through journal publications, conference presentations, and student dissertations.

Student Support

Undergraduate: 3

Graduate: 9

Postdoc: 0

Notable Achievements and Awards

- Graduate student Andrea Jaegge of Dr. Stauffer was recognized with the Best Graduate Student Presentation award at the 2020 Gulf Estuarine Research Society (GERS) conference for her presentation of this research.
- Dr. Stauffer was awarded NSF-funded Healthy Streams, Healthy Coasts Research Experience for Undergraduate (REU).
- Director Tsai is the lead institute PI (LA) for the awarded NSF EPSCoR Track-II, IGM--A Framework for Harnessing Big Hydrological Datasets for Integrated Groundwater Management.
- Director Tsai initiated a Memorandum of Understanding (MOU) signed by Louisiana State University and U.S. Geological Survey, Lower Mississippi-Gulf Water Science Center to facilitate research and data exchange between LSU and USGS-LMG.

Assessing Present And Potential Effects Of Cyanotoxins In South Louisiana Estuaries

Project Type: Annual Base Grant

Project ID: 2019LA119B

Project Impact:

This research project is quantitatively assessing presence of these cyanobacteria and the toxins they produce in estuarine waters of south Louisiana. While cyanotoxin analyses are still underway, this study found that concentrations of particulate microcystins are present in Vermilion Bay. Cyanobacteria were important members of the flood-impacted phytoplankton communities. The flood in 2019 created distinct physical and chemical environment, as indicated by multivariate analyses of several important environmental factors including temperature, salinity, dissolved nutrients, dissolved oxygen (DO), and others. The flood-impacted estuarine waters were, in general, relatively lower in nutrients like nitrate (NO₃) and in DO than in previous years. Salinity was also substantially lower throughout the estuaries than previous years. As a proxy for cyanobacteria biomass, we quantified phycocyanin concentrations during the flood period (mainly July-August 2019) and also towards the end of the low salinity period (September 2019). These concentrations showed an inverse relationship with salinity, suggesting that a lot of the cyanobacterial biomass was attributable to freshwater-tolerant species, i.e. the toxin-producing taxa we are interested in. These taxa tend to be smaller in size, at least on the individual cell level, and we also saw increased dominance in the smaller size classes in summer 2019. That dominance was reduced when salinities started to increase in September, again pointing to an important role of small, freshwater-tolerant species in this event. This project is advancing our understanding of the occurrence, prevalence, and environmental drivers of cyanobacterial toxins with animal- and human-health impacts in this region.