

**Arkansas Water Resources Center
University of Arkansas**

**Annual Technical Report
2019**

Products

Project #	Project title	Type	Information citation
2019AR007B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Publication	Pham, H., D. Wahman, W. Zhang, and J. Fairey, 2019, <i>N</i> -nitrosodimethylamine (NDMA) Formation Mechanisms in Drinking Water Systems, <i>Encyclopedia of Water: Science, Technology, and Society</i> , pp. 1873-1886.
2019AR007B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Publication	Pham, H.; D. Wahman, and J. Fairey, 2021, Updated Reaction Pathway for Dichloramine Decomposition: Formation of Reactive Nitrogen Species and <i>N</i> -nitrosodimethylamine, <i>Environmental Science & Technology</i> , DOI: 10.1021/acs.est.0c06456.
2019AR007B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Pham, H., W. Zhang, D. Wahman, and J. Fairey, Validation of a Kinetic Model for NDMA Formation Relevant to Chloramination, American Water Works Association (AWWA) Water Quality Technology Conference (WQTC), November 3-7, 2019, Dallas, TX (oral presentation by H. Pham).
2019AR007B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Dissertation	Pham, H and J. Fairey, 2021 (Expected), Delineation and Validation of Reactive Nitrogen Species from Dichloramine Decay: Implications of <i>N</i> -nitrosodimethylamine Formation Pathways, PhD Dissertation, Department of Civil Engineering, University of Arkansas, Fayetteville, AR.
2019AR008B	Utilization of Biodegradable Hydroponic Growth Median as a Carbon Source for Greenhouse Wastewater Denitrification	Presentation	Riggio GM, KE Gibson, 2019, Treating One Waste Stream with Another: Using Spent Hydroponic Grow Mats as a Carbon Source for the Anaerobic Denitrification of Greenhouse Wastewater, Proceedings of the 2019 UCOWR/NIWR Annual Water Resources Conference, pp. 98. Available at: https://ucowr.org/wp-content/uploads/2019/07/2019_Conference_Proceedings.pdf Accessed on November 18 2020.

2019AR008B	Utilization of Biodegradable Hydroponic Growth Median as a Carbon Source for Greenhouse Wastewater Denitrification	Presentation	Ferri, A, GM Riggio, KE Gibson, 2019, The Biological Treatment of Hydroponic Wastewater using Spent Substrates as a Carbon Source for Denitrification. 2019 Arkansas Water Resources Center Annual Conference in Fayetteville, AR
2019AR008B	Utilization of Biodegradable Hydroponic Growth Median as a Carbon Source for Greenhouse Wastewater Denitrification	Thesis	Riggio, GM; Advisor: KE Gibson, Spring 2020, Food Safety Risk in an Indoor Microgreen Cultivation System, MS Thesis, Cellular and Molecular Biology, Univerist of Arkansas, Fayetteville, AR, pp.1-164
2019AR009B	Herbicide Mitigation Potential of Tailwater Recovery Systems in the Cache River Critical Groundwater Area	Publication	Grantz, E., D. Leslie, M. Reba, C. Willett, 2020, Residual herbicide concentrations in on-farm water storage-tailwater recovery systems: Preliminary assessment, DOI: 10.1002/ael2.20009
2019AR009B	Herbicide Mitigation Potential of Tailwater Recovery Systems in the Cache River Critical Groundwater Area	Publication	Grantz, E., J.A. Lee, C. Willett, J. Norsworthy, 2020, Soybean response to dicamba exposure in furrow irrigation. Agrosystems, Geosciences, & Environment. DOI: 10.1002/agg2.20039
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Mundy, A. Prater-Rochier, V., Webb, J., Fowler, L., Cruse, K., Bossus, M., Pollock, E. and Dodd, A.. Macroinvertebrate Communities Across a Gradient of Poultry Agriculture in the Eleven Point and Lower Black River Watersheds. Arkansas Annual Water Conference, Fayetteville, AR. July 30, 2019.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Fowler, L., Cruse K., Pollock, E., Mundy, A., and Dodd, A. Assessing the Relationship Between Animal Agriculture and Water Quality in the Mississippi Alluvial Plain. Arkansas Annual Water Conference, Fayetteville, AR. July 30, 2019.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Webb, J., Fowler, L., Pollock, E., Dodd, A., Bossus, M. 2019. Impact of nonpoint source pollution on crustacean physiology in Northeast Arkansas. INBRE Research Conference, Fayetteville, AR. October 26, 2019.

2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Webb, J., Fowler, L., Pollock, E., Dodd, A., Bossus, M. 2019. Impact of nonpoint source pollution on crustacean physiology in Northeast Arkansas. INBRE Research Conference, Fayetteville, AR. October 26, 2019.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Mundy, A., Prater-Rochier, V., Fowler, L., Cruse, K., Webb, J., Pollock, E., Bossus, M, Dodd, A. Macroinvertebrate Communities Across a Gradient of Poultry Agriculture in the Eleven Point and Lower Black River Watersheds. INBRE Research Conference, Fayetteville, AR. October 26, 2019.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Webb, J., Fowler, L., Pollock, E., Dodd, A., Bossus, M. 2020. Impact of nonpoint source pollution on crustacean physiology in Northeast Arkansas. Arkansas STEM Posters – State Capitol, February 19, 2020.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Mundy, A., Prater-Rochier, V., Fowler, L., Cruse, K., Webb, J., Pollock, E., Bossus, M, Dodd, A. Macroinvertebrate Communities Across a Gradient of Poultry Agriculture in the Eleven Point and Lower Black River Watersheds. Arkansas STEM Posters at the Capitol, February 19, 2020.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Fowler, L., Prater-Rochier, V., Cruse K., Pollock, E., Mundy, A., and Dodd, A. Assessing the Relationship Between Animal Agriculture and Water Quality in the Mississippi Alluvial Plain. Arkansas STEM Posters at the Capitol, February 19, 2020.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Webb, J., Mundy, A., Fowler, Cruse K., Prater-Rochier, V., L., Pollock, E., Bossus, M, Dodd, A. 2020. Assessing environmental impact of non-point source water pollution along a gradient f poultry houses. Annual Student Creative Arts and Research Forum, May 19, 2020.

2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Mundy, A., Prater-Rochier, V., Fowler, L., Cruse, K., Webb, J., Pollock, E., Bossus, M, Dodd, A. 2020. Assessing water quality and macroinvertebrate communities along a gradient of poultry agriculture in Northeast Arkansas. Society for Freshwater Science Virtual Poster Forum, June 10, 2020.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Fowler, L., Prater-Rochier, V., Cruse K., Pollock, E., Mundy, A., and Dodd, A. Assessing the Relationship Between Animal Agriculture and Water Quality in the Mississippi Alluvial Plain. Society for Freshwater Science 2020 Meeting.
2019AR010B	Assessing Water Quality and Biological Impacts of Nonpoint Source Pollution in the Eleven Point and Lower Black River Watersheds	Presentation	Dodd, A.K., Fowler, L., Mundy, A., Prater-Rochier, V., and Cruse, K. Impacts of Poultry Agriculture on Water Quality and Biological Condition in Northeast Arkansas. Friends of the North Fork and White River Meeting. November 12, 2019.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, June Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, July Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, August Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, September Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, October Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, November Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, December Newsletter, Arkansas Water Resources Center.

2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2020, Water News, January Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2020, Water News, February Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, March Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, April Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication, Newsletter	Scott, E.E. and B.E. Haggard, 2019, Water News, May Newsletter, Arkansas Water Resources Center.
2019AR-IT	AWRC Information Transfer	Publication	Scott, E.E. and B.E. Haggard, 2019, Turbidity and Ion Concentrations Vary with Land Use and Underlying Geology at the West Fork of the White River
2019AR-IT	AWRC Information Transfer	Publication	Austin, B.J., B.A. Smith, and B.E. Haggard, 2019, Stream Water Quality to Support HUC 12 Prioritization in the Lake Wister Watershed, Oklahoma: August 2017 through May 2019
2019AR-IT	AWRC Information Transfer	Publication	Austin, B.J., V.Eagle, M.A.Evans-White, J. T.Scott, and B.E. Haggard. 2020. Sediment phosphorus release sustains nuisance periphyton growth when nitrogen is not limiting. Journal of Limnology, 79, doi: 10.4081/jlimnol.20201913
2019AR-IT	AWRC Information Transfer	Publication	Henson, E., A. Lasater, and B.E. Haggard. 2019. Reducing dissolved phosphorus in stream water may not influence estimation of sediment equilibrium phosphorus concentrations. Agrosystems, Geosciences and Environment 2:190037
2019AR-IT	AWRC Information Transfer	Publication	McDowell, R., A. Noble, P Pletnyakov, B. Haggard, and L. Mosely. 2019. Global mapping of freshwater nutrient enrichment and periphyton growth potential. Nature Scientific Reports 10:3568

2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B.E. 2019. Microcystin is highly variable in Lake Fayetteville. North Carolina State University, Biological and Agricultural Engineering Department Visit, Raleigh, NC. December 2019.
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B.E. 2019. Microcystin is highly variable in Lake Fayetteville. Lake Fayetteville Partnership Special Meeting, Fayetteville, AR. August 2019.
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B.E. 2019. Big Creek Research and Extension Team: Monitoring to date. Buffalo National River Symposium, National Park Service, Harrison, AR. April 2019.
2019AR-IT	AWRC Information Transfer	Presentation	Shults, M., B.J. Austin, and B.E. Haggard. 2019. Variability in microcystin concentrations in a recreational lake. Arkansas Water Resources Center Annual Conference, Fayetteville, AR. July 2019.
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B.E., B.J. Austin, and D. Lee. 2019. Occurrence of microcystin (or lack there of) across a nutrient gradient in Ozark streams. University Council on Water Resources Annual Meeting, Snow Bird, UT. June 2019.
2019AR-IT	AWRC Information Transfer	Presentation	Grantz, E. and B. Haggard. 2020. What base flow proportion was sampled during the Joint Phosphorus Study?, Northwest Arkansas Regional Planning Council Municipality Organized Session; Virtual Presentation
2019AR-IT	AWRC Information Transfer	Presentation	Grantz, E. and B. Haggard. 2020. What base flow proportion was sampled during the Joint Phosphorus Study?, Poultry Industry Organized Session; Virtual Presentation
2019AR-IT	AWRC Information Transfer	Presentation	Grantz, E. and B. Haggard. 2020. What base flow proportion was sampled during the Joint Phosphorus Study? Illinois River Watershed Partnership Board Meeting; Virtual Presentation

2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B. 2020. Harmful algal blooms – microcystin is highly variable in Lake Fayetteville, BENG 4933 Sustainable Watershed Engineering, Virtual Guest Lecture.
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B. 2020. The Illinois River Watershed – the convergence of science and policy, Springdale High School, AP Environmental Science Class, Virtual Guest Lecture.
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B. 2020. Water-Quality and its Changes in the West Fork of the White River, Beaver Watershed Alliance Annual Symposium, Virtual Panel Session.
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B. 2020. Microcystin is highly variable in Lake Fayetteville, University of Arkansas, Biochemistry Department Seminar Series, Virtual Presentation.
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B. 2020. The Challenges in Monitoring Harmful Algal Blooms and Microcystin at Lake Fayetteville, Lake Fayetteville Partnership, Virtual Seminar.
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B. 2020. The Challenges in Monitoring Harmful Algal Blooms and Microcystin at Lake Fayetteville, Arkansas Department of Environmental Quality HAB Working Group, Virtual Presentation.
2019AR-IT	AWRC Information Transfer	Presentation	Austin, B.J., B. Smith, and B.E. Haggard. 2019. Subwatershed prioritization of the Lake Wister Watershed using baseflow water quality monitoring data. Poteau Valley Improvement Authority Board
2019AR-IT	AWRC Information Transfer	Presentation	Haggard, B. and E. Grantz. Water Quality Trends and Logistical Support. Arkansas Nutrient Reduction Strategy Coordination Committee, Virtual Presentation

Information Transfer Program

We run a robust information transfer program at the Arkansas Water Resources Center that includes an annual water conference, website updates, monthly electronic newsletters and archiving these stories on our “blog”.

We drew in about 160 people for the 2019 conference, with a theme of “Water Management and Nutrient Recovery”, where we facilitated conversations about on water management and nutrient recovery as well as USGS research on the Mississippi Alluvia Plain among students, agency personnel, municipal personnel, interested citizens and other water quality stakeholders from around the state and region.

We continue to maintain and improve our main Center website, awrc.uark.edu, where users navigate an easy to use, aesthetically pleasing site to find current research information, technical reports, raw data reports, conference information, lab information, grant and job opportunities, and more.

We publish monthly electronic newsletters to a listerv of 465 interested stakeholders from students to professionals. Articles cover a range of topics and these articles are archived on our blog website, WaterCurrents.uark.edu. We also share these articles and other posts on Facebook, where we have almost 700 followers, as well as on Twitter and Instagram.

We also develop an annual ‘Arkansas Water Research Bulletin’ to share research activities, especially 104B sponsored research and fact sheets geared toward the general public. All of our IT activities emphasize the USGS 104B program. We encourage 104B research presentations at our conference, we share research results on our website and through our monthly newsletters, we highlight student and faculty work through social media, and we include report articles in the Bulletin.

Student Support

Category	Section 104 Base Grant	Section 104 NCGP Award	NIWR-USGS Internship	Supplemental Awards	Total
Undergraduate	7	0	0	0	7
Graduate	3	0	0	0	3
Post-Doc	1	0	0	0	1
Total	11	0	0	0	11

Notable Achievements and Awards

- Federal Research Grant: Delineating Nitroxyl Formation Pathways from Chloramines and Free Chlorine and Cascades of Reactive Nitrogen Species to *N*-nitrosamines and *N*-nitramines; National Science Foundation (NSF); NSF Award #2034481; Award Amount \$329,548; Start Date: September 1, 2020, Duration: 3 years; Principal Investigator: J. Fairey; NSF Program: EnvE-Environmental Engineering.
- Gina Riggio received First Place in Student Poster competition at the 2019 UCOWR/NIWR Annual Water Conference in Snowbird, UT, June 11-13, 2019

Utilization Of Biodegradable Hydroponic Growth Media As A Carbon Source For Greenhouse Wastewater Denitrification

Project Type: Annual Base Grant

Project ID: 2019AR008B

Project Impact:

Denitrification of spent hydroponic nutrient solution discharged from greenhouses poses a potential environmental hazard. Aerobic denitrification requires a source of organic carbon, which can be costly for treating large volumes of wastewater. This study proposes the use of spent biodegradable hydroponic grow mats as a source of organic carbon. We compared various anaerobic conditions for the digestion of spent organic growth substrate as a source of organic carbon for the potential treatment of hydroponic wastewater.

- Grow mats in tap water demonstrated the greatest concentration of organic carbon produced during anaerobic digestion.
- Anaerobic digestion of grow mats resulted in peak levels of organic carbon after 7 days and decreased thereafter.
- Leaf waste in addition to Biostrate (type of grow mat) and tap water is capable of producing 5 liters of 5454 mg/L (ppm) total organic carbon.

Based on the above results, approximately 12.5 L of nutrient solution (2.5:1 C:N ratio) containing 218 mg/L N can potentially be treated. Our findings provide are the first steps in a sustainable and cost-effective treatment for hydroponic wastewater through utilization of another waste stream (i.e. spent, organic grow mats).

Herbicide Mitigation Potential Of Tailwater Recovery Systems In The Cache River Critical Groundwater Area

Project Type: Annual Base Grant

Project ID: 2019AR009B

Project Impact:

This study monitored residual concentrations of nine herbicides in seven on-farm storage reservoir-tailwater recovery (OFWS-TWR) systems located in the Cache River Critical Groundwater Area, completing a three-year dataset. Growing season (April – September) data were analyzed for spatial differences, including structure type, size, age, and vegetative cover.

- Residues of seven herbicides (2,4-D, 3,4-DCA, clomazone, dicamba, glyphosate, propanil, and quinclorac—but not metolachlor or imazethapyr), were greater in ditches than in reservoirs.
- Residue detections were more frequent overall and more frequently at greater magnitude ($> 2 \mu\text{g/L}$) in reservoirs built before 2010.
- Residue detections $>10 \mu\text{g/L}$ were more frequent in smaller surface area reservoirs ($<20 \text{ ha}$) and reservoirs with vegetated bank protection.
- Residue detections were more frequent overall in ditches with suboptimal vegetative cover, but detections $> 10 \text{ ug/L}$ were more frequent in small ditches (width $< 10 \text{ m}$) and ditches with total vegetative cover.

The observed spatial patterns in residual herbicide concentrations will inform best management practices for OFWS-TWR systems to preserve Arkansas' water resources into the future. Recovered tailwater should be cycled through and sourced from the reservoir before reapplication to minimize the risk of sensitive crop exposure to residual herbicides. Storage reservoirs may require maintenance or updates to reduce risks of herbicide accumulation. Further, the United States Geological Survey and others can use this dataset to improve models of herbicide fate and transport to include the mitigation potential of tailwater recovery systems to reduce herbicide loads from agricultural lands to the Mississippi River Basin.

Assessing Water Quality And Biological Impacts Of Nonpoint Source Pollution In The Eleven Point And Lower Black River Watersheds

Project Type: Annual Base Grant

Project ID: 2019AR010B

Project Impact:

Poultry and livestock agriculture continue to expand in Northeast Arkansas, increasing the potential for nutrient enrichment and ecological degradation in critical waterways in the Mississippi Alluvial Plain. We sampled twelve tributaries of the Eleven Point and Black rivers from June 2019 to February 2020 to determine if relationships existed between poultry and livestock agriculture and water quality, periphyton abundance, presence of algal toxins, dominant water sources, and invertebrate community structure and physiology.

- We found no significant relationships between animal agriculture and stream nutrient levels, though preliminary results from summer 2019 suggested a positive relationship between poultry house density and phosphorus concentrations.
- Fewer pollution-intolerant macroinvertebrate taxa were found in tributaries closer to poultry farm operations.

Our findings suggest that streams near poultry farming operations are in need of targeted mitigation to prevent further declines in sensitive invertebrate taxa. While the mechanism inducing these declines is unclear, our continued work in these watersheds may shed light on the specific habitat metrics or pollutants responsible. Additionally, the positive relationship between poultry house density and phosphorus concentrations during summer 2019 suggests a seasonal component to the impact of poultry farming on in-stream nutrients. These efforts to determine the impact of animal agriculture are critical as poultry agriculture continues to expand in Arkansas, potentially impacting water quality and biological condition throughout the Mississippi Alluvial Plain.

Nitroxyl - The Missing Link in NDMA Formation in Chloramine Systems

Project Type: Annual Base Grant

Project ID: 2019AR007B

Project Impact:

The NDMA formation pathway in chloraminated drinking water remains unresolved. The goal for this project was to investigate the role of nitroxyl and peroxyxynitrite, both hypothesized chloramine decay intermediates and RNS, in the NDMA formation pathway in drinking water systems.

- Profiles of dichloramine decomposition, nitrous oxide formation, and dissolved oxygen consumption indicated the formation of nitroxyl and peroxyxynitrite, both RNS, from dichloramine hydrolysis.
- Experiments with of uric acid, a peroxyxynitrite scavenger, implicated peroxyxynitrite as a central node in the *N*-nitrosodimethylamine (NDMA) formation pathway.
- Revised unified chloramine kinetic model with nitroxyl as the heretofore unidentified intermediate (*I*) of dichloramine hydrolysis accurately simulated kinetic profiles of dichloramine, monochloramine, dissolved oxygen, and NDMA between pH 7 and 10, the pH range of interest in chloramine systems.

The State of Arkansas has twelve public water systems using chloramines, serving a total approximately 100,000 people. These facilities are located throughout the state and have limited resources to dedicate to NDMA control strategies. An accurate understanding of the NDMA formation pathway during chloramination would facilitate development of strategies to curb NDMA formation and promote monochloramine stability. The main findings of the project were published in the journal *Environmental Science & Technology* (Pham, Wahman, & Fairey, 2021).

Do stream phosphorus dynamics correspond with biological condition in the Lake Conway Point Remove Watershed, Arkansas?

Project Type: Annual Base Grant

Project ID: 2018AR405B

Project Impact:

The extent of agricultural land use in watersheds can affect stream health and function, but potential differences between agriculture types have not been explored. We compared nutrient concentrations, phosphorus (P) sorption to sediments, and macroinvertebrate communities between streams with watershed gradients of pastureland in Arkansas and row-crop land cover in Michigan.

- Nitrate, ammonium, and soluble reactive P concentrations were greater in Arkansas streams with more watershed pastureland, while row-crop agriculture was associated with greater nitrate in Michigan streams.
- Arkansas stream sediments sorbed P more rapidly than Michigan sediments, with no links to amount of agricultural land use for streams in either state. The aqueous P concentration at which sediment and water column concentrations reach equilibrium (EPC_0) was greatest in Michigan streams.
- Macroinvertebrate community density was greater in Arkansas streams with greater pastureland, while diversity and richness were lower in row-crop dominated Michigan streams.

We found that pasture and row-crop watershed land use affected surrounding streams differently. Our findings support targeted mitigation to address potential stream ecosystem impairments by type of agriculture in the watershed and to prioritize streams with the greatest potential for recovery. Faster sediment P sorption rates and a more diverse regional macroinvertebrate pool may facilitate a return to pre-impact community characteristics in impaired streams in Arkansas. Greater EPC_0 in Michigan streams suggest greater potential for sediment P release in response to management practices that reduce P inputs to streams, possibly delaying recovery from a legacy of intensive agriculture.