

**New York State Water Resources Institute
Department of Earth and Atmospheric Sciences**

**Annual Technical Report
2019**

Products:

Peer Reviewed Papers

James Knighton, Brian Buchanan, Christian Guzman, Rebecca Elliott, Eric White, Brian Rahm, 2020. Predicting flood insurance claims with hydrologic and socioeconomic demographics via machine learning: Exploring the roles of topography, minority populations, and political dissimilarity, *Journal of Environmental Management*, Volume 272, <https://doi.org/10.1016/j.jenvman.2020.111051>.

Aikaterini Deliali, Dany Chan, Jennifer Oliver, Rassil Sayess, Krystal J. Godri Pollitt & Eleni Christofa (2020) Transitioning to zero-emission bus fleets: state of practice of implementations in the United States. *Transport Reviews*, DOI: 10.1080/01441647.2020.1800132

Rassil Sayess, Adam M. Eyring, and David A. Reckhow, 2021. Source and drinking water organic and total iodine and correlation with water quality parameters. *Water Res.*, 190, 116686.

Book Chapters

Mihai, F., Gündoğdu, S., Khan, F., Olivelli, A., Markley, L., and Emmerik, T. "Plastic pollution in marine and freshwater environments: abundances, sources, and mitigation." *Emerging Contaminants in the Environment: Challenges and Sustainable Practices*, edited by Sarma, H., Dominguez, D., and Lee, W., Elsevier, USA. (In Review).

NYSWRI Publications

Kanishka Singh, James Knighton, M. Todd Walter. Representing time variant water storage and mixing schemes in isotope tracer-aided hydrologic simulation. Technical Report. <https://wri.cals.cornell.edu/grants-funding/104b/2019/>

Timothy S. de Smet, Kenneth Chiu, Austin Scheer, Kely Amejecor. Hyperspectral Drone Detection of Harmful Algal Blooms: Ground truthing new approaches for water quality assessment. Technical Report. <https://wri.cals.cornell.edu/grants-funding/104b/2019/>

Charles Driscoll, Laura Markley, Ellenora Huth. Microplastic pollution in Onondaga and Skaneateles lakes in central New York. Technical Report. <https://wri.cals.cornell.edu/grants-funding/104b/2019/>

Kristen Hychka, Rassil Sayess, Brian Rahm, Meredith Perreault, and Khris Dodson. Staying Ahead of the Curve: Wastewater Surveillance for Monitoring COVID-19 Outbreaks in New York State. Short Communication. Prepared September, 2020. https://wri.cals.cornell.edu/sites/wri.cals.cornell.edu/files/shared/Short_Communication_WWSurveillance_092520.pdf

Assessment, Management, and Planning of Water Resources and Infrastructure in New York State. Prepared September, 2020. https://wri.cals.cornell.edu/sites/wri.cals.cornell.edu/files/shared/documents/2018_WRI_Summary.pdf

Rassil Sayess, Kristen Hychka, and Brian Rahm. Short Communication: Is SARS-CoV-2, the virus causing COVID-19, present in raw and in partially-treated sewage? Prepared May, 2020.

https://wri.cals.cornell.edu/sites/wri.cals.cornell.edu/files/shared/documents/Final_Draft_100420.pdf

Rassil Sayess and Brian Rahm. Per- And Polyfluoroalkyl Substances (PFAS): An Overview. NYSWRI Fact Sheet. Prepared 2020.

https://wri.cals.cornell.edu/sites/wri.cals.cornell.edu/files/shared/documents/PFAS_Infosheet.pdf

Trade & Extension Publications

LaGorga, L., Rahm, B. and Stedinger, J., "Cornell Joins the Club." Clear Waters, New York Water Environment Association, Summer 2020, Vol. 50, No. 2, 33-35.

Information Transfer Program:

Invited Talks, Panel & Testimony

[Brian G Rahm] "Sources of Flooding and Ways to be More Flood Resilient" remote talk presented at Flooding Happens: Understanding How Floods Happen and How to Be More Flood Resilient, part of the CCE Ulster County Climate Change Series, New Paltz, NY, July 10th, 2019 (~10 registered attendees). <http://ulster.cce.cornell.edu/events/2019/06/07/flooding-happens-understanding-how-floods-happen-and-how-to-be-more-flood-resilient>

[Brian G Rahm] Roundtable expert participant at the 5th annual Hobart & William Smith Hackathon, Geneva, NY, October 4th, 2019 (~40 student attendees). <https://www2.hws.edu/hws-hackathon-2019/>

[Brian G Rahm] Invited speaker, Ithaca Water Forum & Networking Event: Bridging State and Local Water Protections, hosted by Environmental Advocates of NY, The Cayuga Lake Watershed Network, and the League of Women Voters of Tompkins County, Ithaca, NY, October 17th, 2019.

[Brian G Rahm] "Water resource literacy as a prerequisite for everything" invited talk given to

- Syracuse University Environmental Engineering program, 10.28.19
- SUNY Buffalo Department of Civil, Structural & Environmental Engineering, 11.15.19

[Rasill Sayess] Panel: Was a panelist for Environmental Finance Center Network for the "Coronavirus Tracking in Wastewater" webinar – June 23, 2020.

[Rasill Sayess] Invited talk: Lower Hudson Partnership and NYC Water Trail Association webinar – June 24, 2020. "Safer community-based water quality monitoring amidst COVID-19" (~30 attendees)

NYSWRI Publications

Rassil Sayess. Wastewater Surveillance of SARS-CoV-2: Resource List. Prepared October, 2020.

https://wri.cals.cornell.edu/sites/wri.cals.cornell.edu/files/shared/documents/COVID_Resources.pdf

Conference Talks & Presentations

Markley, Laura, Driscoll, C., Costello Staniec, A., and Huth, E., Syracuse University. Goldilocks and the Three Surface Water Sampling Methods. Platform Presentation: MICRO2020 International Conference, November 2020, Virtual.

Markley, Laura, Driscoll, C., Costello Staniec, A., and Huth, E., Syracuse University. Distribution and Potential Sources of Freshwater Microplastics in Onondaga and Skaneateles Lakes. Platform Presentation: Society of Environmental Toxicology and Chemistry (SETAC) North America, November 2020, Virtual.

K. Hychka, R. Sayess, E. Fenton, B.G. Rahm. 2020. Evaluating Water Quality Impacts of Clean Water Revolving Fund Loans (2011-2014), NY Water and Environment Association Annual Meeting. February 3, 2020.

[Brian G Rahm] "Managing New York State's Water Resources," invited talk presented at the 2020 Finger Lakes Research Conference. Geneva, NY, January 15th, 2020 (~200 registered attendees)

Extension Activity

[Brian G Rahm] Presented "Trivia on the Teal" to promote WRI's Year of Water initiative as part of Discover Cayuga Lake Boat Tours & Cruises, 8.26.20 - 25 registered attendees

[Brian G Rahm] Co-organizer for webinar: "Wastewater Coronavirus Surveillance Systems: Advancing Research and Municipal Coordination Part II," in cooperation with Syracuse University Environmental Finance Center, New York Water Environment Association (NYWEA), and New York State Association of Counties (NYSAC), held October 28, 2020 (140 attendees)

[Rasill Sayess] Created a new wastewater treatment plant schematic for the Ithaca Area Wastewater Treatment Facility (IAWWTF)

An interactive virtual walking PocketSights Tour was developed using the PocketSights Application (link: <https://wri.cals.cornell.edu/year-water/>)

Natural Resources Inventory for the Village of Montour Falls. September 2019. Alex Goddard, Kalena Bonnier-Cirone, Osamu Tsuda, Kristen Hychka, Katherine Herleman, Chris Skawski, and Terry Carrol. p. 86. <http://csc-site-persistent-prod.s3.amazonaws.com/fileadmin/cicbase/documents/2019/7/3/15621727873446.pdf>.

From 2019NY192B:

- Appearance in the Eagle Bulletin newspaper: "Bag ban hits home for local businesses" and the Daily Orange: "Syracuse retailers adjust to plastic bag ban" in March 2020.
- Appearance in the Newhouse Communications Center (NCC): "How's the New York State Plastic Bag Ban Going?" in April 2020.
- A live panel discussion on Sustainable Beauty Science hosted by The Eco Well on YouTube in November 2020.

Student Support:

Undergraduate – 5
Graduate – 1
Postdoc – 0

Notable Achievements and Awards:

[NYS WRI Staff Member Gives Keynote at Finger Lakes Youth Climate Summit](#)

The [Finger Lakes Youth Climate Summit](#) was hosted by [Finger Lakes Institute](#) at Hobart and William Smith College on Oct. 30, 2019. with the goal of empowering young adults with knowledge and planning actions they can take to combat climate change. This year's theme was "Promoting Water Security Through Science for Society and the Environment". Kristen Hychka, NYS WRI Program Coordinator, gave the keynote--"Sponges in the Landscape: Greening Watersheds in the Face of Increasing Drought and Flooding"--to over 100 high school students and teachers from around the Finger Lakes.

[Rassil Sayess presents on COVID-19 in untreated wastewater](#)

The "Safer Community-Based Water Quality Monitoring Amidst COVID-19" discussion was hosted by the Lower Hudson Partnership—a group of water quality programs at the [Center for the Urban River at Beczak](#), the [Bronx River Alliance](#), and [Riverkeeper](#)—and the [NYC Water Trail Association](#) on June 24, 2020. Rassil Sayess, staff member of the NYS, presented on the knowns and unknowns regarding transmission risks from water contaminated with sewage that may contain SARS-CoV-2. The work presented here is in conjunction with a short communication that was published on the NYS WRI website titled: "Is SARS-CoV-2, the virus causing COVID-19, present in raw and in partially-treated sewage?"

[Local artist completes water resource literacy mural](#)

NYSWRI worked with local artist Norma Gutierrez and non-profit [Ithaca Murals](#) to create a work focused on the connections between community residents and the local water system. Situated at the Ithaca Farmer's Market and located next to the Ithaca Area Wastewater Treatment Facility, the mural strives to highlight the critical role of wastewater treatment in human and environmental health.

Shifts In Hudson River Valley Flood Frequency Following Eastern Hemlock Loss And Succession

Project Type: Annual Base Grant

Project ID: 2019NY189B

Project Impact:

Research has found that simulating tree water storage improves model calibration. We investigate water storage in four common conifers as captured by StorAge Selection (SAS) functions generated via a machine learning-based model. We generate model inputs through stable water isotope-tracer experiments conducted in growth chamber and field settings, examining how key environmental variables drive changes in SAS functions. We integrate the SAS framework, enhanced by our experimental data, into a hydrologic model, and assess whether model performance is improved. Finally, we utilize this model to simulate hydrological impact of hemlock loss under different climate scenarios. This project aims to significantly improve hydrologic predictions by testing the enhancement of a key characteristic of land surface models. Furthermore, the project may increase the accuracy of flood prediction, especially as it relates to the loss of Eastern hemlock in the Northeastern U.S. under different climate scenarios. This work will support efforts to derive accurate economic appraisals of forest management within the Catskill region. This research will also contribute to a fundamental improvement in simulation model structure that are used to predict and evaluate surface hydrology.

Key highlights:

- Project utilizes a novel methodology not previously applied to the study of plant transpiration.
- Project aims to significantly improve hydrologic prediction by testing the enhancement of a key characteristic of land surface models.
- Project may increase the accuracy of flood prediction, especially as it relates to the loss of Eastern hemlock in the Northeastern U.S. under different climate scenarios.

NYSWRI Internship Program

Project Type: Annual Base Grant

Project ID: 2019NY190B

Project Impact:

NYSWRI Interns are offered training in multiple disciplines relevant to on-going programming, are given opportunities to strengthen analytical and communication skills, and gain experience as members of an interdisciplinary team of researchers and extension staff. Interns appear as co-authors on peer-reviewed publications, professional papers, conference talks and posters. Projects pursued with FY19 funding included:

1. Climate Smart Communities (CSC) – NY State’s CSC Certification program supports New York communities in reducing greenhouse gas emissions and improving climate resilience. Interns worked with Tompkins County Extension to develop and present a Natural Resources Inventory for Montour Falls, NY and to create a municipal scorecard for CSC certification.
2. Roadside Ditches - Ten first-order streams across Tompkins County were chosen for sampling and data collection above and below stream-ditch confluence. Results showed that streams were significantly widened and scoured downstream compared to upstream and highlighted the importance of proper ditch management in maintaining healthy watersheds.
3. Glyphosate - Glyphosate is the most heavily used herbicide active ingredient in the world and was traditionally believed to have a low potential for runoff. This project compared lab analysis results from 2018 and 2019 to results from 2015-2017. Analysis indicated that more complex hydrological processes are at play in driving glyphosate loss.
4. Year of Water - This project sought to raise awareness of local water infrastructure and governance by engaging Cornell students and Ithacans in a series of free-choice learning installations. Interns created a PocketSights Tour, an interactive walking tour hosted on the PocketSights App.

Hyperspectral Drone Detection Of Harmful Algal Blooms: Ground Truthing New Approaches For Water Quality Assessment

Project Type: Annual Base Grant

Project ID: 2019NY191B

Project Impact:

Harmful algal blooms (HAB)s are an increasing threat to freshwater quality, public health, and aquatic ecosystems, costing New York State millions of dollars in annual damages. Yet the frequency, magnitude, and duration of HABs is poorly documented for inland freshwater lakes and ponds. Current field-based sampling followed by laboratory analysis to detect and monitor HABs is expensive, labor-intensive, and slow, delaying critical management decisions. The utility of satellite-based multispectral remote sensing to rapidly detect, monitor, and forecast HABs has been demonstrated at large oceanographic scales; however, low spatial and spectral resolution and inadequate revisit time limit the usefulness of satellite-based remote sensing techniques for inland freshwater ponds and lakes. We conducted a pilot study aimed at assessing the utility of efficient low-cost unmanned autonomous vehicle systems and spectral sensors for the rapid real-time detection and monitoring of HABs. The research resulted in the production of chlorophyll-a and cyanobacteria concentration maps and the development of a hyperspectral calibration methodology. This new state-of-the-art research methodology will allow for targeted assessment, monitoring, and design of HABs management plans that can be adapted for other impacted water bodies in New York State and implemented by managers at the NYSDEC, NYSDOH, and NYSDAM.

Key highlights:

- UAV-based hyperspectral sensors can be used to detect and monitor HABs on freshwater lakes.
- A distinctive spectral reflectance peak around 705-715 nm indicates high blue-green algae concentrations as confirmed by laboratory analysis of chlorophyll-a concentration.
- Automated UAS surveys can increase efficiency by decreasing person hours dedicated to sampling and monitoring.

Microplastic Pollution In Onondaga And Skaneateles Lakes In Central New York

Project Type: Annual Base Grant

Project ID: 2019NY192B

Project Impact:

This project provided the first measurements of suspected microplastic abundance and form in the surface waters of Onondaga Lake and its tributaries, as well as in the relatively pristine Skaneateles Lake. Samples from Onondaga Lake had higher concentrations than Skaneateles Lake, likely owing to more prevalent sources of plastic pollution from litter, wastewater effluent, combined sewer overflows (CSOs), and others. We found that microplastic concentrations are highly influenced by sampling methodology, with lower concentrations but greater morphological diversity found in net samples compared to lower volume grab samples. The findings indicate that microfiber pollution is the primary source of microplastics to these freshwater ecosystems. Furthermore, despite a ban on rinse-off cosmetics in 2015, samples from Onondaga Lake contained microbeads. This work suggests the need for further improvements to policies addressing microplastic pollution in New York State and has important implications given the use of Skaneateles Lake as the primary drinking water source for the City of Syracuse.

Key highlights:

- Sampling methodology is an important consideration in determining microplastic concentration, which can vary by orders of magnitude and collect vastly different morphologies.
- Surface water samples from Onondaga and Skaneateles lakes both contain suspected microplastics, with higher concentrations in Onondaga Lake, consistent with abundant and diverse microplastic sources from land use, wastewater effluent, combined sewer overflows, among others.
- Though not yet characterized by chemical analysis, the majority of suspected microplastics were microfibers, a large source of pollution emission into the environment not properly addressed by current plastic pollution policy.

Characterizing Transformation Products Of Organic Micropollutants In Groundwater And Hydrologically Connected Water Supplies Impacted By Onsite Wastewater Treatment Systems

Project Type: National Competitive Grant

Project ID: 2019NY002G

Project Impact:

Project has not yet termed (Progress report available upon request)