Maxwell R.W. Beal

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February 2025

Education

Ph.D. in Civil and Environmental Engineering, 2019 – 2024
University of Wisconsin – Madison, Madison, Wisconsin
Thesis: Leveraging Hydroclimatic Processes and Remote Sensing for Biological Response in Water Resource Management: Applications to Water Quality and Water-related Disease
Advisor: Dr. Paul Block

B.S. Water Resources Science, minor: Geographic Information Systems, 2015 – 2019
Magna cum laude
Northland College, Ashland, Wisconsin

Research Experience

Federal Postdoctoral Researcher – Ecologist, Office of Research and Development, U.S. Environmental Protection Agency, Durham, NC

September 2024 – February 2025

- Developed a machine learning-based spatially distributed forecasting model for the satellite-based Cyanobacteria Assessment Network (CyAN) harmful algae product on Sentinel-3 resolvable lakes across the U.S. conditioned on climate, hydrology, and water quality variables.
- Worked in high performance computing environments (SLURM interface) to develop R data pipelines for nation-wide remote sensing and climate datasets to support development of cyanobacteria forecasts.
- Contributed to the validation of a satellite based surface water temperature model for lakes across the continental U.S.

Postdoctoral Research Assistant, University of Wisconsin – Madison, Water Systems & Society Lab, University of Wisconsin – Madison, Madison, WI

May 2024 – August 2024

- Translation of previously developed remote sensing -based models for harmful algae and dissolved oxygen to Lake Tana, Ethiopia
- Construction of climate-based season ahead forecasts for dengue virus in Colombia
- Proposal writing to support vector-borne disease forecasting efforts

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Graduate Research Assistant, Water Systems & Society Lab, University of Wisconsin – Madison, Madison, WI
2019 – 2024

- Developed seasonal to sub-seasonal forecasting models for cyanobacteria biomass and related beach closings in a small inland lake conditioned on hydrology, climate, and water quality data. Models built in R.
- Created and assessed a system of season-ahead forecasting models for several algae metrics in 178 lakes across the Northeast and Midwest U.S. conditioned on local and global scale hydrology and climate data. Investigated influence of lake characteristics and land cover use on forecast skill across lakes. Models built in R.
- Developed a satellite remote sensing and machine learning based tool to retrieve algae pigments (Chlorophyll-a, phycocyanin) and dissolved oxygen on a small inland lake. Models built in Python.
- Developed climate-based sub-seasonal to seasonal forecasting models for dengue fever cases in four cities across Colombia in collaboration with the UW – Madison Global Health Institute and the One Health Center - Colombia. Models built in Python.

Consultant, Lower Colorado River Authority, Austin, TX
2022 – present

- Worked in a four-person research team to investigate the drivers and predictability of extreme cold and extreme heat across the Electric Reliability Council of Texas (ERCOT) domain at seasonal timescales based on global climate data.
- Developed and assessed machine learning models to predict extreme cold events across the ERCOT domain using temperature thresholds relevant to power generation. Models built in R and Python.
- Evaluated long term changes in the statistical relationship between the El Niño Southern Oscillation and streamflow in the Lower Colorado River basin.

Research Associate, Mary Griggs Burke Center for Freshwater Innovation, Northland College, Ashland, WI
2016 –2018

- Managed invasive aquatic macrophyte research: led field crews of 4-6 people on week-long trips in the backcountry, conducted lake-wide point intercept surveys on the Chippewa Flowage, learned and taught identification of aquatic macrophytes, coordination with Lac Courte Oreilles tribe, data entry and analysis in Microsoft Excel and R.
- Managed mercury contamination field work: led crews of 1-3 people on multiple day and overnight trips to national parks land in northern Wisconsin and Minnesota, collected dragonfly larvae for mercury contamination analysis, joint project with University of Maine and the National Parks Service
- Promotions: Research Assistant to Research Associate *March 2018*
  Research Technician to Research Assistant *March 2017*

Research Assistant, Wildlife Ecology Research Lab, Northland College, Ashland, WI
2017-2019

- Managed conservation biology research on the Osa Peninsula, Costa Rica: one month of independent field work in Corcovado and Piedras Blancas national parks setting camera traps to monitor terrestrial wildlife, data entry and analysis in Microsoft Excel and R. Joint project with ACOSA SINAC (Parks service agency for the Osa peninsula)
- Assisted with radio telemetry, American Kestrel nest box maintenance, and wolf howl surveys in northern Wisconsin.

Peer-Reviewed Publications

Beal, M.R.W, Osorio, J., Block, P. J., Hernandez-Ortiz, J. P., & Ciuoderis, K. Forecasting Dengue: Evaluating the Role of Hydroclimate Information in Subseasonal to Seasonal Prediction. *2024. In Review.*

Beal, M.R.W., & Olson, E. R. (2024). Native macrophyte community response to water-level manipulation for an invasive species. *Ecological Engineering*, *208*, 107380. https://doi.org/10.1016/j.ecoleng.2024.107380

Beal, M.R.W, Mutlu Özdoğan, and Paul J. Block. "A machine learning and remote sensing-based model for algae pigment and dissolved oxygen retrieval on a small inland lake." *Water Resources Research* 60.3 (2024): e2023WR035744. https://doi.org/10.1029/2023WR035744

Beal, M.R.W., Wilkinson, G. M., & Block, P. J. (2023). Large scale seasonal forecasting of peak season algae metrics in the in the Midwest and Northeast US. *Water Research*, *229*, 119402. DOI: 10.1016/j.watres.2022.119402

Beal, M.R.W., O'Reilly, B. E., Soley, C. K., Hietpas, K. R., & Block, P. J. (2022). Variability of summer cyanobacteria abundance: can season-ahead forecasts improve beach management?. *Lake and Reservoir Management*, 1-16. DOI: 10.1080/10402381.2022.2084799

Beal, M.R.W., O'Reilly, B., Hietpas, K. R., & Block, P. (2021). Development of a sub-seasonal cyanobacteria prediction model by leveraging local and global scale predictors. *Harmful Algae*, *108*, 102100. DOI: 10.1016/j.hal.2021.102100

Beal M.R.W., Matzinger P.J., Saborío-R G., Noguera J., Olson E.R. (2020) Survey of medium-sized and large mammals of Piedras Blancas National Park, Costa Rica. *Check List* 16 (4): 939–950. DOI: https://doi.org/10.15560/16.4.939

Other Publications

Olson E.R., **Beal M.R.W.,** Saborío G., Azofeifa A., Montes W. (2020) Wildlife Monitoring Report for Corcovado National Park, Costa Rica – 2018. Technical Report for MINAE–SINAC. *Technical Report*.

Olson E.R., **Beal M.R.W.,** Huss J., Laughlin M.M., and Matzinger P.J. Chippewa Flowage 2015-2017 Aquatic Plant Monitoring Report. *Technical Report*.

Olson, E.R., **Beal M.R.W**., Saborio G., Azofeifa A., and Montes W. WILDLIFE MONITORING REPORT FOR CORCOVADO NATIONAL PARK - 2017. *Technical Report*.

Teaching Experience

Teaching Assistant
Department of Civil and Environmental Engineering, University of Wisconsin – Madison

- Taught three sections of Decision Making for Civil and Environmental Engineers. Class topics included: engineering economics, introduction to optimization (linear, integer, non-linear), and game theory.
- Led lectures, interactive class activities, and graded exams.

Mentoring

- Trained four undergraduate students and one high school student to take water quality samples and process data over two summer field seasons.

Invited Guest Lectures

- *Multi Criteria Decision Analysis*. Decision Making for Civil and Environmental Engineers. April 2023. Department of Civil and Environmental Engineering, University of Wisconsin – Madison.
- *Introduction to Linear Optimization*. Decision Making for Civil and Environmental Engineers. September 2023. Department of Civil and Environmental Engineering, University of Wisconsin – Madison.
- *Hydroclimatic Forecasting and Remote Sensing for Harmful Algae in Small Inland Lakes*. Hydroclimatology for Water Resources Management. September 2023. Department of Civil and Environmental Engineering, University of Wisconsin – Madison.

Selected Presentations

Beal M.R.W., Block P.J. Remote Sensing and Modeling of Cyanobacteria Harmful Algae Blooms. 2024. Center for Environmental Measurement and Modeling Community of Practice. Environmental Protection Agency. ***Invited talk.*** *December 2024*.

Beal M.R.W., Block P.J. Hydroclimatic Forecasting and Satellite Remote Sensing for Harmful Algae in Small Inland Lakes. 2024. Climate, People, and the Environment Program Seminar. University of Wisconsin - Madison. ***Invited talk.*** *September 2024*.

Beal M.R.W., Block P.J. Leveraging Hydroclimatic Processes and Satellite Remote Sensing for Monitoring and Forecasting of Harmful Algae in Small Inland Lakes. 2023. Boase Seminar Series in Hydrology and Water Resources Engineering. University of Colorado – Boulder. ***Invited talk.*** *March 2023*

Beal, M.R.W. and P. Block: Remote Sensing of Harmful Algae Indicators for a Small Inland Lake Using Sentinel- 2 and Sentinel-3 Imagery. *American Geophysical Union Fall Meeting,* Chicago, IL. *Oral Presentation. December 2022*

Beal M.R.W., Wilkinson G., and Block P.J. Large scale seasonal forecasting of algae abundance for inland lakes across the Midwest and Northeast U.S. 2022. Wisconsin Chapter of the American Water Resources Association Spring Meeting. *Oral Presentation. March 2022*

Beal M.R.W. and Block P.J. Large Scale Season-Ahead Forecasting of Algae Abundance in Inland Lakes. 2022. North Central Region Water Network Harmful Algal Bloom Symposium. *Oral Presentation. March 2022*

Beal M.R.W., O'Reilly B., Hietpas K., and Block P.J. Development and Assessment of Sub-seasonal Cyanobacteria Forecasts in Lake Mendota, WI 2020. American Geophysical Union Fall Meeting. *Poster Presentation. December 2020*

Beal M.R.W., Olson E.R., and Lehr R. Managing Invasive Aquatic Macrophytes Using Controlled Water-Level Drawdowns in a Temperate Flowage. 2018. Society for Ecological Restoration Midwest-Great Lakes Chapter Meeting. Stevens Point, WI. *Poster Presentation. April 2018*

Beal M.R.W., Niermann, B., Saborío G., Porras G., and Olson E.R. Diversity and Abundance of Terrestrial Wildlife in Piedras Blancas National Park, Costa Rica. 2018. Midwest Fish and Wildlife Society Conference. Milwaukee, WI. *Poster Presentation. January 2018*

Beal M.R.W., and Olson E.R. Status of Invasive and Native Aquatic Macrophyte Communities in the Chippewa Flowage. 2017. Fall Meeting of the Chippewa Flowage Partners. Hayward, WI. *Oral Presentation. September 2017*

Competitive Funding, Awards, and Scholarships

- Advanced Study Institute Participant: Water Quality and Harmful Blooms in Lake Victoria, Kenya *2022.* National Science Foundation International Research Experience for Students
- Best Student Presentation Award. *2022.* Wisconsin Chapter of the American Water Resources Association. *Significance:* Student Oral Presentation Contest
- Best Student Poster Award. *2021*. University of Wisconsin – Madison Global Health Symposium. *Significance:* Student Poster Contest.
- Parker Matzinger Internship of Impact Scholarship. *2018*. Northland College. *Significance:* Conservation Biology Research in Costa Rica.
- Parsonage Funding Grant. *2018*. Northland College. *Significance:* Conservation Biology Research in Costa Rica.
- REFund Grant. *2017*. Northland College. *Significance:* Raingarden Development and Planning for Northland College Buildings.

Broader Impacts

- Cyanobacteria Forecast Bulletin
    - Season-ahead forecasts for cyanobacteria biomass and beach closings distributed to Wisconsin Department of Natural Resources, and Madison Dane County Public Health.
    - *Summer 2019-2023*
- Citizen Science Microcystin Monitoring Program

    - Facilitated a citizen science microcystin testing program with the Clean Lakes Alliance during summers
    - Conducted microcystin test trainings with citizen science volunteers each year of the program
    - *Summer 2020-2023*
- Developed water quality and remote sensing teaching module targeted towards high school classrooms.
    - *Fall 2023*
- Graduate Student Advisory Committee Representative
    - Represent the Department of Civil and Environmental Engineering at the University of Wisconsin – Madison on the College of Engineering Graduate Student Advisory Committee
    - *Fall 2022-present*
- Participated in Algal Taxonomy and Ecology Workshop with PhycoTech
    - *Summer 2022*
- Northland College Student Association Treasurer
    - Manage the finances of a 501(c)(4) non-profit organization run by the students at Northland College.
    - *Spring 2019*

References:

Dr. Paul Block, Associate Professor of Civil and Environmental Engineering, UW-Madison (paul.block@wisc.edu, 608-263-8792)

Dr. Blake Schaeffer, Research Physical Scientist, Office of Research and Development, Environmental Protection Agency (Schaeffer.Blake@epa.gov, 919-675-0915)

Dr. Brent Johnson, Branch Chief, Ecosystem Condition Branch, Environmental Protection Agency (Johnson.Brent@epa.gov, 859-992-0322)

Dr. Mutlu Ozdogan, Associate Professor of Forest and Wildlife Ecology, UW – Madison (ozdogan@wisc.edu, 608-262-0873)

Dr. Grace Wilkinson Associate Professor of Integrative Biology (Center for Limnology), UW – Madison (gwilkinson@wisc.edu, 608-262-3014)