

# Andrew L. Hamilton, PhD

Postdoctoral Associate

School of Civil and Environmental Engineering  
Cornell University

[andrew.hamilton@cornell.edu](mailto:andrew.hamilton@cornell.edu)  
[andrewlhamilton.com](http://andrewlhamilton.com)

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## Education

- 2017–2021     **PhD, Environmental Sciences and Engineering, University of North Carolina at Chapel Hill.** *Dissertation:* Multi-objective management of financial risks in coupled food-energy-water systems. *Supervisor:* Dr. Gregory W. Characklis.
- 2015–2017     **Masters in Environmental Management, Nicholas School of the Environment, Duke University.** Concentration in Water Resources Management, Certificate in Geospatial Analysis. *Master's project:* Minimization of third-party injury in multi-party water right transfers in Colorado. *Supervisor:* Dr. Mukesh Kumar.
- 2012–2014     **MS, Materials Science, University of California - Santa Barbara.** *Thesis:* Self-consistent field theory for the design of thermoplastic elastomers from miktoarm block copolymer-homopolymer blends. *Supervisor:* Dr. Glenn T. Fredrickson.
- 2008–2012     **BSE, Engineering Physics, Mathematics, Tulane University.** *Summa Cum Laude* with Departmental Honors.

## Appointments

- 2022–Present     Postdoctoral associate, School of Civil & Environmental Engineering, Cornell University
- 2017–2021     Graduate research assistant, Department of Environmental Sciences & Engineering, University of North Carolina at Chapel Hill
- 2016     Intern, Water resources and environmental science, Tetra Tech, Inc.
- 2015–2016     Graduate research assistant, Center for Environmental Implications of Nanotechnology, Duke University
- 2015     Intern, River restoration, American Rivers
- 2012–2014     Graduate research assistant, Materials Department, University of California - Santa Barbara
- 2011     Intern, Engineering, Wyatt Technology Corp.
- 2010     NSF Research Experience for Undergraduates in Computational Science, Department of Chemistry, Louisiana State University
- 2009–2010     Undergraduate research assistant, Department of Chemistry, Tulane University

## Awards and Honors

- 2022     Best Reviewer Award, Journal of Water Resources Planning and Management (ASCE)
- 2021     Department Nominee, UNC Dean's Distinguished Dissertation Award
- 2021     3-Minute Thesis Competition Finalist, UNC Graduate School
- 2020     FAIR Cyber Training (FACT) Fellowship, Purdue University
- 2017     Presidential Management Fellows Program Finalist, U.S. Office of Personnel Management
- 2015–2017     Partial-Tuition Merit Scholarship, Nicholas School of the Environment, Duke University
- 2012     Tulane 34 Award, Tulane University

2012	Senior Scholar Award, Tulane University
2008–2012	Dean’s Honor Full-Tuition Merit Scholarship, Tulane University

## Publications

### Peer-Reviewed Journal Articles

- [9] **Hamilton, A. L.**, Zeff, H. B., Characklis, G. W., & Reed, P. M. (2022). Resilient California water portfolios require infrastructure investment partnerships that are viable for all partners. *Earth’s Future*, 10(4), e2021EF002573. DOI: [10.1029/2021EF002573](https://doi.org/10.1029/2021EF002573).
- [8] **Hamilton, A. L.**, Characklis, G. W., & Reed, P. M. (2022). From stream flows to cash flows: Leveraging Evolutionary Multi-Objective Direct Policy Search to manage hydrologic financial risks. *Water Resources Research*, 58, e2021WR029747. DOI: [10.1029/2021WR029747](https://doi.org/10.1029/2021WR029747).
- [7] Malek, K., Reed, P., Zeff, H., **Hamilton, A.**, Wrzesien, M., Holtzman, N. Steinschneider, S. Herman, J., & Pavelsky, T. (2022). Bias correction of hydrologic projections strongly impacts inferred climate vulnerabilities in institutionally complex water systems. *Journal of Water Resources Planning and Management*, 148(1), 04021095. DOI: [10.1061/\(ASCE\)WR.1943-5452.0001493](https://doi.org/10.1061/(ASCE)WR.1943-5452.0001493).
- [6] Zeff, H. B., **Hamilton, A. L.**, Malek, K., Herman, J. D., Cohen, J. S., Medellín-Azuara, J., Reed, P. M., & Characklis, G. W. (2021). California’s Food-Energy-Water System: An open source simulation model of adaptive surface and groundwater management in the Central Valley. *Environmental Modelling & Software*, 141, 105052. DOI: [10.1016/j.envsoft.2021.105052](https://doi.org/10.1016/j.envsoft.2021.105052).
- [5] Gupta, R. S., **Hamilton, A. L.**, Reed, P. M., & Characklis, G. W. (2020). Can modern multi-objective evolutionary algorithms discover high-dimensional financial risk portfolio tradeoffs for snow-dominated water-energy systems? *Advances in Water Resources*, 145, 103718. DOI: [10.1016/j.advwatres.2020.103718](https://doi.org/10.1016/j.advwatres.2020.103718).
- [4] **Hamilton, A. L.**, Characklis, G. W., & Reed, P. M. (2020). Managing financial risk tradeoffs for hydropower generation using snowpack-based index contracts. *Water Resources Research*, 56(10), e2020WR027212. DOI: [10.1029/2020WR027212](https://doi.org/10.1029/2020WR027212).
- [3] Cormier, S. M., Zheng, L., Leppo, E. W., & **Hamilton, A. L.** (2018). Step-by-step calculation and spreadsheet tools for predicting stressor levels that extirpate genera and species. *Integrated Environmental Assessment and Management*, 14(2), 174-180. DOI: [10.1002/ieam.1993](https://doi.org/10.1002/ieam.1993).
- [2] Shi, W., **Hamilton, A. L.**, Delaney, K. T., Fredrickson, G. H., Kramer, E. J., Ntaras, C., Avgeropoulos, A., Lynd, N. A., Demassieux, Q., & Creton, C. (2015). Aperiodic “bricks and mortar” mesophase: a new equilibrium state of soft matter and application as a stiff thermoplastic elastomer. *Macromolecules*, 48, 5378-5384. DOI: [10.1021/acs.macromol.5b01210](https://doi.org/10.1021/acs.macromol.5b01210).
- [1] Shi, W., **Hamilton, A. L.**, Delaney, K. T., Fredrickson, G. H., Kramer, E. J., Ntaras, C., Avgeropoulos, A., & Lynd, N. A. (2015). Creating extremely asymmetric lamellar structures via fluctuation-assisted unbinding of miktoarm star block copolymer alloys. *Journal of the American Chemical Society*, 137, 6160-6163. DOI: [10.1021/jacs.5b02881](https://doi.org/10.1021/jacs.5b02881).

### In Review

- [1] **Hamilton, A. L.**, Reed, P. M., Gupta, R.S., Zeff, H. B., & G. W. Characklis (2023). Resilient water infrastructure partnerships in institutionally complex systems face challenging supply and financial risk tradeoffs. *In Review*.

## Journal Highlights and Media Coverage

- [4] Smith, H., (2022). California's water from Colorado River could be crippled by a big earthquake. Drought makes fixes vital. *The Los Angeles Times*. <https://www.latimes.com/environment/story/2022-08-23/california-water-supply-shrinking-mwd-earthquake-leaks>.
- [3] Klein, K., (2022). Study warns of potential inequities from water infrastructure investments. *KVPR: NPR for Central California*. <https://www.kvpr.org/environment/2022-05-11/study-warns-of-potential-inequities-from-water-infrastructure-investments>.
- [2] Cook, T., (2022). AGU Research Spotlight: Assessing water infrastructure investments in California. *EOS Magazine*. <https://eos.org/research-spotlights/assessing-water-infrastructure-investments-in-california>.
- [1] Hall, J., (2020). AGU Editor's Highlight: How to hedge the risk of reduced snowpack for hydropower. *EOS Magazine*. <https://eos.org/editor-highlights/how-to-hedge-the-risk-of-reduced-snowpack-for-hydropower>.

## Presentations

\* Indicates presenter

### Conference Oral Presentations

- [17] **Hamilton, A. L.\***, Gupta, R. S., Reed, P. M., Zeff, H. B., & Characklis, G. W. "Discovering key trade-offs and consequential vulnerabilities for robust water supply investment partnerships under deep uncertainty." ASCE World Environmental and Water Resources Congress, Henderson, NV, May 2023.
- [16] **Hamilton, A. L.\***, Reed, P. M., Zeff, H. B., & Characklis, G. W. "Integrated human system complexity into water supply planning and risk assessment with exploratory modeling (Invited)." American Geophysical Union Fall Meeting, Chicago, IL, December 2022.
- [15] **Hamilton, A. L.\***, Gupta, R. S., Reed, P. M., Zeff, H. B., & Characklis, G. W. "Discovering robust infrastructure investment partnerships to meet California's water portfolio goals." American Geophysical Union Fall Meeting, Chicago, IL, December 2022.
- [14] Essaid, H. \*, ..., **Hamilton, A. L.**, et al. "A Synthesis of Delaware River Basin Water Use, Water Management, and Land Use Information in Support of Water Availability Modeling and Assessment." American Geophysical Union Fall Meeting, Chicago, IL, December 2022.
- [13] **Hamilton, A. L.\***, Gupta, R. S., Reed, P. M., Zeff, H. B., & Characklis, G. W. "Key challenges for defining and designing robust infrastructure investment partnerships in deeply uncertain many-actor water supply networks." Annual Meeting of the Society for Decision Making Under Deep Uncertainty, Mexico City, Mexico, November 2022.
- [12] **Hamilton, A. L.\***, Zeff, H. B., Gupta, R. S., Reed, P. M., & Characklis, G. W. "How do natural, engineered, and institutional scales impact water availability and infrastructure investment within complex, interconnected water supply systems?" AGU Chapman Conference on Solving Water Availability Challenges through an Interdisciplinary Framework, Golden, CO, September 2022.
- [11] Dugger, A.L.\* , ..., **Hamilton, A. L.**, et al. "Progress and challenges in integrated human-hydro-terrestrial modeling to understand drought vulnerability in the Delaware River Basin." AGU Chapman Conference on Solving Water Availability Challenges through an Interdisciplinary Framework, Golden, CO, September 2022.
- [10] **Hamilton, A. L.\***, Gupta, R. S., Zeff, H. B., Reed, P. M., & Characklis, G. W. "Exploring the challenges facing California in achieving resilient water portfolios under climatic, economic, and regulatory uncertainty." AGU Frontiers in Hydrology, Virtual, June 2022.

- [9] **Hamilton, A. L.**\*, Gupta, R. S., Zeff, H. B., Characklis, G. W., & Reed, P. M. “Designing effective, fair, and robust water infrastructure investment partnerships under deep uncertainty.” ASCE World Environmental and Water Resources Congress, Atlanta, GA, June 2022.
- [8] **Hamilton, A. L.**\*, Zeff, H. B., Malek, K., Characklis, G. W., & Reed, P. M. “Balancing heterogeneous impacts and preferences in the search for collective water supply infrastructure investments.” ASCE World Environmental and Water Resources Congress, Virtual, June 2021.
- [7] Zeff, H. B.\* , **Hamilton, A. L.**, & Characklis, G. W. “Evaluating and managing drought-related financial risks in California’s north-south water transfer system.” American Geophysical Union Fall Meeting, Virtual, December 2020.
- [6] Malek, K.\* , Reed, P., Zeff, H., **Hamilton, A.**, Holtzman, N., Wrzesien, M., Steinschneider, S., Herman, J., & Pavelsky, T. “Error or insight: Tracing how errors in dynamically downscaled hydrologic projections shape vulnerability inferences in complex water infrastructure systems.” American Geophysical Union Fall Meeting, Virtual, December 2020.
- [5] Gupta, R. S.\* , **Hamilton, A. L.**, Reed, P. M., & Characklis, G. W. “How difficult is it to discover the tradeoffs in designing financial risk portfolios in snow-dominated water-energy systems?” American Geophysical Union Fall Meeting, San Francisco, CA, December 2019.
- [4] **Hamilton, A. L.**\*, Zeff, H. B., Characklis, G. W., Reed, P. M., Cohen, J. S., & Herman, J. D. “Estimating and managing the financial risks of drought for agricultural water institutions.” ASCE World Environmental and Water Resources Congress, Pittsburgh, PA, May 2019.
- [3] Gupta, R. S.\* , **Hamilton, A. L.**, Reed, P. M., & Characklis, G. W. “Can modern multi-objective evolutionary algorithms address high-dimensional financial risk problems in coupled water and energy systems?” ASCE World Environmental and Water Resources Congress, Pittsburgh, PA, May 2019.
- [2] **Hamilton, A. L.**\*, Characklis, G. W., & Reed, P. M. “Direct policy search for multiobjective financial risk management in snow dominated hydropower systems.” ASCE World Environmental and Water Resources Congress, Minneapolis, MN, May 2018.
- [1] **Hamilton, A. L.**\*, Characklis, G. W., & Reed, P. M. “Managing financial risk to hydropower in snow dominated systems: A Hetch Hetchy case study.” American Geophysical Union Fall Meeting, New Orleans, LA, December 2017.

### Conference Poster Presentations

- [6] Essaid, H.\* , ..., **Hamilton, A. L.**, et al. “Modeling strategy in support of integrated water availability assessments in regional water science basins (Invited).” American Geophysical Union Fall Meeting, Chicago, IL, December 2022.
- [5] Dugger, A.\* , ..., **Hamilton, A. L.**, et al. “Decision-relevant multi-model hydrologic evaluation in the Delaware River Basin for assessments of water system vulnerability under drought (Invited).” American Geophysical Union Fall Meeting, Chicago, IL, December 2022.
- [4] Zeff, H. B.\* , Characklis, G. W., Reed, P. M., Hadjimichael, A., & **Hamilton, A. L.** “Adaptively managing water scarcity at multiple scales.” AGU Chapman Conference on Solving Water Availability Challenges through an Interdisciplinary Framework, Golden, CO, September 2022.
- [3] Essaid, H.\* , ..., **Hamilton, A. L.**, et al. “When models talk: Integrated human-hydro-terrestrial modeling to assess Delaware River Basin water resources vulnerability to drought.” AGU Frontiers in Hydrology, San Juan, PR, June 2022.

- [2] **Hamilton, A. L.\***, Zeff, H. B., Characklis, G. W., & Reed, P. M., “Understanding the challenges posed in developing fair and effective investment partnerships to achieve California’s Resilient Water Portfolio Goals.” American Geophysical Union, New Orleans, LA, December 2021.
- [1] **Hamilton, A. L.\***, Characklis, G. W., & Reed, P. M. “Dynamic management of hydrologic financial risk.” Duke University Research Computing Symposium, Durham, NC, February 2020.

## Other Presentations

- [19] **Hamilton, A. L.\***. “Multiobjective and adaptive risk management in coupled natural-human systems.” Civil and Environmental Engineering Department Seminar, Duke University, Durham, NC, April 2023.
- [18] **Hamilton, A. L.\***. “Multiobjective and adaptive risk management in coupled natural-human systems.” Civil and Environmental Engineering Department Seminar, University of California - Irvine, Irvine, CA, April 2023.
- [17] **Hamilton, A. L.\***. “Multiobjective and adaptive risk management in multisector water resources systems.” Civil and Environmental Engineering Department Seminar, Howard University, Virtual, November 2022.
- [16] **Hamilton, A. L.\***, Amestoy, T., & Reed, P. M.. “Exploratory modeling in the Delaware River Basin using a Python-based water management model.” USGS Delaware River Basin Integrated Modeling Webinar, Virtual, October 2022.
- [15] **Hamilton, A. L.\***, Gupta, R. S., Reed, P. M., Zeff, H. B., & Characklis, G. W. “Discovering effective water supply infrastructure investment partnerships with multi-objective evolutionary search.” Environmental and Water Resource Systems Seminar, School of Civil and Environmental Engineering, Cornell University, Virtual, October 2022.
- [14] **Hamilton, A. L.\***, Zeff, H. B., Characklis, G. W., & Reed, P. M. “Financial risks to investment partnerships developing large water infrastructure.” UNC Center on Financial Risk in Environmental Systems Fall 2022 Strategic Planning Retreat, Chapel Hill, NC, October 2022.
- [13] **Hamilton, A. L.\***, Gupta, R. S., Zeff, H. B., Characklis, G. W., & Reed, P. M. “Key challenges for multi-objective, robust design of infrastructure partnerships.” ASCE EWRI Environmental and Water Resources Systems Committee Meeting, Virtual, June 2022.
- [12] **Hamilton, A. L.\***, Gupta, R. S., Reed, P. M., Zeff, H. B., & Characklis, G. W. “Understanding the challenges posed in designing viable infrastructure investment partnerships to achieve California’s resilient water portfolio goals.” Environmental and Water Resource Systems Seminar, School of Civil and Environmental Engineering, Cornell University, Virtual, March 2022.
- [11] **Hamilton, A. L.\*** “Environmental Impact Bonds.” Center on Financial Risk in Environmental Systems Fall 2021 Strategic Planning Retreat, University of North Carolina at Chapel Hill, Chapel Hill, NC, October 2021.
- [10] **Hamilton, A. L.\***, Characklis, G. W., & Reed, P. M. “Managing hydropower financial risks with index contracts.” Center on Financial Risk in Environmental Systems Fall 2021 Strategic Planning Retreat. University of North Carolina at Chapel Hill, Chapel Hill, NC, October 2021.
- [9] **Hamilton, A. L.\*** “Using FAIR principles to improve the usability of a food-energy-water system simulation model.” 2021 FAIR Cyber Training Workshop, Purdue University, Virtual, June 2021.
- [8] **Hamilton, A. L.\***, Characklis, G. W., & Reed, P. M. “Improving policy comprehensibility with entropic sensitivity analysis + visual analytics.” Water Resource Systems Pre-AGU Meeting, Virtual, December 2020.

- [7] **Hamilton, A. L.\***, Characklis, G. W., & Reed, P. M. “A tale of two flows: Managing variable stream flows and cash flows in the water-energy-food nexus.” Departmental Seminar, Department of Environmental Sciences and Engineering, University of North Carolina at Chapel Hill, Chapel Hill, NC, October 2020.
- [6] **Hamilton, A. L.\*** “Integrated liquidity management: How the availability of internal and external financing affects hedging and investment decisions.” Center on Financial Risk in Environmental Systems Fall 2019 Strategic Planning Retreat, University of North Carolina at Chapel Hill, Chapel Hill, NC, October 2019.
- [5] **Hamilton, A. L.\***, Zeff, H. B., Characklis, G. W., & Reed, P. M. “Financial risks of hydrologic variability on irrigation districts and the agricultural sector in California.” Center on Financial Risk in Environmental Systems Fall 2019 Strategic Planning Retreat, University of North Carolina at Chapel Hill, Chapel Hill, NC, October 2019.
- [4] **Hamilton, A. L.\***, Characklis, G. W., & Reed, P. M. “Managing financial risk to hydropower in snow dominated systems.” Center on Financial Risk in Environmental Systems Fall 2018 Strategic Planning Retreat, University of North Carolina at Chapel Hill, Chapel Hill, NC, October 2018.
- [3] **Hamilton, A. L.\***, Characklis, G. W., & Reed, P. M. “Managing financial risk to hydropower in snow dominated systems.” San Francisco Public Utilities Commission, San Francisco, CA, November 2018.
- [2] **Hamilton, A. L.\***, Characklis, G. W., & Reed, P. M. “Managing financial risk to hydropower in snow dominated systems.” Center on Financial Risk in Environmental Systems Spring 2018 Strategic Planning Retreat. University of North Carolina at Chapel Hill, Chapel Hill, NC, February 2018.
- [1] **Hamilton, A. L.\***, Characklis, G. W., & Reed, P. M. “Managing financial risk to hydropower in California.” San Francisco Public Utilities Commission, San Francisco, CA, November 2017.

## Workshops

- [3] 2021 Alliance Graduate Summer School: Inequality and the Environment. Columbia University. Virtual, May 2021.
- [2] 2020 FAIR Cyber Training Workshop. Purdue University as part of FACT Fellowship (see Awards). Virtual, Summer 2020.
- [1] Managing financial risk in environmental systems: efficient and sustainable adaptation in the face of global change. Hoover Institution (Stanford University) and the Center on Financial Risk in Environmental Systems (UNC Chapel Hill). Stanford University, Palo Alto, CA, May 2019.

## Open-Source Software

- [4] **Hamilton, A. L.**, Amestoy, T., & Reed, P. M. (2023), Pywr-DRB: a water management simulation model for Delaware River Basin. <https://github.com/Pywr-DRB/Pywr-DRB>.
- [3] **Hamilton, A. L.**, Cuppari, R. I., & Characklis, G. W. (2021), Python for Environmental Research. <https://github.com/ahamilton144/Python-For-Environmental-Research>. DOI: 10.5281/zenodo.4495708.
- [2] **Hamilton, A. L.**, Zeff, H., Malek, K., Herman, J., Cohen, J., Medellin-Azuara, J., Reed, P. M., & Characklis, G. W. (2021), Graphical User Interface for the California Food-Energy-Water System (CALFEWS) simulation model. <https://mygeohub.org/resources/guicalfews>. DOI: 10.21981/8AJF-D461.
- [1] Zeff, H., **Hamilton, A. L.**, Malek, K., Herman, J., Cohen, J., Medellin-Azuara, J., Reed, P. M., & Characklis, G. W. (2021), California Food-Energy-Water System (CALFEWS). <https://github.com/hbz5000/CALFEWS>. DOI: 10.5281/zenodo.4091708.

## Teaching Experience

2020–2021	Instructor/Developer, Python for Environmental Research (ENVR 890), Department of Environmental Sciences and Engineering, UNC Chapel Hill
2018–2019	Guest Lecturer and Grader, Analysis of Water Resource Systems (ENVR 755), Department of Environmental Sciences and Engineering, UNC Chapel Hill

## Service

2022–Present	Member, Facilitation Team and Uncertainty Quantification/Scenario Development Working Group, MultiSector Dynamics Community of Practice
2022–Present	Contributor, Water Programming Blog, <a href="https://waterprogramming.wordpress.com">https://waterprogramming.wordpress.com</a>
2020	Co-organizer, Environmental Justice Reading Group, UNC Environmental Sciences and Engineering Student Organization
2023–Present	Reviewer, Environmental Modelling and Software
2023–Present	Reviewer, Earth's Future
2023–Present	Reviewer, Advances in Water Resources
2022–Present	Reviewer, Climatic Change
2020–Present	Reviewer, Water Resources Research
2020–Present	Reviewer, Journal of Hydrology
2019–Present	Reviewer, Journal of Water Resources Planning and Management