

# Antonia Hadjimichael

ASSISTANT PROFESSOR · PENN STATE UNIVERSITY

212 Deike Building, State College, PA 16801

✉ hadjimichael@psu.edu | 🏠 <https://www.hadjimichael.info/> | 📄 <https://github.com/antonia-had>

## Appointments

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- 2022-... **Assistant Professor**, Department of Geosciences, Penn State University  
2022-... **Faculty Associate**, Earth and Environmental Systems Institute (EESI), Penn State University  
2017-2021 **Postdoctoral Associate**, Reed Group, School of Civil and Environmental Engineering, Cornell University  
2014-2015 **Visiting Researcher**, Waterschap de Dommel (The Netherlands)

## Education

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- Universitat de Girona** Spain  
PHD WATER SCIENCE AND TECHNOLOGY 2012 - 2016  
• Thesis title: Decision-support for adaptive and sustainable urban wastewater system management in the face of uncertainty
- University College London (UCL)** United Kingdom  
MSC ENVIRONMENTAL MODELLING 2011 - 2012
- University of Leicester** United Kingdom  
BSC MATHEMATICS 2008 - 2011

## Publications

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### PEER-REVIEWED JOURNAL ARTICLES

- Fletcher S., **Hadjimichael, A.**, Quinn J.D., Osman K., Giuliani M., Gold D., Figueiroa A. J., Gordon B., 2022. Equity in water resources planning: a path forward for decision-support modelers. *Journal of Water Resources Planning and Management* 148, 7. [https://doi.org/10.1061/\(ASCE\)WR.1943-5452.0001573](https://doi.org/10.1061/(ASCE)WR.1943-5452.0001573)
- Reed, P.M., **Hadjimichael, A.**, Moss, R.H., Brelsford, C., Burleyson, C.D., Cohen, S., Dyreson, A., Gold, D.F., Gupta, R.S., Keller, K., Konar, M., Monier, E., Morris, J., Srikrishnan, V., Voisin, N., Yoon, J., 2022. MultiSector Dynamics: Advancing the Science of Complex Adaptive Human-Earth Systems. *Earth's Future*, e2021EF002621. <https://doi.org/10.1029/2021EF002621>
- Moss, R.H., Reed, P.M., **Hadjimichael, A.**, Rozenberg, J., 2021. Planned relocation: Pluralistic and integrated science and governance. *Science* 372, 1276-1279. <https://doi.org/10.1126/science.abh3256>
- Hadjimichael, A.**, Quinn, J.D., Reed, P.M., 2020. Advancing diagnostic model evaluation to better understand water shortage mechanisms in institutionally complex river basins. *Water Resources Research*, e2020WR028079. <https://doi.org/10.1029/2020WR028079>
- Quinn, J.D., **Hadjimichael, A.**, Reed, P.M., Steinschneider, S., 2020. Can exploratory modeling of water scarcity vulnerabilities and robustness be scenario neutral? *Earth's Future*. <https://doi.org/10.1029/2020EF001650>
- Hadjimichael, A.**, Reed, P.M., Quinn, J.D., 2020. Navigating Deeply Uncertain Tradeoffs in Harvested Predator-Prey Systems. *Complexity* 2020, Special Issue: Complexity, Dynamics, Control, and Applications of Nonlinear Systems with Multistability. e4170453. <https://doi.org/10.1155/2020/4170453>
- Hadjimichael, A.**, Quinn, J.D., Wilson, E., Reed, P.M., Basdekas, L., Yates, D., Garrison, M., 2020. Defining Robustness, Vulnerabilities, and Consequential Scenarios for Diverse Stakeholder Interests in Institutionally Complex River Basins. *Earth's Future* 8, e2020EF001503. <https://doi.org/10.1029/2020EF001503>
- Hadjimichael, A.**, Gold, D., Hadka, D., Reed, P.M., 2020. Rhodium: Python Library for Many-Objective Robust Decision Making and Exploratory Modeling. *Journal of Open Research Software* 8, 12. <https://doi.org/10.5334/jors.293>

**Hadjimichael, A.**, Comas, J., Corominas, L., 2016a. Do machine learning methods used in data mining enhance the potential of decision support systems? A review for the urban water sector. *AI Communications* 29, 747–756. <https://doi.org/10.3233/AIC-160714>

**Hadjimichael, A.**, Morera, S., Benedetti, L., Flameling, T., Corominas, L., Weijers, S., Comas, J., 2016b. Assessing urban wastewater system upgrades using integrated modeling, life cycle analysis and shadow pricing. *Environmental Science & Technology*. <https://doi.org/10.1021/acs.est.5b05845>

Garcia, X., Barceló, D., Comas, J., Corominas, L., **Hadjimichael, A.**, Page, T.J., Acuña, V., 2016. Placing ecosystem services at the heart of urban water systems management. *Science of The Total Environment* 563–564, 1078–1085. <https://doi.org/10.1016/j.scitotenv.2016.05.010>

## BOOKS, REPORTS AND OTHER PUBLICATIONS

Reed, P.M., **Hadjimichael, A.**, Moss, R., Monier, E., Alba, S., Brelsford, C., Burleyson, C., Cohen, S., Dyreson, A., Gold, D., Gupta, R., Keller, K., Konar, M., Macknick, J., Morris, J., Srikrishnan, V., Voisin, N., Yoon, J., 2022. MultiSector Dynamics: Scientific Challenges and a Research Vision for 2030, A Community of Practice Supported by the United States Department of Energy's Office of Science. <https://doi.org/10.5281/zenodo.5825889>

Reed, P.M., **Hadjimichael, A.**, Malek, K., Karimi, T., Vernon, C.R., Srikrishnan, V., Gupta, R.S., Gold, D.F., Lee, B., Keller, K., Rice, J.S., Thurber, T.B. (2022). Addressing Uncertainty in Multisector Dynamics Research [e-book]. <https://doi.org/10.5281/zenodo.6110623>

Voisin, N., Keller, K., **Hadjimichael, A.**, Monier, E., Reed, P.M., Moss, R.H. (2022). A two-way street: Interdependence of climate variability and change with human systems. *US CLIVAR Variations*. Online, Washington. *US CLIVAR Variations*, 20(1), 22-31. <https://doi.org/10.5065/9mm8-1p50>

## IN REVIEW OR REVISION

**Hadjimichael, A.**, Yoon, J., Reed, P.M., Voisin, N., Xu, W., Inferring water scarcity: do large-scale hydrologic and node-based water systems model representations of the Upper Colorado river basin lead to consistent vulnerability insights? *Journal of Water Resources Planning and Management*

## IN PREP

Taberna A., **Hadjimichael, A.**, Noll, B., Filatova T., Uncertainty in boundedly-rational adaptation to environmental shocks (to be submitted to *Proceedings of the National Academy of Sciences* Special Feature: Modeling Dynamic Systems for Sustainability Science September 2022)

Giang, A., Anderies, J. M., Edwards, M., Fletcher, S., Grubert, E., Gryba, R., Huntington, H., **Hadjimichael, A.**, Marshall, J., Mathias, J., Nock, D., Peacock, S., Reid, A., Saari, R., Sayles, J., Siddiqi, A., Cambron, C.V., Verburg, P., Modeling for equity in sustainability science: practical examples throughout the modeling life cycle and future opportunities. (to be submitted to *Proceedings of the National Academy of Sciences* Special Feature: Modeling Dynamic Systems for Sustainability Science September 2022)

**Hadjimichael, A.**, Reed, P.M., Quinn, J.D, Vernon, C.R., Thurber, T., Addressing scenario selection and planning for the emergence of multi-decadal droughts in the Colorado River. (to be submitted to *Earth's Future* October 2022)

**Hadjimichael, A.**, Reed, P.M., Zeff, H.B., Characklis, G., Vernon, C.R., Thurber, T., Understanding the capacity of adaptive water transfers to modulate the effects of drought in Western multi-actor river basins. (to be submitted to *Earth's Future* December 2022)

## Conference and Invited Presentations

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### INVITED TALKS

September, 2022. *Understanding complex adaptive human-Earth systems through MultiSector Dynamics*. Coffee Hour Colloquium, Department of Geography, Penn State University.

September, 2022. *Planning for water resources systems under uncertainty: the case of the Upper Colorado River Basin*. Environmental and Water Resources Engineering Seminar, Department of Civil and Environmental Engineering, Penn State University.

June, 2022. *Advancing the science of complex adaptive human-Earth systems through MultiSector Dynamics*. Escuela de Gobierno y Transformación Pública, Tecnológico de Monterrey. <https://doi.org/10.5281/zenodo.6611750>

- February, 2022. *Advancing the science of complex adaptive human-Earth systems through MultiSector Dynamics*. Government and Public Entrepreneurship Group, Escuela de Gobierno y Transformación Pública, Tecnológico de Monterrey. <https://doi.org/10.5281/zenodo.6047072>
- February, 2021. *Planning for water resources systems under uncertainty: competition, transitions and multisector dynamics*. Earth and Environmental Systems Institute, Penn State University.
- February, 2020. *Drought vulnerability and consequential scenarios for diverse stakeholders: The Upper Colorado River Basin*. Water in the West, Stanford University.
- June, 2019. *Assessing multi-stakeholder conflicts, vulnerabilities, and risk in the Upper Colorado River Basin*. Binational Laboratory of Sustainability, Vulnerability and Adaptation to Climate Change. Merida, Mexico.
- November, 2016. *Decision making for urban water systems under uncertainty*. IWA Young Water Professionals session. International Integrated Water Cycle Show (iWater). Barcelona, Spain.
- June, 2013. *Towards a decision support system to assess environmental and socio-economic impacts of Urban Wastewater Systems*. Emerging Challenges for a Sustainable and Integrated Urban Water System Management Workshop. LET conference. Bordeaux, France.
- January, 2013. *Towards a decision support system to assess environmental and socio-economic impacts of Urban Wastewater Systems*. Advanced Tools for Wastewater Treatment Workshop. Tiruchirappalli, India.

## CONTRIBUTED PRESENTATIONS

- Hadjimichael, A.**, Yoon, J., Reed, P. M., Voisin, N., Exploring the consistency of water scarcity vulnerabilities across scales: Do our inferences converge?. World Environmental Water Resources Congress (EWRI), Atlanta, Georgia. June, 2022. <https://doi.org/10.5281/zenodo.6624320>
- Hadjimichael, A.**, Yoon, J., Reed, P.M., Voisin, N., Inferring water scarcity vulnerabilities: do converging model representations of water systems lead to convergent insights? American Geophysical Union Fall Meeting. December, 2021. <https://doi.org/10.5281/zenodo.5826341> (poster)
- Hadjimichael, A.**, Reed, P.M., Vernon, C.R., Thurber, T., Exploring the consistency of inferred water shortage vulnerabilities using rival framings of adaptive demands in a multi-actor, multi-sector river basin. American Geophysical Union Fall Meeting. December, 2021. <https://doi.org/10.5281/zenodo.5879234> (poster)
- Hadjimichael, A.**, Quinn, J.D., Reed, P.M., Evaluating the consistency of inferred multi-actor vulnerabilities to agricultural water shortages through the use of rival framings. ASCE World Environmental Water Resources Congress, Online. June, 2021. <https://doi.org/10.5281/zenodo.5879244>
- Hadjimichael, A.**, Quinn, J.D., Reed, P.M., Understanding how water scarcity vulnerabilities vary across multi-sectoral users within institutionally complex river basins. American Geophysical Union Fall Meeting. December, 2020.
- Hadjimichael, A.**, Quinn, J.D., Reed, P.M., Mapping DMDU inference traps: exploring rival framings of scenario discovery to evaluate the consistency of inferred multi-actor agricultural vulnerabilities. Annual Decision Making Under Deep Uncertainty Meeting. Online. November 2020.
- Hadjimichael, A.**, Quinn, J.D., Wilson, E., Reed, P.M., Basdekas, L., Yates, D., Garrison, M., Drought vulnerability and consequential scenarios for diverse stakeholders: The Upper Colorado River Basin. American Geophysical Union Fall Meeting. San Francisco, USA. December, 2019.
- Hadjimichael, A.**, Quinn, J.D., Wilson, E., Reed, P.M., Basdekas, L., Yates, D., Garrison, M., Defining robustness, vulnerabilities, and consequential scenarios for diverse stakeholder interests within the Upper Colorado River Basin. Annual Decision Making Under Deep Uncertainty Meeting. Delft, the Netherlands. November, 2019.
- Hadjimichael, A.**, Quinn, J.D., Wilson, E., Reed, P.M., Basdekas, L., Yates, D., Garrison, M., Assessing multi-stakeholder conflicts, vulnerabilities, and risk in the Upper Colorado River Basin. ASCE World Environmental Water Resources Congress, Pittsburg, USA. May, 2019.
- Hadjimichael, A.**, Reed, P.M., Quinn, J.D., When Tradeoffs Are Not What They Appear and Robustness May Not Exist: The Fisheries Challenge. American Geophysical Union Fall Meeting. Washington DC, USA. December, 2018.
- Hadjimichael, A.**, Reed, P.M., Quinn, J.D., Avoiding fisheries collapse: Can robustness frameworks capture and navigate uncertain harvest tradeoffs? Annual Decision Making Under Deep Uncertainty Meeting. Culver City, USA. November, 2018.
- Hadjimichael, A.**, Reed, P.M., Quinn, J.D., Avoiding Collapse: An Illustration of Problem Framing Challenges using the Fisheries Game. ASCE World Environmental Water Resources Congress. Minneapolis, USA. June, 2018.

**Hadjimichael, A.**, Morera, S., Weijers, S., Comas, J. Environmental benefits to society and sustainability aspects of wastewater treatment processes. WATERMATEX. Gold Coast, Queensland, Australia. June, 2015. (poster)

**Hadjimichael, A.**, Corominas, LL., Poch, M., Comas, J., Towards a decision support system to assess environmental and socio-economic impacts of Urban Wastewater Systems (UWS). ICA conference. Narbonne, France. September, 2013.

**Hadjimichael, A.**, Oliva Felipe, L., Corominas, LL., Poch, M., Cortés U., Comas J., Multi-agent based decision support system for the integrated management of UWWS. ICCE conference. Barcelona, Spain. June, 2013. (poster)

## Teaching Experience

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2022	<b>Risk Analysis in the Earth Sciences (GEOSC 450)</b> , Instructor	<i>Penn State University</i>
2018	<b>Engineering Management Methods (CEE 5930)</b> , Instructor	<i>Cornell University</i>
2018-2019	<b>Interdisciplinary Master of Engineering Project (CEE 5050)</b> , Co-Instructor	<i>Cornell University</i>

## Mentoring

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- 2022-... **Alexander Thames**, PhD Student, Climate Science Dual Title, Penn State University
- 2022-... **Carl Fredrick Guico Aquino**, PhD Student, Climate Science Dual Title, Penn State University
- 2022-... **Enock Bunyon**, MSc Student, Geosciences, Penn State University

## Grants and Contracts

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### **The Baltimore Social-Environmental Collaborative IFL**

DEPARTMENT OF ENERGY, OFFICE OF SCIENCE, EARTH AND ENVIRONMENTAL SYSTEM SCIENCE DIVISION  
Co-PI, (\$489,520)

*Sep. 2022 - Aug. 2027*

### **Coastal Observations, Mechanisms, and Predictions Across Systems and Scales - Great Lakes Modeling (COMPASS-GLM)**

DEPARTMENT OF ENERGY, OFFICE OF SCIENCE, EARTH AND ENVIRONMENTAL SYSTEM SCIENCE DIVISION  
Co-PI, (\$111,705)

*Sep. 2022 - Sep. 2023*

### **Integrated Multisector Multiscale Modeling (IM3), Phase 2**

DEPARTMENT OF ENERGY, OFFICE OF SCIENCE, EARTH AND ENVIRONMENTAL SYSTEM SCIENCE DIVISION  
Co-PI, (\$299,592)

*Jan. 2022 - Sep. 2024*

## Professional Service

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### LEADERSHIP

- 2022 - ... **Consortium of Universities for the Advancement of Hydrologic Science (CUAHSI)**, Penn State Representative
- 2022 - ... **Penn State Water Council**, Member
- 2021 - ... **Society for Decision Making under Deep Uncertainty (DMDU)**, Chair of Communications and Outreach
- 2019 - ... **MultiSector Dynamics Community of Practice Facilitation Team**, Member

### JOURNAL PEER REVIEW

Earth's Future, Environmental Modelling and Software, Hydrology and Earth System Sciences, Journal of the American Water Resources Association, Journal of Environmental Engineering, Journal of Hydrology, Journal of Water Resources Planning and Management, Science of the Total Environment, Water Resources Research

#### FUNDING AGENCY PEER REVIEW

Department of Energy Office of Science (2022)

#### CONFERENCE PEER REVIEW

Annual Decision Making Under Deep Uncertainty Meeting (2022)

World Environmental & Water Resources Congress (2020-2021)

OSPA Judge, American Geophysical Union (AGU) Conference (2019-2021)

#### PROFESSIONAL MEMBERSHIPS

American Society of Civil Engineers

American Geophysical Union

Institute for Operations Research and the Management Sciences

#### CONFERENCE SESSIONS AND COMMITTEES

Organizing Committee, Annual Meeting for the Society of Decision Making under Deep Uncertainty (2022)

Co-convener, *Water and Society: Water resources management and policy in a changing world*, American Geophysical Union (AGU) Conference (2022)

Convener, *Resilience, vulnerability and equity in multi-actor water resources systems*, World Environmental & Water Resources Congress (EWRI; 2022)

Convener, *Resilience, vulnerability and equity in multi-actor water resources systems*, World Environmental & Water Resources Congress (EWRI; 2021)