

Antonia Hadjimichael

ASSISTANT PROFESSOR · THE PENNSYLVANIA STATE UNIVERSITY

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Appointments

- 2022-... **Assistant Professor**, Department of Geosciences, The Pennsylvania State University
2022-... **Faculty Associate**, Earth and Environmental Systems Institute (EESI), The Pennsylvania 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

Universitat de Girona

PHD WATER SCIENCE AND TECHNOLOGY

Spain

2012 - 2016

University College London (UCL)

MSc ENVIRONMENTAL MODELLING

United Kingdom

2011 - 2012

University of Leicester

BSc MATHEMATICS

United Kingdom

2008 - 2011

Publications

PEER-REVIEWED JOURNAL ARTICLES

- Taberna A., Filatova T., **Hadjimichael, A.**, Noll, B., Uncertainty in boundedly-rational households adaptation to environmental shocks. *Proceedings of the National Academy of Sciences Special Feature: Modeling Dynamic Systems for Sustainability Science*. <https://doi.org/10.1073/pnas.2215675120>
- Hadjimichael, A.**, Yoon, J., Reed, P.M., Voisin, N., Xu, W., 2023. Exploring the Consistency of Water Scarcity Inferences between Large-Scale Hydrologic and Node-Based Water System Model Representations of the Upper Colorado River Basin. *Journal of Water Resources Planning and Management* 149, 04022081. <https://doi.org/10.1061/JWRMD5.WRENG-5522>
- 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), *Editor's Choice Award*
- 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/10.5065/9mn8-1p50>

IN REVIEW OR REVISION

Giang, A., Edwards, M.R., Fletcher, S.M., Gardner-Frolick, R., Gryba, R., Mathias, J.-D., Vernier-Cambron, C., Anderies, J. M., Berglund, E., Carley, S., Erickson, J., Grubert, E., **Hadjimichael, A.**, Hill, J.D., Mayfield, E., Nock, D., Pikok, K. K., Saari, R. K., Lezcano, C.M.S., Siddiqi, A., Skerker, J. B., Tessum, C. W., Equity and modeling in sustainability science: examples and opportunities throughout the modeling process. *Proceedings of the National Academy of Sciences Special Feature: Modeling Dynamic Systems for Sustainability Science*. (in revision)

Zeff H.B., **Hadjimichael, A.**, Reed, P.M., Characklis G.W., Using financial contracts to facilitate informal leases within a Western United States water market based on prior appropriation. *Earth's Future* (in revision)

Hadjimichael, A., Reed, P.M., Quinn, J.D, Vernon, C.R., Thurber, T., Multi-actor, multi-impact scenario discovery of consequential narrative storylines for human-natural systems planning. *Earth's Future* (in review)

IN PREP

Gupta, R.S., Vernon, C.R., Thurber, T.B, Gold, D.F., Hirsch, Z.M., **Hadjimichael, A.**, Reed, P.M., statemodify: a Python framework to facilitate accessible exploratory modeling for discovering drought vulnerabilities. (to be submitted to *Journal of Open Source Software* January 2024)

Hadjimichael, A., Schlumberger, J., Haasnoot, M. On the use of visualization to inform decision making under deep uncertainty. (to be submitted to *Global Environmental Change* February 2024)

Hadjimichael, A., Reed, P.M., 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* May 2024)

COMMUNICATION IN POPULAR MEDIA

Sliman, K., Growing Impact: Climate, crops, and the Colorado River *Growing Impact Podcast*, January 2024, <https://iee.psu.edu/news/podcast/growing-impact-climate-crops-and-colorado-river>

Hadjimichael, A., Weaving Data Viz Into Science and Engineering Education. *Nightingale*, June 2023, <https://nightingaledvs.com/weaving-data-viz-into-science-and-engineering-education/>

Thomson, J., When will the megadrought gripping southwestern states end? *Newsweek*, February 2023, <https://www.newsweek.com/megadrought-southwest-states-climate-change-1780833>

Thomson, J., America's drought-hit lakes and rivers in sobering before and after photos, 2002, *Newsweek*, December 2022, <https://www.newsweek.com/drought-lakes-rivers-us-climate-change-1765637>

Hadjimichael, A., What is a flash drought? An earth scientist explains, *The Conversation*, November 2022, <https://theconversation.com/what-is-a-flash-drought-an-earth-scientist-explains-194141>

Selected Conference and Invited Presentations _____

INVITED TALKS

December, 2023. *Advancing uncertainty characterization for understanding projected water scarcity in multi-sector, multi-actor river basins across scales*. American Geophysical Union Fall Meeting. December, 2023. <https://doi.org/10.57931/2281204>

December, 2023. *Advancing scenario discovery to identify impacts and consequential dynamics for complex multi-actor human-natural systems* American Geophysical Union Fall Meeting. December, 2023. <https://doi.org/10.5281/zenodo.8400589>

October, 2023. *Scenario discovery for impacts and consequential dynamics in complex, multi-actor, human-natural systems* Advances in Water Management and Climate Adaptation Lecture Series, Institute of Fluid Mechanics and Technical Acoustics, Technische Universität Berlin, Germany

October, 2023. *Understanding how human and natural processes interact to shape nutrient exports in the Great Lakes* (poster) Multi-Sector Dynamics Workshop, Davis, CA, USA

October, 2023. *Advancing scenario discovery to identify impacts and consequential dynamics for complex multi-actor human-natural systems* Environmental Engineering Seminar Series, Department of Civil and Environmental Engineering, Stanford University. <https://doi.org/10.5281/zenodo.8400589>

March, 2023. *Planning for water resources systems under uncertainty: the case of the Upper Colorado River Basin*. Water Energy Food Nexus Seminar, Department of Ecosystem Science & Management, The Pennsylvania State University.

February, 2023. *Addressing uncertainty in MultiSector Dynamics research: an eBook guide for novice and experienced modelers*. Co-presented with David Gold. Multisector Dynamics Working Group, United States Geological Survey (USGS).

November, 2022. *Planning for water resources systems under uncertainty: the case of the Upper Colorado River Basin*. Energy and Environmental Economics and Policy Initiative (EEPI) Seminar, The Pennsylvania State University.

October, 2022. *Water scarcity vulnerabilities for stakeholders in institutionally complex river basins under uncertainty*. INFORMS Annual Meeting, Indianapolis, USA.

September, 2022. *Advancing the science of complex adaptive human-Earth systems through MultiSector Dynamics*. Climate Dynamics Seminar, Department of Meteorology and Atmospheric Science, The Pennsylvania State University.

September, 2022. *Understanding complex adaptive human-Earth systems through MultiSector Dynamics*. Coffee Hour Colloquium, Department of Geography, The Pennsylvania 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, The Pennsylvania 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, Mexico. <https://doi.org/10.5281/zenodo.6611750>

April, 2022. *Simulation-based optimization: Basic fundamentals and some examples*. Guest lecture for the Modelling & Simulation Discussion Group, Wageningen University, The Netherlands. <https://doi.org/10.5281/zenodo.6457891>

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, Mexico. <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, The Pennsylvania 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.

SELECTED CONTRIBUTED PRESENTATIONS

- Hadjimichael, A.**, Reed, P.M., Quinn, J.D., Vernon, C.R., Thurber, T., Multi-actor, multi-impact scenario discovery of consequential narrative storylines in human-natural systems. Annual Meeting of the Society for Decision Making under Deep Uncertainty, Delft, The Netherlands. October, 2023.
- Hadjimichael, A.**, Bader, M., Hobbs, B., Nicholas, R., Wu, H., Sanders Thach, T., Kirchner, S., Smith, G., Lulo, L.D., Zaitchik, B., Identifying equitable adaptation pathways at scale: the Baltimore Social-Environmental Collaborative. Annual Meeting of the Society for Decision Making under Deep Uncertainty, Delft, The Netherlands. October, 2023.(poster)
- Hadjimichael, A.**, Peng, W., Bader, M., Hobbs, B., Nicholas, R., Wu, H., Sanders Thach, T., Kirchner, S., Smith, G., Lulo, L.D., Zaitchik, B., Advancing the urban science necessary to inform equitable adaptation: the Baltimore Social-Environmental Collaborative (BSEC) Multi-Sector Dynamics Workshop, Davis, CA, USA. October, 2023. (poster)
- 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, GA, USA. 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.**, Corominas, L.L., 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.

Teaching Experience

2023-2024	Water and Society (EARTH 111) , Co-Instructor	<i>The Pennsylvania State University</i>
2023-2024	Data Visualization for Scientists and Engineers (GEOSC 497) , Instructor	<i>The Pennsylvania State University</i>
2022-2023	Risk Analysis in the Earth Sciences (GEOSC 450) , Instructor	<i>The Pennsylvania State University</i>
2023	Data Visualization for DMDU , Instructor	<i>DMDU Summer School, Tecnológico de Monterrey, Mexico</i>
2018-2019	Interdisciplinary Master of Engineering Project (CEE 5050) , Co-Instructor	<i>Cornell University</i>
2018	Engineering Management Methods (CEE 5930) , Instructor	<i>Cornell University</i>

Professional Service

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, Environmental Research Letters, Frontiers in Water, Hydrology and Earth System Sciences, Journal of the American Water Resources Association, Journal of Environmental Engineering, Journal of Environmental Studies and Sciences, Journal of Hydrology, Journal of Water Resources Planning and Management, Regional Environmental Change, Science of the Total Environment, Water Resources Research

FUNDING AGENCY PEER REVIEW - PANEL

Department of Energy Office of Science

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BARD US-Israel Agricultural Research and Development Fund

National Science Foundation Hydrologic Sciences Program

PROFESSIONAL MEMBERSHIPS

American Geophysical Union

Data Visualization Society