

DAVID G. GROVES

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EDUCATION

Pardee RAND Graduate School, Santa Monica, California Ph.D. in Policy Analysis	September 2005
University of Washington, Seattle, Washington M.S. in Atmospheric Sciences	March 2001
Stanford University, Palo Alto, California M.S. in Earth Systems	April 1996
B.S. in Geological and Environmental Sciences	April 1996

EMPLOYMENT

World Bank Group, Washington, DC Senior Climate Change Specialist	2021 – present
RAND Corporation, Santa Monica, California Senior Policy Researcher	2012 – 2021
Codirector Climate Resilience Center	2015 – 2020
Policy Researcher	2008 – 2012
Associate Policy Researcher	2006 – 2008
Pardee RAND Graduate School, Santa Monica, California Adjunct Professor of Policy Analysis	2021 – present
Director Methods Center on Decision Making Under Uncertainty	2018 – 2021
Professor of Policy Analysis	2007 – 2021

SELECT POLICY RESEARCH *(project role: * = principal investigator, † = technical lead) [publication(s)]*

Decarbonization Policy

- *Supporting COVID-19 economic recovery through decarbonization investments in Costa Rica (United Nations Development Programme):* *† Leading study evaluating the near-term employment and other economic benefits of decarbonization investment spending in Costa Rica (2019 – present).
- *Chile decarbonization policy evaluation (Inter-American Development Bank):* *† Collaborating with researchers from University of Chile and Catholic University of Chile to develop an integrated decarbonization model, evaluate Chile’s decarbonization plan, and recommend improvements to ensure its success (2020 – present).
- *Costa Rica decarbonization benefits study (Inter-American Development Bank):* *† Led study assessing the benefits of decarbonizing Costa Rica’s economy in collaboration with the Costa Rican government and University of Costa Rica researchers; developed integrated model of Costa Rica greenhouse gas emissions and decarbonization benefits, and costs for the major sectors (2019 – 2020). [3]

Climate Adaptation and Resiliency

- *Founding co-director of RAND’s Climate Resilience Center:* Curated RAND’s climate resiliency research for external outreach and organized internal climate strategy discussions (2015 – 2021).
- *Climate resiliency of water resources planning in Mendoza, Argentina (Inter-American Development Bank):* *† Evaluated the robustness of Mendoza’s long-term water resources strategy to climate change and other future trend; proposed adaptation strategies focused on

water-use efficiency (2018-2019). [2]

- *Climate resiliency of Africa's energy and water infrastructure plans (World Bank):*[†] Collaborated with other research organizations to evaluate the climate resiliency of Africa's 50-year infrastructure plan; Led the development and implementation of analytic framework for coupled energy-water systems modeling; evaluated climate sensitivity of key proposed hydropower projects and potential robust adaptations (2012 – 2015). [10,20]
- *Climate resiliency of water resources in Lima, Peru (World Bank):*^{*†} Co-led first application of new methodology for evaluating climate uncertainty in Latin American for Lima, Peru's water utility; developed robust approach for implementing Lima's long-term water resources investment plan; led follow-on study evaluating sensitivity to drought and potential for climate-change exacerbation (2013-2018). [9,19]

Coastal Resilience

- *Louisiana's 50-year Coastal Master Plan (Louisiana's Coastal Protection and Restoration Authority):*^{*†} Developed and implemented planning framework and tool used to formulate Louisiana's 50-year, \$50 billion Coastal Master Plans (2012 and 2017); support for 2023 Coastal Master Plan in ongoing. (2010 – present) [6, 14, 18, 23, 26, 27]
- *Climate change and coastal flooding risk in Southern Florida (MacArthur Foundation):*[†] Led technical analysis for case study that developed approach for accounting for climate risk in Southern Florida to coastal flooding; Worked with Broward and Miami-Dade County to assemble integrate groundwater and economic development model that assesses current and future coastal groundwater flooding risk under different climate and economic scenarios (2016 – 2018). [11]
- *California Bay-Delta Levee Investment Strategy (California Bay-Delta Stewardship Council):*^{*†} Led RAND project team in collaboration with engineering firm to develop a risk evaluation framework and tool for the California Bay-Delta levee system (2014 – 2018). [12]

Disaster Recovery

- *Puerto Rico's Economic and Disaster Recovery Plan (Federal Emergency Management Agency):*[†] Led the development and application of decision framework and tool used to formulate Puerto Rico's \$130 billion Economic and Disaster Recovery Plan (2019 – 2020). [4, 5]

Long-term Water Resources Planning

- *Water planning for the uncertain future (U.S. Bureau of Reclamation):*^{*†} Developed interactive web portal for water resources managers to learn about the application of Robust Decision Making (RDM) to water resources climate adaptation planning (2017-2021). [1]
- *Robust long-term water resources plan for Monterrey, Mexico (Fondo de Agua Metropolitano de Monterrey):*^{*†} Developed a robust water management strategy for Monterrey, Mexico that emphasizes integrated water resources management over single-purpose large infrastructure projects (2016 – 2019). [7]
- *Jinan, China's long-term water resources strategy (Shandong Provincial Department of Water Resources):*[†] Technical lead for project applying new methods for water resources planning under uncertainty in Jinan, China. Supervised the development of a new water management systems model and analysis of climate scenarios (2015 – 2017). [15]
- *Climate change assessment of the Colorado River Basin (U.S. Bureau of Reclamation):*^{*†} Developed analytical framework for accounting for thousands of plausible climate and demographic futures for the U.S. Bureau of Reclamation's 2012 Colorado River Basin Study (2010-2013). [16, 24]
- *Robustness of Southern California's water strategy (Metropolitan Water District of Southern*

California):*[†] Led two studies evaluating the robustness of Metropolitan’s Integrated Resources Plan using the Robust Decision Making methodology (2008 – 2010; 2018 – 2020). [28]

- *Methods for accounting for climate change uncertainty in long-term water resources planning (National Science Foundation)*:[‡] Co-developer of new methods for Decision Making Under Deep Uncertainty (DMDU) to long-term water resources planning, with key applications in California, including for the California Water Plan and the Inland Empire Utilities Agency long-term planning) (2003 – 2014). [21, 22, 25, 29, 30, 31, 32, 36]

Decision Analysis Methods

- Co-author of chapter on applications of Robust Decision Making to climate policy and water resources planning in recent book on Decision Making Under Deep Uncertainty, published by Springer (2019). [8]
- *Robust Decision Making (National Science Foundation)*: Early developer of the RDM methodology; co-author of key foundational papers on RDM (2004 – 2007). [33, 35]

AWARDS AND FELLOWSHIPS

Department of Interior’s Partners in Conservation award (shared with Colorado River Basin Study team)	2013
RAND’s President Choice Award	2013
RAND ISE Outstanding Peer Review Award	2010
RAND Gold Award	2009
RAND Silver Award	2007
Pardee RAND Graduate School Rothenberg Dissertation Award	2003
John Vogelstein RAND Graduate School Fellowship	2001
National Science Foundation Graduate Research Fellowship	1996 – 1999
Second place for Larus Prize at American Association for the Advancement of Science 49th Arctic Science Conference, Fairbanks, AK	1998
McGee Foundation and Shell Foundation Graduate Research Grants	1995

SELECT PROFESSIONAL ACTIVITIES

- *Society for Decision Making Under Deep Uncertainty*: Founding member, organizer of annual meetings, convener of sessions
- *American Geophysical Union*: Water and Society Technical Subcommittee member; frequent participant in Annual Meetings
- *National Adaptation Forum*: Frequent presenter and session chair in bi-annual meetings
- *Water Utilities Climate Alliance*: Participant in educational initiatives

SELECT PUBLICATIONS

- [1] Groves, D. G., N. Kalra, J. Syme, E. Molina-Perez, C. Garber, 2021: *Water Planning for the Uncertain Future: An Interactive Guide to the Use of Methods for Decisionmaking Under Deep Uncertainty (DMDU) for U.S. Bureau of Reclamation Water Resources Planning*. RAND Corp., Santa Monica, CA. <https://www.rand.org/pubs/tools/TL320/tool.html>
- [2] Groves, D. G., M. Miro, J. Syme, A. U. Becerra-Ornelas, E. Molina-Perez, V. Saavedra, A. Vogt-Schilb, 2021: *Planificación de infraestructura hídrica para el futuro incierto en América Latina: un enfoque eficiente en costos y tiempo para tomar decisiones robustas de infraestructura, con un estudio de*

caso en Mendoza, Argentina. Inter-American Development Bank, Washington, DC.
<http://dx.doi.org/10.18235/0003030>

- [3] Groves, D. G., J. Syme, E. Molina-Perez, C. Calvo Hernandez, L Víctor-Gallardo, G. Godinez-Zamora, J. Quirós-Tortós, F. De León, A. Murillo, V. Gómez, A. Vogt-Schilb, 2020: *The Benefits and Costs of Decarbonizing Costa Rica's Economy: Informing the Implementation of Costa Rica's National Decarbonization Plan Under Uncertainty*. RR-A633, RAND Corp., Santa Monica, CA.
<https://doi.org/10.7249/RR633-1>
- [4] HSOAC Puerto Rico Recovery Team (includes D. G. Groves), 2020: *Developing Recovery Options for Puerto Rico's Economic and Disaster Recovery Plan: Process and Methodology*. RR-2597, RAND Corp., Santa Monica, CA. https://www.rand.org/pubs/research_reports/RR2597.html
- [5] Groves, D. G., Syme, J., Kalra, N., 2020: *Puerto Rico Economic and Disaster Recovery Plan Decision Support Tool*. RAND Corp., Santa Monica, CA. <https://www.rand.org/hsrd/hsoac/projects/puerto-rico-recovery/publications/decision-support-tool.html>
- [6] Fischbach, J. R., Johnson, D. R., & Groves, D. G., 2019: Flood damage reduction benefits and costs in Louisiana's 2017 Coastal Master Plan, *Environmental Research Communications*, 1 111001.
<https://doi.org/10.1088/2515-7620/ab4b25>
- [7] Molina-Perez, E., Groves, D. G., Popper, S., Ramirez, A., & Crespo-Elizondo, R., 2019: *Developing a Robust Water Strategy for Monterrey, Mexico: Diversification and Adaptation for Coping with Climate, Economic, and Technological Uncertainties*. RR-3017, RAND Corp., Santa Monica, CA.
<https://doi.org/10.7249/RR3017>
- [8] Groves, D. G., Molina-Perez, E., Bloom, E., & Fischbach, J. R., 2019: Robust Decision Making (RDM): Application to Water Planning and Climate Policy, In *Decision Making under Deep Uncertainty*. Springer, Cham, Switzerland, (pp. 135–163). https://doi.org/10.1007/978-3-030-05252-2_7
- [9] Groves, D. G., L. Bonzanigo, J. Syme, N. Engle, I. Rodriguez, 2019: *Preparing for Future Droughts in Lima, Peru: Enhancing Lima's Drought Management Plan to meet future challenges*. World Bank, Washington, D.C. <https://openknowledge.worldbank.org/handle/10986/31695>
- [10] Sridharan, V., O. Broad, A. Shivakumar, M. Howells, B. Boehlert, D. G. Groves, H. Rogner, C. Taliotis, J. E. Neumann, K. M. Strzepek, R. Lempert, B. Joyce, A. Huber-Lee, and R. Cervigni, 2019: "Resilience of the Eastern African Electricity Sector to Climate Driven Changes in Hydropower Generation," *Nature Communications*, 10 (1). Nature Publishing Group: 302.
<https://doi:10.1038/s41467-018-08275-7>
- [11] Groves, D. G., D. Knopman, N. Berg, C. A. Bond, J. Syme, R. Lempert, 2018: *Adapting Land Use and Water Management Plans to a Changing Climate in Miami-Dade and Broward Counties, Florida*. RR-1932-MCF, RAND Corp., Santa Monica, CA.
https://www.rand.org/pubs/research_reports/RR1932.html
- [12] Groves, D. G., N. Kalra, J. Syme, H. Ellis, C. L. Gardiner, and L. H. Roth, 2018: *Decision Support Tool for the San Francisco Bay-Delta Levees Investment Strategy: Documentation and Use*. RR-2139-DSC, RAND Corp, Santa Monica, CA. <https://www.rand.org/pubs/tools/TL266.html>.
- [13] Kalra, N. and D. G. Groves, 2017: *The enemy of good: estimating the cost of waiting for nearly perfect automated vehicles*. RR-2150-RC, RAND Corp., Santa Monica, CA.
https://www.rand.org/pubs/research_reports/RR2150.html.
- [14] Groves, D. G., T. Panis, R. Sanchez, 2017: *2017 Coastal Master Plan: Appendix D: Planning Tool Report*, Louisiana Coastal Protection and Restoration Authority, Baton Rouge, Louisiana.
<https://coastal.la.gov/our-plan/2017-coastal-master-plan/>.

- [15] Groves, D. G., Knopman, D., Syme, J., Kalra, N., & Mao, Z. (2017). *Evaluation of the Jinan City Water Ecological Development Implementation Plan and Recommendations for Improvement*. RR-1682, RAND Corp., Santa Monica, CA. <https://doi.org/10.7249/RR1682>
- [16] Groves, D. G., R. J. Lempert, D. W. May, J. R. Leek and J. Syme, 2016: *Using High-Performance Computing to Support Water Resource Planning: A Workshop Demonstration of Real-Time Analytic Facilitation for the Colorado River Basin*. CF-339, RAND Corp., Santa Monica, CA.
- [17] Willis, Henry H., D. G. Groves, J. Ringel, Z. Mao, S. Efron and M. Abbott, 2016: *Developing the Pardee RAND Food-Energy-Water Security Index: Toward a Global Standardized, Quantitative, and Transparent Resource Assessment*. TL-165, RAND Corp., Santa Monica, CA.
- [18] Groves, D. G., K. Kuhn, J. R. Fischbach, D. R. Johnson, J. Syme, 2016: *Analysis to Support Louisiana's Flood Risk and Resilience Program and Application to the National Disaster Resilience Competition*. RR-1449-CPRA, RAND Corp., Santa Monica, CA.
- [19] Kalra, N. R., D. G. Groves, L. Bonzanigo, E. Molina-Perez, C. Ramos, C. Brandon, I. Rodriguez Cabanillas, 2015: *Robust decision-making in the water sector: a strategy for implementing Lima's long-term water resources master plan*, Policy Research working paper, no. WPS 7439, Washington, D.C., World Bank Group.
- [20] Groves, D. G., Z. Mao, R. Linden, K. Strzepek, R. Lempert, 2015: Adaptation to Climate Change in Project Design, in *Enhancing the climate resilience of Africa's infrastructure: the power and water sectors*, Africa Development Forum, Washington, D.C., World Bank Group.
- [21] Groves, D. G., E. Bloom, E. Molina-Perez, 2014: Robust Water-Management Strategies for the California Central Valley: Technical Analysis for the California Water Plan Update 2013, *California Water Plan Update 2013, Volume 4*.
- [22] Groves, D. G., J. R. Fischbach, N. Kalra, E. Molina-Perez, D. Yates, D. Purkey, A. Fencil, V. K. Mehta, B. Wright, G. Pyke, 2014: *A Framework for Assessing Climate Change Vulnerability and Defining Robust Risk Management Strategies for Water Utilities*, WRF-4262, Water Resources Foundation, Denver, CO, 188pgs.
- [23] Groves, D. G., J. R. Fischbach, D. Knopman, D. Johnson, K. Giglio, 2014: *Strengthening Coastal Planning: How Coastal Regions Could Benefit from Louisiana's Planning and Analysis Framework*. RR-437, RAND Corp., Santa Monica, CA.
- [24] Groves, D. G., J. R. Fischbach, E. Bloom, D. Knopman, 2013: *Adapting to a Changing Colorado River: Making Future Water Deliveries More Reliable Through Robust Management Strategies*. RR-242-BOR, RAND Corp., Santa Monica, CA.
- [25] Tingstad, A., D. G. Groves, R. J. Lempert, 2013, Paleoclimate Scenarios to Inform Decision Making in Water Resource Management: Example from Southern California's Inland Empire, *J. of Water Resources Planning and Management*, (ASCE)WR.1943-5452.0000403.
- [26] Groves, D. G., C. Sharon, 2013: Planning Tool To Support Planning The Future Of Coastal Louisiana, *Journal of Coastal Research*, Special Issue No. 67, 147-161.
- [27] Peyronnin, N., M. Green, C. P. Richards, A. Owens, D. Reed, J. Chamberlain, D. G. Groves, W. K. Rhinehart, K. Belhadjali, 2013: Louisiana's 2012 Coastal Master Plan: Overview of a Science-Based and Publicly Informed Decision-Making Process, *Journal of Coastal Research*, 67, 1–15. https://doi:10.2112/SI_67_1.1
- [28] Lempert, R. J., D. G. Groves, 2010: Identifying and Evaluating Robust Adaptive Policy Responses to Climate Change for Water Management Agencies in the American West, *Technological Forecasting and Social Change*, 77, 960-974.

- [29] Joyce, B., Purkey, D., Yates, D. G., Groves, A. Draper, 2010: "Integrated Scenario Analysis for the 2009 California Water Plan Update" in *California Water Plan Update 2009*, California Department of Water Resources, Sacramento, CA.
- [30] Groves, D. G., D. Yates, C. Tebaldi, 2008: Developing and Applying Uncertain Global Climate Change Projections for Regional Water Management Planning, *Water Resources Research*, 44(W12413).
- [31] Groves, D. G., R. J. Lempert, D. Knopman, S. Berry, 2008: *Preparing for an Uncertain Future Climate in the Inland Empire – Identifying Robust Water Management Strategies*. DB-550-NSF, RAND Corp., Santa Monica, CA.
- [32] Groves, D. G., M. Davis, R. Wilkinson, R.J. Lempert, 2008: Planning for Climate Change in the Inland Empire: Southern California, *Water Resources IMPACT*, July, 10 (4), 14-17.
- [33] Groves, D. G., R. J. Lempert, 2007: A New Analytic Method for Finding Policy-Relevant Scenarios, *Global Environmental Change*, 17, 73-85.
- [34] Groves, D. G., J. R. Fischbach, S. Hickey, 2007: *Evaluating the Benefits and Costs of Increased Water Use Efficiency in Commercial Buildings*. TR-461-Nathanson, RAND Corp., Santa Monica, CA.
- [35] Lempert, R. J., D. G. Groves, S. W. Popper, S. C. Bankes, 2006: A General, Analytic Method for Generating Robust Strategies and Narrative Scenarios, *Management Science*, 52(4).
- [36] Gleick, Peter H., H. Cooley, D. G. Groves, 2005: *California Water 2030: An Efficient Future*. Pacific Institute, Oakland, CA.
- [37] Bernstein, M., D. G. Groves, and A. Moreen, 2005: Water. In *Building a Successful Palestinian State*. MG-146-DCR, RAND Corp., Santa Monica, CA.
- [38] Groves, D. G. and J. A. Francis, 2002: Variability of the Arctic atmospheric moisture budget from TOVS satellite data, *Journal of Geophysical Research*, 107(D24).
- [39] Groves, D. G. and J. A. Francis, 2002: The moisture budget of the Arctic atmosphere from TOVS satellite data, *Journal of Geophysical Research*, 107(D19).
- [40] Groves, D. G., 2001: *The moisture budget of the Arctic atmosphere from TOVS satellite data*, M.S. Thesis, Dept. of Atmospheric Sciences, University of Washington, Seattle, WA.
- [41] Rothrock, D. A., R. Kwok, D. G. Groves, 2000: Satellite views of the Arctic Ocean freshwater balance: In *The Freshwater Budget of the Arctic Ocean*, NATO-Advanced Research Workshop series (Ed: Lewis, E. L.), Kluwer Academic Publishers, Kluwer, The Netherlands, pp. 163-196.