

ROBERT W. HOWARTH

Department of Ecology & Evolutionary Biology
Corson Hall, Cornell University
Ithaca, NY 14853 USA

<http://www.eeb.cornell.edu/howarth/>
e-mail: howarth@cornell.edu
Tel.: (1)-607-280-9981

Education

B.A., Amherst College (*Magna cum laude*), 1974

Ph.D., Massachusetts Institute of Technology/Woods Hole Oceanographic Institution Joint
Program in Biological Oceanography, 1979

Professional Experience

1993-Present	David R. Atkinson Professor of Ecology & Environmental Biology, Cornell University.
2020-Present	Member, Climate Action Council, State of New York (appointed by the Speaker of the State Assembly).
2021-Present	Co-Editor-in-Chief, <i>Ocean-Land-Atmosphere Research</i> (OLAR)
2021-Present	Member of editorial board, <i>Energy Science & Engineering</i>
2016-Present	Distinguished Visiting Fellow, Woods Hole Research Center.
2000-Present	Adjunct Senior Scientist, Marine Biological Laboratory, Woods Hole.
1983-Present	Founding Editor, <i>Biogeochemistry</i> (Editor-in-Chief, 1983-2004).
2019-2020	Chair, the University Assembly, Cornell University.
2018-2019	Vice Chair, the University Assembly, Cornell University.
2014-2019	Editor-in-Chief, <i>Limnology & Oceanography</i> .
2005-2012	Director, Agriculture, Energy, & Environment Program, Cornell University.
2000-2001	Oceans Program Director & Senior Scientist, Environmental Defense Fund.
1995-2000	Director, Program in Biogeochemistry & Environmental Change, Cornell.
1992-1995	Senior Fellow, and coordinator for Initiative in Earth, Atmospheric, & Aquatic Sciences, Center for the Environment, Cornell.
1990-1993	Professor, Section of Ecology & Systematics, Cornell University.
1988-1991	Director, Ecosystems Research Center (US EPA National Center of Excellence), Cornell University.
1985-1990	Associate Professor, Section of Ecology & Systematics, Cornell University.
1980-1985	Assistant and Associate Scientist, Marine Biological Lab, Woods Hole.
1979	Noyes Postdoctoral Fellow, Marine Biological Laboratory, Woods Hole.

Awards and Honors

- One of the ten ever most highly cited marine biologists/aquatic scientists in the world (*PLoS Biol* 18(10): e3000918. <https://doi.org/10.1371/journal.pbio>)
- Selected by ISI Web of Science (Scientific Citation Index) as one of 250 most cited scientists globally in ecology and environmental science disciplines (every year, 2006 to the present).
- One of 50 “Most Influential People” driving energy policy in New York State, City & State New York magazine, three years in a row (2019, 2020, and 2021).
- ASLO John Martin Award, Association for Sciences of Limnology & Oceanography (2018).

- Moore Lecturer, University of Virginia (2017).
- ASLO Sustaining Fellow, Association for Sciences of Limnology & Oceanography (2017).
- Ian Morris Distinguished Scholar, Horn Point Laboratory, University of Maryland (2014).
- Co-Winner, 2013 Atlas Award, “honoring climate heroes worldwide”
- David Schindler Visiting Scholar, Trent University (2013)
- Pritchard Award, best physical oceanography paper published in *Estuaries & Coasts* (2013).
- One of Time Magazine’s 50 “People Who Mattered,” 2011 Person of the Year issue.
- Zayed International Prize for the Environment (2007), jointly with the other lead authors of the Millennium Ecosystem Assessment.
- Lindeman Award in Ecology, University of Minnesota (2003).
- Aldo Leopold Leadership Fellow, Ecological Society of America (2000).
- Eminent Ecologist award, Kellogg Biological Station, Michigan State Univ. (2000).

National and International Committees and Activities

2021	Delegate observer to the UN COP26 negotiations, Glasgow, Scotland.
2017-present	Member, Board of Directors, Food & Water Watch.
2017	Delegate observer to the UN COP23 negotiations, Bonn, Germany.
2017	Chair, Review Panel for Integration of Monitoring and Evaluation into Environmental Restoration Projects to Improve Outcomes in the Gulf of Mexico, National Academy of Sciences.
2015-present	Member, EPA Clean Air Scientific Advisory Committee (CASAC) Secondary National Ambient Air Quality Standards Review Panel for Oxides of Nitrogen and Sulfur, US Environmental Protection Agency.
2015	Delegate observer to the United Nations COP21 negotiations, Paris, France.
2014-2016	Member, National Estuarine Research Reserves Science Collaborative Advisory Board, National Oceanic & Atmospheric Administration.
2010-2014	Member, Working Group on Land and Soils, International Resource Panel, United Nations Environment Programme.
2007-2012	Chair, International SCOPE Biofuels Project: Environmental Consequences of Biofuels (International Council of Science).
2007-2009	President, Coastal & Estuarine Research Federation.
2008-2010	Member, Board of Directors, Council of Scientific Society Presidents.
2007-2011	Co-chair, Committee on Energy & Environment, Council of Scientific Society Presidents.
2005-2013	Representative from the State of New York to the Scientific and Technical Advisory Committee of the Chesapeake Bay Program.
2006-2008	Member, Gulf of Mexico Hypoxia Advisory Panel, US EPA.
2005-2007	Member, Steering Committee, N2007 International N Symposium, Brazil.
2004-2007	Member, Biogeochemistry Rapid Response Team, Ecological Society of America.
2003-Present	Editor, book series on Environmental Management, Springer.
2003-2008	Member, Coast and Oceans Working Group, the Heinz Center.
2003-2006	Director, North American Regional Center, International Nitrogen Initiative.
2003-2014	Member, Advisory Committee, International Nitrogen Initiative.

2002-2005 Coordinating Lead Author, chapter on responses to nutrient pollution, the Millennium Ecosystem Assessment.

2002-2004 Member, Advisory Committee, N2004 International N Symposium, China.

2002-2003 Coordinator and lead author, Working Group to Develop a Federal Interagency Research Plan for Coastal Nutrient Pollution.

2001-2002 Consultant on coastal nutrient pollution, the Pew Oceans Commission.

2000-2003 Member, US Committee for SCOPE, National Academy of Sciences.

2000-2003 Member, Scientific Advisory Board, National Center for Ecological Analysis & Synthesis, University of California at Santa Barbara.

2001-2002 Member, Committee to Evaluate the Water Programs of the US Army Corps of Engineers, National Academy of Sciences.

1992-2002 Co-Chair, International SCOPE Nitrogen Project on Nitrogen: A Regional and Global Analysis (International Council of Science).

2000-2001 Member, Advisory Committee, N2001 Symposium, Potomac, MD.

1998-2001 Member, National Climate Change Assessment (Coastal Marine Sector).

1998-2000 Chair, Committee on Causes and Management of Coastal Eutrophication, National Academy of Sciences.

2000 Chair, Panel on Coastal Nitrogen Pollution, Ecological Society of America.

1996-1998 Member, Board of Scientific Counselors, US Environmental Protection Agency

1994-1995 Member, Panel on Nitrogen Cycling in China, Committee on Scholarly Communication with China, National Academy of Sciences.

1995 Chair, Working group on Scientific Studies in Pristine Areas, National Academy of Sciences.

1994-1997 Member, Steering Committee, Sustainable Biosphere Initiative, ESA.

1994 Member, Committee on High-Priority Science to Meet National Coastal Needs, National Academy of Sciences.

1992-1998 Member, Committee on Ethics, Am. Soc. of Limnol. & Oceanography.

1990-1993 Member, Committee on Opportunities to Improve Wastewater Management for Urban Coastal Areas, National Academy of Sciences.

1991-1995 Member, Advisory Committee for the National Water-Quality Assessment Program, U.S. Geological Survey.

1989-1992 Member, Committee on the Coastal Ocean, National Academy of Sciences.

1991-1993 Member, Governing Board, Estuarine Research Federation.

1988-1990 Member, U. S. National Committee for SCOPE, National Academy of Sciences.

1985-1991 Member, Scientific Advisory Committee, the International SCOPE Sulphur Project (Moscow, USSR), International Council of Science.

1989-1990 Member, Panel on Fluxes of Trace Gases and Nutrients to and from Terrestrial Ecosystems, Committee on Global Change, National Academy of Sciences.

1986-1988 Member, Public Affairs Committee, Am. Soc. of Limnol. & Oceanography.

1981-1984 Member, Panel on Ecological Effects, Committee on Fate and Effects of Oil in the Sea, National Academy of Sciences.

Research Interests

Application of science to sustaining the biosphere; biogeochemistry and aquatic ecosystem science; global and regional nitrogen and phosphorus cycles; global methane cycle; environmental consequences of biofuels; role of trace gases in global warming and climate disruption; life-cycle analysis for greenhouse-gas footprint of energy technologies; influence of land-use, management practices, and climate change on nutrient fluxes from the landscape; atmospheric deposition of nitrogen onto the landscape; controls and consequences of eutrophication in estuaries; biotic, physical, and geochemical controls on nitrogen fixation; environmental management and the effects of pollutants on aquatic ecosystems; alternative energy systems.

Publications:

Editor of eight books and treatises. Author of one textbook: Begon, M., R.W. Howarth, and C. Townsend. 2014. *Essentials of Ecology*, 4th Edition. Wiley. ISBN-13: 978-0470909133

Author or co-author of over 230 peer-reviewed papers. These papers have been cited more than 82,000 times in other peer-reviewed publications. Fifteen of these papers have been cited more than 1,000 times each, seven have been cited more than 3,000 times each, and two have been cited more than 8,000 times each. Howarth is the first author on four of these. All publications are listed chronologically below, with those papers cited at least 1,000 times highlighted in bold.

- 2023 Howarth, R. W. 2023. Phosphorus in all its forms: Book review of *The Devils Element*. *Science* 379: 1096. doi: 10.1126/science.adg3927
- Howarth, R.W., and D. Chen. 2023. The science we need for the ocean we want. *Ocean-Land-Atmosphere Research*. doi: 10.34133/olar.0009
- 2022 Howarth, R.W. 2022. Methane emissions from the production and use of natural gas. *EM Magazine*, December 2022, pages 11-16.
- Haviland, K. A., R. W. Howarth, R. M. Marino, and M. Hayn. 2022. Variation in sediment and seagrass characteristics reflect multiple stressors along a nitrogen-enrichment gradient in a New England lagoon. *Limnology & Oceanography* doi: 10.1002/lno.12025
- Vitousek, P. M., K.K. Tresedor, R.W. Howarth, and D.N.L. Menge. 2022. A “toy model” analysis of causes of nitrogen limitation in terrestrial ecosystems. *Biogeochemistry* doi: 10.1007/s10533-022-00959-z
- Chen, D., and R.W. Howarth. 2022. Share promising ideas, explore new frontiers. . *Ocean-Land-Atmosphere Research*. 2022: 9808635. doi: 10.34133/2022/9808635
- Howarth, R. W. 2022. Nitrogen. In: Thomas Mehner and Klement Trockner (editors), *Encyclopedia of Inland Waters*, 2nd Edition. Elsevier.
- Marino, R. M., and R. W. Howarth. 2022. Nitrogen fixation. In: Thomas Mehner and Klement Trockner (editors), *Encyclopedia of Inland Waters*, 2nd Edition. Elsevier.

- Howarth, R. W. 2022. Methane and climate change. In: John F. Stolz, W. Michael Griffin, and Daniel J. Bain (editors), *Environmental Impacts from Development of Unconventional Oil and Gas Reserves*, Cambridge University Press.
- Howarth, R. W., and M. Jacobson. 2022. Reply to comment on “how green is blue hydrogen?” *Energy Science and Engineering* doi: 10.1002/ese3.1154
- 2021 Howarth, R.W., and M. Jacobson. 2021. How green is blue hydrogen? *Energy Science and Engineering* 9: 1676-1687, doi: 10.1002/ese3.956
- Howarth, R.W., F. Chan, D.P. Swaney, R.M. Marino, and M. Hayn. 2021. Role of external inputs of nutrients to aquatic ecosystems in determining prevalence of nitrogen vs. phosphorus limitation of net primary productivity. *Biogeochemistry* 154: 293-306, doi: 10.1007/s10533-021-00765-z
- Wong, M.Y., S.D. Rathod, R. Marino, L. Li, R.W. Howarth, A. Alastuey, M.A. Alaimo, F. Barraza, M.C. Carneiro, S. Chellam, C. Yu-Cheng, D.D. Cohen, D. Connelly, G. Dongarra, D. Gomez, J. Hand, R.M. Harrison, P.K. Hopke, C. Hueglin, Y. Kuang, F. Lambert, J. Liang, R. Losno, W. Maenhaut, C. Milando, M.I.C. Monteiro, Y. Morera-Gomez, X. Querol, S. Rodriguez, P. Smichowski, D. Varrica, Y. Xiao, Y. Xu, and N.M. Mahowald. 2021. Anthropogenic perturbations to the atmospheric molybdenum cycle. *Global Biogeochemical Cycles*, doi: 10.1029/2020GB006787
- 2020 Howarth, R.W. 2020. Methane emissions from fossil fuels: Exploring recent changes in greenhouse-gas reporting requirements for the State of New York. *Journal of Integrative Environmental Sciences*, doi: 10.1080/1943815X.2020.1789666.
- Wong, M.Y., C. Neill, R. Marino, D. Silverio, and R.W. Howarth. 2020. Molybdenum, phosphorus, and pH do not constrain nitrogen fixation in a tropical forest in the southeastern Amazon. *Ecology* doi: 10.1002/ecy.3211
- Wong, M.Y., N.M. Mahowald, R. Marino, E.R. Williams, S. Chellam, and R.W. Howarth. 2020. Natural atmospheric deposition of molybdenum: a global model and implications for tropical forests. *Biogeochemistry*, doi: 10.1007/s10533-020-00671-w
- 2019 Howarth, R.W. 2019. Ideas and perspectives: is shale gas a major driver of recent increase in global atmospheric methane? *Biogeosciences* 16: 3033–3046, doi:10.5194/bg-16-3033-2019.
- Wong, M.Y., C. Neill, R. Marino, D.V. Silvério, P.M. Brando, and R.W. Howarth. 2019. Biological nitrogen fixation does not replace nitrogen losses after forest fires in the southeastern Amazon. *Ecosystems* doi.org/10.1007/s10021-019-00453-y
- Swaney, D.P., and R.W. Howarth. 2019. Phosphorus use efficiency and crop production: Patterns of regional variation in the United States, 1987-2012. *Science of the Total Environment*, 685, 174e188.https://doi.org/10.1016/j.scitotenv.2019.05.228
- 2018 McCrackin, M.L, B.G. Gustafsson, B. Hong, R.W. Howarth, C. Humborg, O.P. Savchuk, A. Svanbäck, and D.P. Swaney. 2018. Opportunities to reduce nutrient inputs to the Baltic Sea by improving manure use efficiency in agriculture. *Regional Environmental Change* doi.org/10.1007/s10113-018-1308-8
- McCrackin, M.L, B. Muller-Karulis, B.G. Gustafsson, R.W. Howarth, C. Humborg, A. Svanback, and D.P. Swaney. 2018. A century of legacy phosphorus dynamics in a large drainage basin. *Global Biogeochemical Cycles* 32: 1107-1122. doi.org/10.1029/2018GB005914

- Harada, Y., T.H. Whitlow, P.H. Templer, R.W. Howarth, M.T. Walter, N.L. Bassuk, and J. Russell-Anelli. 2018. Nitrogen biogeochemistry of an urban rooftop farm. *Frontiers in Ecology and Evolution*. doi.org/10.3389/fevo.2018.00153
- Swaney, D.P., R.W. Howarth, and B. Hong. 2018. Nitrogen use efficiency and crop production: Patterns of regional variation in the United States, 1987-2012. *Science of the Total Environment* 635:498–511. doi.org/10.1016/j.scitotenv.2018.04.027
- 2017 Zhang, W.S., D. Swaney, B. Hong, R. Howarth, and X. Li. 2017. Influence of rapid rural-urban population migration on riverine nitrogen pollution: perspective from ammonia-nitrogen. *Environmental Science and Pollution Research*, DOI 10.1007/s11356-017-0322-6
- Zhang, W.S., D. Swaney, B. Hong, and R. Howarth. 2017. Anthropogenic phosphorus inputs to a river basin and their impacts on riverine phosphorus fluxes along its upstream-downstream continuum. *J. Geophys. Res. Biogeosciences*, 122. https://doi.org/10.1002/2017JG004004
- 2016 Goyette, J.O., E. Bennett, R.W. Howarth, and R. Maranger. 2016. Changes in anthropogenic nitrogen and phosphorus inputs to the St. Lawrence Basin over 110 years: Impacts on riverine export. *Global Biogeochemical Cycles* 30: 1000–1014, doi:10.1002/2016GB005384.
- Marino, R.M., and R.W. Howarth. 2016. Why is planktonic nitrogen fixation so rare in coastal marine ecosystems? Insights from a cross-systems approach. Pages 127-139 in P. Glibert and T. Kana (editors), *Aquatic Nutrient Biogeochemistry and Microbial Ecology: A Dual Perspective*. Springer, Dordrecht. doi: 10.1007/978-3-319-30259-1_11
- Gao, W., B. Hong, D.P. Swaney, R.W. Howarth, and H. Guo. 2016. A system dynamics model for managing regional N inputs from human activities. *Ecological Modelling* 322: 82-91, doi: 10.1016/j.ecolmodel.2015.12.001
- Hong, B., and R.W. Howarth. 2016. Greenhouse gas emissions from domestic hot water: heat pumps compared to most commonly used systems. *Energy Science & Engineering* 4: 123-133, doi: 10.1002/ese3.112
- 2015 Reynolds, L.K., R. Marino, M.F. Muth, N. McLenaghan, M. Hayn, A.C. Tyler, K.J. McGlathery, and R.W. Howarth. 2015. Evidence of grazer control on nitrogen fixation by eelgrass epiphytes in a temperate coastal bay. *Marine Ecology Progress Series* 526: 11-19, doi: 10.3354/meps11234
- Zhang, W.S., D.P. Swaney, B. Hong, R.W. Howarth, H. Han, and X. Li. 2015. Net anthropogenic phosphorus inputs and riverine phosphorus fluxes in highly populated headwater watersheds in China. *Biogeochemistry* 126: 269–283, doi:10.1007/s10533-015-0145-9
- Zhang, W.S., D. P. Swaney, X.Y. Li, B. Hong, R.W. Howarth, and S.H. Ding. 2015. Anthropogenic point-source and non-point-source nitrogen inputs into Huai River basin and their impacts on riverine ammonia–nitrogen flux. *Biogeosciences* 12: 4275-4289, doi:10.5194/bg-12-4275-2015
- Gao, W., D. P. Swaney, B. Hong, Y. Liu, R. W. Howarth, H. C. Guo. 2015. Evaluating Anthropogenic N inputs to Diverse Lake Basins: A Case Study of Three Chinese Lakes. *Ambio*. 44: 635-646.
- Gao, W., R.W. Howarth, D.P. Swaney, B. Hong, and H. Guo. 2015. Enhanced N input to Lake Dianchi Basin from 1980 to 2010: Drivers and consequences. *Science of The Total Environment* 505: 376-384, doi.org/10.1016/j.scitotenv.2014.10.016.

- Howarth, R.W. 2015. Perspectives on air emissions of methane and climatic warming risk from hydraulic fracturing and shale-gas development: Implications for policy. *Energy & Emission Control Technologies* 3: 45-54.
- Costello, C., X. Xue, and R.W. Howarth. 2015. Comparison of production-phase environmental impact metrics derived at the farm- and national-scale for United States agricultural commodities. *Environmental Research Letters* 10: 114004 doi:10.1088/1748-9326/10/11/114004
- Butler, T., R. Marino, D. Schwede, R. Howarth, J. Sparks, and K. Sparks. 2015. Atmospheric ammonia measurements at low concentration sites in the northeastern USA: implications for total nitrogen deposition and comparison with CMAQ estimates. *Biogeochemistry* 122: 191-210.
- Howarth, R.W. 2015. Editorial: Misconduct in scientific publications. *Limnology & Oceanography*, 60(#4), doi: 10.1002/lno.10131
- Howarth, R.W. 2015. Editorial. *Limnology & Oceanography*, 60(#1), doi:10.1002/lno.10030
- 2014 Howarth, R.W. 2014. A bridge to nowhere: Methane emissions and the greenhouse gas footprint of natural gas. *Energy Science & Engineering* 2: 47-60, doi:10.1002/ese3.35
- Begon, M., R.W. Howarth, and C. Townsend. 2014. *Essentials of Ecology*, 4th Edition. Wiley, Chichester. 480 pages. ISBN-13: 978-0470909133
- Bringezu, S, H. Schütz, W. Pengue, M. O'Brien, F. Garcia, R. Sims, R. Howarth, L. Kauppi, M. Swilling, and J. Herrick. 2014. *Assessing Global Land Use: Balancing Consumption with Sustainable Supply*. A Report of the Working Group on Land and Soils of the International Resource Panel. United Nations Environment Program, Paris, France. ISBN: 978-92-807-3330-3
- Caulton, D.R., P. B. Shepson, R.L. Santoro, J.P. Sparks, R.W. Howarth, A. Ingraffea, M.O. Camaliza, C. Sweeney, A. Karion, K.J. Davis, B.H. Stirm, S.A. Montzka, and B. Miller. 2014. Toward a better understanding and quantification of methane emissions from shale gas development. *Proceedings of the National Academy of Sciences* 111: 6237-6242. doi/10.1073/pnas.1316546111
- Howarth, R.W., M. Hayn, R.M. Marino, N. Ganju, K. Foreman, K. McGlathery, A.E. Giblin, P. Berg, and D. Walker. 2014. Metabolism of a nitrogen-enriched coastal marine lagoon during the summertime. *Biogeochemistry* 118: 1-20, doi:10.1007/s10533-013-9901-x
- Gao, W., R.W. Howarth, B. Hong, D.P. Swaney, and H.C. Guo. 2014. Estimating net anthropogenic nitrogen inputs (NANI) in the Lake Dianchi basin of China. *Biogeosciences* 11: 4577 – 4586, doi:10.5194/bg-11-4577-2014
- Del Barrio, P., N. Ganju, A. L. Aretxabaleta, M. Hayn, A. Garcia, and R. W. Howarth. 2014. Modeling future scenarios of light attenuation and potential seagrass success in a eutrophic estuary. *Estuarine and Coastal Shelf Science* 149: 13-23, doi 10.1016/j.ecss.2014.07.005
- Jacobson, M.Z., M.A. Delucchi, A.R. Ingraffea, R.W. Howarth, G. Bazouin, B. Bridgeland, K. Burkart, M. Change, N. Chowdhury, R. Cook, G. Escher, M. Galka, L. Han, C. Heavey, A. Hernandez, D.F. Jacobson, D.S. Jacobson, B. Miranda, G. Novotny, M. Pellat, P. Quach, A. Romano, D. Steward, L. Vogel, S. Wang, H. Wang, L. Willman, and T. Yeskoo. 2014. A roadmap for repowering California for all purposes with wind, water, and sunlight. *Energy*, doi.org/10.1016/j.energy.2014.06.099
- Howarth, R. W., and A. Ingraffea. 2014. Shale gas: Time to go slow. In *World Energy Monitor, World Energy Forum*. United Nations. New York, NY.

- 2013 Howarth, R. W., and J. Mohan (editors). 2013. *Biomes and Ecosystems*. Salem Press. 1,440 pages, ISBN 978-1-4298-3813-9
- Hayn M., R.W. Howarth, R. Marino, N. Ganju, P. Berg, K. Foreman, A.E. Giblin, and K. McGlathery. 2013. Exchange of nitrogen and phosphorus between a shallow lagoon and coastal waters. *Estuaries & Coasts*, 37: 63–73, doi:10.1007/s12237-013-9699-8
- Jacobson, M.Z., R.W. Howarth, M.A. Delucchi, S.R. Scobies, J.M. Barth, M.J. Dvorak, M. Klevze, H. Katkhuda, B. Miranda, N.A. Chowdhury, R. Jones, L. Plano, and A.R. Ingraffea. 2013. Examining the feasibility of converting New York State's all-purpose energy infrastructure to one using wind, water, and sunlight. *Energy Policy* 57: 585-601, doi.org/10.1016/j.enpol.2013.02.036i
- Jacobson, M.Z., R.W. Howarth, M.A. Delucchi, S.R. Scobies, J.M. Barth, M.J. Dvorak, M. Klevze, H. Katkhuda, B. Miranda, N.A. Chowdhury, R. Jones, L. Plano, and A.R. Ingraffea. 2013. Response to comment on paper examining the feasibility of changing New York State's energy infrastructure to one derived from wind, water, and sunlight. *Energy Policy* 62: 1212-1215, doi.org/10.1016/j.enpol.2013.07.105i
- Hong, B., D.P. Swaney, and R.W. Howarth. 2013. Estimating net anthropogenic nitrogen inputs (NANI) to US watersheds: comparison of methodologies. *Environmental Science & Technology* 47: 5199–5207
- Gettel, G., A. Giblin, and R.W. Howarth. 2013. Controls of benthic nitrogen fixation and primary production from nutrient enrichment of oligotrophic, arctic lakes. *Ecosystems*, doi 10.1007/s10021-013-9701-0
- Tartowski, S.L., and R. W. Howarth. 2013. Nitrogen, nitrogen cycle. *Encyclopedia of Biodiversity*, Elsevier.
- Bettez, N., R. Marino, R.W. Howarth, and E.A. Davidson. 2013. Roads as nitrogen deposition hot spots. *Biogeochemistry* 114: 149-163.
- Berg, P., M.H. Long, M. Huettel, J.E. Rheuban, K.J. McGlathery, R.W. Howarth, K.H. Foreman, A.E. Giblin, and R. Marino. 2013. Eddy correlation measurements of oxygen fluxes in permeable sediments exposed to varying current flow and light. *Limnology & Oceanography* 58: 1329-1343.
- Howarth, R. W. 2013. Shale gas extraction. Pages 354-359 in Craig, R.K., B. Pryd, J.C. Nagle, O. Schmitz, and W. Smith (eds.), *The Berkshire Encyclopedia of Sustainability: Vol. 5, Ecosystem management and Sustainability*. Berkshire, Great Barrington, MA.
- 2012 Howarth, R. W., D. Swaney, G. Billen, J. Garnier, B. Hong, C. Humborg, P. Johnes, C. Morth, and R. Marino. 2012. Nitrogen fluxes from large watershed to coastal ecosystems controlled by net anthropogenic nitrogen inputs and climate. *Frontiers in Ecology & Environment* 10: 37-43.
- Howarth, R. W., R. Santoro, and A. Ingraffea. 2012. Venting and leakage of methane from shale gas development: Reply to Cathles et al. *Climatic Change* 113: 537-549, doi:10.1007/s10584-012-0401-0
- Howarth, R. W., D. Shindell, R. Santoro, A. Ingraffea, N. Phillips, and A. Townsend-Small. 2012. Methane emissions from natural gas systems. Background paper prepared for the National Climate Assessment, Reference # 2011-003, Office of Science & Technology Policy Assessment, Washington, DC.
- Hong, B., D. P. Swaney, C. Mörth, E. Smedberg, H. E. Hägg, C. Humborg, R. W. Howarth, and F. al Bouraoui. 2012. Evaluating regional variation of net anthropogenic nitrogen and

- phosphorus inputs (NANI/NAPI), major drivers, nutrient retention pattern and management implications in the multinational areas of Baltic Sea basin. *Ecological Modeling*, 227: 117-135, doi:10.1016/j.ecolmodel.2011.12.002
- Ganju, N.K., M. Hayn, S. Chen, R.W. Howarth, P.J. Dickhudt, A.L. Aretxabaleta, R. Marino. 2012. Tidal and groundwater fluxes to a shallow, microtidal estuary: constraining inputs through field observations and hydrodynamic modeling. *Estuaries and Coasts* 35: 1285-1298** (Winner of the Pritchard Award, Coastal & Estuarine Research Federation for best paper in physical oceanography, 2013).
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- Swaney, D.P., R.L. Santoro, R. W. Howarth, B. Hong, and K. Donaghy. 2012. Historical changes in the food and water supply systems of the New York City metropolitan area. *Regional Environmental Change*, doi 10.1007/s10113-011-0266-1
- Davidson, E. A., M. B. David, J. N Galloway, C. L. Goodale, R. Haeuber, J. A. Harrison, R. W. Howarth, D. B. Jayne, R. R. Lowrance, B. T. Nolan, J. L. Peel, R. W. Pinder, E. Porder, C. S. Snyder, A. R. Townsend, and M. H. Ward. 2012. Excess nitrogen in the U.S. environment: Trends, risks, and solution. *Issues in Ecology*, report #15, Ecological Society of America.
- 2011 Howarth, R., W., and A. Ingraffea. 2011. Should fracking stop? Yes, it is too high risk. *Nature* 477: 271-273.
- Howarth, R. W., R. Santoro, and A. Ingraffea. 2011. Methane and the greenhouse gas footprint of natural gas from shale formations. *Climatic Change Letters* 106: 679–690, doi: 10.1007/s10584-011-0061-5** (Cited 1,853 times in other peer-reviewed papers as of Aug 1, 2023).
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- 1975 Whitney, D., G.M. Woodwell, and R.W. Howarth. 1975. Nitrogen fixation in Flax Pond, a Long Island salt marsh. *Limnol. Oceanogr.* 20: 640-643.



Raya Salter, Esq.

Founder and Executive Director, Energy Justice Law and Policy Center

Energy and climate justice attorney and policy expert. Experienced organizer, movement lawyer, coalition builder, educator and communicator in the US and internationally. Author, "Energy Justice, US and International Perspectives" (2018).

 www.EJLPC.org / www.RayaSalter.com

 [linkedin.com/in/raya-salter-climate-auntie-54318a1](https://www.linkedin.com/in/raya-salter-climate-auntie-54318a1)

PROFESSIONAL EXPERIENCE

Founder and Executive Director Energy Justice Law and Policy Center

11/2021 - Present

New Rochelle, NY and Birmingham, AL

The Energy Justice Law and Policy Center, is the first energy justice public interest law firm in the United States. Our mission is to implement a just clean energy transition through community lawyering, mobilization, advocacy and education. We are a nonprofit 501(c)(3) organization based in New Rochelle, NY and Birmingham, AL.

Contact : www.EJLPC.org

Member New York State Climate Action Council

12/2019 - Present

New York, NY

The Climate Action Council created the Scoping Plan for New York State's transition to net zero carbon emissions by 2050 pursuant to the 2019 Climate Leadership and Community Protection Act, and is guiding the nation's most ambitious and just climate law.

Contact : <https://climate.ny.gov/resources/climate-action-council/>

Principal Consultant Imagine Power LLC

08/2015 - Present

New York, Hawaii and Oceania

Energy and Environmental Law and Policy Consultancy

- Provide energy policy and advocacy advice to clients in the US and internationally.
- Spent 3 years based in Honolulu, Hawaii; worked with Tetris Billionaire Henk Rogers on energy justice in Oceania, worked for the Ulu Pono Initiative and State of Hawaii (authored performance-based rates legislation).

Contact : www.RayaSalter.com

Policy Organizer NY Renews Climate Justice Coalition

11/2019 - 09/2021

New York, NY

NY Renews is a Coalition of over 350 climate and environmental justice organizations and the lead proponents of the 2019 CLCPA.

- Organized and represented prominent environmental, climate and environmental justice advocates in NY State to implement the 2019 CLCPA. Members include Earth Justice, Environmental Advocates, The NYC Environmental Justice Alliance, UPROSE, PUSH Buffalo, AGREE, New York Lawyers for the Public Interest, People's Action and 32BJ.
- Secured full representation of the environmental justice provisions of the CLCPA in the New York State Energy Plan.
- Ensured that NY State programs, including the Regional Greenhouse Gas Initiative, the Clean Energy Fund and the proposed Environmental Bond Act, contained a "Justice40" carve out for disadvantaged communities.
- Authored and amended the Climate and Community Investment Act carbon pricing legislation (introduced into both the NY Assembly and Senate); organized supporting popular education and trainings for statewide lobbying.
- Led coalition Climate Action Council related policy and organizing, including advising the Climate Justice Working Group and developing the "People's Climate Action Council" platform, a direct action coalition to fight for environmental justice at the Climate Action Council.
- Engaged in successful fundraising for the coalition resulting in several major grants.

PROFESSIONAL EXPERIENCE

Senior Attorney

The Natural Resources Defense Council

08/2013 - 08/2015

New York, NY

- Specialized in utility business model reform (represented NRDC in the "Reforming the Energy Vision" process).
- Developed and executed multi-state strategy for the Energy Efficiency for All Project (pursuant to a \$16 million grant from the JPB Foundation).
- Founding organizer of the Energy Efficiency for All Coalition in NY State.
- Developed analytical and technical studies, including a 9 state energy efficiency potential study, NYC building efficiency studies and NYC solar and battery storage studies.

Regulatory Attorney

Environmental Defense Fund

08/2011 - 08/2013

New York, NY

- Developed multi-state strategy for the EDF "Smart Power" multi-state clean energy advocacy campaign (pursuant to a \$40 million grant from the Robertson Foundation).
- Led execution of the "Smart Power" strategy in New York, New Jersey, California and Illinois.

Energy Regulatory Associate

Dewey & LeBoeuf

08/2008 - 07/2011

New York, NY

- Specialized in utility mergers and acquisitions, project approvals and matters related to inter and intra-state energy transmission.
- Completed a client secondment with the ConEdison Company in NYC (Regulatory Affairs).

EDUCATION

Fordham University School of Law

New York, NY

08/2005 - 06/2008

Wesleyan University

Middletown, CT

08/2000 - 06/2004

- Economics major; included semester abroad at the London School of Economics

TEACHING EXPERIENCE

Adjunct Professor, Energy Law (08/2021 - Present)

- Cardozo School of Law, New York, NY

Adjunct Professor, Energy and the Environment (01/2015 - 07/2015)

- Fordham University School of Law, New York, NY

AFFILIATIONS AND BOARD SERVICE

Movement for Black Lives Black Hive (06/2021 - Present)

Member of the M4BL Black Hive Climate Policy Team and COP 27 Delegation

Evergreen Action (2010 - Present) [↗](#)

Member, Advisory Board

Energy & Environmental Study Institute (EESI) (2020 - Present) [↗](#)

Member, Board of Directors

Initiative for Climate Risk and Resilience Law (2021 - Present) [↗](#)

Member, Advisory Board (ICRRL is a project of Columbia, Vanderbilt and NYU Law Schools with the Environmental Defense Fund)

AFFILIATIONS AND BOARD SERVICE

Member, IUCN World Commission on Environmental Law
(09/2017 - Present) [↗](#)

Project Coordinator, Energy Transitions Programme (2019-2020)

The Coalition for Green Capital

Member, Environmental Justice Advisory Board

HONORS & AWARDS

Climate Hero Award

Human Impacts Institute

- Honored for New York State climate advocacy (2000).

New York Energy and the Environment Power 100

City and State Magazine, 2020, 2021 and 2022

- Recognized as one of NY's "Power 100"

PUBLICATIONS

Book

Energy Justice, US and International Perspectives [↗](#)

Co-Editor

Raya Salter

2018

Edward Elgar

New Frontiers in Energy Law Series

Handbook for Energy Justice

Frameworks for Energy Justice in Action

Author(s)

Raya

Date of Publication

2022 (forthcoming)

Publication Type

Energy Efficiency Potential in Affordable Housing

Natural Resources Defense Council

Raya Salter, Contributor

2015

Nine state energy efficiency potential study.

The Galvin Electricity Initiative

International Experience with Private Sector Participation and Open Access in Power Grids: Open Access Component

Author(s)

Raya Salter, Ashley Brown and Steve Levitzky

Date of Publication

2011

Think NBC

Hurricane season is starting. And Hawaii has more reasons than ever to worry. [↗](#)

Author(s)

Raya Salter

2019

Climate change has made storms that used to be rare on the islands far more likely. Disaster planning and relief has not kept up.

Our Climate (2021 - Present) [↗](#)

Member, Advisory Board (Our Climate empowers and mobilizes youth climate activists)

Felix Fishman Award

New York Lawyers for the Public Interest

- Recognizes lawyers and advocates who demonstrate a commitment to expanding access to justice (2021).

EnergyPolicy.com

Tracking the Value of Smart Grid in Illinois and Beyond

Author(s)

Raya Salter

2014

Natural Gas Journal

Regulatory Treatment of Nonutility Functions

Contributor

Raya Salter

Date of Publication

2009

The Electricity Journal

Can Smart Grid Technology Fix the Disconnect Between Wholesale and Retail Pricing?

Author(s)

Raya Salter and Ashley Brown

Date of Publication

2010

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Smart Grid Issues in State Law and Regulation

Author(s)

Raya Salter and Ashley Brown

2010

World Bank Policy Paper

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2013