

Martin W. Doyle, Ph.D.

Professor of River Science and Policy, Nicholas School of Environment
Director of Water Policy, Nicholas Institute for Environmental Policy Solutions
Duke University
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www.martindoyle.net

Martin Doyle is a Professor at Duke University's Nicholas School of the Environment, and director of the Water Policy Program at the Nicholas Institute for Environmental Policy Solutions. Dr. Doyle's research is at the interface of science, finance, and policy of U.S. water governance. His training is in the hydraulics and sediment transport of rivers, but he also works on infrastructure finance, environmental restoration, impact investing, and the impacts of climate change on the nation's reservoirs. He holds a Ph.D. in earth science from Purdue University, a master's degree in engineering from the University of Mississippi, and bachelor's degrees in physics and mathematics from Harding University.

His basic science research has resulted in several awards: he is a Guggenheim Fellow, a National Academy of Sciences Kavli Fellow, and recipient of the National Science Foundation's Early Career Award. He has twice won the Boggess Award for the most influential paper published in the *Journal of the American Water Resources Association*. For his work bridging environmental science and policy, he was named a Leopold Leadership Fellow by Stanford University, a GlaxoSmithKline Faculty Fellow for Public Policy, and selected as the 2021 Gilbert White Lecturer by the National Academy of Sciences for his career in putting science in service to society.

As an educator and mentor, Dr. Doyle has taught hundreds of students. As a mentor, he has advised 12 PhD students, 4 post-docs, 7 master of science students, and over 30 professional masters students (Environmental Management, Public Policy, or Business Administration). In 2018, he received the Excellence in Graduate Student Mentoring Award from Duke University.

Dr. Doyle has also worked within the federal government on US water and infrastructure policy. He was appointed to the US Army Science Board in 2020, through which he advised the Corps of Engineers leadership. In 2016 he initiated the Department of Interior's Natural Resource Investment Center where he helped push forward the Obama Administration's strategies for innovative infrastructure finance, and the department's strategies for managing water in the west. Prior to that, in 2009 he was the Frederick J Clarke Scholar at the US Army Corps of Engineers, and worked at their Institute for Water Resources on regulatory policy.

In 2017, Dr. Doyle co-founded the Internet of Water with Lauren Patterson, a major initiative to bring basic water information into digital reality. To implement this vision, Doyle and Patterson raised millions of dollars from philanthropic foundations and government agencies, created a business and implementation plan, and hired the initial startup team for the organization. Several states have now passed legislation to implement the Internet of Water vision, which continues to expand nationally.

Beyond his work with government and academia, Dr. Doyle has been engaged in purely private activities including advising multi-national corporations on water sustainability and water risk, working with private investment firms in their development of novel water-related investment funds, advising infrastructure finance projects, and conducting market analysis of water rights.

Since 2013, Dr. Doyle has co-organized and co-led the annual water forum at the Aspen Institute on topics ranging from big data to impact investing to the future of the water policy in the US.

In addition to publishing over 120 peer-reviewed journal articles and law reviews, Doyle is the author of *The Source* – an environmental and political history of America's Rivers, published by W.W. Norton in 2018—which was recognized by Amazon as “one of the best history books of 2018.” His second book – *Streams of Revenue* – was published by MIT Press in 2021, and explores how the use of markets have affected the practice of environmental conservation. He is currently working on a book focused on water, finance, and the past/future of America's cities.

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RESEARCH AND TEACHING INTERESTS

River System Science: river hydrology, hydraulics, ecology, biogeochemistry

Environmental Finance and Policy: water policy, environmental markets, infrastructure finance, impact investing

River History: political economy of river use, politics and technology in US from colonial era – present

Shrinking Cities: ensuring environmental quality and public services in shrinking cities.

EDUCATION

Ph.D. 2002, Purdue University, Earth Science.

M.S.Eng. 1997, National Sedimentation Laboratory-University of Mississippi, Environmental Engineering.

B.S. 1995, Harding University, Physics, Mathematics.

PRIMARY PROFESSIONAL POSITIONS AND AFFILIATIONS

Duke University – Durham, NC

Senior Associate Dean (Jan 2019-June 2020)

Professor of River Science and Policy, Nicholas School of Environment (2011-present)

Department of Civil & Environmental Engineering (secondary appointment)

Director of Water Resources Management Program, Nicholas School of Environment (2011-15, 2017-2019, 2020-present)

Director for Water Policy, Nicholas Institute for Environmental Policy Solutions (2013-present)

Director (2017-2018), Chair of Board (2018-present), Internet of Water

University of North Carolina – Chapel Hill, NC

Associate Professor, Department of Geography (2006-2011)

Joint appointment in Department of Environmental Science & Engineering

Assistant Professor, Department of Geography (2002 – 2006)

Curriculum in Ecology (2002-2011)

Purdue University, West Lafayette, IN

USDA Research Fellow, Environmental Sciences and Engineering Institute (1999-2001)

Graduate Research Assistant, Department of Earth and Atmospheric Sciences (2001-2002)

Inter-Fluve, Inc., Bozeman, MT and Hood River, OR

Hydraulic Engineer (EI) (1997-1999)

National Sedimentation Laboratory, Oxford, MS

Research Assistant Hydraulic Engineer (1995-1997)

Mt. Rainier National Park, Longmire, WA

Hydrologist (1994)

LEAVE, SABBATICAL, AND DETAIL POSITIONS AND AFFILIATIONS

U.S. Department of Interior, Office of the Deputy Secretary – Washington, DC

Natural Resource Investment Center, Senior Conservation Finance Fellow (Jan 2016 – Jan 2017)

U.S. Army Corps of Engineers – Institute for Water Resources, Ft Belvoir, VA

Frederick J Clarke Visiting Scholar (2009 – 2010)

Bren School of Environmental Science and Management

Visiting Professor (summer, 2018, 2020)
Cary Institute of Ecosystem Studies, Millbrook, NY
Visiting Scientist (Fall 2004)

PROFESSIONAL DISTINCTIONS

National and International Recognition

Guggenheim Fellow, 2009-2010
Gilbert White Lecture, National Academy of Sciences, 2021
Kavli Fellow, National Academy of Sciences, 2009
Walton Fellow, Walton Family Foundation, 2021
US Army Science Board, 2020-2021
Meridian Book Award, Association of American Geographers, 2019
G.K. Gilbert Award for Research in Geomorphology, Association of American Geographers, 2018
Outstanding Alumni, Purdue University – Department of Earth, Atmospheric & Planetary Science, 2016
William R. Boggess Award, American Water Resources Association, 2013
William R. Boggess Award, American Water Resources Association, 2010
Julian Simon Fellow, Property and Environment Research Center, 2009-2010
Aldo Leopold Leadership Fellow, Stanford Univ – Woods Institute of Environment, 2008
Frederick J Clarke Fellow, US Army Corps of Engineers-Institute for Water Resources, 2009-2010
GlaxoSmithKline Faculty Fellow for Public Policy, Institute for Emerging Issues, 2008
Editor's Award for Excellence in Reviewing, Amer. Geophysical Union (*Water Resources Res*), 2006
Early Career Award, National Science Foundation, 2005

Distinguished Lectures or Seminars

Ed and Elizabeth Hammond Distinguished Lecture, University of Tennessee, 2018
UDI Distinguished Seminar, Oak Ridge National Laboratory, 2018
Distinguished Speaker Series (Center for Water in West), University of Colorado-Boulder, 2018
Donald Harleman Memorial Lecture in Water Resources Engineering, Penn State University, 2016
Presidential Plenary Speaker, Association of American Geographers, 2015
Borland Distinguished Lecture in Hydraulics, Colorado State University, 2014
Rieth Distinguished Lecture, Purdue University Department of Civil Engineering, 2010
John Treacy Memorial Lecture, University of Wisconsin, 2006

University Recognition

Excellence in Graduate Student Mentoring, Dean of the Graduate School, Duke University, 2018

Recognition of Dissertation and Graduate Research

Horton Grant, American Geophysical Union, 2000
Fahnestock Award, Geological Society of America, 2001
Chorafas Prize, Chorafas Foundation-Switzerland, 2002
Nystrom Award, Association of American Geographers, 2004
Wolman Award, Association of American Geographers, 2002
National Academy of Sciences – Sigma Xi, Dissertation Research Award, 2000
USDA GAANN Dissertation Fellowship, 1999-2001

SCIENCE AND POLICY COMMITTEES AND PANELS

International Joint Commission (US-Canada), Great Lakes Adaptive Management, Independent Advisor
2021-present
US Army Science Board (2020-2021)
Aldo Leopold Leadership Program – Advisory Committee
June 2015 – June 2017
US Army Corps of Engineers, Missouri River Recovery Program – Independent Science Advisory Panel

Dec 2010 – 2015
NC Ecosystem Enhancement Program – Science Advisory Committee
2010-2012
National Ecological Observatory Network
Hydroecology sub-committee
Heinz Center for Policy, Economics and the Environment
Dam Removal Science and Policy Panel
Coalition of Universities for the Advancement of Hydrologic Sciences (CUAHSI)
Floodplain Processes Working Group
National Center for Earth-Surface Dynamics
Morphodynamics following Dam Removal
American Society of Civil Engineers Task Committees
Unstable Channel Processes Task Committee (Secretary)
Dam Decommissioning Task Committee
River Restoration Task Committee

KEY/REPRESENTATIVE PUBLICATIONS

[Complete list of publications provided at end of document]

Books

Doyle (2018). *The Source: How Rivers Made America, and America Remade Its Rivers*. WW Norton.
Best of 2018 (Top 10 Books in History), Amazon.
Meridian Book Award (American Association of Geographers)
Tucson Book Festival
[Reviewed in *Wall Street Journal*, *NY Times Book Review*, *Nature*, *Outside Magazine*, *The New Republic*, among others]

Lave and Doyle (2021). *Streams of Revenue: The Restoration Economy and the Ecosystems it Creates*. MIT Press.
Reviewed in *Nature*.

Doyle (In prep). *Tapped Out: Water Finance and Equity in America's Cities*.

Aspen Institute-Nicholas Institute Water Forum

[Doyle was primary co-organizer, co-convenor, and author/co-author of the annual forum and report series]

Water Affordability and Equity, 2020 Aspen-Nicholas Water Forum, in press.

Ensuring Water Quality: The Future of the Clean Water Act and the Safe Drinking Water in the 21st Century, 2019 Aspen-Nicholas Water Forum.

Regional Integration: Cooperation and Integration for Water Management, 2018 Aspen-Nicholas Water Forum.

The Future of Groundwater, 2017 Aspen-Nicholas Water Forum. 68 pgs.

Internet of Water: Sharing and Integrating Water Data for Sustainability, 2017 Aspen Institute Dialogue Series on Water Data, 33 pgs.

Conservation Finance & Impact Investing for US Water, 2016 Aspen-Nicholas Water Forum. 68 pgs.

Data Intelligence for 21st Century Water Management, 2015 Aspen-Nicholas Water Forum, 67 pgs.

Innovating for a Sustainable and Resilient Water Future, 2014 Aspen-Nicholas Water Forum, 35 pgs.

Key Representative Journal Publications (full list at end of document)

Doyle et al. (2020). Growing options for shrinking cities. *Journal of the American Water Works Association* 112(12): 56-66.

- Doyle and Patterson (2019). Federal decentralization and adaptive management of water resources: reservoir reallocation by the US Army Corps of Engineers. *Journal of the American Water Resources Association* 55(5): 1248-1267.
- Doyle (2018). Addressing the declining appropriations for Bureau of Reclamation infrastructure: policies needed for enabling private finance. *Journal of the American Water Resources Association* 54: 993-1000.
- Doyle et al. (2015). Morphology of streams restored for market and non-market purposes: Insights from a mixed natural-social science approach. *Water Resources Research* 51(7); 5603-5622.
- Doyle and VonWindheim (2015). Environmental management strategy: Four forces analysis. *Environmental Management* 55: 6-18.
- Doyle et al. (2014). The optimal scale of markets for water quality trading. *Water Resources Research* 50(9): 7231-7244.
- Doyle (2012). America's rivers and the American experiment. *Journal of the American Water Resources Association* 48(4): 820-837.
- Doyle and Ensign (2009). Alternative reference frames in river systems science. *BioScience* 59: 499-510.
- Doyle et al. (2008). Aging infrastructure and ecosystem restoration. *Science* 319(5861): 286-287.
- Doyle et al. (2005). Effective discharge analysis of ecological processes in streams. *Water Resources Research*, 41, W1141, doi: 10.1029/2005WR004222.
- Doyle et al. (2003). Channel adjustments following two dam removals in Wisconsin. *Water Resources Research*. 39(1), 1011, doi: 10.1029/2002WR001714.

FOUNDATION/PHILANTHROPY-SUPPORTED INITIATIVES

Internet of Water

(total to date: \$3.84M secured; ~\$6M funding approved, awaiting board approval; all funding via entire Internet of Water Project team at Duke)

George and Cynthia Mitchell Foundation
 Gordon and Betty Moore Foundation
 Pisces Foundation
 S.D. Bechtel Jr Foundation
 Kingfisher Foundation,
 Walton Family Foundation
 George and Cynthia Mitchell Foundation
 Windward Fund
 Xylem, Inc.
 Department of Energy – Oak Ridge National Lab
 BHP Corporate Foundation

Natural Resources Finance (total to date: \$500,000)

Reynolds Foundation (in collaboration with entire development team at Nicholas School)
 TomKat Charitable Trust
 Walton Family Foundation

RESEARCH GRANTS

Funded for basic science/scholarship (total to date: \$5.9M)

Delta at Spring Point Partners
 USDA-Office of Environmental Markets
 USDA – NIFA Program
 US Army Corps of Engineers
 US Fish & Wildlife Service
 National Science Foundation
 U.S. Forest Service

Water Resources Research Institute
National Science Foundation
National Geographic Society
Smithsonian Institution
Bradley Fund for the Environment
NASA Space Grant Consortium

KEYNOTE OR PLENARY PRESENTATIONS

Keynote or Plenary Presentations

2021 Gilbert White Lecture, US National Academy of Sciences
2015 Association of American Geographers Presidential Plenary Speaker, Chicago, IL
2013 International Society of River Science Biennial Symposium, Keynote, Beijing, China
2013 River Restoration Northwest, Hood River, OR
2012 Board Meeting of American Rivers, Fall Meeting
2011 International Society for River Science (ISRS) Biennial Symposium, Opening Keynote, Berlin, Germany
2011 Elwha River Science Symposium, Commemorating the initiation of removal of Elwha dams, Keynote on Science and Policy of Dam removal, Port Angeles, WA

Invited Academic Seminars

2021 University of Washington, Department of Civil Engineering
2021 Utah State University, Department of Watershed Sciences
2018 Distinguished Seminar, Oak Ridge National Laboratory
2018 Hammond Distinguished Lecture, Univ of Tennessee (Dept of Geography)
2018 Boise State University, Department of Geoscience
2017 Distinguished Speaker Series, Western Water Series, CU-Boulder
2017 Distinguished Speaker, Ecole Normale Superieure (Paris)
2016 Penn State University, Civil Engineering, Harleman Memorial Lecture in Water Resources
2014 Colorado State University, Hydrology Days, Borland Hydraulics Lecture
2012 Oregon State University, Water and Society Seminar Series
2012 University of Oregon, Department of Geography
2012 University of South Carolina, Department of Geography and Department of Geology
2010 Purdue University, Public Lecture Series on the Environment and Department of Earth Science and School of Engineering
2009 University of Pennsylvania, School of Law-Program on Law, Economy and the Environment
2009 Georgetown University, Walsh School of Foreign Affairs-Program on Science, Technology and International Affairs (invited 2009)
2009 University of North Carolina – Greensboro, Department of Geography
2008 Oak Ridge National Laboratory, Division of Computational Science and Mathematics
2008 Penn State University, University-wide and general public lecture series for “EarthTalks”
2008 Johns Hopkins University, Department of Geography and Environmental Engineering
2007 University of Maryland – Baltimore County, IGERT Water in Urban Program
2007 Chesapeake Biological Laboratory – University of Maryland
2007 Appalachian Laboratory – University of Maryland
2007 Duke University, Nicholas School of Environment and Earth Science
2006 University of Virginia, Department of Civil and Environmental Engineering
2006 University of Wisconsin, Department of Geography
2005 Virginia Tech University, Department of Civil and Environmental Engineering
2005 Cornell University, Department of Biological and Environmental Engineering
2004 Dartmouth College, Department of Geography and Department of Earth Science
2004 Institute of Ecosystem Studies
2004 University of Connecticut, Department of Geography

2004 University at Buffalo, SUNY, Department of Geography
2004 USGS Columbia Environmental Research Center / University of Missouri
2004 Duke University, Program in Ecology
2004 Furman University, Department of Environmental and Earth Science
2003 Smithsonian Environmental Research Center
2003 Colgate University, Department of Environmental Science
2002 University of North Carolina, Department of Geography
2002 University of Tennessee, Department of Civil and Environmental Engineering
1998 University of Nottingham (UK), Department of Geography

REPRESENTATIVE POLICY AND LAW RELATED ACTIVITIES

[I have engaged in a wide range of policy and legal activities, including testifying before legislative committees, providing expert witness, and related roles and functions]

TEACHING AND ADVISING

Current Graduate Students and Post-doctoral Fellows Advised

Jonny Behrens (PhD, Ecology, 2019-present; Emily Bernhardt primary advisor); ecotoxicology
Erika Smull (PhD, Environment, 2019-); infrastructure and finance
NSF GRFP
Nicholas Bruns (PhD, Duke, Ecology, 2017-); remote sensing in large rivers
University Scholar

Previous PhD Students and Post-docs Advised:

Katy Hansen (PhD, Duke, 2021; M. Mullin primary advisor); Envir. Policy Innovation Center
Rhodes Scholar
Doris Duke Fellow
John Gardner (PhD, Duke, Environment, 2014-2018); Assistant Professor, Univ of Pittsburgh
NSF-EAR Post-Doctoral Fellowship
NSF IGERT Sensor Networks Fellowship
Matt Fuller (PhD, Duke, Environment, 2012-2017); Scientist, EPA
Koehane Fellow
HydroResearch Foundation Fellow
Matt Ross (PhD, Duke, Ecology, 2016-; E. Bernhardt primary advisor); Assist Prof, Colorado State U
NSF Graduate Fellowship
NSF IGERT Sensor Networks Fellowship
Chuck Podolak (post-doc, 2012-2014); Dir. for Environ. Policy, Office of Gov. Doug Ducey (AZ).
AAAS Congressional Science Fellow (Senator Jeff Flake, R-AZ)
PhD Johns Hopkins
Duke Provost Post-doctoral fellow
Autumn Thoyre (PhD, UNC, Geography, 2014), Assist. Prof, San Francisco State Univ.
UNC Royster Graduate Fellowship
Jeff Muehlbauer (PhD, UNC, Ecology, 2013), Research ecologist, USGS Grand Canyon Monitoring
& Research Center
UNC Pogue Graduate Fellowship
NABS President's Award
Brian Lutz (post-doc, 2011-2013), Chief Scientist, Climate Corp/Bayer Crop Science.
PhD Duke
NSF Graduate Fellowship
Kimberly Meitzen (post-doc joint with TNC, 2013), Assist. Prof, Texas State Univ. (Geography).
Lauren Patterson (MS and PhD, Geography, 2012), Sr. Policy Associate, Nicholas Institute

Udall Fellowship

William R Boggess Award for best paper published in JAWRA, 2010

NSF Graduate Research Fellowship

AAG Kasperon Award for Hazards Research 2007

UNC Impact Award 2007

Goldwater Scholar

Tim Baird (PhD, Geography, 2012), Associate Professor, Virginia Tech (Geography)

Fulbright-Hays Fellowship

NSF Doctoral Dissertation Improvement Grant

Chris Sandt (MS, Env Sci & Engin, 2011), Environmental Engineer, DC Water

ASCE Dames and Moore Fellowship

Scott Ensign (PhD, Ecology, 2011), Assistant Director, Stroud Water Research Center.

USGS Mendenhall Post-doctoral fellowship

EPA STAR Graduate Fellowship

Ecological Society of America – Best Biogeosciences Paper Award 2007

JR Rigby (post-doc, 2010-2011); Research Hydrologist, Natl Sedimentation Laboratory

PhD Duke

Marshall Scholar

NSF Graduate Fellowship

Erich Hester (PhD, Ecology, 2008); Assoc Prof, Virginia Tech Univ (Civil Engineering)

EPA STAR Graduate Fellowship

UNC Pogue Graduate Fellowship

Jason Julian (PhD, Geography, 2007); Associate Chair, Prof, Texas State Univ (Geography)

Nystrom Award Finalist

Adam Riggsbee (PhD, Env Sci and Engin. 2006, UNC): Principal/Owner: Riverbank Ecosystems,

Austin TX.

Cailin Orr (Post-doc, 2005-2006, UNC): Carleton College

Joel Sholtes (MS, Geography, 2009), Hydraulic engineer, Bureau of Reclamation

PhD Colorado State University

Melanie Small (MA, Geography, 2007, UNC); Lecturer Connecticut College

Rebecca Manners (MA, Geography, 2006, UNC): Owner, Bed & Breakfast, Vermont

PhD Utah State University

Reds Wolman Award 2005;

Stirling Hydroecology Award 2006

Masters or Undergraduate Students Advised

I have advised > 50 students in the MEM, MBA, MPP, or various undergraduate programs

Graduate and Undergraduate Courses

Water Resources Planning, Water Resources Finance, Business & Environment, Mega-trends in the Environment, River Processes, Eco-hydraulics, Floodplain Processes, Sediment Transport (Purdue), Field Methods, Fluvial Geomorphology, Environmental Geography, Capstone Course in Geography

UNIVERSITY, PROFESSIONAL, AND COMMUNITY SERVICE

International Service

Lifewater International. Volunteer hydrologist for water resources development projects in developing nations

Kenya, 1999 – Well drilling and water planning

Uganda, 2000 – Well drilling and training

El Salvador, 2006 – Surveying of water distribution pipeline; water quality analysis; water planning

Editorial Boards

Ecology

Water Resources Research

Annals of the Association of American Geographers

Proposal Reviews

NSF-Hydrologic Sciences

NSF-Geomorphology and Land Use Change

NSF-Geography and Regional Science

NSF Ecology

NSF-Ecosystems

National Oceanic and Atmospheric Administration

CALFED Delta-Bay Program

National Geographic – Council on Research and Exploration

Manuscript Reviews (ad hoc – not included editing duties, > 300 total):

American Philosophical Society

Annals of the Association of American Geographers

Biogeochemistry

BioScience

Canadian Journal of Fisheries and Aquatic Sciences

Earth-Science Reviews

Earth Surface Processes and Landforms

Ecological Applications

Ecological Economics

Ecological Monographs

Ecology

Ecology and Society

Ecology Letters

Environmental Management

Geological Society of America Bulletin

Geomorphology

Geophysical Research Letters

Gravel-bed Rivers

Hydrological Processes

Journal of the American Water Resources Association

Journal of Geophysical Research – Biogeoscience

Journal of Geophysical Research – Earth Surface

Journal of Hydraulic Engineering

Journal of Hydrologic Engineering

Limnology and Oceanography

Nature

Physical Geography

Proceedings of the National Academy of Sciences

Professional Geographer

Remote Sensing of Environment

Science

Water Resources Research

Water Research

Service to Academe

University or School Reviews

McGill School of Environment

Tenure and Promotion External Reviews:

Georgetown University
Louisiana State University
Oregon State University
Purdue University
Stanford University
University of Minnesota
University of Montana
University of New Mexico
University of North Carolina
University of Pittsburgh
University of South Carolina
University of Texas-Austin
Vanderbilt University
Washington State University
West Virginia University
Western University (Canada)

Departmental and University Activities

Duke University

Provost Office

Board of Trustees Climate Task Force: Future of Duke's Climate and Data Initiatives
Campus Sustainability Initiative (2012-2013)

Nicholas School of the Environment

Space Committee (2020)
Search Committee, Executive-in-residence, Natural Resources Finance (2018)
Search Committee, Dean of the Nicholas School (2017-2018)
Strategic Planning for School of Environment (2015-2017)
Director, MEM Water Resources Management Program (2012-2016, 2018 – present)
Search Committee, Environmental Entrepreneurship (2012)
Search Committee, Ecology/Hydrology Cluster Hire (2011)

Nicholas Institute for Environmental Policy Solutions

Search Committee, Director of Water Policy (2012)

University of North Carolina

Provost Office

UNC Provost Research Awards
UNC Task Force on Future Promotion and Tenure Policies and Practices (2008 in present)
UNC / Institute for Environment Climate Change Committee (for Senator Basnight)
UNC Faculty Committee on Research (2008-present)
UNC Tomorrow Commission Response Team – Environment (2008)

Department of Geography:

Director of Undergraduate Curriculum (2010-present)
Search Committee, International Development (2010)
Chair of Search Committee, Environmental Change (2008-2009)
Search Committee, South Asia (2007-2008)
Colloquium Committee, Chair (2005-2006)
Graduate Studies Committee (2003-present)
Search Committee, Human-Environment (2005-2006)

Institute for the Environment

Center for Landscape Change and Health (Director, 2007-present)

Strategic Planning Committee (“Berke Committee”) (2008)

Curriculum Review Committee (“Band Committee”) (2008)

Curriculum in Ecology:

Admissions Committee, Chair (2005-2006)

Curriculum Review Committee (2002-2003)

Graduate Studies Committee Chair (2005-2006)

Graduate Studies Committee (2003-2004)

Purdue University

School of Science

Dean Search Committee (2001-2002)

Grade Appeals Committee (2001-2002)

PUBLICATIONS

[RSS]: River system science (geomorphology, ecology, biogeochemistry, hydrology)

[EEP]: Environmental economics and policy (ecosystem service markets, infrastructure, floodplain management, legal jurisdictions)

[FINC]: Environmental/conservation finance and impact investing

[HIST]: History or archaeology (political economy of rivers; Cilician geo-archaeology)

Major Works

Doyle, M.W. (2018). *The Source: How Rivers Made America and America Remade its Rivers*. W.W. Norton & Co., New York.

R. Lave and M.W. Doyle. (2021). *Streams of Revenue: The Restoration Economy and the Ecosystems it Creates*. MIT Press.

Peer-reviewed Journal Publications (including in press):

120. Smull, E., L. Patterson and M.W. Doyle (2021, in review). Rising market risk exposure of municipal water service providers in distressed cities. *ASCE Journal of Water Resources Planning & Management*. [EEP/FINC].

119. Patterson, L. and M.W. Doyle (2021, in review). Exploring water affordability across and within utilities. *PLoS One*. [EEP/FINC].

118. Doyle et al. (2020). Growing options for shrinking cities. *Journal of the American Water Works Association* 112(12): 56-66. [EEP/FINC].

117. Robertson, M.M., R. Lave, and M.W. Doyle (2020, accepted). Watershed moments: scalar fixes in neoliberal environmental governance. *Environment and Planning E: Nature and Space*. [EEP]

116. Manning, A.P., J.P. Julian and M.W. Doyle (2020). Riparian vegetation as an indicator of stream channel presence and connectivity in arid environments. *Journal of Arid Environments* 178: 104167 [RSS].

115. Gardner, J.R., T. Pavelsky, and M.W. Doyle (2019). The abundance, size, and spacing of lakes within river networks. *Geophysical Research Letters* 46: 2592-2601. [RSS].

114. M.W. Doyle and L. Patterson (2019). Federal decentralization and adaptive management: Reservoir reallocation by the US Army Corps of Engineers. *Journal of the American Water Resources Association* 55(5): 1248-1267. [EEP]

113. L. Patterson, M. Tchamkina, and M.W. Doyle (2019). Managing rivers under changing natural and societal boundary conditions, part 2: Expected compared with experienced conditions at U.S. Army Corps of Engineers reservoirs. *River Research & Applications* 35: 341-352. [RSS].

112. L. Patterson and M.W. Doyle (2019). Managing rivers under changing natural and societal boundary conditions, part 1: National trends and U.S. Army Corps of Engineers reservoirs. *River Research & Applications* 35: 327-340. [RSS].

111. M. Fuller and M.W. Doyle (2018). Gene flow simulations demonstrate resistance of long-lived species to genetic erosion of habitat fragmentation. *Conservation Genetics* 19: 1439-1448. [RSS].
110. Messer, T., M. Montano, P.L. Ferguson and M.W. Doyle (2020, in review). Impact of dissolved organic matter on Imidacloprid photodegradation rates in natural waters. *Environmental Science: Processes and Impacts*. [RSS].
109. Robertson, M.M., R. Lave and M.W. Doyle (2020, in press). Streams of value: defining rivers and streams as environmental commodities in three US states. *Environment and Planning E*. [EEP]
108. Blaszcak, J., D.L. Urban, M.W. Doyle and E.S. Bernhardt (2019). Scoured or suffocated: urban stream ecosystems oscillate between hydrologic and dissolved oxygen extremes. *Limnology and Oceanography* 64: 877-894. [RSS].
107. Doyle, M.W. (2018). Addressing the declining appropriations for Bureau of Reclamation infrastructure: policies needed for enabling private finance. *Journal of the American Water Resources Association* 54(5): 993-1000. [FINC]
106. Gardner, J.R., S. Ensign, J. Houser, and M.W. Doyle (2020). Light exposure along particle flowpaths in large rivers. *Limnology & Oceanography* 65: 128-142. [RSS].
105. Gardner, J.R., and M.W. Doyle (2018). Sediment-water surface area along rivers: water column vs. benthic. *Ecosystems* 21: 1505-1520. [RSS].
104. Fuller, R.L., J. Dennison, G. Swarr, K. Weichert, C. Griego and M.W. Doyle (2018). Impacts of recreational flow releases on macroinvertebrate drift at different distances from Abanakee Dam, New York, USA. *Northeastern Naturalist* 25: 222-235. [RSS].
103. Patterson, L.A. and M.W. Doyle (2018). A nationwide analysis of U.S. Army Corps of Engineers reservoir performance in meeting operational targets. *Journal of the American Water Resources Association* 54: 543-564. [EEP].
102. Ensign, S.H., M.W. Doyle and J.R. Gardner (2017). New strategies for measuring rates of environmental processes in rivers, lakes, and estuaries. *Freshwater Science* 36: 453-465. [RSS].
101. Fuller, M.R., M.W. Doyle, and D.L. Strayer (2015). Causes and consequences of habitat fragmentation in river networks. *Annals of the NY Academy of Sciences (The Year in Ecology and Conservation Biology)* 1355: 31-51. [RSS].
100. Doyle, M.W., J. Singh, R. Lave and M.M. Robertson (2015). Morphology of streams restored for market and non-market purposes: Insights from a mixed natural-social science approach. *Water Resources Research* 51(7); 5603-5622. [EEP/RSS].
99. Ross, M.R.V., E.S. Bernhardt, M.W. Doyle and J.B. Heffernan (2015). Designer ecosystems: incorporating design into applied ecology. *Annual Review of Environment and Resources* 40: 419-443. [EEP]
98. Podolak, C., and M.W. Doyle (2015). Reservoir sedimentation and storage capacity in the United States: Management needs for the 21st century. *Journal of Hydraulic Engineering* 141(4): 1-8. [EEP]
97. Doyle, M.W. and J. VonWindheim (2015). Environmental management strategy: Four forces analysis. *Environmental Management* 55: 6-18. [EEP]
96. Doyle, M.W., L. Patterson, Y. Chen, K. Schnier, and A.J. Yates (2014). The optimal scale of markets for water quality trading. *Water Resources Research* 50(9): 7231-7244 [EEP].
95. Clay, P., J.D. Muehlbauer and M.W. Doyle (in press, 2014). Effect of tributary and braided confluences on aquatic macroinvertebrate communities and geomorphology in an alpine river watershed. *Freshwater Science* 34(3): 845-856. [RSS]
94. Podolak, C., and M.W. Doyle (2014). Conditional water rights in the western United States: introducing uncertainty in prior appropriation. *Journal of the American Water Resources Association* 51(1): 14-32. [EEP].
93. Miller, B.W. and M.W. Doyle (2014). Rangeland management and fluvial geomorphology in the Simanjiro Plains, Tanzania. *Geomorphology* 214: 366-377. [RSS]
92. Fuller, R.L., J. Dennison, S. Doyle, L. Levy, J. Owen, E. Shope, G. Swarr, L. Vo, K. Weichert, E. DiCesare and M.W. Doyle (2013). Influence of flood history and hydrology on transport of organic matter in a frequently flooded river. *Journal of Freshwater Ecology* 29(1): 37-51. [RSS]
91. Ensign, S.H., M.W. Doyle and M.F. Piehler (2013). The effect of tide on the hydrology and morphology of a freshwater river. *Earth Surface Processes and Landforms* 38: 655-660. [RSS]

90. Muehlbauer, J.D., S.F. Collins, M.W. Doyle and K. Tockner (2014). Spatial extent of the potential “stream signature” in terrestrial food webs using meta-analysis. *Ecology* 95: 44-55. [RSS]
89. Sandt, C.J., and M.W. Doyle (2013). The hydrologic and economic feasibility of micro hydropower upfitting and integration of existing low-head dams in the United States. *Energy Policy* 63: 261-271. [EEP].
88. Meitzen, K.M., M.W. Doyle, M.C. Thoms, and C.E. Burns (2013). Geomorphology within the interdisciplinary science of environmental flows. *Geomorphology* 200: 143-154. [RSS]
87. Yates, A.J., M.W. Doyle, J.R. Rigby and K.E. Schnier (2013). Market power, private information, and the optimal scale of pollution permit markets for North Carolina’s Neuse River. *Resource and Environmental Economics* 35: 256-276. [EEP].
88. K. Schnier, Doyle, M.W., J.R. Rigby, and A.J. Yates (2014). Bilateral oligopoly in pollution permit markets: experimental evidence. *Economic Inquiry* 52(3): 1060-1079. [EEP]
85. Lutz, B. A. Lewis, and M.W. Doyle (2013). Generation, transport, and disposal of wastewater from natural gas development from the Marcellus shale region. *Water Resources Research* 49: 647-656. [RSS]
84. Patterson, L., B. Lutz, and M.W. Doyle (2013). Climate and direct human contributions to changes in mean annual streamflow in the South Atlantic, U.S. *Water Resources Research* 49(11): 7278-7291. [RSS]
83. Patterson, L., B. Lutz, and M.W. Doyle (2013). Characterization of drought in the South Atlantic, U.S. *Journal of the American Water Resources Association* 49: 1385-1397. [RSS]
82. Powers, S., J.P. Julian, M.W. Doyle and E.H. Stanley. Retention and transport of nutrients in a mature agricultural impoundment. *Journal of Geophysical Research – Biogeosciences* 118(1): 91-103. [RSS]
81. Doyle, M.W., R. Lave, M.M. Robertson and J. Ferguson (2013). River federalism. *Annals of the Association of American Geographers* 103: 290-298. [EEP]
80. Ensign, S.H., M.W. Doyle, and M. Piehler (2012). Tidal geomorphology affects phytoplankton at the transition from forested stream to tidal rivers. *Freshwater Biology* 57: 2141-2155. [RSS]
79. Robertson, M.M., T. BenDor, R. Lave, A. Riggsbee, J.B. Ruhl, and M.W. Doyle (2014). Stacking ecosystem services. *Frontiers in Ecology and the Environment* 12: 186-193. [EEP].
78. Doyle, M.W. (2012). America’s rivers and the American experiment. *Journal of the American Water Resources Association* 40: 820-837. [EEP/HIST]
77. Patterson, L., B. Lutz and M.W. Doyle (2012). Streamflow changes in the South Atlantic, United States during the mid and late 20th century. *Journal of the American Water Resources Association* 48: 1126-1138. [RSS]
76. Ensign, S.H., K. Siporin, M. Piehler and M.W. Doyle (2013). Hydrologic versus biogeochemical controls of denitrification in tidal freshwater wetlands. *Estuaries and Coasts* 36: 519-532. [RSS]
75. Doyle, M.W., and F.D. Shields (2012). Compensatory mitigation for streams under the Clean Water Act: Reassessing science and redirecting policy. *Journal of the American Water Resources Association* 48: 494-509. [EEP]
74. Chen, Y., Z. Zhang, S. Du, P. Shi, F. Tao, and M.W. Doyle (2011). Water quality changes in the world’s first special economic zone, Shenzhen, China. *Water Resources Research* 47, W11515, doi: 10.1029/2011R10491. [RSS]
73. BenDor, T., A. Riggsbee, and M.W. Doyle (2011). Risk and markets for ecosystem services. *Environmental Science & Technology* 45: 10322-10330. [EEP]
72. Muehlbauer, J., and M.W. Doyle (2012). Knickpoint effects on macroinvertebrates, sediment, and discharge in urban and forested streams: urbanization outweighs microscale habitat heterogeneity. *Freshwater Science* 31(2): 282-295. [RSS]
71. Muehlbauer, J. E.S. Bernhardt, and M.W. Doyle (2011). Macroinvertebrate community responses to a dewatering disturbance gradient in a restored stream. *Hydrology and Earth System Sciences* 7, 9599-9630, 2010, doi:10.5194/hessd-7-9599-2010. [RSS]
70. Kern, J., G.W. Characklis, M.W. Doyle, S. Blumsack, and R.B. Whisnant (2012). Influence of de-regulated electricity markets on hydropower generation and downstream flow regime. *Journal of Water Resources Planning and Management* 138: 342-355. [EEP]

69. Riggsbee, J.A., R.G. Wetzel and M.W. Doyle (2012). Physical and plant community controls on nitrogen and phosphorus leaching from impounded riverine wetlands following dam removal. *River Research and Applications* 28: 1439-1450. [RSS].
68. Muehlbauer, J., and M.W. Doyle (2012). Benign use of salt slugs on aquatic macroinvertebrates: measuring discharge with salt during an aquatic ecology study. *River Research and Applications* 28: 1858-1863. [RSS]
67. Doyle, M.W., and E.S. Bernhardt (2011). What is a stream? *Environmental Science and Technology* 45: 354-359. [EEP]
66. Doyle, M.W., and M.J. Small (2012). Historical perspectives on stream restoration design in the U.S.A. *Progress in Physical Geography* 36: 138-153. [HIST]
65. Lave, R., M. Doyle, M. Robertson (2010). Privatizing stream restoration in the US. *Social Studies of Science* 40(5): 677-703. [EEP]
64. Ardon, M., J. Morse, M.W. Doyle, and E Bernhardt (2010). The water quality benefits of restoring a large agricultural wetland on the southeastern coastal plain. *Ecosystems* 13: 1060-1078 [RSS]
63. Hester, E.T., and M.W. Doyle (2011). Human impacts to river temperature and their effects on biological processes: a quantitative synthesis. *Journal of American Water Resources Association* 47: 571-587. [RSS]
62. Julian, J.P., S.Z., Seegert, S.M. Powers, E.H. Stanley and M.W. Doyle (2010). Light as a first-order control on ecosystem structure in a temperate stream. *Ecohydrology* 4: 422-432. [RSS]
61. Ardon, M., S. Montanari, J.L. Morse, M.W. Doyle and E.S. Bernhardt (2010). Phosphorus export from a restored wetland ecosystem in response to natural and experimental hydrologic fluctuations. *Journal of Geophysical Research – Biogeosciences* 115, G04031, doi:10.1029/2009JG001169. [RSS]
60. Sholtes, J., and M.W. Doyle (2011). Effect of channel restoration on flood wave attenuation. *Journal of Hydraulic Engineering* 137(2): 196-208. [RSS]
59. Riggsbee, J.A., R. Manners, J.P. Julian, M.W. Doyle, J. Muehlbauer, J. Sholtes, and M.J. Small. Influence of biotic processes on channel forms and processes. *Geomorphology*. [RSS]
58. Rauh, N.K., R.F. Townsend, M.C. Hoff, M.Dillon, M.W. Doyle, C. Ward, R. Rothaus, H. Caner, U. Akkemik, L. Wandsnider, S. Ozaner, and C. Dore (2009). Life in the Truck Lane: Urban development in Western Rough Cilicia. *JOAI (Annual of the Austrian Archaeological Institute)* Spring 2010: 253-312. [HIST]
57. Fuller, R.L., C. Griego, J.D. Muehlbauer, J. Dennison, and M.W. Doyle (2010). Response of stream macroinvertebrates in flow refugia and high scour areas to a series of floods: A reciprocal replacement study. *JNABS* 29: 750-760 [RSS]
56. Patterson, L., and M.W. Doyle (2011). Hyposographic demography across scale. *Professional Geographer* 63(4): 1-17. [EEP]
55. Fuller, R.L., S. Doyle, L. Levy, J. Owens, E. Shope, L. Vo, E. Wolyniak, M.J. Small and M.W. Doyle (2011). Impact of regulated releases on periphyton and macroinvertebrate communities: the dynamic relationship between hydrology and geomorphology in frequently flooded rivers. *River Research and Applications* 27: 630-645. [RSS]
54. Doyle, M.W. and A. Yates (2010). Stream ecosystem service markets under no-net-loss regulation. *Ecological Economics* 69: 820-827[EEP]
53. Riggsbee, A., and M.W. Doyle (2009). Environmental markets: the power of regulation. *Science* 326: 1061. [EEP]
52. BenDor, T., and M.W. Doyle (2010), Planning for ecosystem service markets. *Journal of the American Planning Association* 76: 59-72. [EEP]
51. Havlick, D., and M.W. Doyle (2009). Restoration geographies. *Ecological Restoration* 27(3): 240-243. [EEP]
50. BenDor, T., J. Sholtes and M.W. Doyle (2009). Landscape characteristics of stream and wetland mitigation banking. *Ecological Applications* 19: 2078-2092. [EEP]
49. Doyle, M.W. and S.H. Ensign (2009). Alternative reference frames in river systems science. *BioScience* 59(6): 499-510. [RSS]

48. Orr, C.H., J.J. Clark, P.R. Wilcock, J.C. Finlay, and M.W. Doyle. Morphological and biologic control of limiting nutrient uptake in a field-scale flume (2009). *Journal of Geophysical Research-Biogeosciences* 114, G02019, doi:10.1029/2008JG000825. [RSS]
47. Doyle, M.W., and D. Havlick (2009). Infrastructure in the environment. *Annual Review of Environment and Resources* 34: 349-373. [EEP]
46. Ensign, S.H., M. Piehler, and M.W. Doyle. (2009). Riparian zone denitrification affects nitrogen flux through a tidal freshwater river. *Biogeochemistry* 91: 133-150. [RSS]
45. Lave, R., M.M. Robertson, and M.W. Doyle (2008). Why you should pay attention to stream mitigation banking. *Ecological Restoration* 26:287-289. [EEP]
[chosen as one of 10 pivotal papers by Eitzel et al., (2011) in *Restoration Ecology*]
44. Patterson, L., and M.W. Doyle (2009). Assessing effectiveness of national flood policy through spatiotemporal monitoring of socioeconomic exposure. *Journal of the American Water Resources Association*, 45:1-16. [EEP]
43. Craig, L.S., M.A. Palmer, D.C. Richardson, S. Filoso, E.S. Bernhardt, B.P. Bledsoe, M.W. Doyle, P.M. Groffman, B.A. Hassett, S.J. Kaushal, P.M. Mayer, S.M. Smith, and P.R. Wilcock (2008). Stream restoration strategies for reducing river nitrogen loads. *Frontiers in Ecology and Environment* 6: 529-538. [RSS]
42. Julian, J.P., E.H. Stanley and M.W. Doyle (2008). Basin-scale consequences of agricultural land use on benthic light availability and primary production along a sixth-order temperate river. *Ecosystems*, 11:1091-1105. [RSS]
41. Hester, E.T., and M.W. Doyle. (2009). The influence of in-stream geomorphic structures on stream temperature via induced hyporheic exchange, *Limnology and Oceanography*, 54: 355-367. [RSS]
40. Julian, J.P., M.W. Doyle and E.H. Stanley (2008). Optical water quality in rivers. *Water Resources Research*, vol 44, W10411, doi:10.1029/2007WR006457. [RSS]
39. Julian, J.P., M.W. Doyle, and E.H. Stanley (2008). Empirical modeling of light availability in rivers. *Journal of Geophysical Research-Biogeosciences*, 113, G03022, doi: 1029/2007JG000601. [RSS]
38. Riggsbee, A., C. Orr, D. Leech, M.W. Doyle and R. Wetzel (2008). Suspended sediments in river ecosystems: photochemical sources of dissolved organic carbon, dissolved organic nitrogen and adsorptive removal of dissolved iron. *Journal of Geophysical Research-Biogeosciences*, 113, doi:10.1029/2007JG000654. [RSS]
37. Doyle, M.W., E.H. Stanley, D.G. Havlick, M. Kaiser, G. Steinbauch, W.L. Graf, G.E. Galloway, J.A. Riggsbee (2008). Aging infrastructure and ecosystem restoration. *Science* 319(5861): 286-287. [EEP]
36. Small, M.J., M.W. Doyle, R. Fuller, and R. Manners (2008). Geomorphic vs hydrologic control on stream ecosystems: example using organic matter. *Freshwater Biology* 53: 1618-1631. [RSS]
35. Hester, E.T., and M.W. Doyle (2008). Efficacy of in-channel geomorphic structures for hyporheic exchange. *Water Resources Research* Vol 44, W03417, doi:10.1028/2006WR005810. [RSS]
34. Doyle, M.W. and C. Shields (2008). A measure of discharge effectiveness over the entire flow distribution. *Earth Surface Processes and Landforms* 33: 308-316. [RSS]
33. Manners, R., and M.W. Doyle (2008). A mechanistic model of woody debris jam evolution and its application to wood-based restoration and management. *River Research and Applications* 24: 1104-1123. [RSS]
32. Riggsbee, A., J. Julian, M.W. Doyle and R. Wetzel (2007). Carbon and nitrogen loading during the dam removal process. *Water Resources Research*, Vol 43, W09414, doi: 10.1029/2006WR005318. [RSS]
31. Manners, R., M.W. Doyle, and M.J. Small (2007). Structure and hydraulics of natural woody debris jams. *Water Resources Research* 43, W06432, doi: 10.1029/2006WR004910. [RSS]
30. Doyle, M.W., F.D. Shields, K.F. Boyd, P.E. Skidmore, and D.E. Domminick (2007). Channel-forming discharge selection in river restoration design. *Journal of Hydraulic Engineering* 133: 831-837. [RSS]
29. Renschler, C.S., M. Doyle and M. Thoms (2007). Geomorphology and ecosystems: Challenges and keys to success. *Geomorphology* 89: 1-8. [RSS]

28. Simon, A., M. Doyle, M. Kondolf, F.D. Shields, B. Rhoads, and M. McPhillips (2007). Critical evaluation of how the Rosgen Classification and associated natural channel design methods fail to integrate and quantify fluvial processes and channel response. *Journal of the American Water Resources Association*, 43(5): 1-15. [EEP]
27. Post, D.M., M.W. Doyle, J.L. Sabo, and J.C. Finlay (2007). The problem of boundaries in defining ecosystems: a potential landmine for uniting geomorphology and ecology. *Geomorphology*: 111-126. [RSS]
26. Ensign, S.H., and M.W. Doyle (2006). Nutrient spiraling in streams and river networks. *Journal of Geophysical Research – Biogeosciences*, 111, G04009, doi: 10.1029/FG000114. [RSS]
25. Doyle, M.W., and E.H. Stanley (2006). Exploring links between fluvial geomorphology and nutrient-periphyton dynamics using simulation models. *Annals of Assoc. of American Geographers* 96(4): 687-698. [RSS]
24. Doyle, M.W. (2006). A heuristic model for potential geomorphic influences on trophic interactions in streams. *Geomorphology*, 77: 235-248. [RSS]
23. Fraser, F., M.W. Doyle and H. Young (2006). Creating effective flood mitigation policies. *EOS* 87(27): 265,270. [EEP]
22. Shields, F.D., E.J. Langendoen, and M.W. Doyle (2006). Adapting existing models to examine the effects of agricultural conservation programs on stream habitat quality. *Journal of the American Water Resources Association* 42(1): 25-33. [RSS]
21. Doyle, M.W., E.H. Stanley, D. Strayer, R. Jacobson, and J.C. Schmidt (2005). Effective discharge analysis of ecological processes in streams. *Water Resources Research*, 41, W1141, doi: 10.1029/2005WR004222. [RSS]
20. Doyle, M.W. (2005). Incorporating hydrology into nutrient spiraling theory. *Journal of Geophysical Research* 110, G01003, doi: 10.1029/2005JG000015. [RSS]
19. Ensign, S.E., and M.W. Doyle (2005). In-stream transient storage and associated nutrient retention: Evidence from experimental manipulations. *Limnology and Oceanography*, 50: 1740-1751. [RSS]
18. Doyle, M.W, E.H. Stanley, C.H. Orr, A.R. Selle, and J.M. Harbor (2005). Response of stream ecosystems to dam removal: Lessons from the heartland. *Geomorphology* 71: 227-244.
17. Doyle, M.W. and J. Julian (2005). The most cited works in geomorphology. *Geomorphology* 72: 238-249. [RSS]
16. Sethi, S.A., A.R. Selle, M.W. Doyle, E.H. Stanley, and H.E. Kitchel. 2004. Response of unionid mussels to dam removal in Koshkonong Creek, Wisconsin (USA). *Hydrobiologia* 525:157-165. [RSS]
15. Doyle, M.W., A.R. Selle, J.M. Stofleth, E.H. Stanley, and J.M. Harbor (2003). Predicting the depth of erosion following dam removal using a bank stability model. *International Journal of Sediment Research*, 18(2): 128-134. [RSS]
14. Doyle, M.W., and J.M. Harbor (2003). Modeling the effect of form and profile adjustments on channel equilibrium timescales. *Earth Surface Processes and Landforms* 28: 1271-1287. [RSS]
13. Doyle, M.W., E.H. Stanley, and J.M. Harbor (2003). Hydrogeomorphic controls on phosphorus retention in streams. *Water Resources Research* 36(6): 1147, doi: 10.1029/2003WR002038. [RSS]
12. Doyle, M.W., E.H. Stanley, and J.M. Harbor (2003). Channel adjustments following two dam removals in Wisconsin. *Water Resources Research*. 39(1), 1011, doi: 10.1029/2002WR001714. [RSS]
11. Shields, F.D., R.R. Copeland, P.C. Klingeman, M.W. Doyle, and A. Simon (2003). Sedimentation engineering for stream restoration: A Review. *Journal of Hydraulic Engineering* 129(8): 575-584. [RSS]
10. Doyle, M.W, E.H. Stanley and J.M. Harbor (2003). Towards policies and decision-making for dam removal. *Environmental Management* 31(4): 453-465. [EEP]
9. Doyle, M.W., and J.M. Harbor (2003). A scaling approximation of equilibrium time-scales for sand-bed and gravel-bed rivers responding to base-level lowering, *Geomorphology* 54: 217-223. [RSS]
8. Myers-Kinzie, M., A. Space, C.F. Rich, and M.W. Doyle (2003). Relationship of unionid mussel occurrence to channel stability in urban streams. *Internationale Vereinigung für Theoretische und angewandte Limnologie Verhandlungen* 28(2): 822-826. [RSS]

7. Stanley, E.H., and M.W. Doyle (2003). Trading off: the ecological effects of dam removal. *Frontiers in Ecology and the Environment* 1: 15-22. [RSS]
6. Doyle, M.W., E.H. Stanley, J.M. Harbor, and G.E. Grant (2003). Dam removal in the United States: Emerging Needs for Science and Policy, *EOS* 84(4): 29-33. [EEP]
5. Doyle, M.W., E.H. Stanley, and J.M. Harbor (2002). Geomorphic analogies for assessing probable channel response to dam removal. *Journal of the American Water Resources Association* 38(6): 1567-1579. [RSS]
4. Stanley, E.H., and M.W. Doyle (2002). A geomorphic perspective on nutrient retention following dam removal. *BioScience* 52(8): 693-701. [RSS]
3. Stanley, E.H., M.A. Luebke, M.W. Doyle, and D.W. Marshall. (2002). Short-term changes in channel form and macroinvertebrate communities following low-head dam removal in the Baraboo River, Wisconsin. *Journal of the North American Benthological Society* 21: 172-187. [RSS]
2. Doyle, M.W. and F.D. Shields, Jr. (2000). Incorporation of bed texture into a channel evolution model. *Geomorphology* 34: 291-309. [RSS]
1. Doyle, M.W., C.F. Rich, J.M. Harbor and A. Spacie (2000). Examining the effects of urbanization on streams using indicators of geomorphic stability. *Physical Geography* 21(2): 155-181. [RSS]

Peer-Reviewed Book Chapters

5. Doyle, M.W., and T. BenDor (2012). Freshwater ecosystem service markets. Pages 17-42 in B.D. Garner and R.T. Simmons, *Aquonomics: Water Markets and the Environment*. Transactions Publishers, New Brunswick, NJ. [EEP]
4. Doyle, M.W., and R.L. Fuller (2012). Quantitatively evaluating restoration scenarios for rivers with recreational flow releases. *AGU Monograph: Stream Restoration in Dynamic Fluvial Systems*. [RSS]
3. Doyle, M.W., and E.H. Stanley (2011). Stream ecosystem response to dam removal. In *Dam Removal, American Society of Civil Engineers Monograph*. [RSS]
2. F.D. Shields, Jr., R.R. Copeland, P.C. Klingeman, M.W. Doyle and A. Simon (2008). River Restoration. In Garcia, M. (ed.), *Erosion and Sedimentation: ASCE's Manual 54, 2nd Edition*. [RSS]
1. Wilcock, P.R., J.C. Schmidt, M.G. Wolman, W.E. Dietrich, D. Dominick, M.W. Doyle, G.E. Grant, R.M. Iverson, D.R. Montgomery, T.C. Pierson, S.P. Schilling, and R.C. Wilson (2003). When Models Meet Managers: Examples from Geomorphology. In Wilcock, P.R. and R.M. Iverson (eds.), *Prediction in Geomorphology*. American Geophysical Union: 27-40. [EEP]

Law Reviews

1. Womble, P., and M.W. Doyle (2012). The geography of trading ecosystem services: case study in stream and wetland mitigation banking. *Harvard Environmental Law Review* 236: 229-296.
2. Doyle, M.W., and T. BenDor (2012, in press). Evolving law and policy of freshwater ecosystem service markets. *William & Mary Environmental Law and Policy Review* 36: 153-191.
3. Salzman, J., and M.W. Doyle (2014). Turning the world upside down: reference frames in fluid mechanics and environmental law. *Environmental Law* 44:1-30.

Significant Research Reports (peer-reviewed but not published in scientific literature)

12. Doyle, M.W., L. Olander and T. BenDor (2020). *Compensatory mitigation on federally managed lands*. Nicholas Institute Report NI R 20-01. [FINC].
11. Doyle, M.W. (2019). *The Financial and Environmental Risks of In Lieu Fee Programs for Compensatory Mitigation*. Nicholas Institute Report NI R 19-01, Durham, NC. [FINC].
10. Patterson, L., M.W. Doyle and S. Kuzma (2018). *Creating Data as a Service for U.S. Army Corps of Engineers Reservoirs*. Nicholas Institute Report NI R 18-01, Durham, NC.
9. Gardner, J., M.W. Doyle and L. Patterson (2017). The economic value of public water data. *Nicholas Institute White Paper* NI-17-05 [FINC].
8. Spence, E., B. Copp, X. Kent, D. Vermeer and M.W. Doyle (2017, in review). Environmental impact investing in real assets: What environmental measures do fund managers consider? *Nicholas Institute Report NI17-01*. [FINC].

7. Aspen Institute (2017). Internet of Water: Sharing and Integrating Water Data for Sustainability. Aspen Institute, Washington, DC (Doyle one of 4 co-authors).
6. Bureau of Reclamation (2016). Water Marketing Activities Within the Bureau of Reclamation. US Department of Interior/Bureau of Reclamation, Washington, DC (Doyle one of 4 co-authors).
5. Aspen-Nicholas Water Forum (2016). Impact Investing and Conservation Finance for Water Sustainability. Report from the 2016 Aspen-Nicholas Water Forum, Washington, DC (Doyle as 2nd author).
4. Aspen-Nicholas Water Forum (2015). Water and Big Data. Report from the 2015 Aspen-Nicholas Water Forum, Washington, DC (Doyle as lead author).
3. Aspen-Nicholas Water Forum (2014). Innovating for a Sustainable and Resilient Water Future. Report from the 2014 Aspen-Nicholas Water Forum, Washington, DC (Doyle lead author).
2. Review of Missouri River Recovery Integrated Science Program Spring Pulse Management. Doyle (chair), Murphy (co-chair), Bartell, Farmer, Guy, and Palmer. 2011. Report to the Missouri River Recovery Implementation Committee, US Army Corps of Engineers, and US Fish and Wildlife Service, 68 p.
1. Doyle, M.W., 2007. High Rock Dam and Sediment Delta Flooding and Sedimentation Effects (1927-2058) on City of Salisbury (NC) Critical Infrastructure. Report to City of Salisbury, 39 p.

Editorials, Commentaries, and Non or Less Peer-reviewed

5. Womble, P., and M.W. Doyle (2010). Setting geographic service areas for compensatory mitigation. *National Wetlands Newsletter* Sept/Oct 18-23.
4. Beach, T., N. Dunning and M.W. Doyle. Geoarchaeology and geomorphology: Soils, sediments and societies. *Geomorphology*, 101: 413-415.
3. Doyle, M.W. (2007). The need for exit strategies. *Issues in Science and Technology* (National Academy of Sciences), Winter. [EEP]
2. Doyle, M.W., and M.M. Robertson (2007). Clouded Supreme Court decision necessitates geographic research. *AAG Newsletter* 42(1): 7. [EEP]
1. Renschler, C., M.W. Doyle, and M. Thoms (2006). Geomorphology and ecosystems: challenges and keys for success in bridging disciplines. *Geomorphology* vol 89: 1-8.

Discussions and Replies

5. BenDor, T., and M.W. Doyle (2010). The authors respond [Landscape characteristics of a stream and wetland mitigation program]. *National Wetlands Newsletter*, July/August, 21-23.
4. Shields, F.D., E.J. Langendoen, and M.W. Doyle (2006). Reply: Adapting existing models to examine the effects of agricultural conservation programs on stream habitat quality. *Journal of the American Water Resources Association* 42(6).
3. Doyle, M.W., E.H. Stanley and J.M. Harbor (2003). Reply to J.A. Thornton: Geomorphic analogies for assessing probable channel response to dam removal. *Journal of the American Water Resources Association* 39(5).
2. Doyle, M.W., and J.M. Harbor (2001). Discussion of 'Rapid assessment of channel stability in vicinity of road crossing' by Johnson, P.A., G.L. Gleason and R.D. Hey. *Journal of Hydraulic Engineering* 126: 85-87.
1. Doyle, M.W., and J.M. Harbor (2000). Discussion of 'Evaluation of Rosgen's streambank erosion potential assessment in Northeast Oklahoma', by R. Daren Harmel, C. T. Haan, and Russell C. Dutnell. *The Journal of the American Water Resources Association* 36(5): 1191-1192.

Book Reviews

5. Doyle, M.W. (2014). Review of "The Big Muddy." *Journal of Historical Geography*, in press.
4. Doyle, M.W. (2006). Review of "River Channel Management. *Geomorphology*, 74: 322-323.
3. Doyle, M.W. (2005). Review of 'River Processes.' *Geomorphology* 65: 338-339.
2. Doyle, M.W. (2004). Review of 'Gravel-bed Rivers 5'. *Geomorphology* 57: 437-439.
1. Doyle, M.W., and J.M. Harbor (2002). Review of 'Dam Removal: Science and Decision Making' by the Heinz Center Panel on Dam Removal. *BioScience* 52(8): 749-750.

Edited Books and Volumes

- Renschler, C.S., M.W. Doyle, and M. Thoms, (2007). Geomorphology and Ecosystems. *Geomorphology*. vol 89, issue 1.
- Urban, M., M. Daniels, and M.W. Doyle (2006). Linking Geomorphology and Ecology, Special issue of the journal *Geomorphology*, volume 77, issue 3.
- Beach, T., M.W. Doyle, and N. Running (2008). Geomorphology and Archaeology: Soils, Sediment, and Societies. Special issue of the journal *Geomorphology*, vol 101, issue 3.

Popular Media Outlets

- Doyle and Patterson, Florence shows the benefits, limits of dams. *Raleigh News & Observer*, op-ed, August 27, 2018.
- Doyle and Gisler, Development rush drives enforcement failures in stream program. *Raleigh News & Observer*, op-ed, April 24, 2011.
- Doyle, Bid the dam goodbye, or bid for it. *Raleigh News & Observer*, op-ed, April 29, 2010.
- Doyle and BenDor, Stream restoration: who really benefits? *Raleigh News & Observer*, op-ed, Dec 2009
[note: supported by editorial following day]
- BenDor and Doyle, Stimulus in a watery state. *Raleigh News & Observer*, op-ed, March 2009.
- Doyle, M.W., and L. Patterson, NC overflows with flood risk. *Raleigh News & Observer* op-ed, Sept 4, 2008.
- Doyle, M.W., Kudos and caution to town board. *News of Orange County* op-ed, May 1, 2008.
- Doyle, M.W., Need for fixes can't be ignored. *Raleigh News & Observer* op-ed, May 25, 2008.