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Frequency: 8 times per year

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Regular Article

MEETING ECOLOGICAL AND SOCIETAL NEEDS FOR FRESHWATER

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Human society has used freshwater from rivers, lakes, groundwater, and wetlands for many different urban, agricultural, and industrial activities, but in doing so has overlooked its value in supporting ecosystems. Freshwater is vital to human life and societal well-being, and thus its utilization for consumption, irrigation, and transport has long taken precedence over other commodities and services provided by freshwater ecosystems. However, there is growing recognition that functionally intact and biologically complex aquatic ecosystems provide many economically valuable services and long-term benefits to society. The short-term benefits include ecosystem goods and services, such as food supply, flood control, purification of human and industrial wastes, and habitat for plant and animal life—and these are costly, if not impossible, to replace. Long-term benefits include the sustained provision of those goods and services, as well as the adaptive capacity of aquatic ecosystems to respond to future environmental alterations, such as climate change. Thus, maintenance of the processes and properties that support freshwater ecosystem integrity should be included in debates over sustainable water resource allocation.

The purpose of this report is to explain how the integrity of freshwater ecosystems depends upon adequate quantity, quality, timing, and temporal variability of water flow. Defining these requirements in a comprehensive but general manner provides a better foundation for their inclusion in current and future debates about allocation of water resources. In this way the needs of freshwater ecosystems can be legitimately recognized and addressed. We also recommend ways in which freshwater ecosystems can be protected, maintained, and restored.

Freshwater ecosystem structure and function are tightly linked to the watershed or catchment of which they are a part. Because riverine networks, lakes, wetlands, and their connecting groundwaters, are literally the “sinks” into which landscapes drain, they are greatly influenced by terrestrial processes, including many human uses or modifications of land and water. Freshwater ecosystems, whether lakes, wetlands, or rivers, have specific requirements in terms of quantity, quality, and seasonality of their water supplies. Sustainability normally requires these systems to fluctuate within a natural range of variation. Flow regime, sediment and organic matter inputs, thermal and light characteristics, chemical and nutrient characteristics, and biotic assemblages are fundamental defining attributes of freshwater ecosystems. These attributes impart relatively unique characteristics of productivity and biodiversity to each ecosystem. The natural range of variation in each of these attributes is critical to maintaining the integrity and dynamic potential of aquatic ecosystems; therefore, management should allow for dynamic change. Piecemeal approaches cannot solve the problems confronting freshwater ecosystems.

Scientific definitions of the requirements to protect and maintain aquatic ecosystems are necessary but insufficient for establishing the appropriate distribution between societal and ecosystem water needs. For scientific knowledge to be implemented science must be connected to a political agenda for sustainable development. We offer these recommendations as a beginning to redress how water is viewed and managed in the United States: (1) Frame national and regional water management policies to explicitly incorporate freshwater ecosystem needs, particularly those related to naturally variable flow regimes and to the linking of water quality with water quantity; (2) Define water resources to include watersheds, so that freshwaters are viewed within a landscape, or systems context; (3) Increase communication and education across disciplines, especially among engineers, hydrologists, economists, and ecologists to facilitate an integrated view of freshwater resources; (4) Increase restoration efforts, using well-grounded ecological principles as guidelines; (5) Maintain and protect the remaining freshwater ecosystems that have high integrity; and (6) Recognize the dependence of human society on naturally functioning ecosystems.

Keywords: [ecological education](#), [ecological integrity](#), [ecosystem protection](#), [ecosystem services](#), [freshwater](#), [freshwater ecosystems](#), [lakes](#), [restoration](#), [rivers](#), [waterflow](#), [quantity](#), [quality](#), [timing](#), [seasonality](#), [water management policy](#), [watersheds](#), [wetlands](#)

Received: August 17, 2001; Revised: January 9, 2002; Accepted: January 11, 2002

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Cited by

Octavio Pérez-Maqueo, M. Luisa Martínez, Gabriela Vázquez, Miguel Equihua. (2013) Using Four Capitals to Assess Watershed Sustainability. *Environmental Management* **51**:3, 679-693

Online publication date: 1-Mar-2013.

[CrossRef](#)

Paolo Perona, David J. Dürrenmatt, Gregory W. Characklis. (2013) Obtaining natural-like flow releases in diverted river reaches from simple riparian benefit economic models. *Journal of Environmental Management* **118**, 161-169

Online publication date: 1-Mar-2013.

[CrossRef](#)

Lee J Baumgartner, John Conallin, Ian Wooden, Bruce Campbell, Rebecca Gee, Wayne A Robinson, Martin Mallen-Cooper. (2013) Using flow guilds of freshwater fish in an adaptive management framework to simplify environmental flow delivery for semi-arid riverine systems. *Fish and Fisheries*n/a-n/a

Online publication date: 1-Feb-2013.

[CrossRef](#)

S. C. Watkins, N. S. P. Ning, B. Gawne, D. L. Nielsen. (2013) Managing wetlands as off-river storages: impacts on zooplankton communities. *Hydrobiologia* **701**:1, 51-63

Online publication date: 1-Jan-2013.

[CrossRef](#)

T. E. Grantham, M. Mezzatesta, D. A. Newburn, A. M. Merenlender. (2013) EVALUATING TRADEOFFS BETWEEN ENVIRONMENTAL FLOW PROTECTIONS AND AGRICULTURAL WATER SECURITY. *River Research and Applications*n/a-n/a

Online publication date: 1-Jan-2013.

[CrossRef](#)

Andreas H. Melcher, Raymond Ouedraogo, Stefan Schmutz. (2012) Spatial and seasonal fish community patterns in impacted and protected semi-arid rivers of Burkina Faso. *Ecological Engineering* **48**, 117-129

Online publication date: 1-Nov-2012.

[CrossRef](#)

Ellen M. Porter, William D. Bowman, Christopher M. Clark, Jana E. Compton, Linda H. Pardo, Jenny L. Soong. (2012) Interactive effects of anthropogenic nitrogen enrichment and climate change on terrestrial and aquatic biodiversity. *Biogeochemistry*

Online publication date: 20-Oct-2012.

[CrossRef](#)

Troy G. Zorn, Paul W. Seelbach, Edward S. Rutherford. (2012) A Regional-Scale Habitat Suitability Model to Assess the Effects of Flow Reduction on Fish Assemblages in Michigan Streams ¹. *JAWRA Journal of the American Water Resources Association* **48**:5, 871-895

Online publication date: 1-Oct-2012.

[CrossRef](#)

Ian D. Lunt, Amy Jansen, Doug L. Binns. (2012) Effects of flood timing and livestock grazing on exotic annual plants in riverine floodplains. *Journal of Applied Ecology* **49**:5, 1131-1139

Online publication date: 1-Oct-2012.

[CrossRef](#)

G. R. Kattel. (2012) CAN WE IMPROVE MANAGEMENT PRACTICE OF FLOODPLAIN LAKES USING CLADOCERAN ZOOPLANKTON?. *River Research and Applications* **28**:8, 1113-1120

Online publication date: 1-Oct-2012.

[CrossRef](#)

Thomas F. Turner, Melanie S. Edwards. (2012) Aquatic foodweb structure of the Rio Grande assessed with stable isotopes. *Freshwater Science* **31**:3, 825-834

Online publication date: 1-Sep-2012.

[CrossRef](#)

Daniel A. Auerbach, N. Leroy Poff, Ryan R. McShane, David M. Merritt, Matthew I. Pyne, Thomas K. Wilding. 2012. Streams Past and Future: Fluvial Responses to Rapid Environmental Change in the Context of Historical Variation. , 232-245.

[CrossRef](#)

Jari Ilmonen, Heikki Mykrä, Risto Virtanen, Lauri Paasivirta, Timo Muotka. (2012) Responses of spring macroinvertebrate and bryophyte communities to habitat modification: community composition, species richness, and red-listed species. *Freshwater Science* **31**:2, 657-667

Online publication date: 1-Jun-2012.

[CrossRef](#)

SEBASTIAN BIRK, LEON van KOUWEN, NIGEL WILLBY. (2012) Harmonising the bioassessment of large rivers in the absence of near-natural reference conditions - a case study of the Danube River. *Freshwater Biology*n/a-no

Online publication date: 1-Jun-2012.

[CrossRef](#)

Taegan A. McMahon, Neal T. Halstead, Steven Johnson, Thomas R. Raffel, John M. Romansic, Patrick W. Crumrine, Jason R. Rohr. (2012) Fungicide-induced declines of freshwater biodiversity modify ecosystem functions and services. *Ecology Letters*n/a-n/a

Online publication date: 1-May-2012.

[CrossRef](#)

Randall E Brummett, Malcolm C M Beveridge, Ian G Cowx. (2012) Functional aquatic ecosystems, inland fisheries and the Millennium Development Goals. *Fish and Fisheries* no-no
Online publication date: 1-Apr-2012.

[CrossRef](#)

Joana Rosado, Manuela Morais, António Serafim, Ana Pedro, Helena Silva, Miguel Potes, David Brito, Rui Salgado, Ramiro Neves, Ana Lillebø, António Chambel, Vanda Pires, Carlos Pinto Gomes, Paulo Pinto. 2012. Key Factors in the Management and Conservation of Temporary Mediterranean Streams: A Case Study of the Pardielas River, Southern Portugal. , 273-283.

[CrossRef](#)

Calum Brown, Robert McMorran, Martin F. Price. (2012) Rewilding – A New Paradigm for Nature Conservation in Scotland?. *Scottish Geographical Journal* 1-27

Online publication date: 9-Mar-2012.

[CrossRef](#)

Joel A. Carr, Paolo D'Odorico, Francesco Laio, Luca Ridolfi. (2012) On the temporal variability of the virtual water network. *Geophysical Research Letters* 39:6, n/a-n/a

Online publication date: 1-Mar-2012.

[CrossRef](#)

Martha E. Mather, Holly J. Frank, Joseph M. Smith, Roxann D. Cormier, Robert M. Muth, John T. Finn. (2012) Assessing Freshwater Habitat of Adult Anadromous Alewives Using Multiple Approaches. *Marine and Coastal Fisheries* 4:1, 188-200

Online publication date: 1-Jan-2012.

[CrossRef](#)

Robert A. Holland, Felix Eigenbrod, Paul R. Armsworth, Barbara J. Anderson, Chris D. Thomas, Kevin J. Gaston. (2011) The influence of temporal variation on relationships between ecosystem services. *Biodiversity and Conservation* 20:14, 3285-3294

Online publication date: 1-Dec-2011.

[CrossRef](#)

Tanya M. Doody, Pamela L. Nagler, Edward P. Glenn, Georgianne W. Moore, Kiyomi Morino, Kevin R. Hultine, Richard G. Benyon. (2011) Potential for water salvage by removal of non-native woody vegetation from dryland river systems. *Hydrological Processes* n/a-n/a

Online publication date: 1-Dec-2011.

[CrossRef](#)

R. L. Wilby, C. R. Fenn, P. J. Wood, R. Timlett, T. LeQuesne. (2011) Smart licensing and environmental flows: Modeling framework and sensitivity testing. *Water Resources Research* 47:12, n/a-n/a

Online publication date: 1-Dec-2011.

[CrossRef](#)

L. May, B. M. Spears. (2011) Managing ecosystem services at Loch Leven, Scotland, UK: actions, impacts and unintended consequences. *Hydrobiologia*

Online publication date: 9-Nov-2011.

[CrossRef](#)

G. Darrel Jenerette, Sharon L. Harlan, William L. Stefanov, Chris A. Martin. (2011) Ecosystem services and urban heat riskscape moderation: water, green spaces, and social inequality in Phoenix, USA. *Ecological Applications* 21:7, 2637-2651

Online publication date: 1-Oct-2011.

[Abstract](#) . [Full Text](#) . [PDF \(1580 KB\)](#)

Robert A. Holland, Felix Eigenbrod, Paul R. Armsworth, Barbara J. Anderson, Chris D. Thomas, Andreas Heinemeyer, Simon Gillings, David B. Roy, Kevin J. Gaston. (2011) Spatial covariation between freshwater and terrestrial ecosystem services. *Ecological Applications* 21:6, 2034-2048

Online publication date: 1-Sep-2011.

[Abstract](#) . [Full Text](#) . [PDF \(2387 KB\)](#)

Wyatt F. Cross, Colden V. Baxter, Kevin C. Donner, Emma J. Rosi-Marshall, Theodore A. Kennedy, Robert O. Hall, Jr., Holly A. Wellard Kelly, R. Scott Rogers. (2011) Ecosystem ecology meets adaptive management: food web response to a controlled flood on the Colorado River, Glen Canyon. *Ecological Applications* 21:6, 2016-2033

Online publication date: 1-Sep-2011.

[Abstract](#) . [Full Text](#) . [PDF \(1538 KB\)](#)

B. Stewart-Koster, J. D. Olden, M. J. Kennard, B. J. Pusey, E. L. Boone, M. Douglas, S. Jackson. (2011) Fish response to the temporal hierarchy of the natural flow regime in the Daly River, northern Australia. *Journal of Fish Biology* no-no

Online publication date: 1-Aug-2011.

[CrossRef](#)

Brian S. Caruso. (2011) Science and policy integration issues for stream and wetland jurisdictional determinations in a semi-arid region of the western U.S.. *Wetlands Ecology and Management*

Online publication date: 18-Jun-2011.

[CrossRef](#)

Ate Visser, Joop Kroes, Michelle T.H. van Vliet, Stephen Blenkinsop, Hayley J. Fowler, Hans Peter Broers. (2011) Climate change impacts on the leaching of a heavy metal contamination in a small lowland catchment. *Journal of Contaminant Hydrology*

Online publication date: 1-May-2011.

[CrossRef](#)

Patricia Trujillo-Jiménez, J. Elías Sedeño-Díaz, J.A. Camargo, Eugenia López-López. (2011) Assessing environmental conditions of the Río Champotón (México) using diverse indices and biomarkers in the fish *Astyanax aeneus* (Günther, 1860). *Ecological Indicators*

Online publication date: 1-May-2011.

[CrossRef](#)

Henri Décamps. (2011) River networks as biodiversity hotlines. *Comptes Rendus Biologies* 334:5-6, 420-434

Online publication date: 1-May-2011.

[CrossRef](#)

Mark Everard, Helen L. Moggridge. (2011) Rediscovering the value of urban rivers. *Urban Ecosystems*

Online publication date: 19-Apr-2011.

[CrossRef](#)

S Raghu, JL Spencer, AS Davis, RN Wiedenmann. (2011) Ecological considerations in the sustainable development of terrestrial biofuel crops. *Current Opinion in Environmental Sustainability* 3:1-2, 15-23

Online publication date: 1-Mar-2011.

[CrossRef](#)

B. A. Young, R. H. Norris, F. Sheldon. (2011) Is the hyporheic zone a refuge for macroinvertebrates in drying perennial streams?. *Marine and Freshwater Research*

Online publication date: 1-Jan-2011.

[CrossRef](#)

- D. E. Pataki, C. G. Boone, T. S. Hogue, G. D. Jenerette, J. P. McFadden, S. Pincetti. (2011) Socio-ecohydrology and the urban water challenge. *Ecohydrology* n/a-n/a
Online publication date: 1-Jan-2011.
[CrossRef](#)
- LEON A. BARMUTA, SIMON LINKE, EREN TURAK. (2011) Bridging the gap between 'planning' and 'doing' for biodiversity conservation in freshwaters. *Freshwater Biology* 56:1, 180-195
Online publication date: 1-Jan-2011.
[CrossRef](#)
- Nathan J. Smucker, Morgan L. Vis. (2010) Contributions of habitat sampling and alkalinity to diatom diversity and distributional patterns in streams: implications for conservation. *Biodiversity and Conservation*
Online publication date: 31-Dec-2010.
[CrossRef](#)
- R. Jan Steverson, Sergi Sabater. (2010) Understanding effects of global change on river ecosystems: science to support policy in a changing world. *Hydrobiologia* 657:1, 3-18
Online publication date: 1-Dec-2010.
[CrossRef](#)
- C. S. Santoni, E. G. Jobbágy, S. Contreras. (2010) Vadose zone transport in dry forests of central Argentina: Role of land use. *Water Resources Research* 46:10, n/a-n/a
Online publication date: 1-Oct-2010.
[CrossRef](#)
- Tamara K. Harms, Nancy B. Grimm. (2010) Influence of the hydrologic regime on resource availability in a semi-arid stream-riparian corridor. *Ecohydrology* 3:3, 349-359
Online publication date: 1-Sep-2010.
[CrossRef](#)
- Achim Paetzold, Philip H. Warren, Lorraine L. Maltby. (2010) A framework for assessing ecological quality based on ecosystem services. *Ecological Complexity* 7:3, 273-281
Online publication date: 1-Sep-2010.
[CrossRef](#)
- Defne Apul. (2010) Ecological Design Principles and Their Implications on Water Infrastructure Engineering. *Journal of Green Building* 5:3, 147-164
Online publication date: 1-Aug-2010.
[CrossRef](#)
- John Gunn, Chantal Sarrazin-Delay, Brian Wesolek, Ashley Stasko, Erik Szkokan-Emilson. (2010) Delayed Recovery of Benthic Macroinvertebrate Communities in Junction Creek, Sudbury, Ontario, after the Diversion of Acid Mine Drainage. *Human and Ecological Risk Assessment: An International Journal* 16:4, 901-912
Online publication date: 1-Jul-2010.
[CrossRef](#)
- Paolo D'Odorico, Francesco Laio, Luca Ridolfi. (2010) Does globalization of water reduce societal resilience to drought?. *Geophysical Research Letters* 37:13, n/a-n/a
Online publication date: 1-Jul-2010.
[CrossRef](#)
- Changwei Zhuang, Zhiyun Ouyang, Weihua Xu, Yang Bai, Weiqi Zhou, Hua Zheng, Xiaoke Wang. (2010) Impacts of human activities on the hydrology of Baiyangdian Lake, China. *Environmental Earth Sciences*
Online publication date: 30-Jun-2010.
[CrossRef](#)
- A. M. Suren, T. Riis. (2010) The effects of plant growth on stream invertebrate communities during low flow: a conceptual model. *Journal of the North American Benthological Society* 29:2, 711-724
Online publication date: 1-Jun-2010.
[CrossRef](#)
- S. J. Cooke, A. J. Danylchuk, M. J. Kaiser, M. A. Rudd. (2010) Is there a need for a '100 questions exercise' to enhance fisheries and aquatic conservation, policy, management and research? Lessons from a global 100 questions exercise on conservation of biodiversity. *Journal of Fish Biology* 76:9, 2261-2286
Online publication date: 1-Jun-2010.
[CrossRef](#)
- Y. KANNO, J. C. VOKOUN. (2010) Evaluating effects of water withdrawals and impoundments on fish assemblages in southern New England streams, USA. *Fisheries Management and Ecology* 17:3, 272-283
Online publication date: 1-Jun-2010.
[CrossRef](#)
- Gary Brierley, Helen Reid, Kirstie Fryirs, Nadine Trahan. (2010) What are we monitoring and why? Using geomorphic principles to frame eco-hydrological assessments of river condition. *Science of The Total Environment* 408:9, 2025-2033
Online publication date: 1-Apr-2010.
[CrossRef](#)
- TON H. SNELDER, NICOLAS LAMOUREUX. (2010) Co-variation of fish assemblages, flow regimes and other habitat factors in French rivers. *Freshwater Biology* 55:4, 881-892
Online publication date: 1-Apr-2010.
[CrossRef](#)
- Yvonne Pflüger, Allan Rackham, Scott Larned. (2010) The aesthetic value of river flows: An assessment of flow preferences for large and small rivers. *Landscape and Urban Planning* 95:1-2, 68-78
Online publication date: 30-Mar-2010.
[CrossRef](#)
- Max Nielsen-Pincus, Caren S. Goldberg, Amy Pocewicz, Jo Ellen Force, Lisette P. Waits, Penelope Morgan, Lee Vierling. (2010) Predicted effects of residential development on a northern Idaho landscape under alternative growth management and land protection policies. *Landscape and Urban Planning* 94:3-4, 255-263
Online publication date: 15-Mar-2010.
[CrossRef](#)
- LLUIS BENEJAM, PAUL L. ANGERMEIER, ANTONI MUNNÉ, EMILI GARCÍA-BERTHO. (2010) Assessing effects of water abstraction on fish assemblages in Mediterranean streams. *Freshwater Biology* 55:3, 628-642
Online publication date: 1-Mar-2010.
[CrossRef](#)
- Alan D. Steinman, Pamela Silver, Stuart Fisher, Judy L. Meyer. (2010) The J-NABS 25th anniversary issue: reflecting on the past, synthesizing the present, and projecting into the future. *Journal of the North American Benthological Society* 29:1, 372-380
Online publication date: 1-Mar-2010.
[CrossRef](#)

- A. J. KING, K. A. WARD, P. O'CONNOR, D. GREEN, Z. TONKIN, J. MAHONEY. (2010) Adaptive management of an environmental watering event to enhance native fish spawning and recruitment. *Freshwater Biology* 55:1, 17-31
Online publication date: 1-Jan-2010.
[CrossRef](#)
- N. LEROY POFF, BRIAN D. RICHTER, ANGELA H. ARTHINGTON, STUART E. BUNN, ROBERT J. NAIMAN, ELOISE KENDY, MIKE ACREMAN, COLIN APSE, BRIAN P. BLEDSOE, MARY C. FREEMAN, JAMES HENRIKSEN, ROBERT B. JACOBSON, JONATHAN G. KENNEN, DAVID M. MERRITT, JAY H. O'KEEFE, JULIAN D. OLDEN, KEVIN ROGERS, REBECCA E. THARME, ANDREW WARNER. (2010) The ecological limits of hydrologic alteration (ELOHA): a new framework for developing regional environmental flow standards. *Freshwater Biology* 55:1, 147-170
Online publication date: 1-Jan-2010.
[CrossRef](#)
- Laurel Reichold, Emily M. Zechman, E. Downey Brill, Hillary Holmes. (2010) Simulation-Optimization Framework to Support Sustainable Watershed Development by Mimicking the Predevelopment Flow Regime. *Journal of Water Resources Planning and Management* 136:3, 366
Online publication date: 1-Jan-2010.
[CrossRef](#)
- THEODORE E. GRANTHAM, ADINA M. MERENLENDER, VINCENT H. RESH. (2010) Climatic influences and anthropogenic stressors: an integrated framework for streamflow management in Mediterranean-climate California, U.S.A.. *Freshwater Biology* 55, 188-204
Online publication date: 1-Jan-2010.
[CrossRef](#)
- ANGELA H. ARTHINGTON, ROBERT J. NAIMAN, MICHAEL E. McCLAIN, CHRISTER NILSSON. (2010) Preserving the biodiversity and ecological services of rivers: new challenges and research opportunities. *Freshwater Biology* 55:1, 1-16
Online publication date: 1-Jan-2010.
[CrossRef](#)
- P. Castro-Díez, N. González-Muñoz, A. Alonso, A. Gallardo, L. Poorter. (2009) Effects of exotic invasive trees on nitrogen cycling: a case study in Central Spain. *Biological Invasions* 11:8, 1973-1986
Online publication date: 1-Oct-2009.
[CrossRef](#)
- RUSSELL G. DEATH, ZOË S. DEWSON, ALEXANDER B. W. JAMES. (2009) Is structure or function a better measure of the effects of water abstraction on ecosystem integrity?. *Freshwater Biology* 54:10, 2037-2050
Online publication date: 1-Oct-2009.
[CrossRef](#)
- Brett A. Bryan, John Kandulu, Daniel A. Deere, Monique White, Jacqueline Frizenschaf, Neville D. Crossman. (2009) Adaptive management for mitigating Cryptosporidium risk in source water: A case study in an agricultural catchment in South Australia. *Journal of Environmental Management* 90:10, 3122-3134
Online publication date: 1-Jul-2009.
[CrossRef](#)
- Ton H Snelder, Nicolas Lamouroux, John R Leathwick, Hervé Pella, Eric Sauquet, Ude Shankar. (2009) Predictive mapping of the natural flow regimes of France. *Journal of Hydrology* 373:1-2, 57-67
Online publication date: 30-Jun-2009.
[CrossRef](#)
- David R. Steward, Trevor S. Ahring. (2009) An analytic solution for groundwater uptake by phreatophytes spanning spatial scales from plant to field to regional. *Journal of Engineering Mathematics* 64:2, 85-103
Online publication date: 1-Jun-2009.
[CrossRef](#)
- Matthew J. Deitch, G. Mathias Kondolf, Adina M. Merenlender. (2009) Surface water balance to evaluate the hydrological impacts of small instream diversions and application to the Russian River basin, California, USA. *Aquatic Conservation: Marine and Freshwater Ecosystems* 19:3, 274-284
Online publication date: 1-May-2009.
[CrossRef](#)
- Ines Winz, Gary Brierley, Sam Trowsdale. (2009) The Use of System Dynamics Simulation in Water Resources Management. *Water Resources Management* 23:7, 1301-1323
Online publication date: 1-May-2009.
[CrossRef](#)
- Colin Schenk, Bastien Roquier, Marc Soutter, André Mermoud. (2009) A System Model for Water Management. *Environmental Management* 43:3, 458-469
Online publication date: 1-Mar-2009.
[CrossRef](#)
- Pim Vugteveen, H. J. R. Lenders. (2009) The duality of integrated water management: science, policy or both?. *Journal of Integrative Environmental Sciences* 6:1, 51-67
Online publication date: 1-Mar-2009.
[CrossRef](#)
- Bruce C. Chessman, Meredith J. Royal, Monika Muschal. (2009) The challenge of monitoring impacts of water abstraction on macroinvertebrate assemblages in unregulated streams. *River Research and Applications* n/a-n/a
Online publication date: 1-Jan-2009.
[CrossRef](#)
- Jonathan G. Kennen, Karen Riva-Murray, Karen M. Beaulieu. (2009) Determining hydrologic factors that influence stream macroinvertebrate assemblages in the northeastern US. *Ecohydrology* n/a-n/a
Online publication date: 1-Jan-2009.
[CrossRef](#)
- Philippe Baran. (2008) Le débit élément clé de la vie des cours d'eau : bilan des altérations et des possibilités de restauration.. *La Houille Blanche*:6, 26-33
Online publication date: 1-Dec-2008.
[CrossRef](#)
- Mitchell A. Pavao-Zuckerman. (2008) The Nature of Urban Soils and Their Role in Ecological Restoration in Cities. *Restoration Ecology* 16:4, 642-649
Online publication date: 1-Dec-2008.
[CrossRef](#)
- G. Mathias Kondolf, Paul L. Angermeier, Kenneth Cummins, Thomas Dunne, Michael Healey, Wim Kimmerer, Peter B. Moyle, Dennis Murphy, Duncan Patten, Steve Railsback, Denise J. Reed, Robert Spies, Robert Twiss. (2008) Projecting Cumulative Benefits of Multiple River Restoration Projects: An Example from the Sacramento-San Joaquin River System in California. *Environmental Management* 42:6, 933-945
Online publication date: 1-Dec-2008.

[CrossRef](#)

C. ORDOYNE, M. FRIEDL. (2008) Using MODIS data to characterize seasonal inundation patterns in the Florida Everglades. *Remote Sensing of Environment* **112**:11, 4107-4119
Online publication date: 15-Nov-2008.

[CrossRef](#)

Michael T. Barbour, N. LeRoy Poff, Richard H. Norris, J. David Allan. (2008) Perspective: Communicating our science to influence public policy. *Journal of the North American Benthological Society* **27**:3, 562-569
Online publication date: 1-Sep-2008.

[CrossRef](#)

C. Henriques, I. P. Holman, E. Audsley, K. Pearn. (2008) An interactive multi-scale integrated assessment of future regional water availability for agricultural irrigation in East Anglia and North West England. *Climatic Change* **90**:1-2, 89-111
Online publication date: 1-Sep-2008.

[CrossRef](#)

Pamela L. Nagler, Edward P. Glenn, Osvel Hinojosa-Huerta, Francisco Zamora, Keith Howard. (2008) Riparian vegetation dynamics and evapotranspiration in the riparian corridor in the delta of the Colorado River, Mexico. *Journal of Environmental Management* **88**:4, 864-874
Online publication date: 1-Sep-2008.

[CrossRef](#)

Michael P. Carey, Martha E. Mather. (2008) Tracking change in a human-dominated landscape: developing conservation guidelines using freshwater fish. *Aquatic Conservation: Marine and Freshwater Ecosystems* **18**:6, 877-890
Online publication date: 1-Sep-2008.

[CrossRef](#)

P. A. Harrison, P. M. Berry, C. Henriques, I. P. Holman. (2008) Impacts of socio-economic and climate change scenarios on wetlands: linking water resource and biodiversity meta-models. *Climatic Change* **90**:1-2, 113-139
Online publication date: 1-Sep-2008.

[CrossRef](#)

BRIAN M. DEEGAN, GEORGE G. GANF. (2008) The loss of aquatic and riparian plant communities: Implications for their consumers in a riverine food web. *Austral Ecology* **33**:5, 672-683
Online publication date: 1-Aug-2008.

[CrossRef](#)

Pascal Irz, Julien De Bortoli, François Michonneau, Thomas R. Whittier, Thierry Oberdorff, Christine Argillier. (2008) Controlling for natural variability in assessing the response of fish metrics to human pressures for lakes in north-east USA. *Aquatic Conservation: Marine and Freshwater Ecosystems* **18**:5, 633-646
Online publication date: 1-Jul-2008.

[CrossRef](#)

Debra PC Peters, Peter M Groffman, Knute J Nadelhoffer, Nancy B Grimm, Scott L Collins, William K Michener, Michael A Huston. (2008) Living in an increasingly connected world: a framework for continental-scale environmental science. *Frontiers in Ecology and the Environment* **6**:5, 229-237
Online publication date: 1-Jun-2008.

[Abstract](#) . [Full Text](#) . [PDF \(1056 KB\)](#) . [Supplemental Material](#)

John S. Sanderson, Natasha B. Kotliar, David A. Steingraeber, Claudia Browne. (2008) Simulated natural hydrologic regime of an intermountain playa conservation site. *Wetlands* **28**:2, 363-377
Online publication date: 1-Jun-2008.

[CrossRef](#)

Peter Bridgewater. (2008) A New Context for the Ramsar Convention: Wetlands in a Changing World. *Review of European Community & International Environmental Law* **17**:1, 100-106
Online publication date: 1-Apr-2008.

[CrossRef](#)

Henriette I. Jager, Brennan T. Smith. (2008) Sustainable reservoir operation: can we generate hydropower and preserve ecosystem values?. *River Research and Applications* **24**:3, 340-352
Online publication date: 1-Mar-2008.

[CrossRef](#)

Edward P. Glenn, Kate Hucklebridge, Osvel Hinojosa-Huerta, Pamela L. Nagler, Jennifer Pitt. (2008) Reconciling Environmental and Flood Control Goals on an Arid-Zone River: Case Study of the Limitrophe Region of the Lower Colorado River in the United States and Mexico. *Environmental Management* **41**:3, 322-335
Online publication date: 1-Mar-2008.

[CrossRef](#)

D ROUX, J NEL, P ASHTON, A DEACON, F DEMOOR, D HARDWICK, L HILL, C KLEYNHANS, G MAREE, J MOOLMAN. (2008) Designing protected areas to conserve riverine biodiversity: Lessons from a hypothetical redesign of the Kruger National Park. *Biological Conservation* **141**:1, 100-117
Online publication date: 1-Jan-2008.

[CrossRef](#)

A. B. W. James, Z. S. Dewson, R. G. Death. (2008) The effect of experimental flow reductions on macroinvertebrate drift in natural and streamside channels. *River Research and Applications* **24**:1, 22-35
Online publication date: 1-Jan-2008.

[CrossRef](#)

J. P. Julian, M. W. Doyle, E. H. Stanley. (2008) Empirical modeling of light availability in rivers. *Journal of Geophysical Research* **113**:G3,
Online publication date: 1-Jan-2008.

[CrossRef](#)

Preston McEachern. (2008) Cumulative effects management and the role of predictive models in the new policy for regulating land disturbance in Alberta. *Journal of Environmental Engineering and Science* **7**:S1, 13-22
Online publication date: 1-Jan-2008.

[CrossRef](#)

Jiun-Jiun Ferng. (2007) Human Freshwater Demand for Economic Activity and Ecosystems in Taiwan. *Environmental Management* **40**:6, 913-925
Online publication date: 26-Nov-2007.

[CrossRef](#)

Dale S. Turner, Michael D. List. (2007) Habitat mapping and conservation analysis to identify critical streams for Arizona's native fish. *Aquatic Conservation: Marine and Freshwater Ecosystems* **17**:7, 737-748
Online publication date: 1-Nov-2007.

[CrossRef](#)

Kate A. Brauman, Gretchen C. Daily, T. Ka'eo Duarte, Harold A. Mooney. (2007) The Nature and Value of Ecosystem Services: An

- Overview Highlighting Hydrologic Services. *Annual Review of Environment and Resources* 32:1, 67-98
Online publication date: 1-Nov-2007.
[CrossRef](#)
- Zoë S. Dewson, Alexander B. W. James, Russell G. Death. (2007) A review of the consequences of decreased flow for instream habitat and macroinvertebrates. *Journal of the North American Benthological Society* 26:3, 401-415
Online publication date: 1-Sep-2007.
[CrossRef](#)
- Jiun-Jiun Ferng. (2007) Biophysical assessments in evaluating industrial development: An experience from Taiwan freshwater aquaculture. *Ecological Economics* 63:2-3, 427-434
Online publication date: 1-Aug-2007.
[CrossRef](#)
- Bridget R. Scanlon, Ian Jolly, Marios Sophocleous, Lu Zhang. (2007) Global impacts of conversions from natural to agricultural ecosystems on water resources: Quantity versus quality. *Water Resources Research* 43:3, n/a-n/a
Online publication date: 1-Mar-2007.
[CrossRef](#)
- Achim Paetzold, Chihiro Yoshimura, Klement Tockner. (2007) Riparian arthropod responses to flow regulation and river channelization : Riparian arthropod responses to river regulation. *Journal of Applied Ecology* 45:3, 894
[CrossRef](#)
- Andrea Bradford, Rabeya Noor, Hugh Whiteley. (2007) Ecological Flow Assessment for Hanlon Creek, Ontario: Use of Synthesized Flows with Range of Variability Approach. *Canadian Water Resources Journal* 32:2, 111-128
Online publication date: 1-Jan-2007.
[CrossRef](#)
- Jenq-Tzong Shiau, Fu-Chun Wu. (2006) COMPROMISE PROGRAMMING METHODOLOGY FOR DETERMINING INSTREAM FLOW UNDER MULTIOBJECTIVE WATER ALLOCATION CRITERIA1. *JAWRA Journal of the American Water Resources Association* 42:5, 1179-1191
Online publication date: 1-Oct-2006.
[CrossRef](#)
- N POFF, B BLEDSOE, C CUHACIYAN. (2006) Hydrologic variation with land use across the contiguous United States: Geomorphic and ecological consequences for stream ecosystems. *Geomorphology* 79:3-4, 264-285
Online publication date: 30-Sep-2006.
[CrossRef](#)
- Angela H. Arthington, Stuart E. Bunn, N. LeRoy Poff, Robert J. Naiman. (2006) THE CHALLENGE OF PROVIDING ENVIRONMENTAL FLOW RULES TO SUSTAIN RIVER ECOSYSTEMS. *Ecological Applications* 16:4, 1311-1318
Online publication date: 1-Aug-2006.
[Abstract](#) . [Full Text](#) . [PDF \(316 KB\)](#)
- I. P. Holman. (2006) Climate change impacts on groundwater recharge- uncertainty, shortcomings, and the way forward?. *Hydrogeology Journal* 14:5, 637-647
Online publication date: 1-Jun-2006.
[CrossRef](#)
- Stephen C. Sanborn, Brian P. Bledsoe. (2006) Predicting streamflow regime metrics for ungauged streams in Colorado, Washington, and Oregon. *Journal of Hydrology* 325:1-4, 241-261
Online publication date: 1-Jun-2006.
[CrossRef](#)
- G. Darrel Jenerette, Larissa Larsen. (2006) A global perspective on changing sustainable urban water supplies. *Global and Planetary Change* 50:3-4, 202-211
Online publication date: 1-Apr-2006.
[CrossRef](#)
- D GAWLIK. (2006) The role of wildlife science in wetland ecosystem restoration: Lessons from the Everglades. *Ecological Engineering* 26:1, 70-83
Online publication date: 1-Jan-2006.
[CrossRef](#)
- Virginia Dale, Steve Archer, Michael Chang, Dennis Ojima. (2005) ECOLOGICAL IMPACTS AND MITIGATION STRATEGIES FOR RURAL LAND MANAGEMENT. *Ecological Applications* 15:6, 1879-1892
Online publication date: 1-Dec-2005.
[Abstract](#) . [Full Text](#) . [PDF \(268 KB\)](#)
- Ellen Wohl, Paul L. Angermeier, Brian Bledsoe, G. Mathias Kondolf, Larry MacDonnell, David M. Merritt, Margaret A. Palmer, N. LeRoy Poff, David Tarboton. (2005) River restoration. *Water Resources Research* 41:10, n/a-n/a
Online publication date: 1-Oct-2005.
[CrossRef](#)
- Brooke Hassett, Margaret Palmer, Emily Bernhardt, Sean Smith, Jamie Carr, David Hart. (2005) Restoring watersheds project by project: trends in Chesapeake Bay tributary restoration. *Frontiers in Ecology and the Environment* 3:5, 259-267
Online publication date: 1-Jun-2005.
[Abstract](#) . [Full Text](#) . [PDF \(1125 KB\)](#) . [Supplemental Material](#)
- Ruth Mathews. (2005) A Six-Step Framework for Ecologically Sustainable Water Management. *Journal of Contemporary Water Research & Education* 131:1, 60-65
Online publication date: 1-Jun-2005.
[CrossRef](#)
- PAUL S. GILLER. (2005) River restoration: seeking ecological standards. Editor's introduction. *Journal of Applied Ecology* 42:2, 201-207
Online publication date: 1-Apr-2005.
[CrossRef](#)
- M.A. PALMER, E.S. BERNHARDT, J. D. ALLAN, P.S. LAKE, G. ALEXANDER, S. BROOKS, J. CARR, S. CLAYTON, C. N. DAHM, J. FOLLSTAD SHAH, D. L. GALAT, S. G. LOSS, P. GOODWIN, D.D. HART, B. HASSETT, R. JENKINSON, G.M. KONDOLF, R. LAVE, J.L. MEYER, T.K. O'DONNELL, L. PAGANO, E. SUDDUTH. (2005) Standards for ecologically successful river restoration. *Journal of Applied Ecology* 42:2, 208-217
Online publication date: 1-Apr-2005.
[CrossRef](#)
- Jorge Ortiz-Zayas, Frederick Scatena. (2004) Integrated water resources management in the Luquillo mountains, Puerto Rico: an evolving process. *International Journal of Water Resources Development* 20:3, 387-398
Online publication date: 1-Sep-2004.
[CrossRef](#)
- Faith R. Kearns, Maggi Kelly, Karin A. Tuxen. (2003) Everything happens somewhere: using webGIS as a tool for sustainable natural resource management. *Frontiers in Ecology and the Environment* 1:10, 541-548

Online publication date: 1-Dec-2003.

[Abstract](#) . [Full Text](#) . [PDF \(511 KB\)](#)

N LeRoy Poff, J David Allan, Margaret A. Palmer, David D. Hart, Brian D. Richter, Angela H. Arthington, Kevin H. Rogers, Judy L. Meyer, Jack A. Stanford. (2003) River flows and water wars: emerging science for environmental decision making. *Frontiers in Ecology and the Environment* 1:6, 298-306

Online publication date: 1-Aug-2003.

[Abstract](#) . [Full Text](#) . [PDF \(567 KB\)](#)

S. J. Ormerod. (2003) Current issues with fish and fisheries: editor's overview and introduction. *Journal of Applied Ecology* 40:2, 204-213

Online publication date: 1-Apr-2003.

[CrossRef](#)

Brian D. Richter, Ruth Mathews, David L. Harrison, Robert Wigington. (2003) ECOLOGICALLY SUSTAINABLE WATER MANAGEMENT: MANAGING RIVER FLOWS FOR ECOLOGICAL INTEGRITY. *Ecological Applications* 13:1, 206-224

Online publication date: 1-Feb-2003.

[Abstract](#) . [Full Text](#) . [PDF \(361 KB\)](#)

BARRY R. NOON. (2003) The Integrity of US Ecosystems. *BioScience* 53:7, 674

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