

# River Conservation Challenges and Opportunities

Edited by

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**RAMON J. BATALLA** is a fluvial geomorphologist at the University of Lleida, Spain. His research develops in the fields of monitoring and modelling fluvial processes, especially sediment transport; human interference on catchment and fluvial processes, especially in Mediterranean areas; sediment management in regulated rivers, fluvial hydrology, river restoration and eco-geomorphology. He participates and leads competitive projects and research contracts at a national and international level with the focus in the analysis of river dynamics and associated bio-physical processes. He leads the Fluvial Dynamics Research Group–RIUS ([www.fluvialdynamics.com](http://www.fluvialdynamics.com)).

**NÚRIA BONADA** is an interim associate professor at the University of Barcelona, Catalonia, Spain, and member of the Freshwater Ecology and Management (FEM) research group. Her research interests mainly focus on the ecology and conservation of freshwater ecosystems. In particular, she has been working on large-scale spatial patterns of aquatic macroinvertebrates and their response to past, present and future disturbances, combining community and population approaches.

**ANDREW BOULTON** is adjunct professor in Ecosystem Management at the University of New England, New South Wales, Australia. His research interests range from the ecology of intermittent streams and dryland rivers through to ground-

water ecology and the ecohydrological processes occurring where rivers and groundwaters exchange within the stream bed. He has been involved in several large projects assessing the ecological benefits of environmental water allocations and the installation of engineered log jams to promote surface-groundwater exchange in rivers. He is passionate about the importance of good scientific communication as a means of helping water managers access the best available science to guide wise decisions in river conservation.

**TIM BURT** is master of Hatfield College and professor of Geography at Durham University, United Kingdom. His main research interests are in process studies in hillslope hydrology, water quality (in particular, long-term variation in nutrient fluxes) and climate change during the period of instrumental records. He was appointed fellow of the American Geophysical Union in 2012.

**LINDSAY CORREA** is an environmental scientist with the Delta Science Program at the Delta Stewardship Council (a State of California Agency) in Sacramento, California, USA. Her work focuses on the integration of science, policy and management in the California Delta. She is specifically interested in interdisciplinary approaches to organizing, synthesizing and communicating science to inform policy, planning and management decision-making.

**CLIFF DAHM** is professor of Biology at the University of New Mexico in Albuquerque, New Mexico, USA. His research interests are ecosystems studies, surface water and ground water interactions, stream and river restoration, biogeochemistry, and the interface between science and policy. He is particularly interested in the application of good science and useful metrics in assessing stream and river restoration efforts and in effectively communicating science to managers, decision makers, planners, and politicians.

**SYLVAIN DOLÉDEC** is professor of Ecology at the University Lyon 1, France. His research interest focuses on studying the role of environmental filters on the biodiversity of stream communities. He has contributed to the development of methodologies for analysing the structural and functional responses of stream invertebrate communities (in terms of multiple biological traits) to the variability of the physical habitat and to the intensity of land use. He currently contributes to the development of the so-called multiple trait-based approaches to address the potential consequences of climate change, the effect of restoring base-flow, and the combined effects of multiple human pressures on stream communities and ecosystems.

**DAVID DUDGEON** is chair professor of Ecology and Biodiversity and associate dean (research) of the Faculty of Science at the University of Hong Kong. There he

has spent 30 years researching and writing about the streams and rivers of monsoonal East Asia, and the invertebrates and vertebrates that live in and around them, on topics ranging from food-web dynamics to conservation of freshwater biodiversity. Dudgeon is a member of committees tasked with addressing freshwater issues under the auspices of the international biodiversity organization Diversitas, and the Global Water System Project; he also sits on the editorial boards of several international journals.

**ARTURO ELOSEGI** is professor of Ecology at the University of the Basque Country, Spain. His research field focuses on river ecosystem functioning, including nutrient retention, storage and breakdown of organic matter, and whole stream metabolism. He is especially interested in the effects of human activities such as forestry and agriculture on river health, and in the interplay between hydromorphology and ecosystem functioning. He has participated in several restoration projects and collaborates actively with planners, policy makers and managers.

**PETER ESSELMAN** is assistant professor of Zoology at Michigan State University in East Lansing, MI, USA. His research focuses on understanding how natural and anthropogenic landscape factors influence fishes and aquatic ecosystems, and how this knowledge can be used to inform resource management. His work spans geographic scales, from global to single watersheds, in the neotropics and North America. Specific areas of interest include multi-scale determinants of fish community patterns, application of statistical models to spatial decision support, and spatial optimization of management activities.

**KURT FAUSCH** is professor of Ecology at Colorado State University in Fort Collins, Colorado, USA. His research with colleagues focuses on connectivity and other critical habitat features for stream fish, the effects of invasive salmonids at individual to ecosystem scales, the role of fluxes of invertebrates that link streams and their riparian zones, and effects of climate change on stream salmonids. He has conducted basic and applied research on streams, primarily in western North America and Japan, and collaborates actively with managers and policy makers to advance conservation of stream and river ecosystems.

**DEB FINN** has been based in the Willamette River basin since starting a short research postdoc appointment at Oregon State University in early 2006. She is an educator and researcher in stream ecology, with an emphasis on mountain headwater streams, climate change impacts in vulnerable aquatic systems, and combined approaches for understanding connectivity in and among river networks. She has taught students at Oregon State and Colorado State Universities, the University of Birmingham (UK), and Linn-Benton Community College

(Oregon, USA), and she is a member of the board of directors of *Freshwaters Illustrated* ([freshwatersillustrated.org](http://freshwatersillustrated.org)).

**EMILI GARCIA-BERTHOU** is professor of Ecology at the University of Girona, Spain. His research focuses on the ecology of freshwater fish with emphasis on invasive species. He is mainly interested in understanding the ecological consequences of human impacts such as the introduction of alien species, water abstraction, and habitat degradation in inland waters, including streams, lakes, and coastal habitats.

**ANTONI GINEBREDÀ** is research professor at the Institute of Environmental Assessment and Water Research, Spanish Council of Scientific Research (IDAEA-CSIC) in Barcelona, Spain. His research interests are focused on all quality aspects of the water cycle, including the relationships between chemistry and ecology, ecotoxicology, wastewater treatment, pollutants' fate and dynamics and risk assessment.

**PETER GOODWIN** is the DeVlieg presidential professor in Ecohydraulics, and founded the Center for Ecohydraulics Research at the University of Idaho in Boise, Idaho, USA. His particular expertise lies in sedimentation and river management, but he also teaches and researches topics in fluid mechanics, hydrology and aquatic ecosystem restoration. He currently serves as the lead scientist for the Delta Science Program in Sacramento, California.

**NANCY B. GRIMM** is a professor of Ecology and a senior sustainability scientist at Arizona State University, USA. Her research addresses how human-environment interactions and climate variability influence ecosystem processes and services in both riverine and urban ecosystems. She is the director of the Central Arizona–Phoenix Long-Term Ecological Research program, an interdisciplinary study of the Phoenix urban socioecological ecosystem where her current research focus is how stormwater infrastructure affects hydrologic and biogeochemical dynamics. She also conducts long-term research on hydrological disturbance regimes and ecology of a desert stream ecosystem.

**TAMARA HARMS** is an assistant professor at the University of Alaska Fairbanks. Her research is focused on the intersection of hydrologic flowpaths and spatial heterogeneity in streams, riparian zones, hillslopes, and whole watersheds. She is particularly interested in cycles of carbon, nitrogen, and phosphorus, and has studied desert, urban, boreal, and arctic ecosystems.

**KIM JENKINS** is a senior lecturer in the School of Biological, Earth and Environmental Science at the University of New South Wales, Australia, and a member

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of the Australian Wetlands, Rivers and Landscapes Centre. Her research investigates disturbances to flow-ecology relationships at broad landscape scales. She has identified sensitive indicators for assessing the success or failure of flow restoration in floodplain wetlands. Her focus is on the microscopic end of arid-zone food webs, on the organisms and processes that underpin iconic wetland biota (waterbirds, fish and trees). Kim works closely with government and community stakeholders to develop water management strategies for rivers and wetlands.

**RICHARD KINGSFORD** is professor of Environmental Science and director of the Australian Wetlands, Rivers and Landscapes Centre at the University of the New South Wales, Sydney. His research field focuses on wetland and river ecology, particularly changes in abundance and diversity of waterbirds. He also investigates long-term impacts of water resource development on wetlands, including the building of dams, diversions and floodplain development. He also focuses his work on the measurement and management of environmental flows for wetlands and rivers and in so doing, works with managers to implement adaptive management processes.

**OWEN McDONOUGH** is a research scientist with the Environmental Protection Agency in the USA. His research has focused on the role of agricultural wetland restoration and hydrologic connectivity on downstream carbon and nitrogen dynamics. He is particularly interested in the ecosystem services headwater streams and adjacent wetlands provide to larger river networks and the role of catchment land use on stream health.

**JEREMY MONROE** is visual communicator and filmmaker of aquatic science and conservation. Through the nonprofit organization Freshwaters Illustrated, he works to create films and imagery that share and celebrate the beauty and value of freshwater life and the community of scientists that work to understand and conserve it. He directed *RiverWebs*, a documentary film that shares the nature and science behind stream food webs. Jeremy lives with his wife and two daughters in Corvallis, Oregon within canoe-carting distance to the Willamette River.

**ISABEL MUÑOZ** is professor of Ecology at the University of Barcelona, Spain. Her research has focused on river ecology through the biology of invertebrates. Recent work has been performed on the responses of benthic community to hydrology, organic matter quality and human impacts in Mediterranean rivers. In ecotoxicology, she is working on the effects of emerging contaminants on invertebrates.

**FUTOSHI NAKAMURA** is professor of forest Ecosystem Management at Graduate School of Agriculture, Hokkaido University, Japan. His research interests are forest-stream interaction, dynamics of riparian forests, structure and function of

riparian zone, and disturbance and restoration ecology. He has been involved in planning and evaluating many of river restorations projects in Hokkaido, Northern Island. He is the leader of not only river restoration in Kushiro River as introduced in this book, but also partial removal and improvement of check dams in Shiretoko World Heritage Site.

**JUNJIRO NEGISHI** is associate professor at the Faculty of Environmental Earth Science, Hokkaido University, Japan. His research has focused on the understanding of ecology of benthic organisms in streams, and floodplain lakes, and small drainage channels within rice paddy fields. Most of the findings are to provide practical implications to ecosystem management for balancing the conservation of biodiversity and human exploitations of natural resources.

**MARGARET PALMER** is professor and director of the National Socio-Environmental Synthesis Center of the University of Maryland, based in the USA. Her research interests are on river and stream restoration with a particular focus on urban systems. Much of her work has been on freshwater tributaries of the Chesapeake Bay where efforts to reduce the movement of excess nitrogen and sediments downstream requires novel approaches to restoring streams and upland regions of the watershed.

**MIRA PETROVIC** is ICREA professor at the Catalan Institute for Water Research, Girona, Spain. Her main research interest is in the field of analytical environmental chemistry, specifically chemical analysis of trace organic contaminants, such as pharmaceuticals, endocrine disrupting compounds and surfactants, and the study of their fate and behaviour in the aquatic environment, and during wastewater and drinking water treatment.

**GILLES PINAY** is a director of Research in the National Centre of Scientific Research (CNRS) in France and the Director of the Environmental Observatory of Rennes (OSUR), France. His research interests concern the biogeochemistry of rivers and wetlands but also the role of landscape structure on the fluxes of nutrients in agricultural catchments. He has conducted most of his research in temperate regions of Europe but has also work in more pristine regions of Alaska.

**SERGI SABATER** is professor of Ecology at the University of Girona and senior researcher at the Catalan Institute for Water Research, both based in Girona, Spain. His research interests lie in river structure and functioning, particularly the role that microbial biofilms play in river ecosystems. He has performed most of his research on Mediterranean river systems, and is especially keen to understand how much they are affected by rising water scarcity, pollution, and other human pressures, all of them impacting on water resources and biodiversity.



**FRAN SHELDON** is an associate professor in the Griffith School of Environment, Griffith University, Australia, and a Member of the Australian Rivers Institute. Her research focuses on the impacts of land use change and flow change on river ecosystem health; she is also interested in how extreme flow variability in dryland rivers drives spatial and temporal changes in community dynamics. She has worked extensively with stakeholder groups in Australia to understand the impacts of anthropogenic disturbance in river health and use this information to guide restoration.

**R. JAN STEVENSON** is professor of Zoology at Michigan State University, MI, USA. With a technical expertise in algal taxonomy and ecology, he tests ecological theory and develops approaches for solving environmental problems. He is particularly interested in how ecological systems respond to environmental change. His work with federal and state officials to develop protocols for ecological assessment and water quality criteria stimulates new directions for his research, including relating ecosystem services and condition in coupled human and natural systems to water management policy.

**DAMIÀ VERICAT** is a fluvial geomorphologist with interests in sediment transport, channel morphodynamics and ecohydraulics. He holds undergraduate and doctoral degrees from the University of Lleida, Spain. He possesses a Ramon y Cajal research fellowship at the University of Lleida. Damià's research interests include monitoring and modelling of fluvial dynamics, with special emphasis on sediment transport and associated geomorphic processes (e.g. sedimentary and morphological processes in the river channel). His research extends to remote sensing of fluvial systems, sediment and water management in human-stressed river corridors, and to eco-geomorphology, interactions between physical and ecological processes, their evolution and drivers.

**PETER WIJSMAN** is a program manager for ARCADIS-US in San Francisco, California, and works in water resources management for San Francisco Bay and the Sacramento-San Joaquin Delta. He also is associated with the Water Education Foundation, a non-profit organization that seeks to create a better understanding of water resources and their management worldwide. His experience in Europe and the United States has focused on the effects of climate change on land and water environments, and he also has been involved in ecosystem restoration in the Netherlands, New Orleans and the Mississippi Delta, New York and the Florida Everglades.