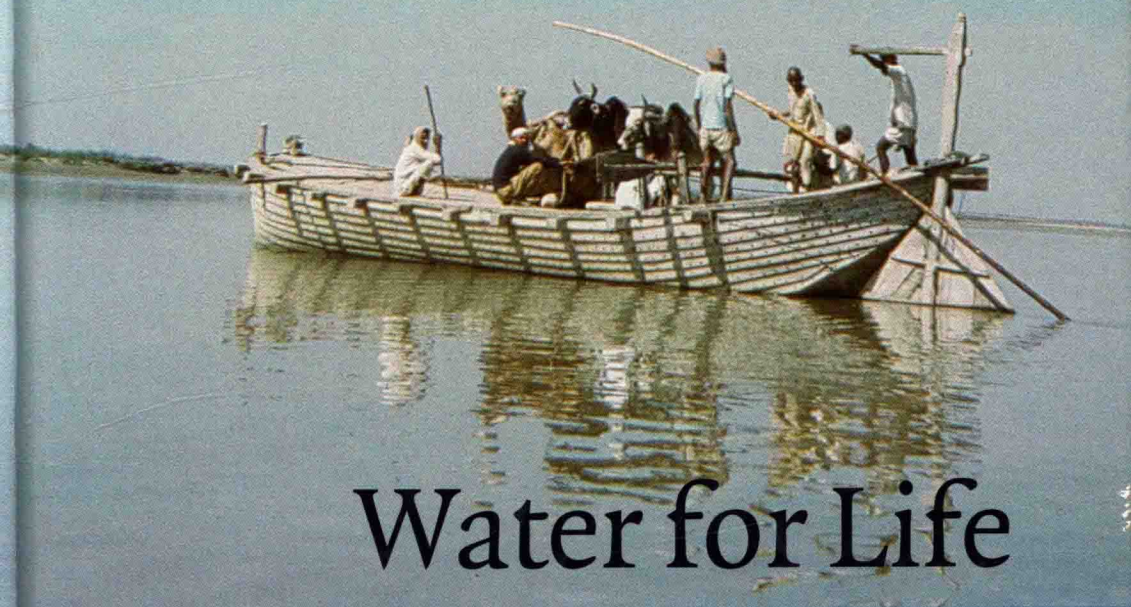


James L. Wescoat, Jr. and Gilbert F. White



Water for Life

Water Management and
Environmental Policy

CAMBRIDGE

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Environmental Policy

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Water for Life

Water Management and Environmental Policy

Successful water management is crucial for the proper operation of natural environmental systems and for the support of human society. These two aspects are interdependent, but decisions about one are often made without regard to effects upon the other. A persistent challenge is to consider them together. This book is the first to explore fully the relationship between water management, environmental conditions, and public policy. It combines a careful review of the character and evolution of water management, and evaluates management from the standpoint of the quality of the natural environment. Topics covered include domestic and industrial water supply and waste disposal, groundwater use, river channel and floodplain management, and integrated river basins. The processes of social decision making are examined against a backdrop of plant-soil-water-ecosystem relationships and ecosystem change. Examples are drawn from around the world, from local watershed management to international river basin planning, with emphasis on integrative approaches.

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Preface

To arrive at truly integrated water management no aspect has been more difficult than the joint evaluation of social and environmental consequences. For example, not until 2000 was there a systematic examination of methods to evaluate the social benefits of flood protection projects along with the social costs of altering the floodplain environment through such management.

This book reflects our attempt to canvass the need and suitable methods for carefully combining the two. It seeks to appraise the range of problems and the available methods of addressing them in the broader context of integrated management. It does not attempt to describe all relevant efforts from around the world but it does seek to evaluate some representative examples of problems and of constructive methods of addressing them.

The idea for this book initially emerged in the mid 1980s after a period of intense conflict between proponents of continued water development and activists for environmental protection. Although considerable progress had occurred in water resource systems modeling and environmental science and policy, they seemed to develop to a significant degree along separate lines. One of the more extreme cases was the parallel development of water laws related to supply and of environmental laws that dealt with water quality: in some countries and states these integrally related topics are administered by different agencies in different ministries and with different bodies of law.

Although inefficient and unnecessary in many ways, conflict between these two fields has in some cases been productive, yielding innovative solutions to complex water and environmental problems. Protracted conflict over dam operations on the Colorado River in the USA, for example, led to an adaptive management program linking scientists, stakeholders, and river managers in a science-based program of

experimentation, monitoring, and management. Conflict between India and Pakistan over the Indus River led to the Indus Waters Treaty, which has endured through more than a half-century of unrelated regional conflicts.

At the same time, collaborative and cooperative processes have also yielded increasing harmonization of water and environmental management. Community-based watershed movements arose in many regions of the world in the late twentieth century, in some cases driven by legal requirements but in other cases driven by educational and place-based movements, designed to experience, understand, and enjoy local resources. Although clearly successful in terms of human cooperation, how long can these local coalitions be sustained? Which ones will make an enduring ecological or cultural difference?

To address these questions, this volume adopts a broad perspective, developed in its first four chapters. It begins by probing in general ways the problem of conflict, gaps, and harmony between water management and environmental policy. The second chapter considers how these phenomena serve jointly as challenges and opportunities, which it compares with the intense international interest at the turn of the present century in envisioning future trends, problems, and solutions. However, whether one considers watershed movements or global change, the third chapter reminds us that some aspects of emerging proposals have been attempted previously. How did gaps between water and environmental management arise in the first place? How did earlier societies address and transform them? When did they do so sustainably, and when not? By retracing the unfolding consciousness of ecosystem effects of water use back to its roots, we arrive at a topic that sets the stage for the rest of the volume – natural waters and the inherent variability of water supplies and water quality in ecological as well as hydrologic terms.

Five chapters address key intersections between water and environmental management, starting with the soil–water–plant relations that support all ecological and agricultural systems. Beginning with soil moisture dynamics and associated processes of irrigation and drainage, the book then digs deeper into ground water resources, described in at least one legal case as “so secret, changeable and uncontrollable” as to lie beyond regulation (*Roath v. Driscoll*, 20 Conn. 533, 541 [1850]) – a frontier for science, management, and policy. As a high water table rises to the surface, from springs to great lakes, Chapter 7 reflects upon wetlands and lakes. This is followed by a chapter on river channels, which encompasses competing and sometimes complementary perspectives on river channel engineering, riparian ecosystems, and floodplain

management. In the late twentieth century few topics were as controversial as large dams with the jointly social and environmental impacts of their reservoirs upstream and altered flows and river ecology downstream. The final chapter in this series turns to domestic and industrial water use, which are sometimes regarded as driving forces of aquatic environmental depletion and degradation. But scholars like Anne Spirn (*The Granite Garden: Urban Nature and Human Design*, 1984), along with scientific serials like *Environment and Urbanization*, *Journal of Industrial Ecology*, *Environment*, and *Water and Environment*, remind us that cities, industries, and societies are inseparable from the ecosystems they inhabit.

The final two chapters of the volume reflect upon how individuals and groups make decisions about water and environmental management. Chapter 11 compares and contrasts the extraordinary wealth of human experience in different regions, cultures, and environments around the world, which is a collective resource for all, but until recently accessible only to a few. However, an appendix to the volume highlights the dramatically increasing access to international water and environmental information through the Internet. As this information is increasing faster than our capacity to identify, synthesize, and use it, the appendix provides a guide to using Internet resources, as well as a list of water websites pertinent to each chapter of the book and region of the world. The final chapter returns to the theme of integrated water and environmental management, envisioned for centuries, and occasionally achieved. That chapter highlights three current and emerging approaches for their challenges and opportunities: community-based watershed management, adaptive management, and global environmental policy.

This volume is the fruit of several years of collaborative discussion and writing, between the authors and colleagues in related fields. It has been a pleasure to write. We are grateful for support from the University of Colorado Distinguished Professor program; to James Robb, Cartographer in the Department of Geography; and to Sugandha Brooks of the Institute of Behavioral Sciences for her patient and careful preparation of the manuscript. Hugh Brazier provided excellent editorial advice, which helped clarify our writing and ideas. We thank our editors at Cambridge University Press – Alan Crowden, Maria Murphy, Claire Nugent and Carol Miller – for their sustained encouragement over the years. Our main hope is that our book contributes to the further harmonization of these two vital fields of water and environmental management for the joint benefit of humans and their fellow creatures and the waters of the planet.

Abbreviations

BCE	Before Common Era (= BC)
CE	Common Era (= AD)
CEQ	United States Council on Environmental Quality
EPA	See USEPA
ESCAP	See UNESCAP
FAO	United Nations Food and Agriculture Organization
GEF	Global Environmental Facility
GEWEX	Global Energy and Water Cycle Experiment
GIS	Geographic Information Systems
GWP	Global Water Partnership
ICID	International Commission on Irrigation and Drainage
ICOLD	International Commission on Large Dams
ICWE	International Conference on Water and the Environment
IDNDR	International Decade of Natural Disaster Reduction
IGBP	International Geosphere–Biosphere Programme
IHA	International Hydropower Association
IIASA	International Institute for Applied Systems Analysis
ILEC	International Lake Environment Committee
ILRI	International Land Reclamation Institute
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature and Natural Resources (also known as IUCN – the World Conservation Union)
IWA	International Water Association
IWMI	International Water Management Institute
LUCC	Land Use and Cover Change
NAS	National Academy of Sciences
NOAA	National Oceanic and Atmospheric Administration

NRC	National Research Council
NRCS	National Resources Conservation Service
PWRPC	President's Water Resources Policy Commission
SCOPE	Scientific Committee on Problems of the Environment
TNC	The Nature Conservancy
UNCED	United Nations Conference on Environment and Development
UNCHS	United Nations Centre for Human Settlements
UNEP	United Nations Environment Program
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNFCCC	United Nations Framework Convention on Climate Change
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USHUD	United States Department of Housing and Urban Development
USSL	United States Salinity Laboratory
WASH	Water and Sanitation for Health
WATMANET	Asian Watershed Management Network
WCD	World Commission on Dams
WCED	World Commission on Environment and Development
WHO	World Health Organization
WMO	World Meteorological Association
WRC	United States Water Resources Council
WWC	World Water Council

Conversions of selected units of hydrologic measurement

Length

1 centimeter (cm) = 0.3997 inch = 0.01 meter

1 kilometer (km) = 1000 meters (m) = 0.62 mile (mi)

1 foot (ft) = 30.48 cm = 0.3333 yard

1 mile = 5280 ft = 1.609 km

Area

1 hectare (ha) = 2.471 acres

1 square kilometer (km²) = 100 ha = 247 acres

1 acre = 0.40469 ha

Volume

1 liter (l) = 1000 cm³ = 0.2642 gallon

1 gallon = 3.785 liters

1 acre foot = 1233.48 m³

For details and other units see Gleick, 2000a, pp. 300–309.

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