



The Ecohydrology of South American Rivers and Wetlands

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Preface

The term ecohydrology was popularized in the early 1990s and quickly adopted by fields of study ranging from plant physiology to aqueous geochemistry. The enthusiastic and widespread use of this term, however, has diluted its meaning and many are left wondering “what is ecohydrology really?” In this book we subscribe to the concept of ecohydrology embodied in the Fifth Phase (1996–2001) of UNESCO’s International Hydrological Programme (IHP). The Ecohydrology Programme stimulated a broad spectrum of creative research integrating the physical processes of hydrology with the biological processes of ecology. Together, these processes serve to regulate environmental conditions within aquatic systems, maintaining energy levels, water quantity and water quality within ranges suitable to the native flora and fauna. While the research objectives of the Ecohydrology Programme centred on understanding fundamental processes, there was also an explicit objective of evaluating how these natural processes could be incorporated into water management programmes. In more developed nations these processes might serve to enhance the highly engineered systems already in place, while in less developed nations these ecohydrological processes might serve as the primary means for managing water quantity and quality through natural attenuation and ecological engineering.

One continent with great potential to capitalize on the natural attenuation effects of ecohydrological processes is South America, the wettest and most ecologically diverse continent on Earth. South America’s annual average precipitation of 1600 mm is more than twice that of any other continent, producing an unrivalled waterscape of giant rivers and wetlands. The continent is also rich in indigenous and colonial cultures. Today more than 300 million people inhabit the continent, distributed among 13 countries originally established as Spanish, Portuguese, French, Dutch, and British colonies. The health and prosperity of South America are closely linked to the abundance and quality of its water resources. According to the World Resources Institute, hydropower accounts for nearly 80% of South America’s electricity supply and natural rainfall is the sole source of water to 92% of the continent’s agricultural lands. South Americans also turn to their large rivers and wetlands for drinking water, food, transportation, recreation, and waste disposal.

South Americans have greatly benefited from the resources derived from their rivers and wetlands, but these aquatic systems have not generally benefited from their association with humans. Dam building, dredging, and canalization are expanding across the continent, eliminating the natural flow regimes of many river reaches and draining wetlands. Much of the riparian vegetation lying along river margins in more developed portions of the continent has been removed, and even in rural areas humans tend to focus their activities at river and wetland margins where soils are often more fertile. The disturbance of riparian zones has changed the rates of material exchanges from land to aquatic systems, generally increasing erosion and contaminant fluxes. Uncontrolled waste discharges have also degraded water quality in many urban rivers and wetlands, and this poor water quality has had strong negative feedbacks on the health of many urban and downstream rural poor.

The content of this book stems mainly from the International Symposium on Hydrology and Geochemistry of Large-Scale River Basins (with special emphasis on the Amazon and other tropical basins), held 15–19 November 1999, in Manaus Brazil. However, each chapter goes beyond the scope of the material presented in the symposium and seeks to provide a broader overview of ecohydrological processes operating in South America's most important aquatic systems. Chapters describe river reaches ranging from pristine to heavily impacted and detail processes operating both in channels, wetlands, and in riparian environments. The continent's three largest rivers, the Amazon, Orinoco, and Paraná, receive the greatest attention, but the condition of important rivers in the States of São Paulo (the Piracicaba River) and Rio de Janeiro (the Paraíba do Sul River) is also evaluated. Together these chapters convey a message of urgent need for action bolstered by the realization that many spectacular ecosystems remain to be preserved and the natural attenuation processes operating in these ecosystems stand to aid South America in achieving its goal for sustainable use of its resources. The authors and I hope that through these insights into our current understanding of the interactions of hydrology, water quality, and biological communities, this book might contribute to better management and conservation of these unique ecosystems and resources.

We owe a great deal of thanks to the many individuals who reviewed drafts of the chapters and the agencies and foundations that funded the individual research efforts; they are acknowledged in the chapters. Maciej Zalewski chaired the Scientific Steering Committee of the IHP Ecohydrology Programme and provided much appreciated encouragement at the beginning of this project. This book was made possible through the generous financial support of UNESCO's Regional Bureau for Science in Europe, and the individual efforts of Philippe Pypaert. The symposium on which several of the chapters were based was organized by the HiBAm (Hydrology and Geochemistry of the Amazon Basin) Project, under the leadership of Jean-Loup Guyot. Invaluable assistance was provided by Penny Kisby and Madelyn Mateo in preparing the manuscript.

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