

Ten years since the Millennium Ecosystem Assessments: a Global Perspective on Water Ecosystems Services

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Fresh water is vital for the function of all terrestrial ecosystems – the flora and the fauna that make up those ecosystems and, of course, for humans. Humanity relies on water not just for drinking, but also for food production, dealing with waste, providing energy and transport, to name but a few. To meet its needs humanity harnesses water through dams, irrigation networks and pumps and pipes that supply drinking water and remove wastes. It is estimated that humanity consumes between 1000-1700 m³ of the globe's surface and groundwater resources per year; that is between 22% and 150% of the annual global supply of fresh water (Hoekstra & Wiedmann 2014). This proportion is likely to increase as the global human population increases in the next thirty years and the demands for water in developing countries catches up with that of developed countries. According to the Intergovernmental Panel on Climate Change, changes in climate will amplify existing stress on water availability and will exacerbate different forms of water pollution, with impacts on ecosystems, human health and water system reliability in large parts of the world (Stocker et al. 2013).

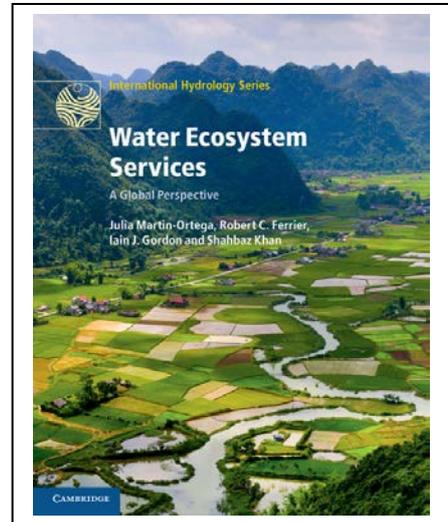
For a number of years, academics have tried to understand the linkages between the water system and human needs and the impacts that anthropogenic activities have on the water system itself. In the early days, the scientific approach sat within individual domains (e.g. hydrology for the water cycle (Thompson 1999); ecology for ecological impacts of water pollution (Abel 1996)). Given the complexity of the interactions and the centrality of humans in the water environment, more recently interdisciplinary approaches have come to the fore (e.g. Ferrier and Jenkins (2010); Renaud & Kuenzer (2014)). The latest of such approaches is what we define in this book as ecosystem services-based approaches. These encompass a range of ways of understanding, assessing and managing ecosystems at which core is the notion of ecosystem services, understood as the benefits that humans obtain from ecosystems.

The water cycle intimately embraces the ecosystems services paradigm. From regulating to provisioning and cultural services, the water environment provides a unique context through which to express the state of natural capital and flows between different ecosystems and the effects they produce on human wellbeing. Much has been written about ecosystem services and approaches using this notion are now being applied to the practical management of ecosystems around the world. Given that ten years have passed since the publication of the Millennium Ecosystem Assessment (2005) it is time to reflect on what has been achieved, what lessons can be learnt and how we can improve the application of ecosystem services-based approaches for managing water ecosystems in the future.

This Special Session aims to develop a better understanding of water as a service delivered by ecosystems, by furthering the understanding and the potential of ecosystem services-based approaches. This understanding is necessary not only to identify and quantify the

critical linkages that regulate the interrelationships of hydrology and biota, but also to elucidate how the control of these linkages contributes to environmental sustainability, human livelihoods and wellbeing.

This Special Session has been designed to mirror a recent publication entitled *Water Ecosystem Services: A Global Perspective*, published by Cambridge University Press as part of UNESCO's International Hydrology Series. In this publication, leading academic and non-academic authors, from prestigious research institutions, world global organizations and international non-government organizations, describe the forefront of the application ecosystem services-based approaches to address global water challenges. Recognising that the challenge is multi-faceted the authors come from a range of disciplinary backgrounds (from hydrological modelling, to environmental economics, through environmental psychology, international law and ecological sciences) and 'real world' experiences in conservation, water management and business. The result is a balance between global and world-regional visions and national and regional case studies from across the world.



After an introduction by Prof. Bob Ferrier, the opening presentation of the Special Session, entitled *What defines ecosystem services based approaches?* (Martin-Ortega, J., Glenk, K., Jorda-Capdevila, D. & Holstead, K.), provides an in-depth history of the notion of ecosystem services and proposes a definition of ecosystem services-based approaches based on four defining core elements (i.e. a) focusing on the status of ecosystems, and the recognition of its effects on human well-being; b) understanding the bio-physical underpinning of ecosystems in terms of service delivery; c) integrating natural and social sciences and other strands of knowledge for a comprehensive understanding of the service delivery process and d) assessing the services provided by ecosystems for its incorporation into decision-making). These core elements articulate discussions on a range of broad issues on each of the individual chapters of the book, which are organized in four parts:

- Part I looks at how ecosystem services-based approaches can help address major global challenges, such as climate change, food and energy supply and biodiversity loss at regional and global scales. This part will be represented in the Special Session by a presentation on *Assessing climate change risks and prioritising adaptation options using a water ecosystem services-based approach*, by Dr. Samantha Capon, Griffith University.

- Part II reflects upon whether the notion of ecosystem services is useful in the context of frameworks for water resources management and nature conservation, with a focus on the practicalities of the implementation of the approach. This part will be represented in the Special Session by a presentation on the *Implementation of the European Water Framework Directive: what does taking an ecosystem services-based approach add?* – by Dr. Kirsty Blackstock from The James Hutton Institute; complemented by a presentation on *The use of ecosystem services information to inform river basin planning* – by Dr. Rebecca Badger, from the Scottish Environment Protection Agency.
- Part III provides examples of assessments of ecosystem services through a number of case studies from across the world showing the latest advances in the integration of the biophysical quantification of ecosystem service delivery with economic valuation techniques. This part will be represented in the Special Session by a presentation on *Policy support systems for the development of benefit-sharing mechanisms for water-related ecosystem services* – by Dr. Mark Mulligan, Kings College London.
- Part IV broadens the perspective, providing innovative insights from less explored areas such as business, cultural ecosystem services, human rights, beliefs and emotions towards water ecosystem services and the role of community partnerships. This part will be represented in the Special Session by the presentations *Ecosystem services-based approaches to water management: what opportunities and challenges for business?* – by Dr. Joel Houdet, African Center for Technical Studies (ACTS) and *The interface between human rights and ecosystem services* – by Dr. Stephen Turner, Lincoln University

As witnessed by the pollution of waterways, the depletion of aquifers and the degradation of wetlands, the pressures on the planet's water resources are already significant. With growing human populations, aspirations of increased economic growth and climate change these pressures are likely to increase for the foreseeable future. If water based ecosystems are to continue to provide the services that support human life and spiritual and material well-being to the current and future generations, society will have to start taking seriously the values (in their different dimensions) of ecosystems. This Special Session is aimed at enabling a discussion on the current thinking and applications of ecosystem services-based approaches to inform future water decision-making in this context. Attendees to this Special Session are invited to participate in this discussion with contributions (via twitter and traditional means) to a concluding round table facilitated by Prof. Iain Gordon.

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