

Management of Wetlands

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This special issue comprises articles reporting research into wetlands. The common feature of this research is that it directed towards bridging the gap between science and policy. Research has been conducted explicitly to provide information which decision-makers can use for managing wetlands.

The term 'wetlands' attempts to generalise the interface between water and land. It is an umbrella term, encompassing the very large range of terms used to describe such systems. Wetlands have been receiving considerable public and policy attention in recent years. It is now widely recognised that they provide many important goods and services to human societies. Examples include drinking water, flood mitigation, water quality control, fish, and recreational and residential opportunities. Wetlands also support various endangered, charismatic and migratory species. Increased interest in wetlands stems from recognition that human activities are compromising the ability of wetlands to deliver these goods and services. The greatest sources of stress on wetlands include: changes in land use with habitat loss and fragmentation; resource extraction; drainage and reclamation, and pollution. Various international agreements exist to protect wetlands and their dependent species, but despite this, many wetlands over the world are under threat. Turner et al. (2000) identify four main reasons for this: (1) market failures due to the public good nature of wetlands; (2) externalities caused by economic activities such as agriculture, industry, and water abstraction; (3) lack of understanding of the many values associated with wetlands due to the complexity and 'invisibility' of spatial relationships among groundwater, surface water and wetland species; and (4)

frequent failure of policy intervention and land use planning due to inconsistent treatment of wetlands by economic, agriculture, environmental and nature protection policies.

Wetland goods and services, and their future, is of prime concern to the Netherlands, which explains a bias in the research reported here. Much of the Netherlands is wetland, lying at the interface between land and water. Expected climate change will only exacerbate the struggle of this nation to secure its population and associated activities from high water levels.

What are the key issues regarding wetland management at the moment? This special issue attempts to elaborate on a number of these issues, as well as taking on board the different perspectives of different disciplines. Disciplines represented in this special issue include management science, policy science, economics, hydrology, and ecology. Most articles draw on more than one of these.

The articles may be grouped into three categories: the science-policy interface; scientific research and management; and policy and stakeholders.

Two articles address the science-policy interface. The article by Goosen and Vellinga focuses on issues encountered in the Netherlands. An analysis of recent water management projects reveals constraints regarding: (1) national versus local goals; (2) limited sense of urgency among members of the public; (3) lack of coordination in the water management community; (4) unclear views about nature conservation; and (5) limited understanding of wetlands in relation to flood risk management. The authors propose platforms for collaborative planning as a way of improving stakeholder participation in early stages of decision-making. Negotiation and mediation support tools can enable stakeholders and mediators to formulate more purposely the problems that need to be addressed. The articles by Van der Werff and Lindahl and Söderqvist, also in this special issue, elaborate further on stakeholder participation.

The article by Turner et al. explores four interrelated management problems—eutrophication of shallow lakes, sea level rise, flooding risks and tourism—in various wetland management options in the Norfolk and Suffolk Broads in the United Kingdom. They use the Driving Forces Pressure State Impact Response (DPSIR) framework to analyse the problem from an interdisciplinary ecological-economic perspective. Balancing various

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wetland functions and resolving conflicts between stakeholder groups are an important challenge for wetland managers. Scientific aspects, particularly the mixture quantitative and qualitative approaches, add further complications. Research found support for both the individual-based, willingness-to-pay approach and a participatory social-deliberation approach. With this combination of approaches, actual and potential resource-use conflicts were identified.

Three articles demonstrate how science (particularly natural science) can contribute to wetland management. A range of management issues is addressed: methane production in rice paddies and its contribution to the emission of greenhouse gases (Bodgeom et al.); wetland restoration in dunes (Bodgeom et al.) and river flood plains (Gilbert et al.) in the Netherlands; sustainable freshwater use on Mallorca, Spain (Veraart et al.).

The article by Bodegom et al. is directed towards identifying knowledge gaps crucial to our understanding of how the environment in general (comprising both social and natural elements) and wetland processes in particular interact. Two methods are emphasised, scaling and uncertainty analysis, and are tested on two cases. Key research issues for both cases were shown to be scale-dependent. Spatial and temporal variability, as well as data constraints, were shown to be the main sources of uncertainty, particularly at larger scales.

The article by Veraart et al. is directed towards the development of state indicators that provide information on the sustainability (or otherwise) of freshwater use on Mallorca. This article shows that it was not tourist development but agricultural intensification which has brought about unsustainable water use, and that the main adverse impact of this unsustainable use is saline intrusion. Bio-indicators, primarily plant species, can be identified to illustrate the extent of these impacts.

The article by Gilbert et al. is directed towards supporting decisions for regional development of the Vecht River floodplain. It combines information on the regional economy with hydrological and ecological information to develop an evaluation framework for testing alternative development paths. These alternative paths consider agricultural intensification, restoration of wetlands by converting agricultural land to nature, and investment in recreation. Evaluation procedures which maintain spatial

detail provide additional insights into development options.

Two articles analyse patterns of interaction between policy makers and local stakeholders in the management of wetlands.

The article by Lindahl and Söderqvist describes decision-making and implementation of a catchment-based environmental program in southern Sweden. Through a mix of methods, including stakeholder analysis, they researched the participatory policy approach that successfully established sound nutrient transportation, and water and nature preservation of wetlands and riparian zones. For these purposes, interactions were generated between regional authorities, municipalities, a consultancy firm, a local university, and farmers. This network replaced the official, but rather obsolete River Water Protection Association. Additional success factors were full cost coverage for farmers and the building of trust in policy makers among farmers.

The article by Van der Werff studies stakeholder responses to the plan to create the Green River in the Netherlands. This proposed wetland would divert excess water from the River Rhine through the River IJssel into the sea. Interviews and observations found that local stakeholders were well-organised. While willing to consider the advantages and disadvantages of the Green River, they are also able to negotiate skillfully with authorities. Confusion arises as authorities, technical experts, residents and entrepreneurs represent changing mixes of worldviews. Premodernity, modernity and postmodernity are advocated or followed by conflicting or collaborating parties.

This special issue offers a taste of the multidisciplinary research into wetlands that is being undertaken in Europe and by European researchers. As will be seen in the following articles, this research is very diverse.

Reference

- Turner RK, van den Bergh JCJM, Söderqvist T, Barendregt A, van der Straaten J, Maltby E, van Ierland EC (2000) Ecological-economic analysis of wetlands: scientific integration for management and policy. *Ecol Econ* 35:7–23