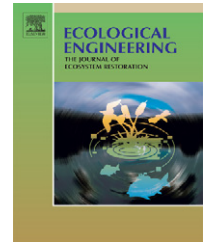


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Editorial

Pollution control by wetlands

ARTICLE INFO

Keywords:

Constructed wetlands
Heavy metals
Nitrogen removal
Organic pollutants
Pharmaceuticals
Phosphorus retention
Wetland modelling
Wetland restoration

ABSTRACT

The 2nd International Symposium on Wetland Pollutant Dynamics and Control (WETPOL 2007), organised by the Department of Geography of the University of Tartu (Estonia) in co-operation with partners from the Estonian University of Life Sciences (Tartu, Estonia), Ghent University (Belgium), and the UNESCO-IHE (Delft, The Netherlands), was held 16–20 September 2007, in Tartu, Estonia. At this meeting, 140 oral presentations (including 9 keynote speeches) and 70 posters by representatives from 38 countries were presented. About half of the presentations considered purification processes in both semi-natural and constructed wetlands. The editorial paper highlights trends in studying the cycling of nitrogen, phosphorus, carbon, heavy metals, and organic pollutants in wetlands, but also in the modelling of pollutant removal and the functioning of plants in the wetland environment. It also describes the WETPOL 2007 meeting, which served as the source of the selected papers, and briefly explains the main aspects of these papers.

1. Introduction

Among the values of wetlands and the ecosystem services they provide (Costanza et al., 1997), water quality improvement and the control of pollutant transport are the most important regulatory functions (Mitsch and Gosselink, 2000, 2007; Blackwell et al., 2002; Zedler and Kercher, 2005; Verhoeven et al., 2006).

People have used wetlands for pollution control for centuries (Mitsch and Jørgensen, 1989, 2004), although the scientifically based use of wetlands for wastewater treatment in constructed wetlands began in the 1950s and 1960s with investigations by Prof. K. Seidel and Prof. R. Kickuth in Germany (Seidel, 1966; Kickuth, 1970, 1984). Constructed treatment wetlands are defined as engineered wetlands that utilize natural processes involving wetland vegetation, soil, and their associated microbial assemblages to assist, at least partially, in treating wastewater or other polluted water sources (Kadlec and Knight, 1996). The number of constructed treatment wetlands receiving wastewater from municipal, industrial, agricultural, and storm water sources has increased to more than 20,000 across the world (Vymazal and Kröpfelová, 2008). If planned properly, these treatment wetlands offer opportunities to regain some of the natural functions of wetlands and offset some of the significant losses in the wetland area.

The success is based on the combination of differently loaded and organized smaller wetland cells, which have the ability to guarantee proper oxic and/or anoxic conditions and outflow quality. With appropriate siting, design, pretreatment, monitoring, operation and maintenance, these manmade systems can often emulate natural wetlands by providing integrated ecological functions within the watershed and landscape (Kadlec and Knight, 1996; Mitsch and Gosselink, 2007).

A brief analysis using publications indexed by the Institute of Science Information (ISI) Web of Science (WoS) from 1980 to July 2008 shows that the number of papers on constructed wetlands has been increasing up to 194 per year, reaching the total number of 1894 papers over that period (Fig. 1). In this study, the following combinations of keywords occurred in the title, keywords and abstract of papers that have been used: “constructed wetland(s)”, “pollution control” and wetland(s), and purification and wetland(s). About 95% of all of the publications contained the term “constructed wetlands”. The majority of the publications in this field were published in two journals: *Water Science and Technology* and *Ecological Engineering*. The average share of *Ecological Engineering* was 15%, varying from 0 to 23% (Fig. 1).

This special issue covers a wide spectrum on pollution control by wetlands from various aspects of constructed wetlands’ performance to the cycling of heavy metals in wetlands.

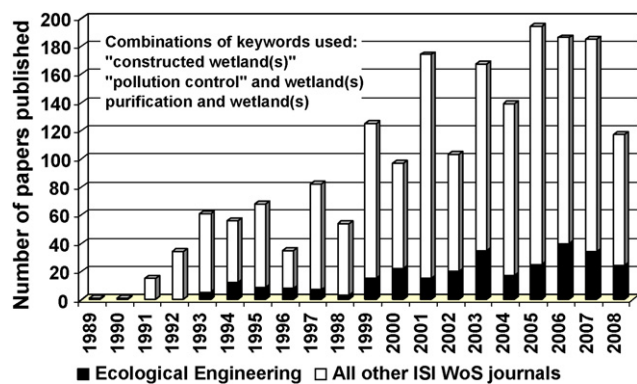


Fig. 1 – Pattern of scientific publications on pollution control by wetlands in 1989–July 2008. All the journals indexed by the ISI Web of Science (WoS) are considered.

2. The 2nd International WETPOL 2007 Symposium in Tartu, Estonia

The 2nd International Symposium on Wetland Pollutant Dynamics and Control (WETPOL 2007), organised by the Department of Geography of the University of Tartu (Estonia) in co-operation with partners from the Estonian University of Life Sciences (Tartu, Estonia), Ghent University (Belgium), and the UNESCO-IHE (Delft, The Netherlands), was held 16–20 September 2007 in Tartu, Estonia. The main objective of this workshop was to provide participants with new and innovative methods for wetland research and wastewater treatment that will help reduce pollution from several pollution sources.

The WETPOL 2007 symposium was a follow-up to the first WETPOL meeting held in September 2005 in Ghent, Belgium, considering similar process-based topics on pollutant dynamics in various types of wetlands. The removal and fate of pollutants in natural and constructed wetlands for pollution control and natural restoration aspects were the other main topics of the symposium.

The main conference topics were:

- nitrogen, phosphorus and carbon cycling in wetlands;
- heavy metals in wetlands;
- organic pollutants in wetlands;
- attenuation of faecal microbial contaminants in wetlands;
- redox-sensitive processes;
- molecular/microbial advances in wetland research;
- functioning of plants in the wetland environment;
- assessment and evaluation of ecological effects;
- modelling of pollutant removal;
- model-based design and operation;
- site-specific and generic risk assessment of pollutants;
- wetlands' role in catchment management;
- wetland hydrology.

One hundred forty oral presentations and 70 posters were presented during this symposium. Nine keynote speakers from the USA, UK, Denmark, the Netherlands and Esto-

Table 1 – Invited plenary lectures at the 2nd International Symposium on Wetland Pollutant Dynamics and Control (WETPOL 2007) held 16–20 September 2007 in Tartu, Estonia.

Ülo Mander, University of Tartu and Tiina Nõges, Estonian University of Life Sciences: “Wetlands and lakes in Estonia”
Robert H. Kadlec, University of Michigan, USA: “Comparison of free water and horizontal subsurface wetlands to treat nutrients and pollutants”
Chris Freeman, University of Wales, UK: “Molecular and microbial advances in wetland research”
William J. Mitsch, Ohio State University, USA: “Restoration of coastal and riverine wetlands”
Jerome O. Nriagu, University of Michigan, USA: “Heavy metals in wetlands”
Chris Craft, Indiana University, USA: “Tidal marshes and climate change”
Hans Brix, University of Århus, Denmark and Tom Headley, New Zealand Water and Wastes Association: “The role of macrophyte-derived organic carbon for denitrification in treatment wetlands”
Nancy B. Dise, Manchester Metropolitan University, UK: “Atmospheric deposition, microbial cascades and ecosystem responses”
Jos T.A. Verhoeven and Merel B. Soons, Utrecht University, The Netherlands: “Wetland restoration for biodiversity or environmental quality: Landscape considerations”

nia highlighted the most important results of and problems in wetland research and restoration (Table 1). Contributions to this symposium represent 38 countries. In addition to European presentations, contributions from Australia, Brazil, Canada, China, Colombia, India, Japan, Korea, Mexico, New Zealand, Tanzania, Taiwan, Thailand, Turkey and the United States were included. The size of the WETPOL 2007 symposium was about the same as the first WETPOL symposium (ca. 165 participants from 40 countries) in Belgium.

Based on the papers presented at the symposium, three special issues of the journal *Ecological Engineering* will be published in 2009: *Molecular and Microbial Advances in Wetland Research* (guest editor Dr. Karin Tonderowski), *Wetland Restoration* (guest editor Dr. Jos Verhoeven), and on *Pollution Control by Wetlands* (this special issue).

During the symposium, three field trips were made: (1) to Lake Võrtsjärv and its catchment, (2) to the Endla Nature Reserve (with visits to the Männikjärve raised bog; Fig. 2a), the Vooremaa drumlin landscape, and Lake Peipsi (Fig. 2b), and (3) to the South-East Estonian landscapes. During technical field trips, the participants became acquainted with the problems of the use and sustainable management and protection of wetlands in various conditions. In addition, a post-symposium excursion to several protected wetland ecosystems in western Estonia was organized from 21 to 22 September: the Kuresoo raised bog (the largest bog complex in Estonia; Fig. 2c) in Soomaa National Park, the Nigula raised bog in the Nigula Nature Reserve, and reedbeds, coastal meadows and floodplain meadows in Matsalu National Park. Also, the largest restored wooded meadow of Nedrema (Pärnu County) was visited.

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