# XXXVIII IAH Congress

## Groundwater Quality Sustainability
## Krakow, 12–17 September 2010

# Extended Abstracts


**Editors:**
**Andrzej Zuber**
**Jarosław Kania**
**Ewa Kmiecik**



University of Silesia Press 2010

abstract id: **543**

topic: **2**
**Groundwater and dependent ecosystems**

**2.3**
**Interactions of surface and ground waters**

title: **Ecohydrological system solutions to enhance ecosystem services: the Pilica River demonstration project**

author(s): **Iwona Wagner**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland,
iwwag@biol.uni.lodz.pl

**Katarzyna Izydorczyk**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Edyta Kiedrzynska**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Joanna Mankiewicz-Boczek**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Tomasz Jurczak**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Agnieszka Bednarek**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Adrianna Wojtal-Frankiewicz**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Piotr Frankiewicz**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Sebastian Ratajski**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Zbigniew Kaczkowski**
International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland

**Maciej Zalewski**
(1) International Institute of Polish Academy of Sciences — European Regional Centre for Ecohydrology under the auspices of UNESCO,
(2) Department of Applied Ecology, University of Łódź, Poland,
mzal@biol.uni.lodz.pl

keywords: ecohydrology, ecosystem

The application of ecohydrology principles as part of Integrated Water Resources Management (IWRM) has the potential to enhance the resilience of a catchment to anthropogenic impacts. Linking this approach with an understanding of water users and social and economic conditions in a given region, provides a foundation for the development of system solutions. Improving the quality of the environment, and the ecosystem services provided, can be a driver of new employment opportunities that contribute to both the overall economy of a region and sustainability.

A methodology for ecohydrology implementation for Integrated Water Resources Management includes the following four steps: a) monitoring of threats, b) assessment of cause-effect relationships, c) development of ecohydrological methods, and d) development of system solutions (Zalewski, 2002)

Identification of threats is usually driven by stakeholder concerns and the existing and potential environmental problems they perceive. Quantification of threats requires **monitoring** of the appearance, intensity, seasonal and/or spatial dynamics of a threat, as well as the risk or costs to society (and stakeholders).

Monitoring programmes provide a basis for the identification and quantification of the **cause-effect relationships** that determine the dynamics of the threat, as well as its drivers. This step requires a close look at hydrology-biota relationships, and recognition of the impact of other abiotic and biotic drivers. Understanding cause-effect relationships can help to recognise the hierarchy of factors controlling the threat, and thresholds for the switch between the abiotic and biotic regulation, following the assumption that the abiotic ones are the primary force of ecosystem dynamics while biotic regulation may become dominant at optimal abiotic conditions (first principle of ecohydrology). Based on these results, the thresholds for the resilience (or resistance) of individual ecosystems to stress can be determined, which is necessary for enhancing their absorbing capacity (second principle).

The hierarchy of factors controlling the dynamics of a threat can be used to identify the key processes that can be controlled using **ecohydrological tools and methods** that employ dual regulation between hydrology and biota in the individual elements (e.g., for wetlands, pre-reservoirs, ecotones, floodplains, constructed systems) to improve or rehabilitate water resources in a catchment. The methods use intrinsic properties of these ecosystems such as the pulsing character of water, energy and matter flows through floodplains, high productivity of ecotone zones, enhanced sedimentation and siltation in the upper reaches of reservoirs, hydrodynamic effects on phytoplankton composition, and others. Existing hydrological infrastructure, such as dams, levees, and irrigation systems, can actually provide an advantage in lowering the costs of potential adjustments of hydrological parameters (e.g. water level regulation, water retention time, and hydroperiod at a floodplain). Dual regulation may be also employed by using new soft-constructions such as vegetated embankments for hydrodynamic control, and the reconstruction of floodplain banks for water retention control and others.

These individual methods can be synergistically linked as part of the described earlier **system solutions** contributing to the enhancement of the overall resilience of a catchment (third principle of ecohydrology), enhancing a catchments ability to provide ecosystem services (Krauze, Wagner, 2008) and improving ecological security of societies and sustainability. At this stage, the system solution should also be tested and modified accordingly, following the concepts of the adaptive management.

This approach was formulated and tested within a UNESCO-IHP and UNEP-IETC Demonstration Project on the Pilica River in Poland. The key management issue addressed has been the ecological and health hazards resulting from eutrophication of the river-reservoir system and toxic cyanobacterial blooms which also impact on recreational uses of the area.

International Association of Hydrogeologists

AGH University of Science and Technology

2-vol. set + CD
ISSN 0208-6336
ISBN 978-83-226-1979-0