

Ecohydrology in the face of the Anthropocene

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Abstract

The problem of sustainability of water and ecosystem resources in the face of global change in the "Anthropocene" era is dependent on many aspects such as: climatic processes, poverty eradication, peace and security, health and quality of life. That is why there exist an urgent need to develop transdisciplinary approach which should be helpful to evaluate recent threats and opportunities for problem solving and capacity building. Ecohydrology concept provides framework for integration different disciplines of sciences and creates socioeconomic feedbacks integrating and harmonising hydrological, ecological and socioeconomic processes in the basin scale for sustainable water ecosystems and societies.

Key words: Ecohydrology, integrative science, freshwater resources.

Ecohydrology, key-concept for large river restoration

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Abstract

Successful restoration requires clear goals and objectives to succeed. Possibilities for and constraints of rehabilitation – both from a process-oriented view as well as from the nature conservation perspective differ strongly according to the landscape setting of a particular river segment and to the degree of anthropogenic changes. Large river restoration requires the development of an integrative scientific approach between ecology, hydrology and river engineering. For defining ecological targets and the long-term sustainability of restoration programmes two aspects are particularly relevant. First, reference standards must be applied. Reference standards have to be based on the original landscape dynamics as defined by hydrology and bedload transport which resulted in a dynamic equilibrium of fluvial processes, habitat composition and consequently characteristic patterns of biodiversity and biogeochemical processes. The application of reference standards has to follow this cause-effect sequence. A second major requirement, dependent on this cause-effect chain between fluvial dynamics, habitat composition and ecology is the development of a prognostic eco-hydrological parameter set which allows an evaluation of restoration scenarios and a prediction of their effects at a range of temporal and spatial scales.

Key words: sustainability, reference standards, biodiversity, ecological integrity, hydrological dynamics, ecohydrology

The World Lake Vision and ecohydrology: case study from Wisconsin, USA

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Abstract

The *World Lake Vision* represents a firm global foundation for lake management across national and cultural boundaries. It provides a set of sustainable use and protection goals for our global water resources. Based on seven principles, the *World Lake Vision* emphasizes the need for a balance between people, and requires the participation of citizens and policy makers in lake management planning efforts. The recently-completed lake and stream restoration project at Upper Kelly Lake, City of New Berlin, Waukesha County, and Village of Hales Corners, Milwaukee County, Wisconsin (USA) forms a case study illustrating the successful application of these seven principles. Upper Kelly Lake is a small drainage lake in an urbanized location, with a stream inlet that has been historically channelized. Through the efforts of the Kelly Lakes Association, Inc., in addition to local and state governments, lake protection and lake management grants were acquired to fund the stream and wetland restoration project described in this case study.

Key words: stream restoration, lake management, public-private partnership, citizen action

Global freshwater resources for sustainable development

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Abstract

The notion of sustainable development exploits the concept of inter-generational and intra-generational equity. Availability of freshwater resources in adequate quantity and quality is an indispensable element of the life support system, essential to attain the sustainable development and the particular Millennium Development Goals. In many regions, increasing pressures, such as population growth with consequences for settlements and production of food and fiber, and human aspirations to better living standards and consumptive life style, are likely to render the road to sustainable development even more difficult. The water shortage problems are likely to grow in a number of areas, unveiling the need for curbing water demands and for improving efficiency of water use. Sustainable development should have a mechanism of resilience against floods and droughts and an appropriate preparedness system. In order to solve increasingly complex needs a holistic and integrated approach is needed, benefiting of synergies with other disciplines.

Keywords water resources, water projections, water management, hydrological extremes, water stress, adaptation, sustainable development

Wetlands and waters on European eastern border: is this the opportunity for the application of ecohydrology in Transborder Biosphere Reserves?

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Abstract.

UNESCO-MAB Biosphere Reserves are introduced to the readers. The network of over 400 Biosphere Reserves existed in 98 countries in 2003. The important characteristic of Biosphere Reserves is their spatial organization: they comprise the strictly protected “core zone”, the partly protected “buffer zone” and “transition zone”, where the normal land use characteristic for the region is accepted. The Polish MAB Committee introduced and established the idea of Transborder Biosphere Reserves; especially in Europe there are many valuable natural regions divided by state borders. Along Poland’s eastern border, which is now the eastern border of European Union, there are interesting Biosphere Reserves, rich in wetlands, lakes and rivers. This project provides the opportunity to apply some ecohydrology methods to the management of this water rich border area.

Key words: transborder biosphere reserves, ecohydrologic methods, eastern borders of European Union

An overview of the world's water resources problems in 2050

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Abstract

The French Academy of Sciences published in October 2006 a “Science and Technology Report” entitled “Continental Waters”, which was prepared by the Academy for the French Government, to examine some of the perceived major water problems that will face the World towards the middle of the present century. The aim of this report, written by a panel of contributors, members and non-members of the Academy, was to determine the possibility of major crises occurring in the World due to water-related problems, and to suggest possible actions to anticipate such crises.

The perceived potential risks were linked to climate change consequences for water resources availability, to the increase of the World's population, to the impact of society on water ecosystems, to potentially deteriorating drinking water quality, and to the increasing number of mega-cities (with more than ten million inhabitants) mostly in the developing world.

The paper focuses on the major findings of this report, i.e. the consequences of the increase of the World's population, estimated to be in the range 8 - 10 billion inhabitants by 2050, and the likely consequences of climate change, for both average and extreme events. The available solutions for feeding a larger population are reviewed, and irrigation, rain-fed agriculture, and improvement of the efficiency of water use are discussed. The potential for competition between food production and bio-energy production is also examined. The most likely scenario is a drastic increase in rainfed agriculture on some continents (South America, Africa), at the expense of forest and natural virgin land, and the strong dependence of other continents (Asia, North Africa and the Middle East) on imported food products.

Finally, the risk of a global food shortage in case of severe droughts (e.g. during very strong El Niño events) in large portions of the Globe is discussed.

Key words: World water balance; climate change; extreme events; El Niño; food supply; bio-energy.

The subsurface water system role for surface and coastal water pollution

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Abstract

This paper addresses two main questions: 1. What is the role and importance of the subsurface water system (soil water and groundwater) for determining nutrient and pollutant loading in surface and coastal waters, and the responses of this loading to different source abatement measures? 2. Is present water flow and quality monitoring sufficient for accurate understanding of this subsurface water system role? Simulation results for nitrogen loading in the Swedish Norrström drainage basin indicate that slow reversible mass transfer and transport processes in the subsurface may be essential for determining future surface and coastal water loads and their responses to various source abatement measures. Subsurface and surface water monitoring exemplification for Sweden and the whole Baltic Sea Drainage Basin, however, indicates important data gaps, which may make it difficult or impossible to discriminate among different possible interpretations and model quantifications of the subsurface water system processes and their contributions to nutrient and pollutant loading in surface and coastal waters.

Keywords: groundwater-surface water interaction, nutrients and nutrient cycling, water quality, catchment, environmental monitoring

Single scale flood risk of small basins in Slovakia.

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Abstract

The concept of risk based only on the estimate of probability is referred to as a single scale conception. The paper deals with estimates of maximum discharge with different exceedance probability for small basins with relatively short gauging or for ungauged basins by the method of regional frequency analysis - index flood. Such a quantification of flood risk analysis is an indispensable prerequisite for flood risk mapping. Estimation of flood risk by application of regional frequency analysis involves solutions to three key problems: 1) division of the study territory into regional classes, 2) selection of regional distribution functions and estimate of their parameters, and 3) regression estimate of mean annual maximum discharges.

Key words: regional frequency analysis, index flood, hydrological heterogeneity, *L*-moments.