

## **Integrating the social sciences into ecohydrology: facilitating an interdisciplinary approach to solve issues surrounding water, environment and people**

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### **Abstract:**

This paper identifies and outlines some issues that need to be addressed in order to integrate the social sciences into the current work on ecohydrology. In an attempt to overcome the gap that currently exists—that ecohydrologists have yet to fully deal with the important factor related to people's relationship to water and the surrounding environments—the paper emphasizes the need to understand the specific social and cultural dimensions of a given environment in order to define the various and multifaceted relationships people have with the environment. The paper concludes that bringing together concepts and methodologies from the social sciences will facilitate ecohydrology to move forward as a truly integrated science.

**Key words:** Social and cultural factors; integrated science, people-water relations.

## **Anthropogenic flooded lands and atmospheric methane**

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### **Abstract**

The secular increase of the atmospheric methane has been attributed to fossil fuels, biomass burning, waste deposition, rice paddies, and beef production. In this article we reinforce that a neglected methane source are the anthropogenic flooded lands (AFL). The reasons rely on the drop-pressure effect, where dam turbine/spillway may annually release larger amounts of methane than the flooded surface itself. Based on current available information, the methane emissions through global AFL surfaces are estimated as nearly 12 Tg CH<sub>4</sub> for a total AFL area of 1.5 10<sup>6</sup> km<sup>2</sup>. The global AFL annual emissions through spillways and turbines in 2005 are respectively 10 and 70 Tg CH<sub>4</sub>, for low (S1) and high (S2) dissolved methane concentration scenarios. A 5-year time step series between 1880 and 2004 of the global atmospheric methane (Antarctic ice core and ground station) exhibits good agreement to AFL emissions, especially for the S2 scenario. Remote sensing flux estimation and ecohydrology solutions to mitigate emission and recover AFL methane for energy production are also briefly discussed. By this approach, about 80 Tg CH<sub>4</sub> could be annually recovered for energy production in the world, 30% of which in Brazil.

**Key words:** methane emission, emission mitigation, methane recovery, sustainable energy.

**The use of remote sensing and modelling  
to detect small-dam influences on land-use changes  
along downstream riparian zones**

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**Abstract**

A land-use change detection analysis was performed on a headwater basin to assess the influence of floodwater control structures on riparian zone development over a ~30 year period (1973-2001). Multitemporal satellite datasets were used to compare vegetation and leaf area index (LAI) changes in the riparian zones of 33 impounded reaches to 33 non-impounded reaches within this basin. Results showed a significant increase in woody vegetation for both groups, but a compositional shift toward more riparian species along the reaches downstream of dams (6% in 1973 and 39% by 2001). LAI over the ~30 yr period increased significantly along impounded streams, and indicates potentially wetter soils along bank environments for these reaches. Stream water discharges for a typical 2 yr flood event were analyzed using the Soil Water Assessment Tool (SWAT) software, simulating with and without-dams scenarios to compare total recession-flow differences. Flow-recession discharge from dam totals were generally greater than non-dammed stream scenarios because of increased water residence time from prolonged outflow. The average annual basin-wide water budget showed the dams increase groundwater recharge, deep aquifer recharge, and reevaporation to the soil layers.

**Keywords:** LAI, SWAT, change detection analysis, water budget, headwater streams, stream discharge

**Impact of the Al-Qara mountain fogwater forest  
on groundwater recharge  
in the Salalah coastal aquifer, Sultanate of Oman**

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**Abstract**

This study demonstrates the link between the experimental work in Jabal AlQara fogwater forest on horizontal precipitation and groundwater recharge to the Salalah coastal plain aquifer. The future impact of the forest continuous deterioration on the aquifer WAS investigated by simulation modeling. The results of the fieldwork show that measured horizontal precipitations (interaction between trees and fogwater) are considerably higher than measured vertical precipitations (rainfall) during the wet monsoon season. Simulation modeling of the impact of reduction in groundwater recharge originating from the mountain indicated that the reduction of the tree cover would result in a significant impact on the aquifer sustainability. It is recommended that recent government efforts to maintain the fogwater forest by reducing the population of camels and trees planting be continued and strengthened.

**Key words:** camels browsing, fogwater forest, horizontal precipitation, Dhofar Mountains, Oman.

**Mass occurrence and toxicity  
of the cyanobacterium *Lyngbya majuscula*  
under phosphorus–limited conditions  
in the Red Sea.**

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**Abstract**

Large mass of *Lyngbya majuscula* has occurred on the surface of coral reefs in Farasan island in the Red Sea, Saudi Arabia. It was also observed that dermatitis symptoms appeared on people bathing and swimming in this area. The present study describes the toxicity of field samples and batch cultures of *L. majuscula* to *Artemia salina* and mice, and investigates effects of inorganic and organic phosphates on the growth and toxicity of this cyanobacterium during batch experiments. The extract of field samples of *L. majuscula*, was highly toxic to *A. salina* with LC<sub>50</sub> value of 2.8 mg cm<sup>-3</sup>. This extract also showed a moderate toxic effect to intraperitoneally injected mice (LD<sub>50</sub> = 425 mg kg<sup>-1</sup>), and highly dermatotoxic effect including skin redness and inflammation within 24 hours upon application to shaved back of mice (LC<sub>100</sub> = 88 mg dm<sup>-3</sup>). In addition, the study revealed that the growth of *L. majuscula* increased by increasing inorganic and organic phosphate concentrations. In contrast, the highest toxicity of this cyanobacterium was obtained in phosphorus-depleted cultures, and decreased by increasing phosphate concentration in the medium. The results of phosphatase activity assay revealed a high enzyme activity (8.6 μmol pNP mg<sup>-1</sup> dry wt h<sup>-1</sup>) of the field samples of *L. majuscula*. The activity increased by increasing organic phosphate concentrations, but decreased with high inorganic phosphate concentrations during batch experiments. The present study suggests that *L. majuscula* mats could be the causative agent in dermatitis developed in swimmers and bathers in Farasan Island waters, and that formation of these mats would be enhanced by organic phosphate resulting from human activities and rotted seaweeds.

**Key words:** Cyanobacteria, dermatotoxic, marine, mats, phosphatase.

## **The response of zoobenthos to “natural channelization” of a small river**

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### **Abstract**

In October 2003, the small-sized river Gałęzówka (Lublin Upland) was channelized on its prevailing length, according to the assumptions of so-called “natural channelization”, i.e. among others, without straightening the river channel and leaving some river sections untouched. The surveys were carried out in 2003-2004, before and after the channel works, at two 100 m long sections: the disturbed site, and one placed upstream untouched reference site.

Physical and chemical analysis suggested slightly better water quality at the reference site. Both density and biomass of the zoobenthos at the two sites were predominated by chironomid larvae and Tubificidae. The channel works did influence strongly taxa richness, dominance structure, density and biomass of the fauna. This was evident especially one month after the channel works. Values of Shannon-Wiener diversity index were higher at the disturbed site, however. The seasonal changes in density and biomass at the disturbed site exhibited a different pattern than at reference one. After one month after the channel works, the fauna of the two sections studied exhibited rather high level of faunistic similarity, suggesting high rate of animal communities reviving.

**Key words:** „natural channelization”, zoobenthos, biological diversity, river.

## **Zoobenthos of salmon rivers in the Kola Peninsula and Karelia (north-east Fennoscandia)**

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### **Abstract**

Based on the study of zoobenthos in the salmon rivers of the Kola Peninsula and Karelia for 1978-2001, the abundance of food for young Atlantic salmon *Salmo salar* L. is assessed. A prevailing group in density (73%) and biomass (66%) of zoobenthos are larvae of amphibian insects such as chironomids and black flies, mayflies, stoneflies and caddis flies regarded as food objects for juvenile salmonid fishes. On average, quantitative characteristics of bottom communities of the rivers of the Kola Peninsula and Karelia vary from 4 up to 16 thousand ind m<sup>-2</sup> and from 5.5 up to 15.5 g m<sup>-2</sup>. The food conditions for juvenile salmon in the rivers of the Kola Peninsula and Karelia can be estimated as average.

**Key words:** bottom fauna, invertebrates, density, biomass, food conditions, salmonid fishes.

**Seasonal patterns of testate amoebae and ciliates  
in three peatbogs: relationship to bacteria and flagellates  
(Poleski National Park, Eastern Poland)**

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**Abstract**

The abundance and biomass of microbial communities has been assessed in three types of peatbogs, in order to test a hypothesis that the microbial communities (testate amoebae and ciliates) differed among peatbogs and that differences could be related to moisture conditions, water chemistry, bacterial and flagellate densities. The highest numbers of testate amoebae were found in spring and summer, however the highest numbers of ciliate communities were noted in spring and autumn. The relations demonstrated between bacteria, heterotrophic flagellates and protozoa may point to an important process of matter and energy flow from bacteria to higher trophic levels. In low pH peatbog, relations between microbial loop components were stronger. Consuming much of bacterial productions, protozoa become an important link between bacteria and micrometazoans. The studies showed that protozoa community is determined by pH and water level mainly in summer. In spring and autumn additional factors may be important. Probably conductivity, total organic carbon and concentration of appropriate food (bacteria and flagellates) are the major regulator of abundance and biomass of testate amoebae and ciliates.

**Key words:** peatbog, *Sphagnum*, microbial loop, testate amoebae, ciliates