

## **Soil hydrology for ecohydrology in drylands: examples from Tunisia, China and Cape Verde Islands. A review**

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### **Abstract**

A fundamental factor for developing and maintaining the susceptibility of dryland ecosystems is the efficient use of available water. Because of pressure on fresh water resources, practical tools are needed for using more efficiently the rain water, this by regulating soil hydrological processes. For this purpose, 'water harvesting' techniques, referring to small hydraulic structures to collect runoff water, are widely used in arid and semi-arid regions. This paper evaluates three such structures.

In Tunisia the indigenous 'jessour' terraces and ground water recharge systems are described. It was found that the CCR (*catchment to cropping area ratio*) should be larger than 7.4 in order to provide sufficient amounts of runoff water to the terrace for the cultivation of olive trees for an 'average' annual rainfall amount of 235 mm.

In China a field experiment was set up in the semi-arid region of the loess plateau to evaluate different tillage practices on their effect on increasing the water storage in the soil profile for better crop growth. It was concluded that subsoiling was the best practice in terms of water conservation. It resulted in the highest increase in water storage during the fallow period, and hence more water was made available to winter wheat during the growing season.

On the Cape Verde Islands, with low annual rainfall (100-500 mm), mainly occurring during a few major rainfall events, three land use systems were compared in three adjacent small catchments. A catchment with traditional agriculture and one with natural vegetation, both without soil and water conservation systems, were compared with a catchment with trees in water collecting bench terraces and micro-catchments. Lower runoff amounts measured during the third year of monitoring reflected the newly installed soil and water conservation practices in the afforested watershed.

**Key words:** Water harvesting, jessour, water balance, tillage, catchment, runoff

**The influence of wind on cyanobacterial bloom development in shallow, lowland reservoir in central Poland**

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**Abstract**

The influence of wind speed and direction on the appearance, spatial distribution and reduction of potentially toxic *Microcystis* bloom was studied in a shallow lowland, eutrophic reservoir built in the middle course of the Pilica River. During two selected years, wind determined the transport of blooms, but also reduced the cyanobacterial biomass in water column. During periods of moderate winds (about 2 m s<sup>-1</sup>), the difference of temperature in a vertical profile of water was observed and the cyanobacterial bloom was transported by the wind, forming a surface scum on the leeward shore. Short-term turbulence induced by strong wind (about 5 m s<sup>-1</sup>) reduced the cyanobacterial biomass from 35 mg dm<sup>-3</sup> to below 1 mg dm<sup>-3</sup>. Long-term mixing (3 weeks) of the reservoir not only decreased the cyanobacterial biomass but also changed the seasonal succession of the phytoplankton - from cyanobacteria to diatoms.

**Keywords:** cyanobacteria, *Microcystis*, spatial distribution, wind mixing effect

## **Bioaccumulation of heavy metals in aquatic bryophytes from streams in the Sudeten Mountains (Poland, Czech Republic) and the source area of the Ebro (Spain)**

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### **Abstract**

In this study the mean heavy metal concentrations in aquatic bryophytes from the Sudeten Mountains (Poland and Czech Republic) and from the non industrialized source area of the river Ebro (Spain) are presented. Concentrations of Ba, Co, Cd Cr, Cu, Fe, Mn, Ni, Pb, Sr, V and Zn were measured in water and in the aquatic bryophytes *Fontinalis antipyretica*, *Platyhypnidium riparioides* and *Chiloscyphus* sp. The matrix of 41 samples from 36 sampling sites and 12 heavy metals, after standardization, was submitted to numerical classification which revealed that bryophytes from the source area of the Ebro and Sudeten Mountains were differentiated in the value of PCA factor 1, which was related to the concentration of the metals Cr, Ni, V and Fe. Bryophytes from the source area of the Ebro were differentiated in the value of PCA factor 2 which was related to the concentration of the metals Ba and Co. This means that the metals Cr, Ni, V and Fe have a main influence on the elemental composition of the same bryophyte species growing in two regions differing from each other in climate, rock composition and soil conditions. The results show possibility of using the examined species in bioindication the pollution with various concentrations of these metals.

**Key words:** *Fontinalis antipyretica*, *Platyhypnidium riparioides*, *Chiloscyphus* sp., barium, chromium, cobalt, iron, nickel, vanadium.

**Chemical changes and nutrient release during decomposition processes of mature leaves of *Nuphar lutea* (L.) Sibith. & Sm under laboratory conditions**

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**Abstract**

Aspects of the decomposition of the floating leaves of *Nuphar lutea* (L.) Sibith. & Sm were studied under laboratory conditions. Plant material, collected from five lakes from Leszczyńskie Lakeland in West Poland were incubated and analysed to show changes in chemical composition.

The rate at which the particular elements were released from decomposing leaves and returned to the environment was different. Potassium and sodium were released in the first phase of decomposition. Also phosphorus was released relatively faster than magnesium and calcium. Nitrogen was mineralized in the last phase of *N. lutea* decomposition.

The leaf turnover rate of *N. lutea* amounted to a mean 4.9, meaning release of elements is repeated on average 4.9 times a year.

**Keywords:** degradation, detritus, plant litter, Nymphaeaceae

**Production and elemental composition of floating leaves of *Nymphaea alba* L. and *Nuphar lutea* (L.) Sibith. & Sm in selected lakes in West Poland**

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**Abstract**

Year-long research into ecology of floating-leaved macrophytes *Nymphaea alba* and *Nuphar lutea* was done in three eutrophic lakes (in west Poland) by a non-destructive leaf-marking method. The leaf persistence changed significantly during the growing season from 28 to 63 days. Life span of the floating leaf and the macro- and microelement concentrations were highest during the spring and autumn but lowest in summer, when plants reached maximum leaf area and biomass. These trends were the same in case of both species independently of lake's water and sediment chemistry. Because of the high leaf turnover (4.9), water lilies can act as "nutrient pump" in shallow freshwater. Positive correlation between surface area of each leaf blade and its biomass, shows that the biomass of floating leaves maybe assessed from their area.

**Key words:** biomass, development of plant, floating-leaved plants, leaf life span

**Influence of methyl mercury compounds of natural origin on feeding behavior in two species of freshwater planarians**

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**Abstract**

The effect of methyl mercury compounds of natural origin was investigated on two key reactions of planarian feeding behavior: the approach to the prey and pharyngeal protrusion. Two types of food, with low and high mercury concentrations, were used to judge the approach reaction in view of differences in food preference. The number of oligochaetes consumed, or successful results of planarian contact with prey, was determined by observing the pharyngeal protrusion reaction. Accumulation of methyl mercury by planarians indicates that individuals from the control group preferred prey containing the low mercury concentration. Organisms from the treated group did not exhibit prey preference. These results indicate that mercury in the tissues of dead fish in freshwater bodies can pose a hazard to detritivorous invertebrates.

**Key words:** prey, methyl mercury, pharynx, planarians, *Dugesia tigrina*, *Polycelis tenuis*.

**Chromosomal studies of *Zoarces viviparus* L. (Zoaridae) and *Myoxocephalus scorpius* L. (Cottidae) from different parts of distribution area**

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**Abstract**

Chromosomal polymorphism in fishes is well documented and there is the need to know the karyotypic responses of the species to changes in water environment. Eelpout *Z. viviparus* and shorthorn sculpin *M. scorpius* from the North and White seas were karyotyped to detect the extent of intraspecific chromosomal variation. The results indicate that geographically isolated populations of these two species from northern and southern parts of their distribution area are karyotypically similar. *Z. viviparus* has 48 chromosomes ( $2n=2m+6sm+40sta$ ,  $NF=56$ ) and appears to be the same in different regions. The modal diploid chromosome number for shorthorn sculpin from the North and White Seas was 36 ( $2n=8m+2sm+4st+22a$ ,  $NF=46$ ). Shorthorn sculpin exhibited a chromosomal variation in different parts of its area caused by Robertsonian translocations ( $2n=35-38$ ,  $NF=46$ ). No differences were found between populations of shorthorn sculpin from the White and North Seas by frequency of these Robertsonian rearrangements. The karyotype structure in both species does not depend on temperature and salinity gradients in different water bodies.

**Keywords:** chromosome number, polymorphism, eelpout, shorthorn sculpin, North Sea, White Sea, environmental conditions

**<sup>1</sup>Changes in fish populations in Danube delta lakes: effects of hydrology and water quality change. Review of results and potential for rehabilitation**

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**Abstract**

Long term fish catch statistics indicate that the commercial catch in the Danube delta (Romania) has declined about three-fold in the last half of 20<sup>th</sup> century. The fish community changed dramatically due to habitat loss, hydromorphological changes and pollution (nutrients, microcontaminants). To reverse this anthropogenic impact, several ecological reconstruction projects (polder re-opening, blocking man-made canals) have been completed. Two case studies are presented to illustrate the feasibility of damage reversal: 1) Fish have recolonised an ecologically rehabilitated 2100 ha polder rapidly (1-5 years) through openings in the embankments and re-flooding in 1994. The rebuilt habitats and the fish communities however, reflect the general eutrophic character of lakes elsewhere in the delta. 2) The direct hydrological connectivity from the river to a complex of lakes, which was blocked to mitigate siltation, showed an immediate shift from rheophilic/eurytopic to eurytopic/limnophilic species in just one season (2001 vs 2002). The biomass decreased dramatically in the lakes that were closest to the river. We conclude that ecological reconstruction from a terrestrial polder to lacustrine habitats is simple to achieve through re-establishment of hydrological connectivity, but restoration pristine fish communities depends upon recreating former hydrological patterns and water quality that are more difficult to achieve.

**Key words:** fisheries, environmental changes, polder re-opening, connectivity, Romania

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