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ECOTONES FOR REDUCTION OF DIFFUSE POLLUTIONS

Katarzyna Izydorczyk, Wojciech Fratczak, Leszek Baginski and Maciej Zalewski from the European Regional Centre for Ecohydrology under the auspices of UNESCO, of the Polish Academy of Sciences, and the Regional Water Management Authority in Warsaw outline the vital role of the LIFE+ EKOROB

The diffuse (non-point) pollution coming from the agricultural landscape is one of the most important factors of eutrophication, which reduces ecosystem services available to the community due to the stimulation of growth of toxic algal blooms in reservoirs, lakes and coastal zones. The strategy for reducing diffused loads should be based on the systemic approach, which addresses the Ecohydrology principles (Zalewski et al. 1997; Zalewski 2011), especially the 'dual regulation' assumption saying that biocenotic processes can be regulated by hydrology and, vice versa, biocenotic structure and interactions shape hydrological processes.

One of the key measures, which Ecohydrology postulates for a systemic basin scale methodology, is the use of buffer zones (i.e. ecotones, permanent vegetation adjacent to an aquatic ecosystem) as a tool for lowering the pressure on a freshwater ecosystem caused by nutrients coming from the landscape. This multifunctional element of the catchment area efficiently reduces nitrogen and phosphorus concentrations from diffuse pollution through biochemical and physical processing of nutrients. However, the effectiveness of vegetated buffer zones depends on many factors which need to be considered in the course of establishing new ecotone zones, or reshaping existing ones.

These include: geomorphological characteristics of the site (slope, exposure, insolation, soil structure), dynamics of hydrological conditions (changes in the water level, frequency and extent of extreme phenomena) and the type of land management (such as recreation and agriculture).

Nutrient removal efficiency depends also on the width of the buffer zone. The empirical research and diagnosis of buffer zones in the shoreline of Poland's Sulejow reservoir conducted through the LIFE+ EKOROB project: Ecotones for reduction of diffuse pollutions (LIFE08 ENV/PL/000519, www.ekorob.pl) showed that in the case of high phosphorus and nitrogen initial load, and under limited area conditions, the plant buffer zones need enhancement by additional elements.

For areas heavily polluted by nitrogen compounds such as the Barkowice Bay demo site, where nitrate concentration in groundwater (ab. 100 mgNO_3/l) classified it as polluted according to the Nitrates Directive (>50 mg NO_3/l), the denitrification wall is a solution which enhances the plant ecotones. The study of Bednarek and other researchers (Bednarek et al. 2010) indicated a high reduction of mineral forms of nitrogen (approx. 75%) in the groundwater flowing through the wall. Although it is an artificial structure, such a wall is invisible in the landscape and intensifies naturally occurring processes of denitrification.

For shorelines with groundwater heavily contaminated with phosphorus (ab. 3,0 mgPO_4/l – Zarzecin demo site) a geochemical barrier with phosphorus-absorbent substrate was proposed as an additional element of a vegetation buffer zone, which enhances the phosphorus adsorption capacity.

Harmonising nature conservation with the local community constitutes a challenge. In both cases, the shoreline is intensively used for recreational purposes. The lack of tourist infrastructure in the sites contributes to the devastation of the vegetation buffer zones. That is why, alongside the actions focused on restoring mosaic ecotone zones, it was proposed to construct recreational infrastructures, such as jetties for bathing and boating.

The experience gained from the studies of newly-constructed ecotones enhanced by biogeochemical barriers will be used in the development of the action programme to reduce diffuse pollution in the Pilica river basin.

The solution seems to be a proper way towards achieving a good ecological status of ecosystems and water quality improvement due to the low construction cost, small labour input, high operating efficiency and the lack of interference with the landscape.

Katarzyna Izydorczyk, Wojciech Fratczak, Leszek Baginski, Maciej Zalewski

ekorob@warszawa.rzgw.gov.pl
k.izydorczyk@erce.unesco.lodz.pl
www.ekorob.pl
www.warszawa.rzgw.gov.pl
www.erce.unesco.lodz.pl