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*Review Article*

# Biomonitoring as a prerequisite for sustainable water resources: a review of current status, opportunities and challenges to scaling up in East Africa

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## Abstract

Degradation of aquatic ecosystems in the Lake Victoria basin (LVB) and the rest of East Africa has elicited concern because of its bearing on social and economic development. Rapid population growth, industrialization and its associated urbanization, agricultural intensification and habitat loss have increased pressure on the integrity of water resources. Costs associated with traditional approaches to monitoring water quality have become prohibitive while not giving reliable early warning signals on resource condition to aquatic resource managers. The purpose of this paper is to explore approaches to developing macroinvertebrate- and fish-based biomonitoring tools in the LVB and East Africa and the challenges they face through a review of studies that have been carried out in the region. The hypothesis is that aquatic biota in the LVB provides cost-effective and integrative measures of the physical and chemical habitat conditions thus necessitating their use in assessment and monitoring of water resources. In the LVB macroinvertebrate and fish based indices of biotic integrity (IBIs) have demonstrated their utility in identifying sources of impairment, determining the extent of impacts and stand to give natural resource managers a scientifically defensible rationale for developing guidelines for conservation and management. Despite this significant step, however, adoption and use of indices as part of regular monitoring programs are yet to be realized. We recommend for the advancement and adoption of biological criteria as an integrated approach to monitoring human-induced stress in riverine ecosystems of the East Africa region.

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*Review Article*

# Water quality change and habitat potential in riparian ecosystems

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## Abstract

Riparian ecosystems play a vital role in providing ecosystem services that include habitat support and protection of water quality. This study assessed the role of riparian ecosystems along the lateral and longitudinal dimensions of the watershed system. A reach-scale assessment, spatial analysis using GIS, and a dynamic simulation of interactions were used to evaluate riparian dynamics in the Westfield River Watershed of Massachusetts. Riparian and riverine characteristics (slope, soils, and flow regime), disturbance regimes (land use and bank impairment), bird habitat suitability, available niches for wildlife, and vegetation biomass were found to vary along the longitudinal dimension of the watershed. Habitat potential (suitability to sustain a species) declined in general (trend) with riparian distance and a maximum potential was observed at an intermediate level. Dynamic simulation was performed using the STELLA model to quantify interactions between different reaches, land conditions, and land use to quantify soil loss (RUSLE equation) and spatial accumulation. Simulations showed a spatial influence in sediment transfer and loading into the stream. Policy simulations on land use in specific riparian locations showed a significant impact of urbanization on the water quality of the river. Significant reductions in soil loss (3%–48% decrease, depending on the spatial location of the practice) could be achieved through implementation of Best Management Practices (BMPs). Optimal placement of BMPs and conservation efforts in the riparian zone could be used to protect habitat potential and water quality of the watershed.

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*Review Article*

# Hydric potential of selected river basins in Slovakia

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## Abstract

Landscape attributes affect the quantity, quality, distribution and accessibility of water resources. Except for fixed and hardly impacted environmental characteristics affecting the hydric potential of the landscape, it is possible by optimal land use planning and management to modify its ability to infiltrate and detain precipitation. The use of landscape characteristics as an efficient tool in river basin management can improve disturbed conditions in catchments. In this paper, we have focused on the evaluation of the hydric potential of six river basins in Slovakia. Assessing the most relevant landscape attributes in relation to the protection of water resources, we have identified areas with various landscape hydric potentials (LHPs), which should be taken into consideration when developing a river basin management plan. The spatial distribution of LHP categories undermines the customary view that the landscape's ability to infiltrate and retain water is affected by only some of the physical–geographic attributes (frequently presented as hydrogeological bedrock and soil characteristics). The LHP distribution in model catchments is explained through specific combinations of factors having the greatest influence.

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# Seasonal dynamics of periphytic algae in the vicinity of the hydroelectric plant in the Pasłęka River (north-east Poland)

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## Abstract

This study of the periphytic algal differentiation of epiphyton, epilithon and algae on the dam was carried out above and below the hydroelectric plant on the Pasłeka River in the vegetative seasons of 2001–2003. During this period there was varying mean monthly precipitation and therefore varying water levels. The damming of this river caused a decrease in water discharge above the plant and an increase below it. The highest mean biomass was recorded for periphytic algae on the dam and the lowest for epiphyton. The highest nutrient concentrations ($N_{tot}$, $PO_4$ and Si) favored epiphyton growth on sites with slow discharge, and this was supported by positive correlations between algal biomass and nutrients. The substratum type and water velocity at sites with rapid water discharge exerted greater regulation on the growth of epilithon and the algae on the dam than any nutrient. Differences were observed in the biomass of periphytic algae when varying precipitation regulated water levels. The maximum biomasses were as follows: (1) epiphyton at low water in 2003, (2) epilithon at a medium water level in 2001 and (3) periphytic algae on the dam at high water in 2002. A decrease in all studied periphytic algal biomass was noted with increased precipitation from April to November. This was related to lower nutrient concentrations and light availability monitored by water transparency, rather than to a low water level. This indicated that the current velocity and precipitation induced water level indirectly regulated the growth of these algae during the vegetative season.

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# Occurrence of bacteria, protozoans and metazoans in waters from two semi-urbanized areas of Cameroon

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## Abstract

This study was based on the assessment of the physico-chemical indicators of water quality and the enumeration of bacteria (total coliforms, faecal coliforms, faecal streptococcus, and *Escherichia coli*), entero-pathogenic protozoans (*Cryptosporidium*, *Giardia*, *Cyclospora*, and *Isospora*), helminth eggs and the distribution of ciliated protozoa which are biological indicators of aquatic pollution. The mean abundances of total coliforms varied from 882 CFU/100 mL (wells) to 946 CFU/100 mL (springs) in the Obala area, and from 813 CFU/100 mL (springs) to 1056 CFU/100 mL (wells) in the Monatélé area. *Giardia* sp., *Cyclospora cayetanensis* and *Cryptosporidium* sp. were the most abundant emerging intestinal protozoa isolated, while *Metopus ovatus*, and *Caenomorpha medusula*, were prominent indicators of the level of aquatic contamination that were identified in our study. These results revealed a deteriorating quality of the water exploited by these semi-urbanized communities, and a high sanitary risk that was linked to the presence of the numerous pathogens identified in the water samples analyzed.

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*Review Article*

# Toxic effect of norharmane on a freshwater plankton community

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## Abstract

Recently, some aquatic cyanobacteria and bacteria were found to produce norharmane and other β-carboline analogs. Some studies revealed bioactivity of these compounds against cyanobacteria and microalgae in batch monocultures. However, the toxic effects of these compounds on natural plankton community have not been explored yet. In the present study, laboratory microcosm experiments were conducted to test the possible allelopathic effects of norharmane on freshwater plankton community (<150 μm). The results showed that norharmane reduced the growth (cell number) of most plankton groups. The inhibitory effect of norharmane on the growth of different plankton groups was concentration and time-dependent. The highest concentration of norharmane (120 μM) caused complete inhibition of the growth of most plankton species on the first day of incubation, whereas the complete growth inhibition of these species occurred on the fifth day of incubation at the lowest concentration (0.6 μM). Based on the median inhibition concentration ($IC_{50}$) for one and five-day exposure to norharmane, cyanobacteria ($IC_{50}$ = 0.03–4 μM), flagellate chrysophytes ($IC_{50}$ = 0.5–1.5 μM) and ciliates ($IC_{50}$ = 0.4–2.7 μM) seemed to be more sensitive to norharmane than chlorophyta ($IC_{50}$ = 0.6–5 μM), dinoflagellates ($IC_{50}$ = 0.7–4 μM) and diatoms ($IC_{50}$ = 2–8 μM). This study suggests that toxic effects, mediated via the excretion of norharmane by aquatic organisms could cause significant changes in the plankton communities leading to the dominance of norharmane producing species and enhancement of the eutrophication in aquatic environments.

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