

Impact of land use on water quality in River Njoro Watershed, Kenya

W. A. Shivoga, M. Muchiri, S. Kibichi, J. Odanga, S. N. Miller, T. J. Baldyga and C. M. Gichaba
Egerton University, P.O. Box 536, Njoro, Kenya, Email: shivogawa@yahoo.co.uk

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Introduction Water resources within the River Njoro watershed have become degraded due to high population growth rate and change in land use upsetting environmental stability. Land cover classification using Landsat images (Baldyga *et al.*, 2004) shows loss of about 20% of forested areas between 1986 and 2003 in the watershed. The forested and large-scale farm areas have been converted mainly into small-scale mixed agriculture and human settlements. These changes have impacted negatively on the ecological integrity and hydrologic processes in the watershed (Shivoga, 2001) but little is known about the influence of specific land uses on water quality of the river.

Materials and methods Data recorded from ten sampling sites along River Njoro were used to examine the contribution of nutrients from subwatersheds upstream draining each of the sites. Standard Digital Elevation Model GIS analysis was used to determine the spatial distribution of land cover types and subwatershed contributing runoff to the sites in the river. Water and sediment samples were collected for chemical analysis related to upstream land use types and size of subwatersheds.

Results The mid-stream portion of the river near Egerton University, with industrial, human settlement and agricultural land uses, accounted for the highest cover, the lower the P loss from the subwatershed. There was, however, significant decrease in nutrient levels downstream indicating natural purification as the river flows through an area of large-scale farming with dense riparian vegetation. Small-scale farms and bare lands contribute over 55% of the phosphorus (P) load to the River Njoro. The size of the subwatershed accounts for about 53% variability in soluble P in the river. Grassland cover had a negative relationship with P loss ($R^2 = 0.4171$) indicating that the more the grass cover, the lower the P loss from the subwatershed.

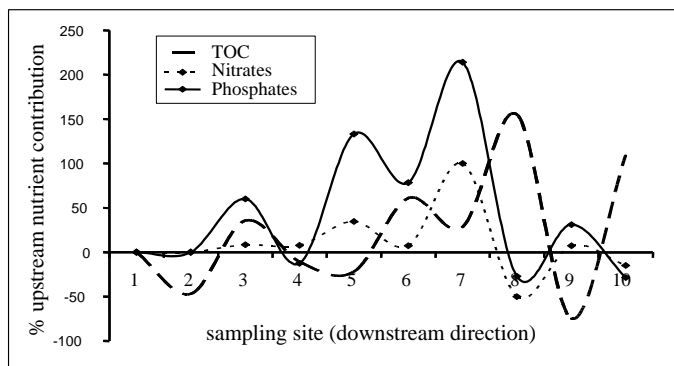


Figure 1 Downstream variation in contribution of phosphate, nitrate and organic matter

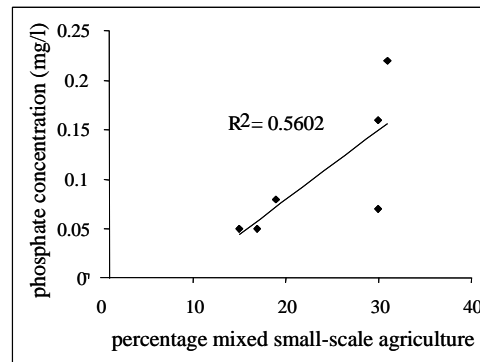


Figure 2 Relationship between proportion of land comprising small scale mixed farming and phosphate concentration in the river contribution of nutrients

Conclusions Quantification of land use in subwatersheds is important for characterising water quality in the River Njoro watershed. Upland land uses are as important as near-stream land uses. Intact riparian corridors along the river provide natural purification and recovery of the ecological integrity of the River Njoro. Grassland cover reduces the P loss from the watershed. The intact riparian zone retains nutrients from the large-scale farms surrounding the river, thereby significantly reducing the contribution of nutrients from the arable land to the river.

References

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