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Linking land-use type and stream water quality using spatial data of fecal indicator bacteria and heavy metals in the Yeongsan river basin

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ABSTRACT

This study reveals land-use factors that explain stream water quality during wet and dry weather conditions in a large river basin using two different linear models-multiple linear regression (MLR) models and constrained least squares (CLS) models. Six land-use types and three topographical parameters (size, slope, and permeability) of the watershed were incorporated into the models as explanatory variables. The suggested models were then demonstrated using a digitized elevation map in conjunction with the land-use and the measured concentration data for *Escherichia coli* (EC), Enterococci bacteria (ENT), and six heavy metal species collected monthly during 2007–2008 at 50 monitoring sites in the Yeongsan Watershed, Korea. The results showed that the MLR models can be a powerful tool for predicting the average concentrations of pollutants in stream water (the Nash-Sutcliffe (NS) model efficiency coefficients ranged from 0.67 to 0.95). On the other hand, the CLS models, with moderately good prediction performance (the NS coefficients ranged 0.28–0.85), were more suitable for quantifying contributions of respective land-uses to the stream water quality. The CLS models suggested that industrial and urban land-uses are major contributors to the stream concentrations of EC and ENT, whereas agricultural, industrial, and mining areas were significant sources of many heavy metal species. In addition, the slope, size, and permeability of the watershed were found to be important factors determining the extent of the contribution from each land-use type to the stream water quality. The models proposed in this paper can be considered useful tools for developing land cover guidelines and for prioritizing locations for implementing management practices to maintain stream water quality standard in a large river basin.

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