

# Geovisualisation of Land Use in Rivers: Visualisations of the downstream effects of the rural lands of New Zealand

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## Abstract

Land use and its management have the potential of major impacts on natural resources including water bodies, soils and soil nutrients. New Zealand's economy is heavily dependent on intensive rural land uses, for example, the value of livestock, cropping and dairy farming grew from nearly \$2.7 billion in 1991 to almost \$5 billion in 2007. However these activities affect the soils with at times increased run off and leaching into freshwater systems, and with upstream land use activities having downstream impacts.

Research into land use impacts on New Zealand's freshwater systems and the monitoring of these systems is typically portrayed in tables, maps, graphs, pie charts, and flow diagrams (for example, Parfitt *et al*, 2006). As public participation becomes more prevalent in environmental decision-making, however, there is a growing need to communicate effectively with a non-expert audience. Geovisualisation provides an effective means of communicating landscape related information.

This paper looks into geo-visualisation of the impact of land uses on streams in their catchments through the leaching of excess nutrients, with water quality known to decline in lowland streams and rivers in pasture-dominated catchments. Recent developments in New Zealand for this visualising include a web-based map display that colour-codes streams by leaching rates (NIWA, 2010). This work is a deeper exploration of the possibilities that cartographic representation present for representing downstream impacts of land uses.

Two catchment areas in the central North Island were chosen for their mix of land covers and rural land uses. Published leaching rates for individual land uses were allocated across the catchment and accumulated into the stream networks. The visualisations developed are Google Earth-based, a very accessible system with a publicly well-known interface. The nitrogen loadings in the streams are shown in 3-D showing height and graduated colour to stress their magnitude.

Impacts of land use activities or policies on streams in the catchments need to be understood by all stakeholders. Visualisations that stress problem issues such as nitrogen loadings provide another way of communicating important information and data, including to and between central and local government, civil engineers, farmers and land owners, to help understand the impact of their activities or policies on the streams.

**Keywords:** land use, visualisation, leaching, rivers, nitrogen