

Sources of nitrogen and phosphorus emissions to Irish rivers: estimates from the Source Load Apportionment Model (SLAM)

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More than half of the river and lake water bodies in Europe are at less than good ecological status or potential, and diffuse pollution from agriculture remains a major, but not the only, cause of this poor performance. In Ireland, it is evident that agri-environmental policy and land management practices have, in many areas, reduced nutrient emissions to water, mitigating the potential impact on water quality. However, additional measures may be required in order to further decouple the relationship between agricultural productivity and emissions to water, which is of vital importance given the on-going agricultural intensification in Ireland. Catchment management can be greatly supported by modelling, which can reduce the resources required to analyse large amounts of information and can enable investigations and measures to be targeted.

The Source Load Apportionment Model (SLAM) framework was developed to support catchment management in Ireland by characterising the contributions from various sources of phosphorus (P) and nitrogen (N) emissions to water. The SLAM integrates multiple national spatial datasets relating to nutrient emissions to surface water, including land use and physical characteristics of the sub-catchments to predict emissions from point (wastewater, industry discharges and septic tank systems) and diffuse sources (agriculture, forestry, peatlands, etc.). The annual nutrient emissions predicted by the SLAM were assessed against nutrient monitoring data for 16 major river catchments covering 50% of the area of Ireland. At national scale, results indicate that the total average annual emissions to surface water in Ireland are over 2,700 t yr⁻¹ of P and 80,000 t yr⁻¹ of N. The SLAM results include the proportional contributions from individual sources at a range of scales from sub-catchment to national, and show that the main sources of P are from wastewater and agriculture, with wide variations across the country related to local anthropogenic pressures and the hydrogeological setting. Agriculture is the main source of N emissions to water across all regions of Ireland.

The SLAM results have been incorporated into an Integrated Catchment Management process and used in conjunction with monitoring data and local knowledge during the characterisation of all Irish water bodies by the Environmental Protection Agency. This demonstrates the successful integration of research into catchment management to inform the identification of (i) the sources of nutrients at regional and local scales and (ii) the potential significant pressures and appropriate mitigation measures.