



The role of catchment characteristics in determining surface water nitrogen in four upland regions in the UK

R.C. Helliwell¹, J.J.L. Davies³, M.C. Coull¹, C.D. Evans², D. Norris², R.C. Ferrier¹, A. Jenkins³ and B. Reynolds²

¹ Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen, AB15 8QH, UK.

² Centre for Ecology and Hydrology, Bangor, Gwynedd, LL57 2UP, UK.

³ Centre for Ecology and Hydrology, Wallingford, Oxfordshire, OX10 8BB, UK.

Email for corresponding author: r.helliwell@macaulay.ac.uk

Hydrochemical and catchment data from 80 upland moorland sites in four regions with contrasting climate, soils, geology and geomorphology have been analysed to assess the key catchment attributes that influence enhanced leaching of soluble nitrogen to surface waters. The regions are the South Pennines of northern England, the Snowdonia National Park in North Wales, the Galloway region of southwest Scotland and the Mourne Mountains in Northern Ireland, all highly acidified, with median pH values of < 5.5. Linear regression of mean summer and winter concentrations for nitrate (NO_3^-), ammonium (NH_4^+), dissolved organic nitrogen (DON) and dissolved organic carbon (DOC) were expressed as functions of catchment attributes. Nitrate concentrations in waters draining catchments dominated by peaty soils (large C pool) were considerably lower than those in catchments dominated by mineral soils (small C pool). Hence, if future N deposition levels are maintained or increase, high-altitude catchments with small carbon pools are potentially more susceptible to NO_3^- leaching. All N species exhibit seasonality; this is most marked in Snowdonia and least marked in the South Pennines, which implies that the South Pennines have reached an advanced stage of N saturation. Surface water inorganic N concentrations and dissolved organic carbon (DOC) to dissolved organic N (DON) ratio can be related to deposition inputs in all surveys, although relationships differ throughout the year. If the DOC/DON ratio is indicative of catchment N saturation, levels of N retention are at least partially determined by deposition levels. This study identifies N

deposition as a major inter-regional control on the degree of catchment N saturation and on N leaching to surface waters; it stresses the importance of catchment factors in modifying the relationship between N deposition and leaching in acid sensitive UK upland catchments.

KeyWords: Regional; Seasonal nitrogen deposition and leaching; catchment characteristics; South Pennines; Snowdonia; Galloway; Mourne Mountains.