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Long-term changes in precipitation and stream water chemistry in small forest and moorland catchments at Beddgelert Forest, north Wales

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Abstract. Changes in the chemistry of bulk precipitation and stream water between 1982 and 2000 are described for small moorland and forest catchments located within Beddgelert Forest in north Wales. Two forest catchments were partially clearfelled in 1984 (D2; 68% and D4; 28%) whilst a third (D3) remained as an unfelled control until autumn / winter 1998/99 when partial felling took place in the headwaters. Over the monitoring period, the annual mean pH of bulk precipitation increased from 4.6 to 5.1 whilst the annual mean non-seasalt sulphate concentration decreased from 0.53 mg S l⁻¹ in 1985 to 0.24 mg S l⁻¹ in 2000. Since 1985, the annual wet deposition flux of non-seasalt sulphur decreased by 50% to 8.4 kg S ha⁻¹ yr⁻¹ in 2000. Annual mean inorganic nitrogen concentrations and annual wet deposition fluxes have remained relatively unchanged since 1982. The decrease in atmospheric sulphur deposition is reflected by decreased annual mean concentrations of non-seasalt sulphur, acidity, aluminium and calcium in all four streams irrespective of clearfelling activities. Annual variations in nitrate-N and potassium concentrations in the forest streams, largely determined by pulses of leaching following forest clearance, had no effect on stream acidity. In common with UK upland catchments, annual mean concentrations of dissolved organic carbon have increased from about 1 mg C l⁻¹ in 1985 to between 1.5 and 2 mg C l⁻¹ in 2000, although there is considerable year to year variability. Two boreholes drilled adjacent to catchments D3 and D4 have confirmed the presence of alkaline, base rich groundwater at Beddgelert. Although the boreholes are only 150 m apart, there are large differences in chemistry suggesting that different groundwater reservoirs have been intercepted providing further evidence of the complexity and heterogeneity of groundwater systems in upland catchments.

Keywords: acid deposition, acidification, recovery, forestry, clearfelling, trends, Beddgelert, streams, rainfall

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