The effects of mixed measures of best management practice and habitat restoration on streamwater nutrients at catchment scales (Tarland catchment, NE Scotland)

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National mitigation measures in Scotland have been driven by GAEC (Good Agricultural and Environmental Condition) and the PEPFAA code (Preventing Environmental Pollution from Agricultural Activities). These strive for minimal maintenance in maintaining organic matter status, structure and guarding against soil erosion. Key measures include buffer strips to stop poaching and stream access by cattle, tillage and chemical, manure or slurry applications at stream margins. Vulnerable catchments are further protected by mandatory nutrient budgeting within designated Nitrate Vulnerable Zones. These measures will be reinforced from 2008 by the Scottish Government's set of national General Binding Rules, again including stream buffer zones, with additional regionally-targeted rules by 2012.

The Tarland Burn (NE Scotland) drains an area of relatively intensive agriculture (60% arable plus improved grassland) into the River Dee, a prime example of an oligotrophic river with species protected under Natura 2000. Water quality is an issue in such tributaries (mean annual SRP 18 µg/l and NO_3 3.8 mgN/l), but especially for the receiving waters and sensitive ecology in the main stem (SRP 1.7 µg/l and NO_3 0.4 mgN/l). Results on water quality changes over six years are reported for the Tarland Burn which has undergone mitigation measures and habitat improvements since 2000. Measures adopted have included fenced stream buffer strips, treatment of a major septic tank outflow, flooding control and improvements in public awareness of catchment issues.

Water quality at the catchment scale (52 km^2) has shown improvements in terms of suspended sediment (SS) concentrations and loads. Ninety percentile SS concentrations had decreased from 150 to 60 mg/l during 1999 to 2005, reflecting improvements in erosion at higher flows. Ninety percentile SRP concentrations have declined from 60 to 30 µgP/l during the same period, but there have been no reductions in NO_3 and increases in NH_4 concentrations. In exploring the processes behind these changes we compared control subcatchments with those where mitigation had occurred. Stream buffering and treatment of a point source had improved SS and SRP concentrations in a mesoscale subcatchment and this was linked to the return of *Salmonid* parr and reduced siltation of stream bed gravels. However, in a headwater where stream buffering alone had taken place there was no apparent improvements. Justification of buffer zones in the control of diffuse pollution is given by exploring changes in sediment and phosphorus concentrations over storms in an unbuffered headwater. Rapid increases in concentrations of SS and P forms in response to hydrograph rises (with strong clockwise hysteresis) showed that pollutants were very rapidly transferred to streams. Such responses suggested pollutant sources were near to, or in stream channels.