



An investigation into the influence of stocking density on the properties of soil and vegetation and the water quality of surface runoff in intensively managed grasslands

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Understanding the sources of sediment in catchment surface waters is essential to remediate sediment-related water quality problems and meet water quality guidelines and legislation such as the EU Water Framework Directive. At present, intensively managed grasslands have been largely overlooked as a potential source of sediments, despite their extensive coverage. Bilotta et al. (2008) provided the first field-scale evidence of the rates of erosion and sediment yields from intensively managed grasslands. However, the propensity of grasslands to erode and act as a source of sediments and sorbed contaminants is likely to be dependent upon the intensity of grazing (i.e. the stocking density). Here, work is presented from a field-based, plot-scale experiment which investigated the influence of grazing at a range of simulated stocking densities (0, 2, 4, 6 LSU ha⁻¹) on the properties of soil, vegetation, and the concentrations and yields of suspended solids (SS), volatile organic matter (VOM), total phosphorus (TP), total carbon (TC), and total nitrogen (TN) in surface runoff. Results show that concentrations and yields of SS, VOM, and TP increase with increasing stocking density. If the concentrations of SS observed in surface runoff from these plots were observed in streams and rivers, then only the concentrations (mean of 7-10 mg L⁻¹) in runoff from the 0 LSU ha⁻¹ stocking density (i.e. ungrazed) would meet the EU

Freshwater Fisheries Directive guidelines (25 mg L^{-1}). The concentrations of TP observed in surface runoff from all of the stocking densities, including the 0 LSU ha^{-1} , are in excess of those reported to cause serious eutrophication problems in both rivers and lakes ($35\text{-}100 \mu\text{g L}^{-1}$). (OECD, 1982). This is a likely consequence of the high residual levels of TP in the soils (mean pre-grazing level of 1052 mg kg^{-1}). The implications of this are that whilst lowering the stocking density of grassland may reduce sediment-related water quality problems, it may not solve phosphorus-related water quality problems if there are high residual levels of phosphorus in the soil. Interestingly, from an agronomic perspective, an abrupt decline in herbage dry matter yield as stocking density increases beyond 2 LSU ha^{-1} was also observed. Therefore, as well as having negative environmental impacts, high stocking densities may be detrimental to the productivity of livestock farming.

Bilotta, G.S., Brazier, R.E., Butler, P., Freer, J., Granger, S., Haygarth, P.M., Krueger, T., Macleod, C.J.A, Quinton, J., (2008) Rethinking the contribution of drained and undrained grasslands to sediment related water quality problems. *Journal of Environmental Quality* (accepted 18/10/07).

OECD, 1982. Eutrophication of waters, monitoring, assessment and control, Organisation for Economic Cooperation and Development, Paris.