

Science Project: The Impact of De-Stocking on the Microbiological Quality of Rivers in the Caldw Catchment

Summary SC020045/S

Diffuse microbiological pollution from agriculture is an important factor influencing the quality of bathing and shellfish waters in the UK. This project, commissioned by the Environment Agency and undertaken by scientists from ADAS and CREH, monitored the impact of radical changes in farm animal stocking density on microbiological quality of watercourses in the Caldw catchment (Cumbria). The catchment is predominantly a productive grass growing area with dairy and stock rearing farms, although the upper part of the catchment consists of open fells used for sheep grazing.

During 2001 the UK suffered a major outbreak of Foot and Mouth Disease (FMD) which led to a cull of farm animals at Infected Premises and Direct Contacts. Approximately 80% of the cattle and 90% of the sheep in the Caldw catchment were culled, providing an opportunity for this study. The key aim was to develop a relationship between stock density and microbial water quality.

The project modelled the relationship between water quality and animal stocking density (plus a range of other variables) as farmers re-stocked during the post-FMD period. Information sources included Defra annual farm census statistics, animal movement data from the British Cattle Movement System (BCMS), log sheets completed by farmers in the catchment, and field measurements of microbial water quality,

rainfall and river flow. The animal count data was used to model manure loadings to the catchment during the study period. Unfortunately, FMD imposed restrictions on access to land which precluded field measurements being made during the period of lowest stock density.

Outcomes

Faecal indicator concentrations increased downstream in the catchment during all flow conditions. Sub-catchment delivery of faecal indicator organisms into the watercourses exhibited strong seasonality, with summer concentrations exceeding winter concentrations at all sites. This reflected stock movement patterns with over-wintering indoors. High flow periods – particularly those in summer - exhibited the greatest concentrations, and dominated faecal indicator fluxes through the catchments. These latter two facts have implications for future studies of diffuse pollution management and remediation strategies.

Tentative relationships between stock density (expressed in livestock units), and high flow faecal indicator organism concentrations were developed. The confidence limits of these relationships are currently large and further research would be required for their consolidation.

However multiple regression modelling demonstrated that the best predictor of faecal indicator organism concentration in the watercourse was the proportion of improved pasture in the catchment upstream. This has been a consistent outcome from similar land use modelling exercises in catchments around the UK.

The land-use data required for this kind of modelling exercise are readily available (CEH Land Cover 2000) and further development of generic models relating land use to microbiological quality is possible. This approach could be used to highlight risk areas, and so inform the development of Programmes of Measures for the Water Framework Directive.

Reforms to the Common Agricultural Policy are likely to have a considerable impact upon stocking density on improved pasture over the coming years. Further development of models relating stocking density to water quality is therefore required, to contribute to the strategic development of CAP related planning for the environment.

This project is paralleled by a second study deriving relationships between nutrients and animal stocking density, with the object of deriving similar land use / watercourse nutrient relationships.

This Summary relates to information from Science Project P2-293 (SC020045) reported in detail in the following output-

Science Report SC020045/SR (P2-293/SR)

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