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# Evaluating the water quality benefits of land management change – a case study of the Holnicote Estate, Exmoor

Project summary SC120042

The Holnicote project was set up in 2009 as part of the Defra Flood Management Demonstration Scheme to provide evidence to show how integrated land management change can contribute to reducing local flood risk while improving ecosystem services within the catchment. These include landscape quality, biodiversity, carbon stewardship, water quality, amenity and recreation. This report summarises the water quality component of the scheme and was a collaborative project between the University of Exeter, The National Trust and the Environment Agency.

The Water Framework Directive sets ecologically based water quality targets to be achieved through catchment management. However, there are significant gaps in our understanding of the cumulative effectiveness of multiple measures on a number of pollutants at the catchment scale.

Two catchments with contrasting land use, Aller and Horner Water, on the National Trust Holnicote Estate in Somerset provided the opportunity to compare the effect of land use mitigation measures to reduce local flood risk on water quality. Horner Water is dominated by semi-natural vegetation and located on high ground. The Aller catchment is dominated by intensive agricultural land use at near sea level. This study evaluated the effects of upland ditch blocking on physicochemical and biological parameters of water quality in the upland Horner Water catchment one year after installation. In the Aller catchment land management interventions included: restoration of old mill ponds for increased flood water storage; planting of floodplain woodland; and construction of flood alleviation levées.

Variations in soil physical and chemical properties were characterised in the two study catchments to identify the likely critical source areas of diffuse water pollution. This covered bulk density, total carbon, nitrogen, C:N ratio, ratio of naturally occurring stable N isotopes $^{15}N/^{14}N$, total phosphorus, inorganic phosphorus and organic phosphorus.

This study showed that agricultural land use has a profound influence on soil properties and the movement of sediment and carbon from land to water. Intensive agriculture, including livestock grazing and arable land use in the agricultural Aller catchment, resulted in soil properties being uniform, and higher losses of sediment and particulate carbon. This was despite the semi-natural Horner Water catchment supporting soils with higher carbon content.

Agricultural land use also affected the quality and quantity of the dissolved organic carbon. The agricultural catchment exported sediment and carbon more readily than the semi-natural catchment, even during small and medium sized rainfall events. In contrast, the semi-natural catchment was more resilient to sediment and carbon losses, with losses only occurring during extreme rainfall events.

Biological monitoring, using macroinvertebrates, was potentially more sensitive to detecting the impact of upland ditch blocking on water quality than the traditional approach of monthly monitoring of physico-chemical water quality parameters. The study also found that a new biological monitoring tool, the Proportion of Sediment-sensitive Invertebrates (PSI) index, could be developed further to measure the impact of sediment action on ecology.

While the study established a water quality baseline prior to the implementation of land management interventions, further monitoring is needed to evaluate the effectiveness of land management changes on achieving water quality improvements at a catchment scale over the next few years.

Parts of the report are reproduced from a PhD thesis by Miriam Glendell, *Evaluating an Ecosystem Management Approach for Improving Water Quality on the Holnicote Estate, Exmoor,* submitted to the University of Exeter in 2013.

This summary relates to information from project SC120042, reported in detail in the following output(s):

**Report:** SC120042/R
**Title:** Evaluating the benefits of catchment management for multiple ecosystem services

**October 2014**

**Internal Status:** Released to all regions
**External Status:** Publicly available

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This project was funded by the Environment Agency's Evidence Directorate, which provides scientific knowledge, tools and techniques to enable us to protect and manage the environment as effectively as possible.

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