

## **Ecosystem Interactions –Scaling Issues** Defra contract number: NR0152 Summary

In order to provide evidence about the importance of taking into account key interactions between ecological systems for decision making, this project used information generated from integrated approaches taken towards understanding human impacts on the environment in two contrasting projects. The key contrast between the two datasets used was in terms of scale, with Countryside Survey designed to provide national information (based on a surveyed sample of representative 1km squares) and the Loweswater (RELU) project designed to provide information specific to the small catchment of Loweswater (based on a whole catchment survey).

The project consisted of two main strands; 1) modelling the interactions between land and water in the delivery of ecosystem services at catchment, 1km squares and national scales and considering how scale and approach impacted on the value of model outputs (sections 1 and 3 of the report) and 2) detailed analysis and reflection on the importance of scale and approach within the Loweswater catchment project (section 2 of the report). For 1) the project used data generated from previous projects at the two different scales outlined above. A Bayesian Network model (informed by process based catchment modelling of water quality) was used to model impacts of individual farmer land use on the production of ecosystem services at the catchment scale. A Boosted Regression Tree model was used to model water quality at national scales based on the relationships identified within the Countryside Survey data sample. The Land Utilisation and Capability Indicator (LUCI) model was also used to model catchment scale delivery of ecosystem services.

### **Conclusions:**

Geographical scale is an important consideration for understanding ecosystem interactions and their role in the delivery of ecosystem services. Process based models of interactions between land and water and their impacts on water quality provide valuable policy information at national levels and play an important role in understanding impacts at local levels. But it is at local levels where insight into the challenges of multiple ecosystem service delivery within a socio-ecological system can best identify potential policy or management approaches which can effect change where it is required. The Loweswater example shows that despite biophysical catchment constraints on farmer income (from produce) farming still negatively impacted on water quality in the catchment. Relationships between landscape quality, farming income and water quality were less clear, not least because of limits to knowledge about relationships between aspects of landscape quality and wider ecosystem services including water quality. The work suggests that stakeholder engaged, socio-ecological approaches to understanding ecosystem service delivery are essential, but complex, even at local scales.