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Modelling with stakeholders as part of an analytic-deliberative approach to catchment management

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It has increasingly been realised that the protection of water resources requires a 'twin-track' approach of scientific research and deliberative stakeholder engagement at the catchment scale (Smith and Porter, 2009, DOI 10.1007/s10113-009-0102-z). This presents exciting opportunities for mutual learning from all involved, which can enhance both the societal responsibility of individuals and organisations as well as the scientific enquiry. Graphics and computer models can be used to merge scientific with local contextual knowledge to build a decision support tool that is shared and trusted by all parties. In this paper, we demonstrate such a model building exercise as tested with stakeholders for case studies of diffuse water pollution in the Broads in Norfolk and the upper Tamar catchment in southwest England. A Bayesian Belief Network (BBN) approach was chosen as it can easily be interpreted graphically, can accommodate different types of knowledge and can incorporate probabilistic estimates of uncertainty for data inputs, processes and model predictions. The paper will show how we quantified such uncertainties for a nutrient export coefficient model subject to the computational limitations of the BBN approach. The main thrust of the paper will then report how stakeholder engagement with the modelling approach was facilitated, how local ownership of and contribution to the modelling approach was developed, how stakeholder expectations evolved, and the outcomes delivered by the approach. Conclusions are drawn concerning the benefits of and means for combining scientific expertise with local stakeholder knowledge, how models may be advanced by incorporating expert knowledge explicitly and how this knowledge can best be elicited and utilised.