Climate change, land use change and ecological status of Finnish rivers: A Bayesian network approach

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The European Water Framework Directive requires the ecological status of European water bodies to be good in light of advanced biological indicators. Multiple stressors impact ecological status in water bodies, so the diagnosis of the causes of deterioration becomes increasingly important. Currently, practical management focus on the control of single stressors which are assumed to be dominant. Modelling methods have widely been used to predict effects of altered land use and climate change on water quality. However, process based models typically predict abiotic responses and neglect biological effects of modelled changes in abiotic conditions. These, however, are important for river basin management. We applied a Bayesian network (BN) modelling approach to link future scenarios of climate change, land use change and modification of water bodies to ecological status. The objective was (i) to assess the combined effect of changes in land use and climate on the ecological status of a river and (ii) to assess the suitability of the BN modelling approach for this purpose. The BN was able to model effects of climate change and management on ecological status of a river, by combining scenarios, process-based model output and ecological, hydrological and water quality data. The results showed that the benefits of better land-use management were partly counteracted by future warming under these scenarios. Thus, the BN approach is potentially useful for water body diagnosis in river basins.