BAYESIAN MODELLING WITH INFORMATIVE PRIORS FOR ECOLOGICAL APPLICATIONS

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Many ecological management decisions are by necessity made with limited data, so rely on substantive prior information including expert knowledge. A Bayesian statistical modelling framework is well suited in such cases as it provides an explicit method for combining data with prior information. Elicitation within this framework supports rigorous development of prior models, and requires formulation of informative rather than non-informative prior models. Recent reviews have examined formulation of informative priors but cite very few ecological examples. In this paper we draw on our experiences to address this gap. Case studies highlighted include: indirect prior formulation, for generalized linear models in ecotoxicology or landscape ecology, or for multivariate mixtures in regionalisation; and decomposition of elicitation of vegetation condition benchmarks.

The review revealed key issues that recur when formulating ecological priors for expert elicitation. Existing expert panel processes can be harnessed to facilitate elicitation and compiling information. Software tools streamline elicitation, enable interactive feedback and provide experts with a dual spatial and environmental gradient view. Visualising the changing impact of prior information on the posterior aids model evaluation and communication. Finally matching the way experts easily express their knowledge provides more effective elicitation and more reliable priors.