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Collating expert opinions on brush-tailed rock wallaby habitat: indirect elicitation using an elicitation tool and GIS

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A plethora of approaches have been developed for habitat modelling. In practice, approaches that rely on expert opinion are often preferred, due to the difficulties of timely collation of sufficient relevant data and/or of building robust models using this data. Bayesian statistics provides a useful bridge between expert knowledge and data when it becomes available. The Bayesian framework requires that expert opinion is explicitly elicited at the outset of modelling, and encoded as a prior distribution, before seeing the data. We briefly outline a number of expert-informed Bayesian statistical modelling approaches to habitat modelling, which may elicit different types of information from experts, and then encode this using various statistical approaches.

Logistic regression is a common choice for statistical habitat models. However experts may find it difficult to express their knowledge directly in terms of regression coefficients. Instead they may find it easier to take an indirect approach, and estimate responses for specific scenarios with given covariate values. One example of this "modular" predictive approach to elicitation for regression has been investigated recently by some of the authors. Their approach allowed experts to predict response at sites one by one, using a map-based interface to access the sites. Expert opinions were encoded using the posterior predictive distribution for regression. Prototype software allowed experts to quantify the plausibility of a range of responses at a number of elicitation sites, for two specific case studies.

The success of the prototype led to a recent project to redevelop it within a more modern computing environment. An important concern was that the linking of four packages—for statistical computing, graphics, GIS and user interface—needed to be more resilient to version changes. Other changes were implemented. Extra methods of presenting information graphically were added. The tight coupling with GIS was relaxed to enable more flexibility and less reliance on commercial software. A relational database was introduced to manage responses from several experts, at various times, for different elicitation 'projects'. The underlying encoding method was changed from relying on the posterior predictive approach to viewing expert knowledge as data.

Since the innovative prototype was introduced, further information has been collated on the case study concerning the threatened brush-tailed rock wallaby (*Petrogale penicillata*). The original dataset of 50 sites has been supplemented by a further 350 sites, designed to target the range of potential habitat factors. Stratified random sampling was undertaken with respect to broad environmental factors (geology, remnant vegetation and landcover). Gradsect sampling ensured coverage of site-specific characteristics such as topographic factors. In addition several experts were consulted, before viewing the data, to provide their opinions using the redeveloped elicitation tool. Experts were expected to provide useful information to mediate problems with the dataset, including the difficulties of working with habitat measures at landscape scale, and the limited scope of the data which did not provide full coverage of the habitat design space.

This presentation summarizes the contributions of the tool and the Bayesian approach to the next generation of analysis on this rock wallaby. Some mention of the challenges of combining multiple expert opinions is made, although this is considered in more depth elsewhere.