# Designing optimal survey schemes to inform conservation decisions

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Conserving biodiversity means working with limited resources and incomplete information. In the face of uncertainty, practitioners can develop plans for expanding protected area systems (prioritisations) using existing data or they can gather evidence -- by surveying sites for species of conservation interest -- to refine them. However, such evidence gathering reduces the funds available for purchasing sites for conservation and so survey schemes need to be strategically designed. Here, we investigated various approaches for generating survey schemes. Using a case-study, we obtained existing survey data for native species, survey costs, and land acquisition costs. Next, we designated new sites and modelled the probability that the study species occupied them. We then used conventional approaches to generate survey schemes by selecting sites with (i) geographically representative locations; (ii) environmentally representative conditions; (iii) uncertain model predictions; (iv) high occupancy probabilities; and (v) low acquisition costs. To compare them, we also generated survey schemes by (vi) directly maximizing return on investment. After generating these survey schemes, we evaluated them using value of information analyses. We found that survey schemes generated by maximizing return on investment were far more effective than conventional approaches. In particular, survey schemes generated by increasing the geographic coverage and environmental diversity of surveyed sites had the poorest performance. Under limited budgets, survey schemes generated using conventional approaches misallocated a large proportion of the available funds so that little remained for purchasing sites to achieve conservation objectives. It was only under relatively large budgets, when the majority of sites could be purchased for conservation, that conventional approaches had near-optimal performance. Our results show that schemes for gathering evidence can be substantially improved by explicitly quantifying their capacity to improve conservation decisions. We recommend using value of information analyses, when feasible, to optimally allocate resources for gathering evidence and conserving biodiversity.