# Optimizing ecological surveys for conservation

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## Information

Conference: AWMS annual conference 2022

Website: https://awms.org.au/Conference/

Dates: 6 December – 8 December

Submission type: Talk

Word count: 245 / 250

## Abstract

Biodiversity conservation means working with limited funding and incomplete information. To help achieve this, ecological surveys can locate species and, subsequently, inform plans for establishing new protected areas. However, conducting surveys also reduces funding available for new protected areas—producing a dilemma. Here we present a novel framework to assess and optimize survey plans. Our framework, grounded in value of information analysis, assesses survey plans based on how they can improve coverage of species within resulting protected area systems. Crucially, it considers land acquisition and survey costs. We applied our framework to a case study comprising nine plant species in Ontario (Canada). We generated optimized survey plans using our framework. We also assessed the performance of survey plans generated using conventional approaches, such as using statistical, biogeographical, or economic criteria. Our results demonstrate that our framework successfully identifies survey plans that are likely to improve the performance of plans for protected areas. We also found that conventional approaches for designing survey plans can squander funding, because they select places that are unlikely to improve conservation decision making. Indeed, surveying places that are most likely to contain species of interest had the worst performance, because data collected at these places would likely provide very little new information. Moreover, conventional approaches had the worst performance under limited budgets that are typical of real-world contexts. Our findings highlight the importance of carefully considering how new data can potentially alter management decisions when designing plans for data collection.