# Accounting for imperfect detection when evaluating the effectiveness of invasive species control

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**Abstract:** Many invasive plant species are sparsely distributed across large areas. Management of these species is often undertaken using a search and destroy approach where people search the landscape and treat (destroy) any individuals found. However, detection is imperfect and so these searches need to be undertaken on multiple occasions. Given limited resources, an explicit objective is to optimize efforts by targeting those areas for follow up visits that have the highest predicted abundance. In order to simultaneously estimate both abundances and detection rates from data on search & destroy efforts, it is necessary to have a good model of the detection process itself. Using a case study of invasive willow control across a 120 $km^2$ region in alpine Australia, we used intensively monitored sample plots to characterise how detection rates depend on perceived abundance for three groups of willow control contractors. We used Bayesian models to fit an exponential detection function where the detection rate varied with plant size, between contractors, with the total number of willows treated, and on features of the contractors' movements. We found that detection rates decreased with increasing abundance but areas with high abundance were subject to greater search effort. We combined these models with GPS tracking data representing six weeks of search and destroy missions to predict the remaining abundance of willows across the landscape and hence identified areas that are priorities for follow up control.