Introduction to the symposium on search and detection

Those managing biosecurity at borders or eradicating weeds, pests and diseases share a common problem. Unless the unwanted organism is highly conspicuous, it can be extremely difficult to find the first few invaders, or the last few survivors. Thus, non- detection after a search does not necessarily mean the animal, plant or disease is not in fact present. Depending on the effectiveness of the search, the absence of evidence may provide only weak evidence of absence. These uncertainties create risks for managers. Falsely declaring an unwanted organism absent when it is in fact present but undetected is likely to have adverse, and potentially major, biological, economic and political consequences. Conversely, it is obviously wasteful to continue with management and surveillance when in truth the organism is no longer present.

In the eradication context, managers can adopt one of two approaches to deal with this uncertainty. The first is a 'fail-safe' approach, often used in eradicating rodents from islands using a single 'over-engineered' aerial baiting operation. Meticulous planning is required to make sure nothing goes wrong with their control event because they only get one shot at it, and the control method itself provides no information on success or failure. That approach is adopted because it perceived that the costs of searching for survivors and then dealing with them is likely to far outweigh the costs of waiting until failure is revealed by weight of numbers and time and having to repeat the occasional failure.

In contrast, managers eradicating a pest or weed by successive control events can adopt a 'safe-fail' approach because they have more flexibility to learn from the information provided by the control events. The major uncertainty here lies in the 'stop rules' - when to declare success. Objective stop rules require surveillance data, but to be 100% sure no unwanted organisms remain managers would have to search everywhere with a perfect detection device, something rarely possible or affordable. Managers therefore have to balance the cost and sensitivity of surveillance against the risks of being wrong, and then search to meet that level of certainty.

Some major unresolved issues for the 'fail-safe' type of eradication are whether it is possible to improve the efficiency of search and detection so that failures can be promptly managed, and potentially so that the level of over-engineering required to guarantee success can be reduced. For the 'safe-fail' type of eradication the need is to ensure relevant information is collected during the control phases of the operation to allow stop rules to be quantified, and for development of analytical tools to allow better estimates of the residual risks and costs of falsely declaring success.

In November 2008, a two-day symposium of 25 invited papers on the theme of 'Search and detection: theory and application in disease and wildlife management' was held in Wellington. Papers were presented to an audience of about 60 people by researchers from New Zealand, Canada, Australia, Mexico, and the USA. Some of these papers, and others on the theme of the symposium submitted later, are published in this special issue along with the abstracts of the papers presented at the symposium. The symposium and this special issue were supported with funding from the New Zealand Foundation for Research, Science and Technology, Landcare Research, the Invasive Animals Cooperative Research Centre, the Australian Biosecurity Cooperative Research Center, and the Australasian Wildlife Management Society.

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