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# DEVELOPING A DECISION SUPPORT SYSTEM FOR IMPROVING POSSUM CONTROL PLANNING

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***Abstract:*** Brushtail possums are a major invasive pest in New Zealand. A decision support system (DSS) has been developed to enable those involved in operational planning or delivery of possum control to access available relevant knowledge when making operational decisions. The DSS comprises checklists that ensure users consider relevant constraints and issues, a database of best-practice information on possum control, and an "expert" system that recommends actions based on information provided by the user.

***Key Words:*** decision support system, invasive species, possum, management, *Trichosurus vulpecula*, vertebrate pest.

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## INTRODUCTION

The brushtail possum (*Trichosurus vulpecula*) was introduced into New Zealand from Australia in the mid- to late-1800s, and has become a widespread pest. In particular, the possum is a significant wildlife host and vector of bovine tuberculosis (Tb, *Mycobacterium bovis*), and about NZ$50 million is spent annually on controlling possum numbers in disease-risk areas. Control is also carried out over about 1.1 million ha to limit their damage to conservation areas. Possum control has been supported over several decades by research focused on improving control tools and understanding possum behaviour and ecology (Montague 2000). Consequently, there is a wealth of information available to possum control managers and contractors who undertake possum control on the relative effectiveness and cost of various control tools, control strategies, non-target and environmental impacts, possum biology and behaviour, and legal and biological constraints to operational procedures. Unfortunately, much of this information is found only in formally published scientific papers and books or in unpublished reports, and as a consequence is not readily available to many of the relevant "end-users".

## DEVELOPMENT OF A DECISION SUPPORT SYSTEM

A decision support system (DSS) was developed to enable those involved in operational planning or delivery of possum control to access available relevant knowledge when making operational decisions. DSSs have been developed primarily for the agriculture industry to improve the transfer of information from researchers to end-users and to help the latter interpret and apply it to a range in agricultural systems, including invertebrate pests (Stuth and Smith 1993, El-Azhary et al. 2000, Ghosh and Samanta 2003), grazing systems (Sinclair and Rickert 2000), and diagnoses of animal diseases (Kroschewski et al. 2006, Eisler et al. 2007).

The Possum DSS has three components: (1) Checklists that ensure users consider relevant constraints and issues when planning a possum control operation. Two checklists containing a range of constraints were developed, one for vector managers and one for control contractors. For disease vector managers, the constraints identified include vector control boundaries, stratification of the proposed control area, existing possum density, strategic control options, legislation underpinning control, and post-control possum population monitoring and auditing. For possum control contractors, the constraints include their capability to do the job using the techniques chosen,

technique cost-effectiveness, relevant legislation, environmental risks arising from control (including risks to non-target species), public opposition, and the behavioural responses of possums to the control devices planned for use. (2) A database of best-practice information on possum control. The information is presented as a series of points rather than as large blocks of text in order to make the information more readable. Additional "supplementary" information was collated and linked using hyperlinks through keywords to allow the user to easily locate other information as required. All information is accessible, either directly through a "best-practice index" or through the links provided with the recommended actions, and includes information covering both the mechanics of control (e.g. the specifications of carrot and cereal bait and protocols for aerial delivery, baits for ground control, use of bait stations, bait shyness, pre-feeding, and use of trap and trap suppliers). Also included are strategies for control (e.g., what approaches to use in areas receiving high and low rainfall, areas controlled within the previous three years, areas containing Tb-infected deer and pigs [including how to handle infected carcasses], areas containing game animals considered to be important hunting resources, and areas containing protected wildlife). Additional issues related to possum control such as human health and environmental contamination are also documented. (3) An "expert" system that recommends actions based on information provided by the user. Twenty-nine key rules were identified using 10 control scenarios developed by the authors. A set of 24 queries (prerequisites) was developed that users of the system must consider and identify as true or false. These prerequisites are then submitted to an inference engine, which provides the system interrogator with a set of recommended actions. Mandarax software was selected as the DSS because (1) it is open-source software (i.e. freely available) licensed under the non-invasive LGPL (Lesser General Public Licence) system, (2) expertise in using the system was available in New Zealand, and (3) it has components that make it easy to integrate into web-based systems. Mandarax uses backward-chaining inference (reasoning), and the conclusions of the rules are the actions recommended by the system. This system enables the end-users to better understand the logic used by the system, which increases the trust they have for the system. This in turn encourages them to provide feedback to system managers on the rules used. For the latter, the system facilitates feedback via email. This function turns the system into a two-way communication and knowledge-sharing tool.

A draft DSS (http://possumdss.landcareresearch.co.nz) was developed and made publicly accessible on the Web in early 2006.

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