

# Encompassing the relative non-target risks from agents and their alien plant targets in biological control assessments

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**Abstract** Criticisms about the safety of biological control of alien plants has resulted in a risk-averse approach, where the risks posed by the agent are paramount and the risks posed by the alien plant are neglected. We argue that the risk associated with non-target damage from agents needs to be assessed relative to that of their target alien plants. A literature review of the non-target risks associated with biological control agents was undertaken in terms of the risk to native species from agents relative to the risk to native species from their alien plant targets. We then developed a framework that compares the consequence with the likelihood of non-target damage for

both agents and their targets to provide an overall risk rating. Assessments of the risk of damage from both agents and their target alien plants will enable researchers, managers and policy makers to better assess the risks from biological control.

**Keywords** Non-target effects · Likelihood · Consequence · Framework · Risk-averse

## Introduction

Alien plant species are a significant global problem (Pimentel 2002). Thus considerable effort has been directed towards their control and management. One such control measure, classical weed biological control (biological control hereafter), uses the alien plant's natural enemies as the method of control (van den Bosch and Messenger 1973). Biological control has been used for > 140 years to control alien plants (McFadyen 1998; Moran and Hoffmann 2015), and has been shown to be a cost-effective control technique (Fowler et al. 2000), based on both current benefit-cost analysis (Page and Lacey 2006) as well as estimated future benefits (van Wilgen et al. 2004).

Whilst there are significant benefits from the biological control of alien plants, there have been some undesirable outcomes, which have resulted in some major criticisms of the science (e.g. Howarth 1991; Simberloff and Stiling 1996a, b). The basis of

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