When do we need to incorporate human behaviour into models of weed control, and how do we do it?

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Summary Most attempts to understand weed invasions consider only biological or ecological factors such as species traits, dispersal ability, landscape features and the receiving community. If there is no weed management, or weeds are managed in a 'command and control' fashion, then little more is needed. There are many instances however, where weed control decisions are made in a decentralised fashion (for example in agricultural landscapes). In these cases human behaviour also needs to be included in the model. This can add a great deal of complexity because human behaviour is shaped by a wide range of influences; lifestyle priorities, social pressure, economic considerations, and attitudes toward risk. Furthermore, decision makers constantly adapt their strategies in response to both changes in weed distribution and other decision makers.

Trying to understand how these factors, in conjunction with invasion ecology, influence weed distribution and abundance presents a new challenge to modelling weed control. Problems associated with understanding both ecological and anthropogenic systems are magnified by new and complex interactions.

In this regard, recent resource use models set in landscapes where decision making is decentralised (for example Iwasa *et al*. 2007), hold much promise. These models work by reducing the decision making process to a simple logistic decision rule. In these models each agent can choose one of two options. The benefit received from making a given choice determines the probability of an agent making that choice. These models have the benefit of being relatively simple and very flexible.

I have adapted a logistic decision rule model to weed invasions in agricultural landscapes. This model is used to suggest the most suitable systems in which to test the proposition; human behaviour and social conditions play a crucial role in determining how weed invasions unfold in decentralised decision making systems.

It was found that those systems with a lot of relatively similar decision makers or a few very recalcitrant decision makers are best for testing the above proposition.

Despite the difficulties inherent in trying to understand and integrate two complex systems like human behaviour and invasion ecology, it is vital that we do so. Understanding how our behaviour interacts with invasion ecology will help us predict how control strategies are likely to be implemented in practice, how effective they will be, and how much they will ultimately cost or profit us. In the end it is the answers to these questions that will determine how and if weed control is undertaken in the long term.

Keywords Weed control, landscape scale model, decentralised decision making, invasive species.

ACKNOWLEDGMENTS

This project would not have been possible without support from the Queensland Murray Darling Committee and Condamine Alliance.

REFERENCE

Iwasa, Y., Uchida, T. and Yokomizo, H. (2007). Nonlinear behaviour of the socio-economic dynamics for lake eutrophication control. *Ecological Economics* 63, 219-29.