Green alien space invaders: adding the spatial dimension to weed population models

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Summary Weed management is an essential part of every agricultural system. However, weed management is difficult because the dynamics of weed populations are influenced by a mix of interrelated factors, many of which may be hard or impossible to observe directly and/or play out over long periods of time. Computational simulation modelling provides an important tool for integrating existing knowledge in order to help understand, predict and manage weed population dynamics. However many weed population models have treated weed populations as spatially homogeneous, ignoring the possibility of spatial heterogeneity in environments, management, densities and genetics. We hypothesise that in many situations accounting for spatial heterogeneity is essential.

This presentation will describe some examples where spatially explicit modelling of weed populations has been used to address real world weed management issues. The examples include predicting spread of invasive weeds in urban bushland and agricultural landscapes; evaluating whether occasional strategic inversion (mouldboard ploughing) can slow the evolution of herbicide resistance; exploring whether eradication could be a viable strategy for dealing with herbicide resistance; and investigating whether accounting for spatial heterogeneity changes predictions of how quickly resistance will spread through a weed population and impact crop yields.

In each of the examples, results show that the spatial dimension is essential for properly understanding and predicting the issue being examined. While space may not be the final frontier in the war against weeds, it is an important step in overcoming the green invaders. Spatial heterogeneity should be considered when using computational simulation modelling to help understand, predict and manage weed population dynamics.

Keywords Weed, simulation, model, spatial, invasion, resistance, evolution, spread.