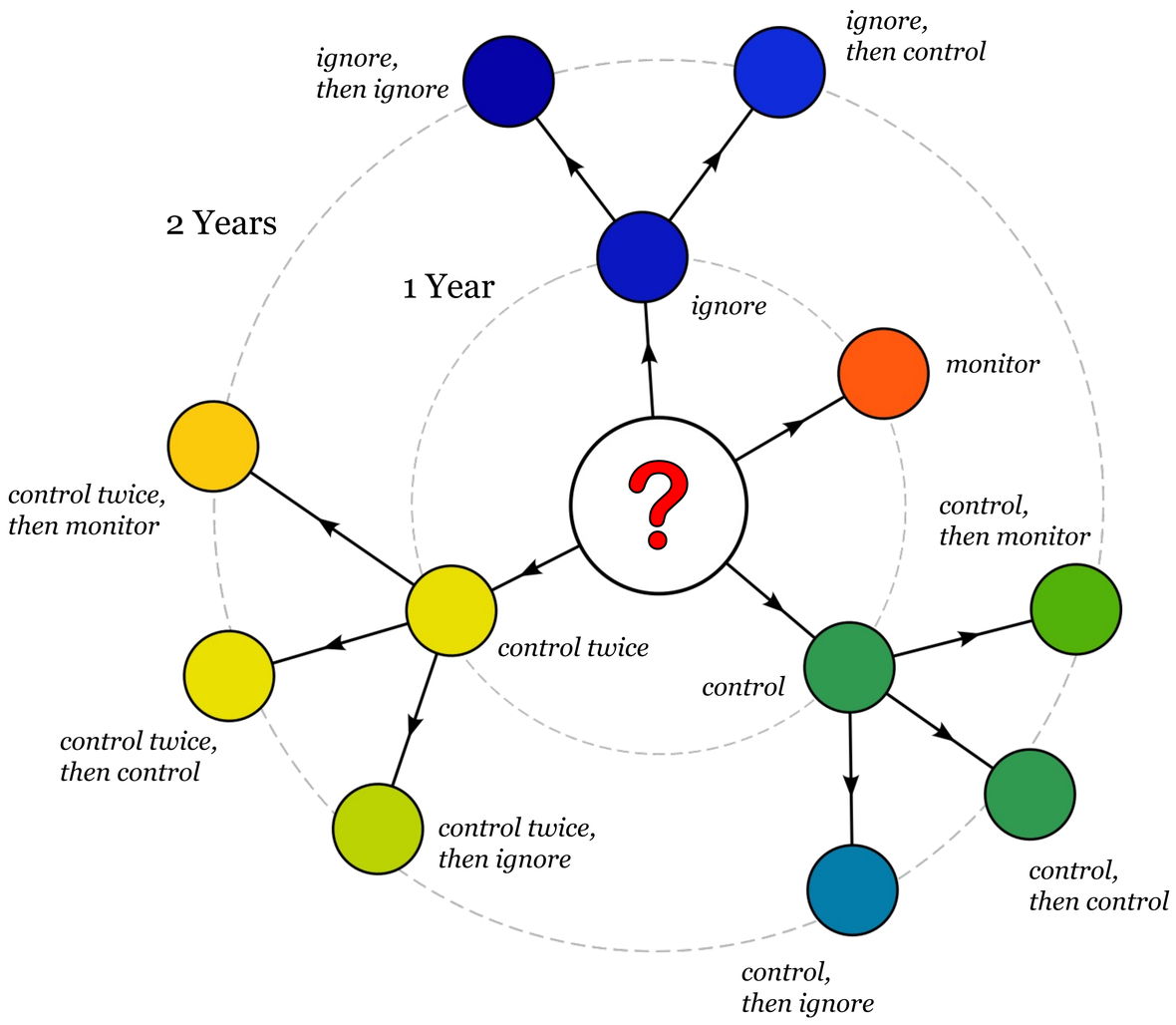
Invasive Species Management: *to monitor or control?*

Thomas K. Waring[1,2], Vera Somers[3], Michael McCarthy[4], Christopher M. Baker[1,2,5]

THE UNIVERSITY OF MELBOURNE



Not all management interventions are created equal...

- Is aggressive *control* worthwhile, if the invasive population remains small?
- Should further decisions be deferred, until *monitoring* is carried out?
- Should *nothing* be done, saving resources for other problems?

We aim to provide a general framework within which such questions can be answered.

Methods

- We use techniques from the study of Partially Observed Markov Decision Problems (POMDPs).
- Our process starts with a confidence interval for the species abundance.
- Then we can recommend the optimal action, accounting for multiple control options, monitoring with varying uncertainty, and interventions which combine the two.

The plot below shows the result of this process, with the options displayed in the network above. At each time step, the manager can:

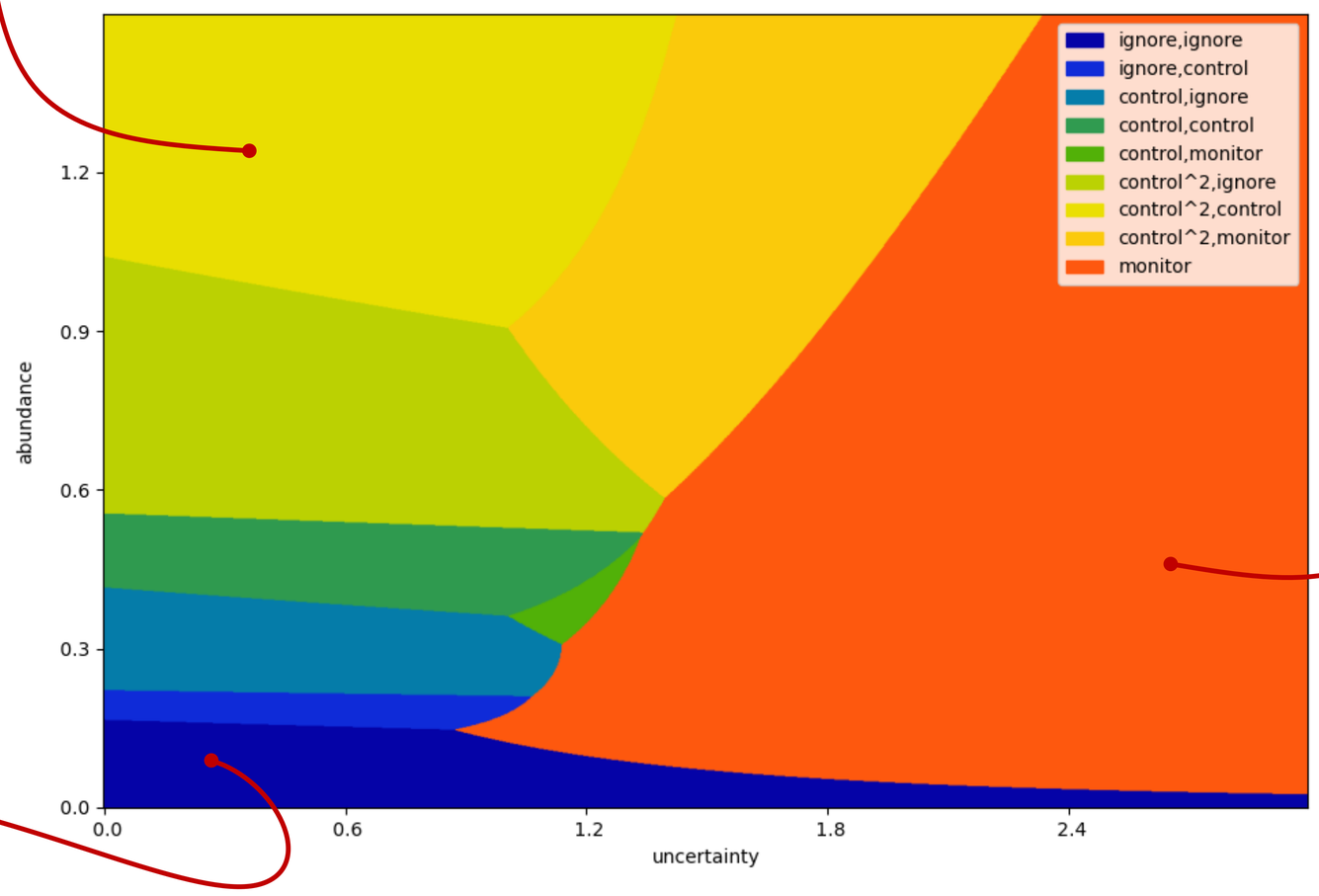
- Do nothing,
- Apply a control measure once, or twice,
- Or monitor the infestation.

This decision is based on an estimate of the species abundance, and an estimate of uncertainty.

At high abundance and low uncertainty, the manager can be confident that control is the optimal intervention

At higher uncertainty, the manager prefers to monitor the invasive species before making further decisions

Optimal management interventions

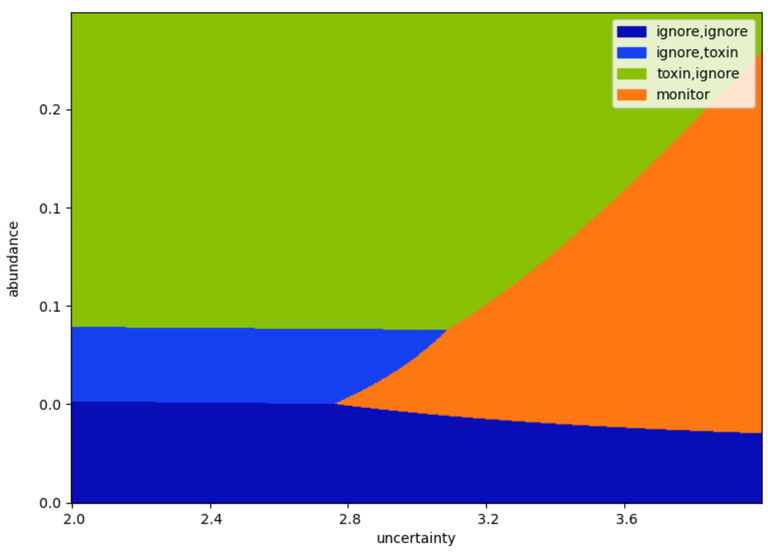


At *low* abundance and *low* uncertainty, it is optimal to do nothing

As disease abundance increases, so should the *intensity* of control measures taken.

We apply our methods to control of tropical fire ants on Ashmore Reef.

Optimal interventions: *S. geminata* on Ashmore Reef



Uncertainty makes the decision less clear. As a result, it may be optimal to defer control until after monitoring the species.

For model details, further examples, and colourblind-friendly versions, scan here.

[1]School of Mathematics and Statistics, The University of Melbourne, Parkville, VIC, 3010, Australia
[2]Melbourne Centre for Data Science, The University of Melbourne, Parkville, VIC, 3010, Australia
[3]OPTIMA, The University of Melbourne, Parkville, VIC, 3010, Australia
[4]School of Biosciences, The University of Melbourne, Parkville, VIC, 3010, Australia
[5]Centre for Excellence in Biosecurity Risk Analysis, The University of Melbourne, Parkville, VIC, 3010, Australia