A new tool to help policy makers choose cost–effective options for invasive species management. The tool:

- can map the current and likely future range and population densities of invasive species under different management scenarios, to assist the cost-effective management of invasive animals and diseases.
- is user-friendly and can run on a desktop computer.
- can produce reports to communicate the likely impacts of different strategies to senior decision makers, land managers and interest groups.

Invasive species are having a major impact on vegetation communities and ecosystem processes throughout Australia. The impacts of invasive species, like wild horses in alpine areas, present a major challenge to land managers, especially in national parks.

Prioritising conservation activities requires an understanding of the location and spread of invasive species, and the likely effectiveness of different control methods. Effective management of invasive species is also challenging due to the social acceptability of management options.

We have developed a new tool that helps policy makers choose cost–effective options for invasive species management.
How can the tool be used?
The SPADE tool allows park managers to explore the impacts and costs of different management intervention strategies using their desk-top computer.

Managers can use the tool to project the likely range and population density of invasive species, under a range of different scenarios of population growth rates, dispersal patterns and management.

Land managers can generate assessment reports of the likely cost-effectiveness of different approaches to use when communicating with senior managers, decision makers and community groups.

How does this tool help with landscape-scale biodiversity conservation?

To coordinate efforts for a greater effect, park managers can collaborative with neighbouring jurisdictions to run SPADE.

Using SPADE, the park managers can run the model numerous times using different assumptions for the current range, population growth rates, combination of control methods, and the timing and intensity of control.

For example, in the Australian Alps the population of wild horses is estimated to be in the order of 12,000 animals. The agencies responsible for managing the impacts of wild horses have annual targets for capture and relocation of wild horses. However, they aren’t confident they are having sufficient impact to limit the spread of animals and the damage to wetlands and bogs that lie at the headwaters of critically important Alps catchments such as the Murray and Snowy Rivers.

Developing the tool

The decision support tool grew from discussions at the 2012 Alps Science Management Forum, hosted by the Australian Alps Liaison Committee and the Landscapes and Policy NERP Hub at Jindabyne. As a result, we developed a spatially-specific model to guide cost-effective management of invasive species, such as wild horses and fallow deer.

We call it SPADE, the Spatial Population Abundance Dynamics Engine. We initially developed the model for the management of wild horses in the Australian Alps and fallow deer in Tasmania.

We are using input data on wild horse range and abundance collected by park rangers. The involvement of park rangers in the project is essential to the design and testing of the model; ensuring it is practical and useful to operations.

We aimed to develop a tool that assists government agencies and interest groups make decisions about the most cost-effective and socially acceptable approaches to managing invasive animals and diseases.

How does the tool work?

SPADE uses observations

The model uses information on the current and potential abundance of a species (for example, deer or wild horses), across a specified landscape (for example, the Australian Alps or the Tasmanian Midlands), combined with relevant information about species demography, (for example, breeding and mortality) to calculate a spatially-explicit estimate (for example, a map or graph) of the species’ abundance over time.

SPADE uses different management strategies

The model can run using different input parameters to simulate different management strategies and gauge their potential effectiveness. For example, determining the cost-effectiveness of a ‘high early removal’ strategy in the first few years followed by more selective control methods once the population recovers to detectable levels. The model enables the user to determine how long it will take for the population to recover to detectable levels and compares the cost-effectiveness of a strategy with more modest annual targets.

The model includes options to automatically score management strategies against a variety of goals, for example benefit-cost ratio, species density in high-priority areas and ‘welfare score’ (control methods that minimise stress to the animals).

Modelling interactions between species

SPADE has advanced features such as the capability to model the interactions between multiple species in the landscape over time, as well as incorporating more detailed input data such as spatial variation in management cost. For example, some areas in the landscape may be more difficult to access.
How SPADE Works

Step 1: Input current knowledge about species to SPADE

- **Carrying Capacity**
  How many animals can be supported in a given area.
  (food dependent)

- **Initial Conditions**
  What’s currently happening on the ground.

- **Demographic Information**
  Information about how the animal lives & behaves.

- **Dispersal Characteristics**
  How the animal spreads.

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Step 2 – Run SPADE with current management scenario

What we are currently doing to manage the invasive species.

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Step 3 – Run SPADE again with different management goals

What happens if we do this? What can we do to get a desired outcome?

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Possible Outputs

- Maps
- Changes to population size
- Resources needed
- Eradication Costs
Where to from here?
In February 2014, park rangers from NSW and Victoria visited Dr Beeton’s lab to refine the model and test potential management scenarios using datasets collected in the field by the rangers. Demographic parameters, carrying capacities and dispersal rates were used in the model to ensure the tool captures as best it can what is happening on the ground. These rangers will become ‘SPADE Champions’ within their organisations, using their knowledge of the model to assist others within their organisations to use it for a range of applications. It is hoped the model will be operational by mid-2014.

Who are the researchers?

Professor Chris Johnson

Chris leads the hub’s Wildlife Project that is developing distribution models for selected mammal, bird and reptile species. They are examining patterns of concordance of habitat and climatic refugia for Tasmania, and modelling species distributions for priority invasive animals in the Australian Alps.

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Dr Nick Beeton

Nick is an ecological modeller who specialises in novel ways of estimating species distributions and population dynamics. He completed his PhD in 2011 studying the Tasmanian devil and Devil Facial Tumour Disease (DFTD), in particular looking at the effectiveness of potential management strategies.

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Further reading