



Cost Benefit Analysis for Regional Weed Management User Guide

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Introduction

The cost benefit analysis tool is a web applet that enables a cost-benefit analysis to be conducted for a proposed Weed Management Programme within a Regional Pest Management Plan as required by the New Zealand Biosecurity Act 1993. It is suitable for the species-led “Exclusion”, “Eradication”, “Progressive Containment” and “Sustained Control” programme types defined in the National Policy Direction but not the site-led “Protecting Values in Places” programme. The model assumes that the weed would spread logistically in the absence of the programme and that the management would prevent this spread. The Benefits in the CBA are the lost earnings that would be prevented by the management and the Costs are the sum of the programme’s implementation costs and lost earnings in the infested area.

The results of the analysis are presented firstly as a graph of the spread of the weed over time under a no-management scenario, secondly as a graph of weed spread under the selected managed scenario and thirdly as a graph of the discounted values of the Benefits and Costs of the programme. The Net Present Value of the programme is the sum of the discounted Costs and Benefits and this is presented along with the Internal Rate of Return (the discount rate giving NPV=0.0).

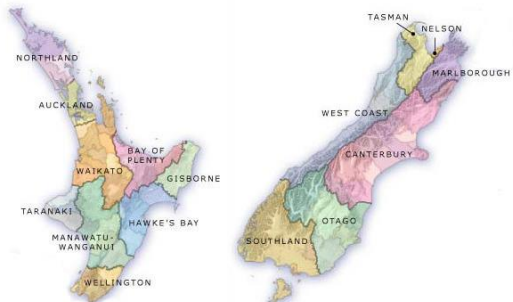
When interpreting the results consider whether the scenario report is reasonable and defensible. For a programme to be considered economically worthwhile it should have an NPV greater than zero. An important step in interpreting the results is to see how sensitive the NPV and IRR values are to changes in your parameter values. This sensitivity testing can be conducted by moving the sliders or typing in alternative values.

For guidance on cost-benefit analysis visit

<http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/primer>

Startup screen

The startup screen allows you to specify the name of a weed species, region, type of management programme and the duration of the CBA.

Input Parameter	Value
Step 1) Weed Species Name:	<input type="text" value="Hairy spider weed"/>
Step 2) Region:	<input type="text" value="Canterbury"/>
<p>Click on map or select from drop-down menu.</p> 	
Step 3) Management Programme:	<input type="radio"/> Exclusion <input type="radio"/> Eradication <input checked="" type="radio"/> Progressive containment <input type="radio"/> Sustained control
Step 4) Number of years over which the CBA is to be conducted:	<input type="text" value="100"/>
<input type="button" value="Begin"/>	

- 1) **Weed species** is a free-form entry and is only used in the scenario report. Type the name of the weed species that is the subject of this CBA analysis. You may enter whatever you desire here (Latin name, synonym(s), common name(s), Latin and common name(s)).
- 2) **Region** can be selected from the dropdown list or by clicking on the map.
- 3) **Management Programme** The selection you make here affects the CBA that you will conduct on the following screen. There are only four options as defined in the “National Policy Direction for Pest Management 2015”. Their descriptions are available as popup tooltips in the CBA if you hover your mouse directly over a management programme option.
- 4) **Number of years over which the CBA is to be conducted** specifies the number of years over which you wish to run your CBA analysis, and therefore how many years will be available for entry of programme implementation costs.

Click the “Begin” button to enter the main screen once these initial values are set.

Main Screen

The layout and options available on this screen vary depending on the type of management programme selected on the startup screen. The upper portion of this screen has three graphs showing;

- 1) The weed invasion trajectory without management
- 2) The weed invasion trajectory under the selected management programme
- 3) The costs and benefits of the selected management programme

Below the three graphs is an area to enter yearly costs and a brief summary report of the outcomes.

Invasion Trajectory Without Management

Initial area infested (ha):

Max area that could become infested (ha):

Time for infestation to reach 90% of max. years:

Invasion Trajectory With Progressive Containment Management

Time to containment: years

Containment area (ha):

Costs and Benefits

Cash operating surplus (\$ per ha):

Reduction in cash operating surplus caused by the weed (%):

Discount rate (%):

NPV = \$8,730,790
IRR = >100%

Yearly Costs

Enter yearly implementation costs of the proposed weed management programme below. Use the ↓ icon to propagate values downwards.

It is assumed that the implementation cost expenditure is 100% effective in achieving the goal of the proposed management programme (Exclusion, Eradication, Progressive Containment, Sustained Control).

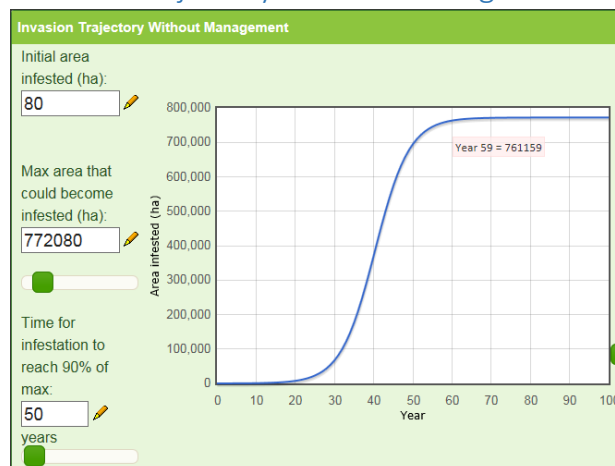
Year	Cost
1	\$10000 ↓
2	\$10000 ↓
3	\$10000 ↓
4	\$10000 ↓
5	\$1000 ↓
6	\$1000 ↓
7	\$0 ↓
8	\$0 ↓

Scenario Report


Region: Canterbury (area=4,534,600ha)
 Weed Species: Hairy spider weed
 Area infested = 8,000ha
 Maximum area that could become infested = 902,272ha
 Time for infestation to reach 90% of maximum = 99 years (r = 0.06984, the spread rate)
 Cash operating surplus = \$99/ha
 Discount rate = 8%
 Number of years for this simulation=100
 Net Present Value (NPV) = \$8,730,790
 Internal Rate of Return (IRR) = >100% (the discount rate giving NPV=0.0)

NOTES
Max area that could become infested: Estimated using climex model by Sagget et. el. 2012

Invasion Trajectory without Management



This graph shows the invasion trajectory of the weed species if no management programme was applied. It is used in the Costs and Benefits section to determine the benefits (value of losses prevented) of the proposed programme. The settings in this section are the same under all management programme types.

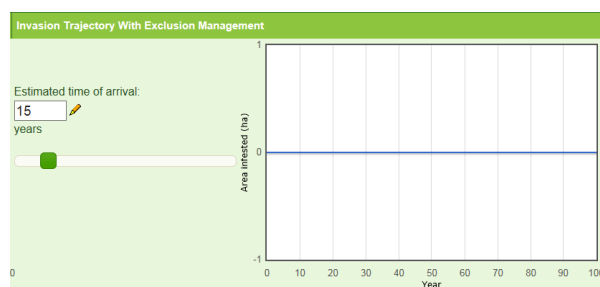
Values may be entered into the text boxes or set with the slider where available. If you wish to make a note about a value you use, such as how it was estimated or a reference to where the value was sourced from you can click the  icon. Any notes that you add here will be displayed in the "Scenario Report" section.

"Max area that could become infested" must be larger than the initial area infested. This is enforced by the interface.

"Time for infestation to reach 90% of max" is limited to 500 years.

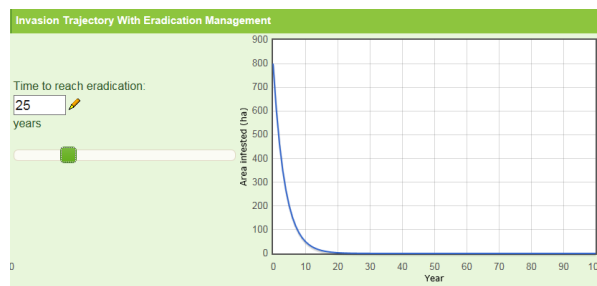
Invasion Trajectory with Exclusion Management

Under an exclusion management programme the area infested will always remain at 0 because the management programme is always assumed to be successful. However, the setting that you make here for "Estimated time of arrival" into the region (i.e. number of years from now when you'd expect the weed to first establish in the region in the absence of your proposed exclusion programme) will affect the "Invasion Trajectory without Management" graph by governing the year in which it starts.



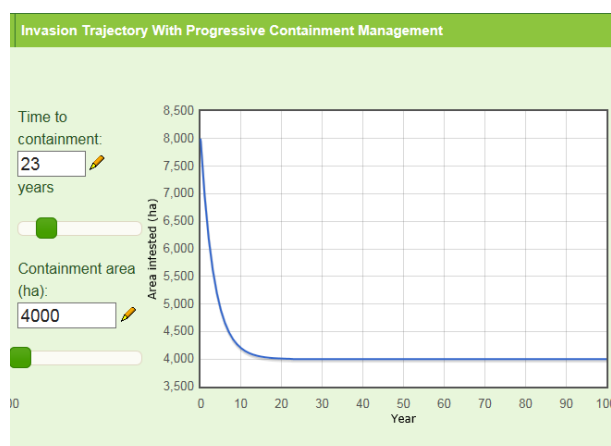
Invasion Trajectory with Eradication Management

Under an eradication management programme the area infested will drop to 0 after the specified “Time to reach eradication”.



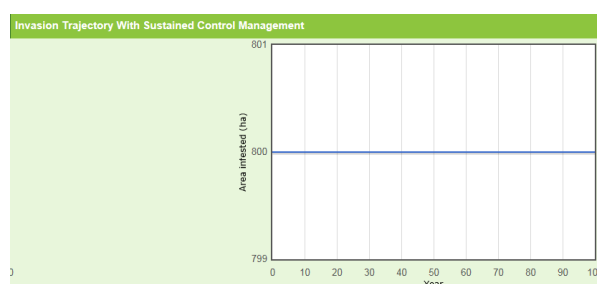
Invasion Trajectory with Progressive Containment Management

Under a progressive containment management programme the area infested will increase or decrease to the specified “Containment area” after the number of years set by “Time to containment”.



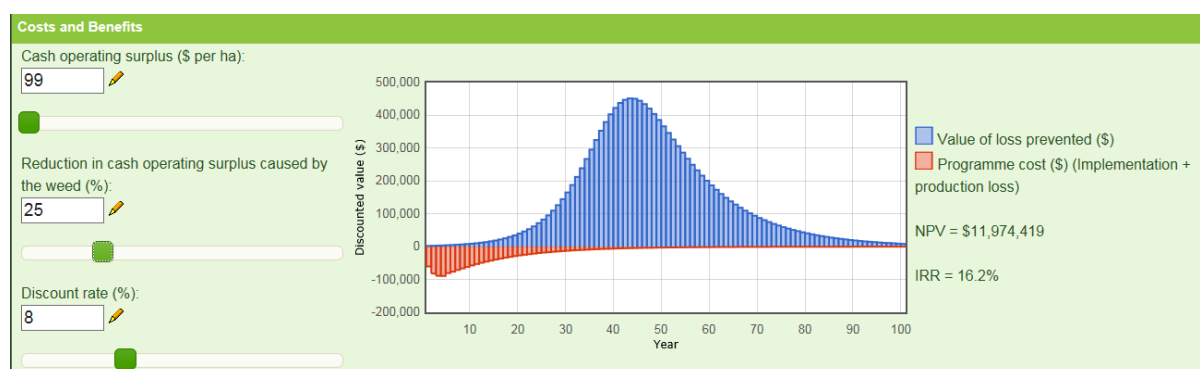
Invasion Trajectory with Sustained Control Management

Under a sustained control management programme the invasion trajectory will remain constant at the same level as “Initial area infested”. There are no values additional values that may be specified for this management programme type.




Costs and Benefits


Having defined the invasion trajectory for your weed in both the absence of your programme and in its presence, it is now time to define the benefits and costs of the programme. In the costs and benefits graph the year by year costs (negative values) and benefits (positive values) are plotted and their sum over time (calculated by the app) is the Net Present Value (NPV) of your programme. First you must quantify the value (\$/ha) of the system that your weed will impact upon in “Cash operating surplus”. Cash operating surplus may not always be the appropriate measure of system value and in these cases enter the system’s value using an appropriate alternative metric. Next enter a value that defines the % reduction in the system’s value that the weed is expected to cause. Lastly enter an appropriate value for the discount rate. Once you have entered your programme’s year by year implementation costs under “Yearly Costs” below, your costs and benefits graph will illustrate how the benefits and costs of your programme, in present value terms, flow over the years. The NPV and Internal Rate of Return (IRR) of your programme, given your current parameter settings, are presented to the right hand side of the graph. The sensitivity of your programme’s NPV and IRR to the input parameter values can now be tested either by adjusting the sliders or by typing in alternative values.












Yearly Costs

The yearly costs section allows you to enter the implementation costs for each year of the programme that you have selected. The number of years here is determined by the “Number of years over which the CBA is to be conducted” setting on the startup screen. The process of entering multiple yearly costs is made easier by using the  icon to copy values downwards from the row you click the icon on. These year by year implementation costs are added (by the app) to any costs associated with lost production value on the infested area (from the weed’s expected invasion trajectory in the presence of your programme) and plotted as negative values (in red) in the above costs and benefits graph.

Yearly Costs

Enter yearly implementation costs of the proposed weed management programme below. Use the  icon to propagate values downwards.

It is assumed that the implementation cost expenditure is 100% effective in achieving the goal of the proposed management programme (Exclusion, Eradication, Progressive Containment, Sustained Control).

Year	Cost 
1	\$10000 
2	\$10000 
3	\$10000 
4	\$10000 
5	\$1000 
6	\$1000 
7	\$0 
8	\$0 

Scenario Report

The scenario report gives a brief report on the results of the scenario you have set up.

If you added any notes they will be displayed at the bottom of the scenario report.

Scenario Report

Region: Canterbury (area=4,534,600ha)
 Weed Species: Chilean needle grass
 Area infested = 800ha
 Maximum area that could become infested = 772,080ha
 Time for infestation to reach 90% of maximum = 99 years ($r = 0.0916$, the spread rate)
 Cash operating surplus = \$99/ha
 Discount rate = 8%
 Number of years for this simulation=100
 Net Present Value (NPV) = \$2,486,004
 Internal Rate of Return (IRR) = 44.53% (the discount rate giving NPV=0.0)

NOTES

Max area that could become infested: Estimated using climex model by Sagget et. el. 2012