Landscape Futures Analysis

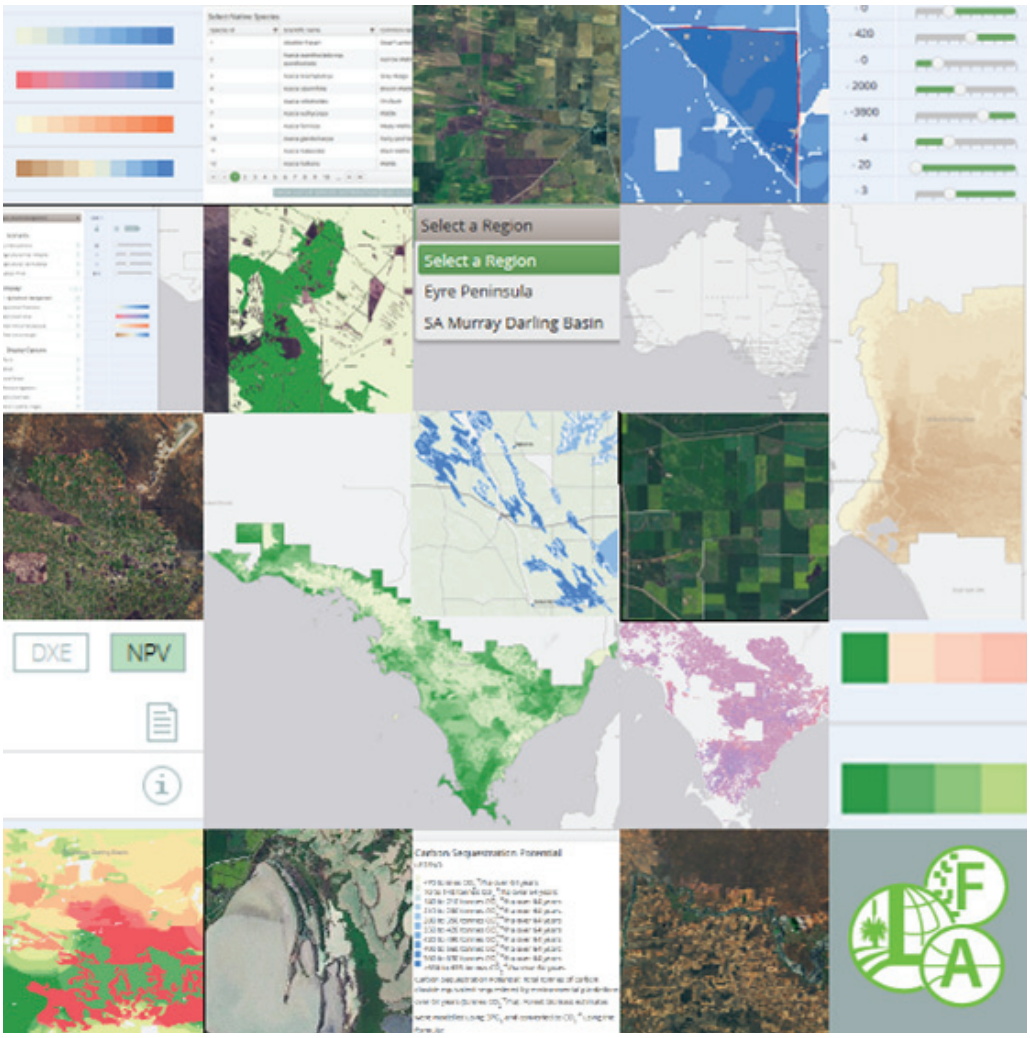
NCCARF National Climate Change Adaptation Research Facility

Australian Government
National Water Commission

# Landscape Futures Analysis Tool (LFAT)

## Tutorials

**A set of step-by-step examples demonstrating how the Landscape Futures Analysis Tool can be used to explore key NRM planning issues under a range of climate, agricultural commodity and carbon price scenarios**



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**Core Partners:**

THE UNIVERSITY of ADELAIDE

CSIRO

Government of South Australia
Eyre Peninsula Natural Resources Management Board

Government of South Australia
South Australian Murray-Darling Basin Natural Resources Management Board

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The role of NCCARF is to lead the research community in a national interdisciplinary effort to generate the information needed by decision-makers in government, business and in vulnerable sectors and communities to manage the risk of climate change impacts.

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# Contents



# Introduction

The following tutorials will guide you through the Landscape Futures Analysis Tool (LFAT) using easy to follow step by step examples. You have the option to complete each of the tutorials or complete just the tutorials that relate to the modules you will be using. Completing these tutorials will give you a firm understanding of how to operate the Landscape Futures Analysis Tool and how the tool can be used to aid in research and management decisions.

The LFAT can be accessed at www.lfat.org.au.
If you are using Windows Explorer 8 or older, the Google Chrome Frame plugin must be installed in order to use the LFAT. The Google Chrome Frame plugin can be found at http://www.google.com/chromeframe.

**Figure 1: Log in screen.**

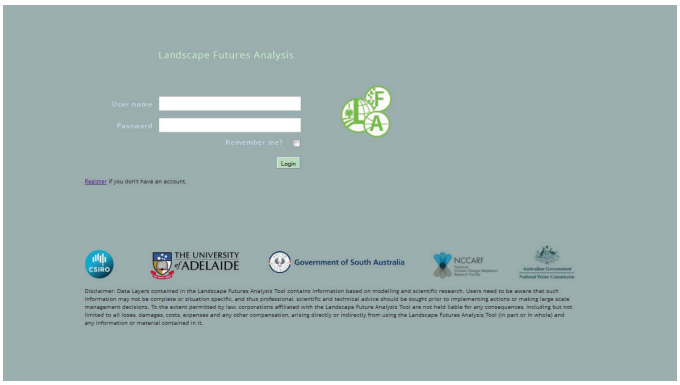
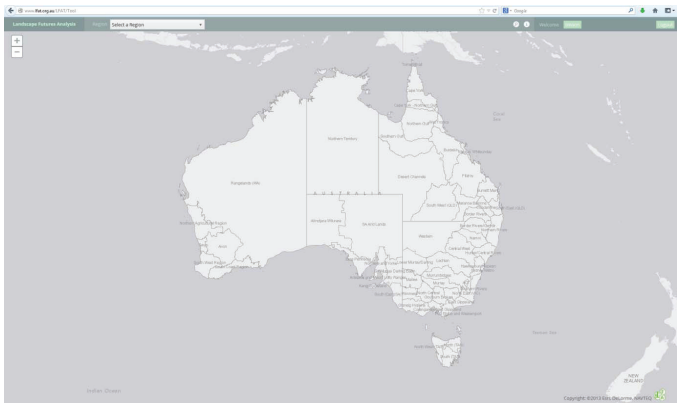



**Figure 2: The LFA tool – Satellite imagery of Australia.**



The initial page viewed when entering the site is the login page shown in Figure 1. In order to access the Landscape Futures Analysis Tool, users must initially register a username and password from lfat@adelaide.edu.au. If you already have a username and password, enter this information to access the site (Figure 2).

The initial step is to select a region for analysis from the dropdown list located at the top of the screen (Figure 3). In this version there are two study areas available: The Eyre Peninsula (EP) natural resources management (NRM) region and the South Australian Murray Darling Basin (SA MDB) NRM region. Once a region has been selected, the Content Palette (Figure 4a) will open providing a range of analysis and display options.

For the purposes of this tutorial, select 'Eyre Peninsula' from the region selection drop down list. The Content Palette contains a module selection drop-down, parameters for scenario selection, layers related to the selected module, tools for analysis and options to display base layers including roads, towns, cadastral information and satellite imagery.

**Figure 3: Region selection dropdown list.**

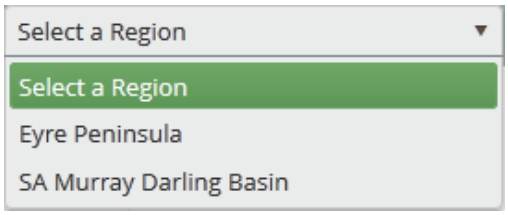
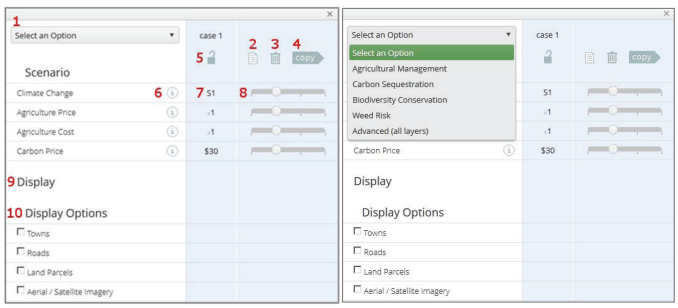



**Figure 4: a) Content Palette and b) Module selection.**



There are four modules to select from, each related to a different aspect of landscape futures analysis: Agricultural Management; Carbon Sequestration; Biodiversity Conservation and Weed Risk Management. To select a module, click the 'Select an Option' dropdown list on the Content Palette (Figure 4b).

1. Module selection dropdown list – selects from the four available modules
2. Delete case – deletes the currently selected case. Note – If there is only one case, this case cannot be deleted
3. Copy case – creates a new case that is a duplicate of the currently selected case
4. Lock/Unlock case – shows/hides the case sliders and legends. The layer can only be edited when in the unlocked position, and only one layer can be unlocked at a time
5. Information icon – displays information related to the relevant layer/parameter. Information icons for layers contain detailed legends
6. Current value of parameter
7. Sliders – adjust values for the relevant parameter
8. Display - contains the layers for the selected module
9. Display Options – allows the user to overlay base layers including towns, roads, land parcels and satellite imagery.

As a default, the Content Palette has one case that can be duplicated to create new cases by using the copy case function. 


Once created, cases can be deleted using the delete case function. 

As there must always be at least one case in the Content Palette, it is not possible for all cases to be deleted. When working with multiple cases, use the lock/unlock function  to select the case to be edited. Case scenarios are edited using the sliders for that particular case (Figure 4a – item 8). The selectable scenarios are:

- Climate Change: S0, S1, S2 and S3 (S0 is the default)
- Agriculture Price Multiplier: 0.5x, 1x, 1.5x and 2x (1x is the default)
- Agriculture Cost Multiplier: 0.5x, 1x, 1.5x and 2x (1x is the default)
- Carbon Price: \$15/tonne $CO_2$-e, \$30/tonne $CO_2$-e, \$45/tonne $CO_2$-e and \$60/tonne $CO_2$-e (\$15/tonne $CO_2$-e is the default).

# 1 Tutorial 1: Agricultural Management

This tutorial will look at viewing layers and retrieving layer information using the Agricultural Management module.

1. Select the Agricultural Management module from the drop down menu located at the top of the Content Palette (Figure 5).
2. Adjust the scenario settings for case 1. For this tutorial select Climate Scenario S0 (baseline climate), Agriculture Price Multiplier x1 and Agriculture Cost Multiplier x1 (There is no underlying data related to Carbon Price in this module).
3. Ensure that the AER/NPV selection option is set to AER (AER will be displayed alongside 'Agricultural Value' in the display).
4. Select the Agricultural Production layer in the display section. The spatial layer should be displayed on the map screen (Figure 6).

**Figure 5: Module selection.**

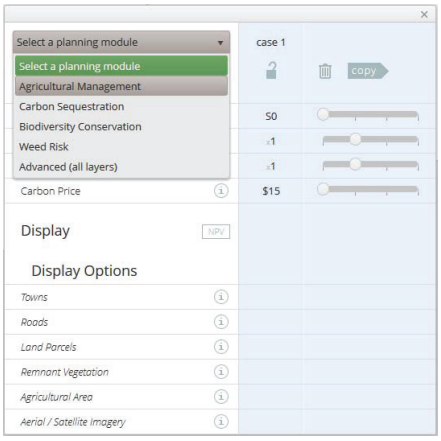
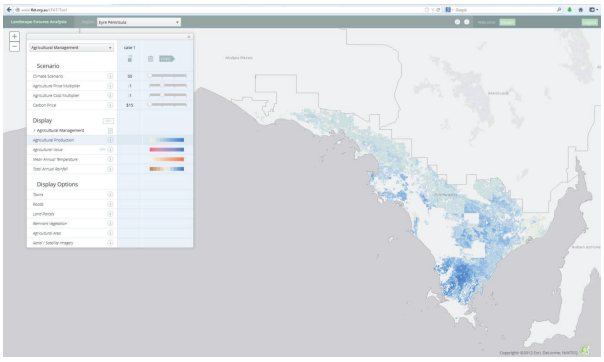



**Figure 6: Agricultural Production layer displayed on the map screen.**



5. Click the information button ⓘ to view details about the Agricultural Production layer as well as a legend with value ranges for each legend colour (Figure 7).
6. Using the mouse cursor, identify Agricultural Production at a number of locations on the map. This should bring up a window with the class and pixel value at that location (Figure 8). Repeat this step for Agricultural Value, Mean Annual Temp and Mean Annual Rainfall.

**Figure 7: Agricultural Production information.**

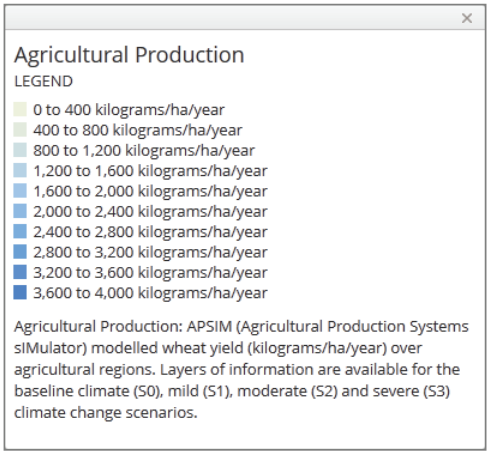
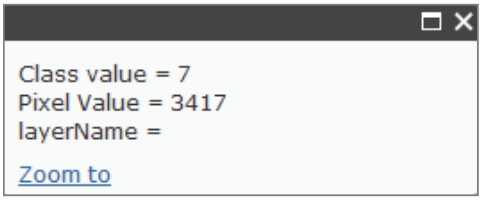



**Figure 8: Value identifier window.**



7. Select the case notes icon to display summary statistics for the Agricultural Management option across the entire study region.
8. Select the copy case icon to make a duplicate of case 1. Case 1 will lock and the duplicate case (case 2) will be unlocked and active (Figure 9).
9. Adjust the climate scenario setting from S0 to S3 (severe climate change) and observe the changes to each of the layers. Select the case notes option to examine how climate change impacts the spatial statistics for the entire study region.
10. Open the Navigation Tools Palette located at the top right of the screen (Figure 10).

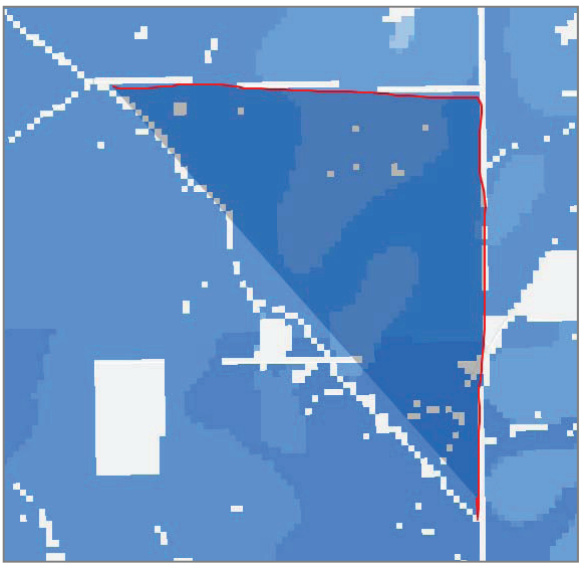
**Figure 9: Duplication of cases.**


**Figure 10: Navigation Tools Palette.**

11. Use the select Area of Interest (AOI) selection tool and select an area of interest (Figure 11). Once an area is selected, repeat Step 7 for both case 1 and case 2 to obtain statistics for the selected area of interest.

This tutorial has demonstrated how the Landscape Futures Analysis Tool can be used to explore agricultural production and value estimates along with underlying climate data at regional and local scales, as well as how to create cases for different scenario settings and display statistics for a selected area.

**Figure 11: Area of Interest (AOI) selection tool.**



# 2 Tutorial 2: Carbon Sequestration

This tutorial looks at using the Carbon Sequestration module to generate a GO/NO GO map for carbon monoculture plantings using a multi-criteria analysis. When investigating suitable areas for carbon plantations, there are a number of criteria to consider including:

- suitability for carbon plantations
- economic viability of carbon plantations
- highly productive agricultural regions are maintained
- areas of a high biodiversity importance are preserved
- carbon plantations are not too close to highly populated areas where they may pose a fire risk
- areas with a high risk of dryland salinity or erosion are given priority to assist with mitigating these risks
- important wetlands and areas with high groundwater recharge potential are avoided

The multi criteria approach of this module gives the user control over which of these issues will be considered in the carbon plantation GO/NO GO analysis and the thresholds that affect the amount of land suitable for carbon plantations.

1. Select the Carbon Sequestration module from the drop down menu located at the top of the Content Palette.
2. Adjust the scenario settings for case 1. For this tutorial select Climate Scenario S0 (baseline climate), Agriculture Price Multiplier x1, Agricultural Cost Multiplier x1 and Carbon Price $30.
3. Ensure that the AER/NPV selection option is set to AER (AER will be displayed alongside 'Agricultural Value' and 'Carbon Value' in the display).
4. Highlight the 'Carbon Value' layer under Display. View the information for the layer. Click the box next to the layer name to add this layer to the 'Carbon Sequestration GO/NO GO' analysis.
5. Select the 'Threshold Sliders' button to access the sliders for adjusting threshold values for each of the layers (Figure 13). For the selected 'Carbon Value' layer, adjust the threshold slider to select a threshold of 0. In this case, only areas with an estimated potential to make an annual profit will be considered for carbon plantations.

**Figure 12: Module selection.**

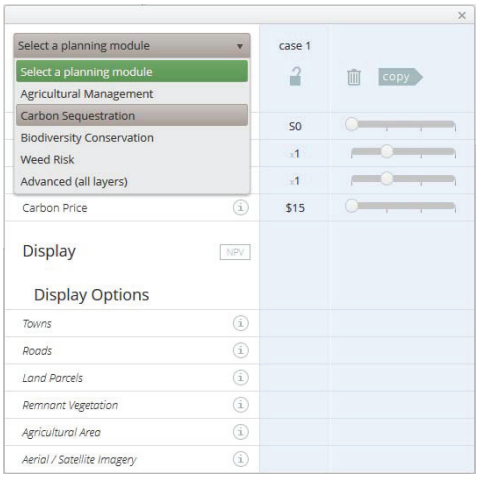
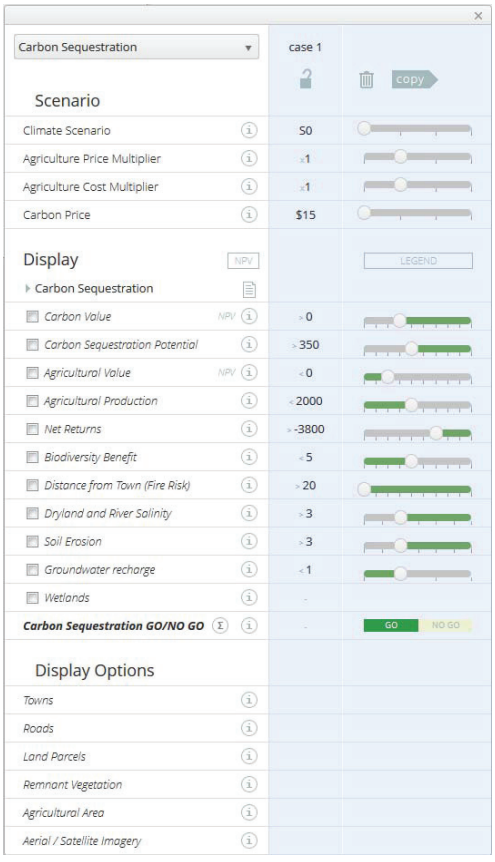


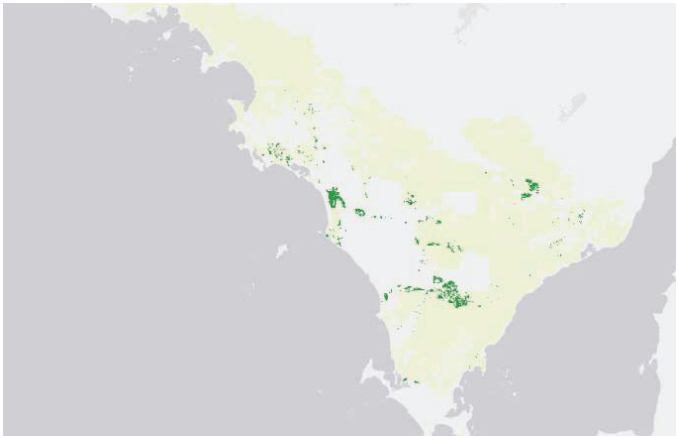

**Figure 13: Content Palette showing threshold sliders.**



6. Highlight the 'Agricultural Value' layer under Display. View the information for the layer. Click the box next to the layer name to add this layer to the 'Carbon Sequestration GO/NO GO' analysis.
7. For the selected 'Agricultural Value' layer, adjust the threshold slider to select a threshold value of 0. In this case, only areas that project a loss under continued agricultural production will be considered for carbon plantations.
8. Highlight the 'Biodiversity Benefit' layer under Display. View the information for the layer. Click the box next to the layer name to add this layer to the 'Carbon Sequestration GO/NO GO' analysis.
9. For the selected 'Biodiversity Benefit' layer, adjust the threshold slider to select a threshold value of 9. In this case, areas with a very high biodiversity benefit will not be considered for carbon plantations.
10. Highlight the 'Distance from Town' layer under Display. View the information for the layer. Click the box next to the layer name to add this layer to the 'Carbon Sequestration GO/NO GO' analysis.
11. For the selected 'Distance from Town' layer, adjust the threshold slider to select a threshold value of 5. In this case, only areas greater than 5 kilometres from a town will be considered for carbon plantations.
12. Highlight the 'Soil Erosion' layer under Display. View the information for the layer. Click the box next to the layer name to add this layer to the 'Carbon Sequestration GO/NO GO' analysis.
13. For the selected 'Soil Erosion' layer, adjust the threshold slider to select a threshold value of 2. In this case, only areas at a moderate or higher risk from soil erosion will be considered for carbon plantations.
14. Highlight the 'Groundwater Recharge' layer under Display. View the information for the layer. Click the box next to the layer name to add this layer to the 'Carbon Sequestration GO/NO GO' analysis.
15. For the selected 'Groundwater Recharge' layer, adjust the threshold slider to select a threshold value of 2. In this case, areas that have a high groundwater recharge potential will not be considered for carbon plantations.
16. To generate the carbon plantations GO/NO GO map, select the 'Run GO/NO GO Model' button Σ located in the 'Carbon Sequestration GO/NO GO' layer in the display. While generating the output, the Executing... icon should be visible in the top-right hand corner of the display. Select the case notes icon to display summary statistics for the generated carbon plantations GO/NO GO map. The resulting layer should appear similar to Figure 14.
17. Select the copy case icon to make a duplicate of case 1. Explore different threshold settings for each of the selected layers and repeat step 17 to observe how various settings can alter the result.

This tutorial has shown how the Landscape Futures Analysis tool can be used to identify areas suitable for possible carbon plantations taking into account a number of criteria including carbon sequestration potential, estimated carbon value, agriculturally productive areas, areas with a high biodiversity value, wetlands, areas where salinity and erosion could be mitigated through carbon plantations and areas where groundwater recharge could be affected.

**Figure 14: Result of Carbon Sequestration GO/NO GO analysis.**



# 3 Tutorial 3: Biodiversity Conservation

1. Select the Biodiversity Conservation module from the drop down menu located at the top of the Content Palette (Figure 15).
2. Next to the 'Species Distribution' dialogue, select the 'Choose Species' button. This will open the 'Select Native Species' window to select species to add to the display (Figure 16).

**Figure 15: Module selection.**

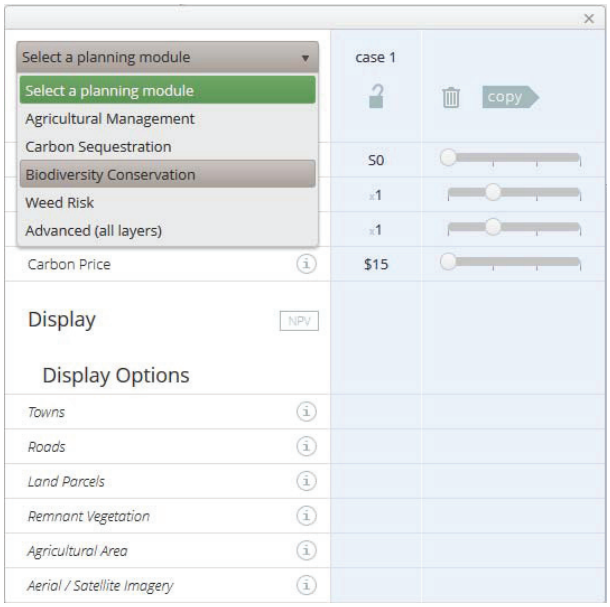
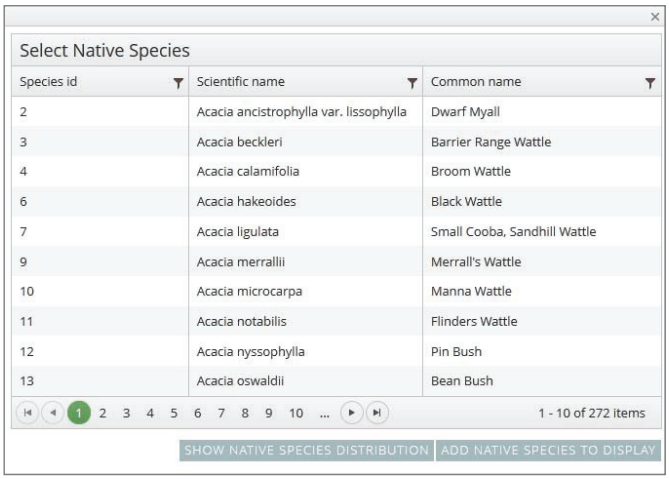



**Figure 16: Native Species selection.**




3. Within the 'Select Native Species' window, use the filter icon next to the Common name list to open the filtering window. This window is used to select species to be used in the analysis. For this example select 'is equal to' in the top drop down menu and type 'Broom Wattle' in the dialogue box directly underneath (Figure 17). Click 'Filter' to close the filtering window and show the matching species. When the desired species is available in the 'Select Native Species' window, highlight the species and click the 'Show Native Species Distribution' button to view the layer. Once you have observed the layer, click the 'Add Native Species to Display' button to include the species in the display window.
4. Repeat step 3 for Species 2, selecting 'Pin Bush' as the native species of interest for this layer.
5. When both species are loaded as layers in the display, close the 'Select Native Species' window by pressing the 'x' button in the top right hand corner.
6. Select the copy case icon copy to make a duplicate of case 1. Case 1 will lock and the duplicate case (case 2) will be unlocked and active (Figure 18).

**Figure 17: Filter window.**

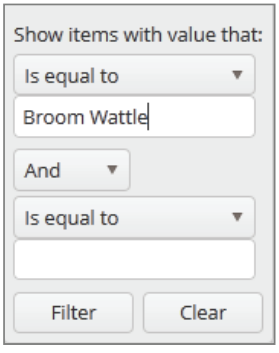



**Figure 18: Duplicating cases.**

7. Adjust the climate scenario setting under case 2 from S0 to S3 (severe climate change) and click between the cases to observe the changes in species distribution for each of the native species (Figure 19 – Pin Bush and Figure 20 – Broom Wattle).
8. Select the 'Incentive Payment' layer. Adjust both the 'Agriculture Price Multiplier' and 'Carbon Price' scenarios to inspect how much land would require a payment to be converted from traditional agriculture to carbon plantations under a range of agricultural and carbon price scenarios.
9. Select the 'Cost Benefit' layer. The cost benefit is calculated as the net present value of agricultural production minus the net present value of environmental plantings divided by the biodiversity score.
10. Select the case notes icon to display summary statistics for the Biodiversity Conservation option across the entire study region.

This tutorial has demonstrated how the Landscape Futures Analysis Tool can be used to explore options for biodiversity conservation across the study region, how these options will be impacted by changes in climate, agricultural commodity prices, input costs and carbon price, and how individual species may potentially respond to climate change.

**Figure 19 – Species distribution for Pin Bush (Acacia nyssophylla) under climate scenario (a) S0 and (b) S3.**

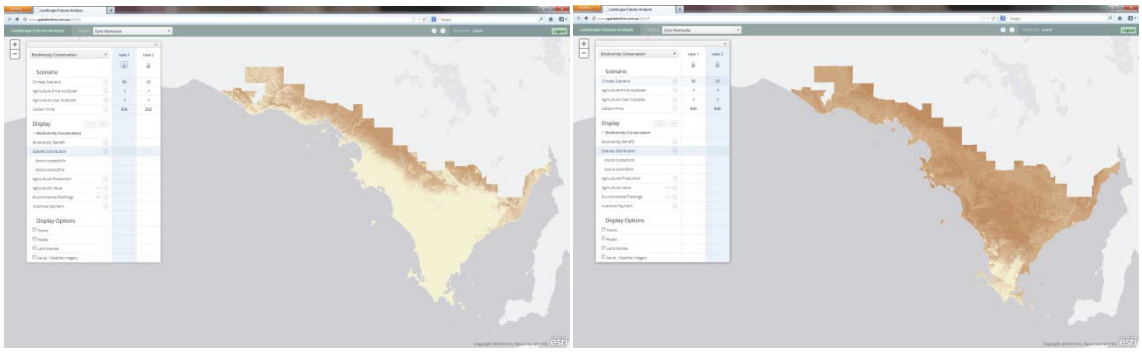
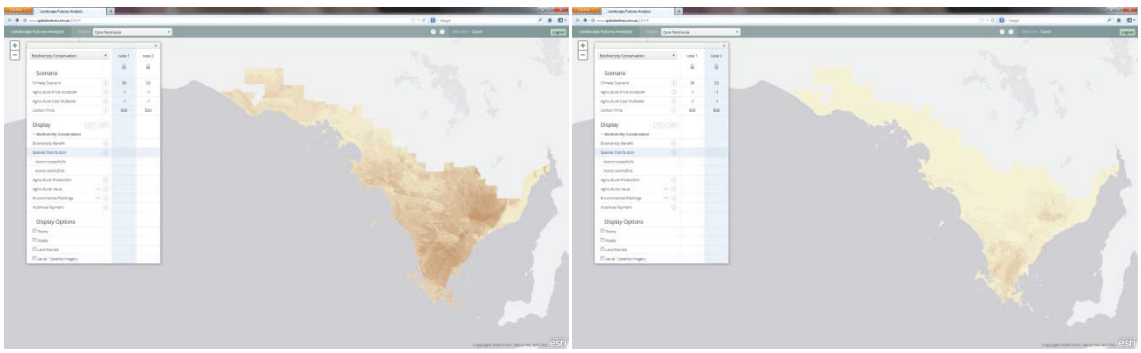


**Figure 20: Species distribution for Broom Wattle (Acacia calamifolia) under climate scenario (a) S0 and (b) S3.**



# 4 Tutorial 4: Weed Risk Management

1. Select the Weed Risk Management module from the drop down menu located at the top of the Content Palette.
2. Next to the 'Weed Species Suitability' dialogue, select the 'Choose Species' button. This will open the 'Select Weed Species' window to select weeds species to add to the display (Figure 21).
3. Within the 'Select Weed Species' window, use the filter icon next to the Common name list to open the filtering window (Figure 22). This window is used to select weed species to be used in the weed risk analysis. For this example select 'is equal to' in the top drop down menu and type 'Barley Grass' (Hordeum glaucum) in the dialogue box directly underneath. Click 'Filter' to close the filtering window and show the matching species. When the desired species is available in the 'Select Weed Species' window, highlight the species and click the 'Show Native Species Distribution' button to view the layer. Once you have observed the layer, click the 'Add Native Species to Display' button to include the species in the display window.
4. Repeat step 3 for Species 2 and 3, selecting 'African Box-thorn' and 'Hoarhound' as the weed species of interest for these layers (*Note: when the 'is equal to' option is selected, the text entered in must be identical to the name in the list. If it is difficult finding these species with this option, try using the 'Contains' option and enter part of the species name).
5. When all three species are loaded as layers in the display, select the 'Run Weed Risk Hotspots Model' button Σ located in the 'Weed Risk Hotspots' layer in the display to create a hotspots layer representing each of the selected weed species. While processing, the Executing Weed Hotspot Model... icon will be visible in the top-right hand corner of the display (Note: if there are many species selected this process may take some time). Explore the newly created Weed Risk Hotspots layer to observe how it relates to the individual weed species habitat layers.
6. Once the Weed Risk Hotspots layer for the selected species has been produced, it is now possible to run the Agricultural Weed Risk model. This layer is calculated by multiplying the Weed Risk Hotspots layer with the Agricultural Production layer and rescaling the resulting layer to a common scale from low risk to extreme risk. To run this model, select the 'Run Agricultural Weed Impact Model' button Σ located in the 'Agricultural Weed Risk' layer in the display. Once completed, explore the

**Figure 21: Weed Species selection.**

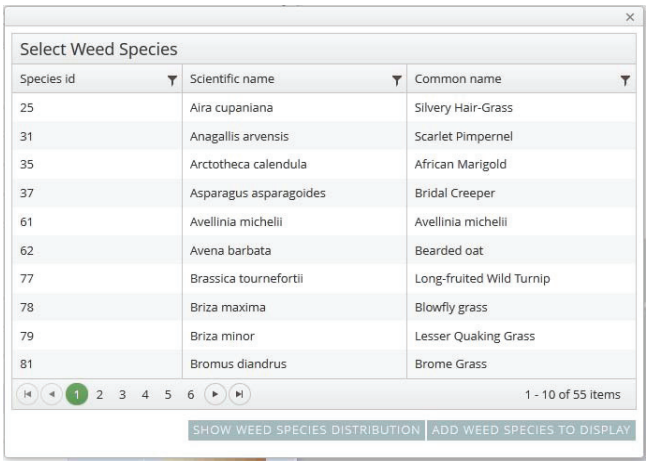
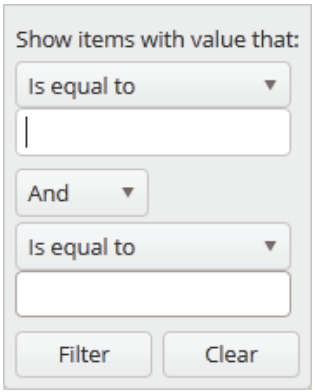



**Figure 22: Filter window.**



newly created agricultural weed risk layer to observe how it relates to the Weed Risk Hotspots and Agricultural Production layers.

7. Once the Weed Hotspots Layer for the selected species has been produced, it is also possible to run the Ecological Weed Risk model. This layer is calculated by multiplying the Weeds Hot Spot analysis layer with the Biodiversity Benefit layer and rescaling the resulting layer to a common scale from low risk to extreme risk. To run this model, select the 'Run Ecological Weed Impact Model' button Σ located in the 'Ecological Weed Risk' layer in the display. Once completed, explore the newly created agricultural weed risk layer to observe how it relates to the Weed Risk Hotspots and Biodiversity Benefit layers.
8. Select the case notes icon to display summary statistics for the Weed Risk Management module for the selected case.
9. Select the copy case icon copy to make a duplicate of case 1. Adjust the Climate Scenario slider to S3 to and repeat steps 5 to 8 to conduct Weed Risk Management analysis for the new case.

Here we have seen an example of using the Landscape Futures Analysis Tool to assess the potential risk from a variety of weed species to agricultural regions and areas of ecological importance and how this risk may either increase or decrease under the impacts of climate change. This example highlights how this module can be used to identify areas that may require management to reduce the risk to agricultural production or biodiversity within the region.