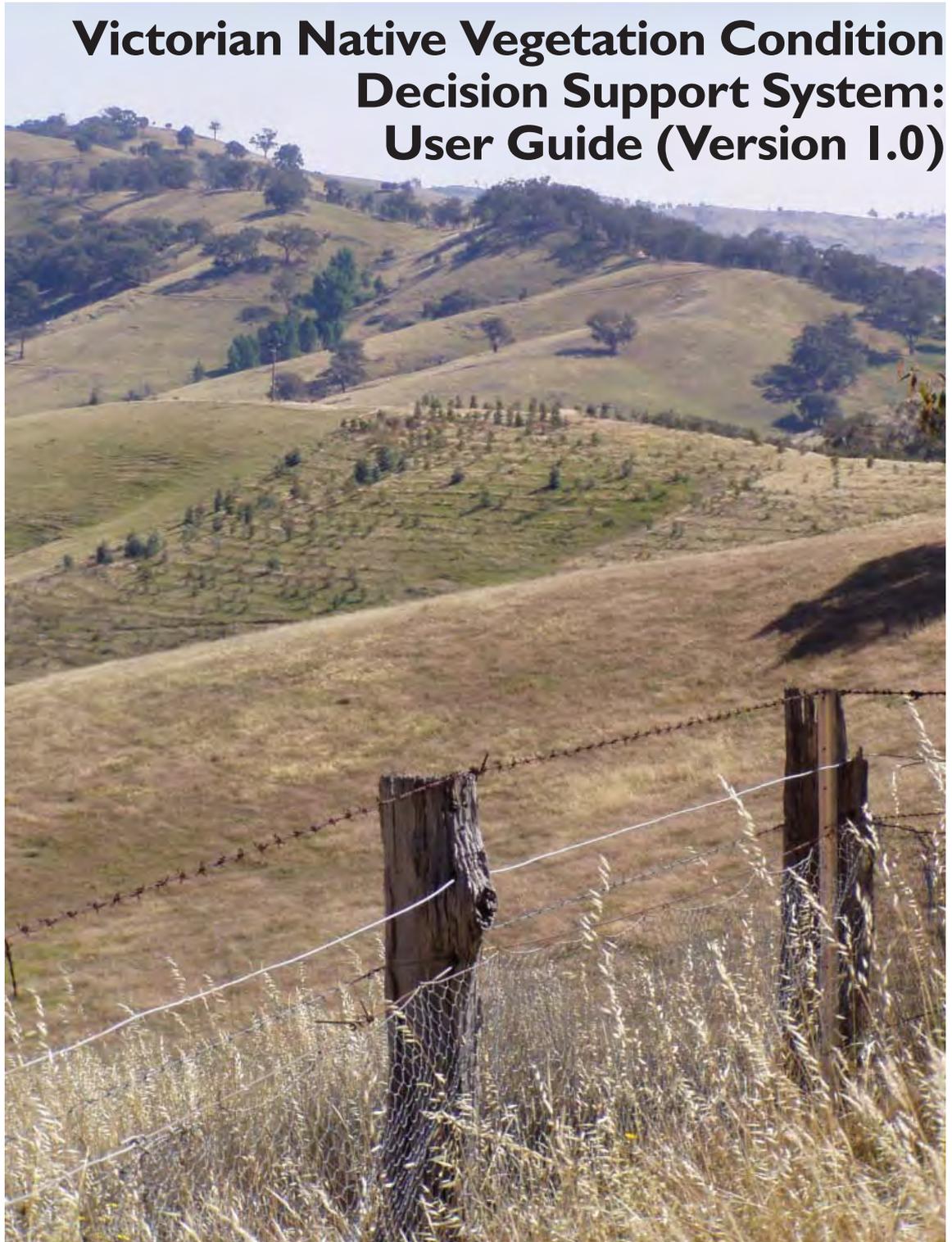




**LANDSCAPE LOGIC**  
LINKING LAND AND WATER MANAGEMENT TO RESOURCE CONDITION TARGETS

## Technical Report No. 30

# Victorian Native Vegetation Condition Decision Support System: User Guide (Version 1.0)



**Australian Government**

**Department of Sustainability, Environment,  
Water, Population and Communities**

December 2010

Cover photo: ?

Preferred citation: Merritt WS and Manger P (2010) Victorian Native Vegetation Condition Decision Support System: User Guide (Version 1.0). Landscape Logic Technical Report No. 30, Hobart.

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ISBN 978-0-9870694-9-8

**LANDSCAPE LOGIC** is a research hub under the Commonwealth Environmental Research Facilities scheme, managed by the Department of Sustainability, Environment, Water, Population and Communities.

It is a partnership between:

- **six regional organisations** – the North Central, North East & Goulburn–Broken Catchment Management Authorities in Victoria and the North, South and Cradle Coast Natural Resource Management organisations in Tasmania;
- **five research institutions** – University of Tasmania, Australian National University, RMIT University, Charles Sturt University and CSIRO; and
- **state land management agencies in Tasmania and Victoria** – the Tasmanian Department of Primary Industries & Water, Forestry Tasmania and the Victorian Department of Sustainability & Environment.

The purpose of Landscape Logic is to work in partnership with regional natural resource managers to develop decision-making approaches that improve the effectiveness of environmental management.

Landscape Logic aims to:

1. Develop better ways to organise existing knowledge and assumptions about links between land and water management and environmental outcomes.
2. Improve our understanding of the links between land management and environmental outcomes through historical studies of private and public investment into water quality and native vegetation condition.



# Victorian Native Vegetation Condition Decision Support System: User Guide (Version 1.0)

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## Summary

This document details how the Victorian Native Vegetation Condition Decision Support System (DSS) can be used to explore likely response in vegetation quality to landholder actions and environmental conditions. A quick start guide is provided in Box 1. This will allow you to quickly learn to open and navigate through the DSS. However, the construction of scenarios is more complicated and the main body of this document:

- introduces users to the concepts of DSS,
- describes the features of the tool developed for the Victorian native vegetation condition component of Landscape Logic,
- details how to use the tool to construct management and other scenarios,
- summarises how to view and export model results, and
- outlines how to update the data bases and supporting documentation in the DSS.

The user guide is primarily intended for those users who will use the DSS to construct and run scenarios and undertake simple updates. Radical change to the interface and underlying models and data bases will need (at a minimum) guidance from staff at iCAM.

Three levels of a person's technical expertise can be considered which will define what level of changes to the DSS should be made by that person.

- Programmer: any changes to the ICMS software and the DSS interface source code need to be undertaken by a programmer. The source code for the DSS interface (and the ICMS software platform) has not been provided with the package and persons who are interested in such changes need to contact the relevant software developers (CSIRO and iCAM).
- Model developer: Any changes to the underlying ICMS model should only be made by person familiar with model development and programming (particularly using the ICMS software). For this DSS, the model developers was Dr Wendy Merritt at Integrated Catchment Assessment and Management centre (iCAM).
- User: these users should not make changes to the software, underlying models and data, or the settings that collectively determine what files are expected to be found and what the DSS interface is expected to look like. They may make superficial changes to an application (e.g. modifying text in supporting documentation; creating, running and saving scenarios).

Appendix 1 summarises the various files that make up the DSS package. It identifies which files can be modified by which type of users.

## **Acknowledgements**

The development of the Victorian Native Vegetation Condition Decision Support System was funded by the Australian Government as part of the Landscape Logic Commonwealth Environmental Research Facilities program. The landscape scale models used to construct the DSS data bases were developed by ANU in collaboration with Landscape Logic research and NRM partners and their input during the DSS development was invaluable. This model was developed by Dr Libby Rumpff as part of Landscape Logic and AEDA CERF research hubs.

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## Box 1. Quick Start Guide

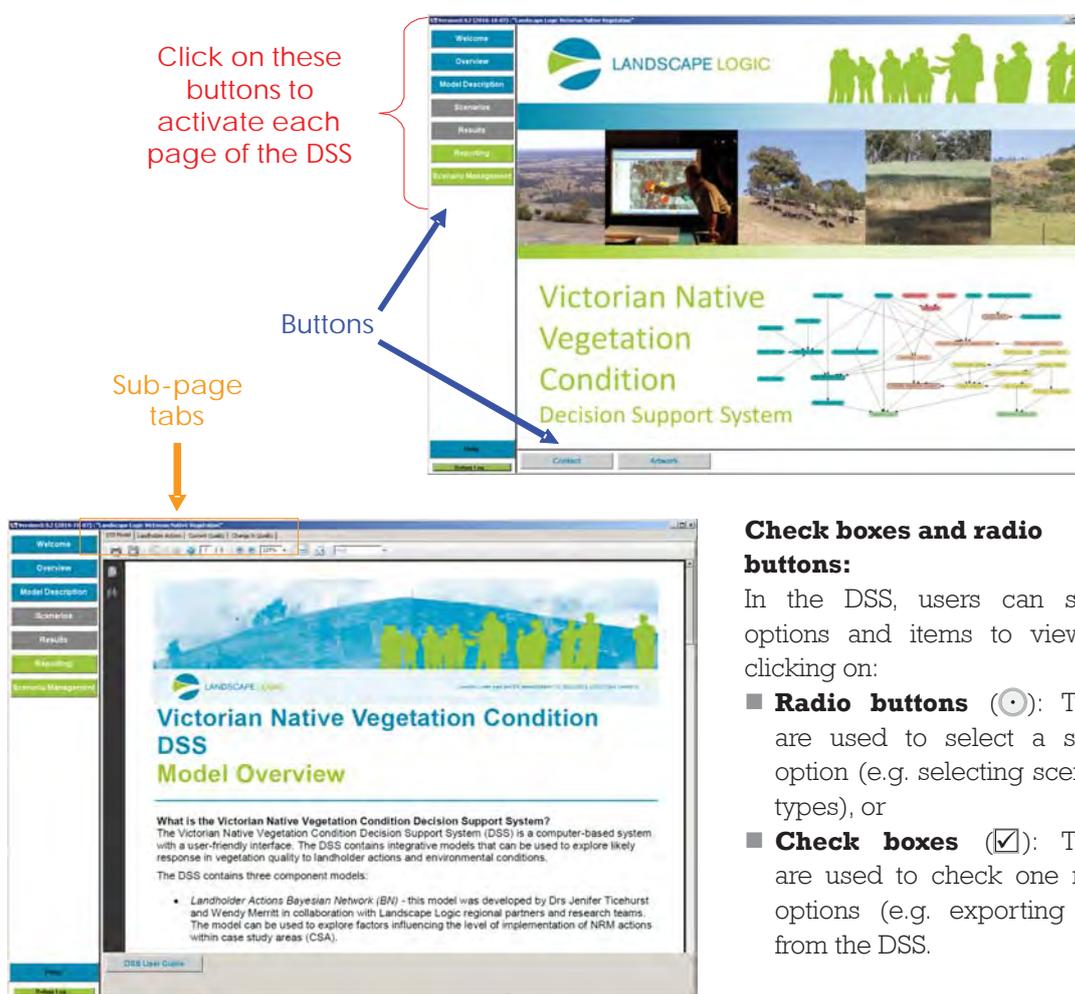
### Victorian Native Vegetation Condition Decision Support System

The software and files for each tool are contained within a folder named *LL\_VegBN*. This folder can be copied from the CD on the top level of the local disk of your computer.

**Opening a project:** To open ICMS double-click on *ICMSBuilder.exe* which is located in the top level of the *LL\_VegBN* folder. To open a project click on *File*, scroll down the menu and click *Open*. This will bring up a screen which you can use to browse for the project you want to open. All projects are stored in the *Projects* folder: (e.g. *LL\_VegBN\Projects\LL\_VegBN\_v1\_Nov2010.icm*).

**Opening the project interface:** To open the DSS interface click on the Plugins icon (🔌), click on *LL\_VegBN (LL\_VegBN.dll)* and then on *Open*.

**Navigating through the interface:** The software consists of seven main pages, which are activated by clicking on the coloured tabs on the left side of the page. A help button exists to give you guidance on the use of the features on each page. Some pages have a number of sub-pages that can be accessed by clicking on the tabs on the top left of the page.



#### Check boxes and radio buttons:

In the DSS, users can select options and items to view by clicking on:

- **Radio buttons** (☉): These are used to select a single option (e.g. selecting scenario types), or
- **Check boxes** (☑): These are used to check one more options (e.g. exporting data from the DSS).

#### 'Hotspot' Diagrams:

The *Landholder Action*, *Current Quality* and *Change in Quality* sub-pages of the *Model Description* page all have 'hotspot' features where users can click on boxes or hover over subcatchments to get information and model results.

**Constructing scenarios:** Before constructing and running scenarios, users should read the DSS User Guide and click on the Help button to guide use of the DSS.

## What is the Victorian Native Vegetation Condition DSS?

The Victorian Native Vegetation Condition Decision Support System (DSS) is a computer-based system with a user-friendly interface. The DSS contains integrative models that can be used to explore likely response in vegetation quality to landholder actions and environmental conditions.

The DSS contains three component models:

- **Landholder Actions Bayesian Network (BN)** – this model was developed by Drs Jenifer Ticehurst and Wendy Merritt in collaboration with Landscape Logic regional partners and research teams. The model can be used to explore factors influencing the level of implementation of NRM actions within case study areas (CSA).
- **Current Quality (BN)** – this model was developed by Drs Wendy Merritt and Jenifer Ticehurst in collaboration with Landscape Logic regional partners and research teams. The model estimates the initial state of vegetation quality within the CSA.

- **Change in Quality BN** – this model was developed by Drs Libby Rumpff and David Duncan as part of Landscape Logic and AEDA CERF research hubs. It can be used to explore the likely change in quality of vegetation at a site in response to management interventions and/or environmental conditions

The tool is not intended to make decisions with respect to the use and management of native vegetation on private lands. Rather, it can show plausible response of key indicators to user defined scenarios.

The Landholder Actions and Current Quality BNs are landscape scale models and can be used to look at what the landscape looks like now as well as the environmental and social context. The Change in Quality BN can be used to ask the question: given the current condition, how will a site respond to interventions?

## Background

### The Landscape Logic CERF Research Hub

Landscape Logic is a research hub funded by the Australian federal government Commonwealth Environmental Research Facilities (CERF) program. The project aim was to “improve the way scientific information is used as an aid to decision making, and to establish links between management actions and natural resource condition” ([www.landscapelogic.org.au](http://www.landscapelogic.org.au); Accessed 22 March 2010).

One aim of the research hub was to integrate new and existing knowledge on the efficacy of management interventions and model the impact of these interventions on resource condition. The primary modelling technique selected at the outset of Landscape Logic were BNs because they can be used to integrate across complex systems and scientific disciplines, communicate predictions effectively, and thus assist catchment managers make informed management decisions (Ticehurst and Pollino, 2007).

Two DSS were developed as part of Landscape Logic: the *Tasmanian Aquatic Condition DSS* and the *Victorian Native Vegetation Change DSS*. The latter models the effectiveness of NRM interventions on native vegetation quality on private land in northern Victoria, Australia, whilst the *Tasmanian*

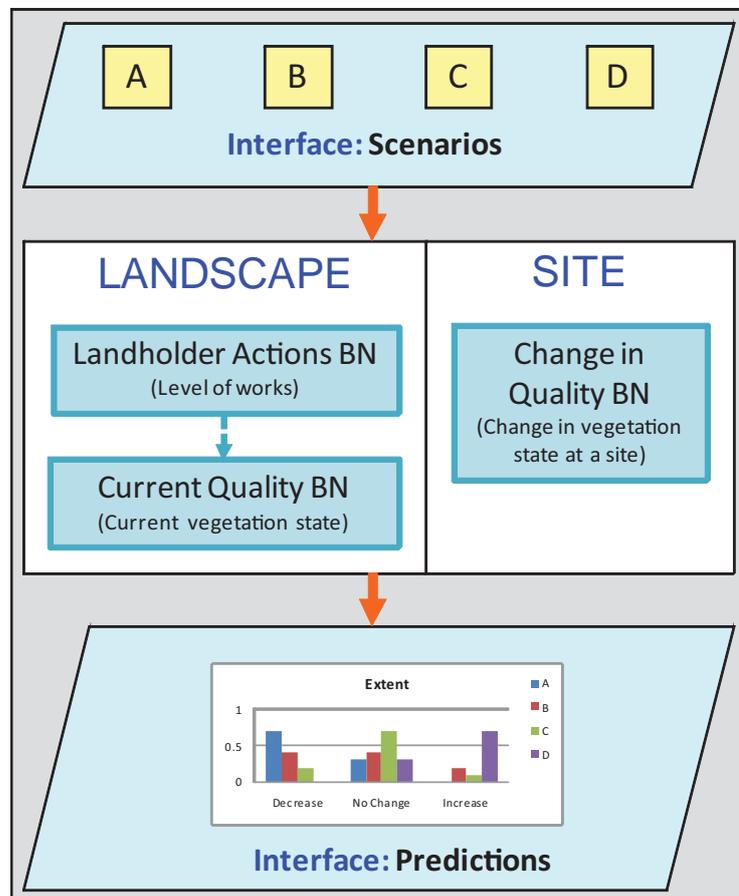
*Aquatic Condition DSS* simulates the impact of catchment condition on water quality and aquatic health. Conceptually both DSS are similar: BNs are the integration tool and both implementations are based on linking output probability distributions from one model to another. However, due to the different way in which spatial aspects are represented and how scenarios are constructed and results are viewed, two DSS have been developed with their own tailored graphical user interface (GUI). This User Guide focuses solely on the Victorian Native Vegetation Condition DSS.

### A Decision Support System for Native Vegetation Condition on Private Land in Northern Victoria

A decision support system (DSS) is a tool designed to support decision-making. They are often computer-based tools that allow users to explore what-if questions or alternate options for managing the system of interest. This DSS features three main components (Figure 1):

- Data Base – numeric and qualitative information that allow users to explore and interpret the impacts of different scenario options.
- Model Base – the models used to manipulate data and generate output from user-defined

Figure 1. The Victorian Native Vegetation Condition DSS.



actions. Data stored in the data base are input to, or created by, the model base.

- Interface – a DSS interface allows users to navigate through the tool, run the models and view outputs. The interface is kept separate from the model base to facilitate the use of the DSS by users who are not familiar with programming and computer models.

The Data Base in this DSS consists of probabilistic data that describes the cause-and-effect relationships between variables in the three Bayesian networks. In addition, the DSS data base incorporates qualitative information that is intended to support the use of the DSS for exploring

management, climate or other scenarios.

The Model Base consists of the three component models mentioned above. The models are coded in the Integrated Component Modelling System (ICMS) – a software platform developed by CSIRO Land and Water (Reed *et al.*, 2000; Cuddy *et al.*, 2002). A screen capture of the ICMS model for the DSS is shown in Figure 2. Each object – shown as a different icon in the figure – has data and/or models associated with it.

Each object – shown as a different icon in the figure – has data and/or models associated with it. (Table 1).

Table 1. Objects in the Victorian Native Vegetation Condition DSS.

| Icon  | Object Class | Model   | Description  |
|---|--------------|---|--|
|    | Parent       | N/A   | These are parent objects that contain the component models (Landholder Actions, Current Quality and Change in Quality).  |
|    | Input Nodes  | LandscapelInput<br>SitelInput<br>LandscapelLink | The LandscapelInput and SitelInput codes: <ul style="list-style-type: none"> <li>• defines the probability distribution for each <b>input node</b> in the landscape scale BNs (<i>Landholder Actions</i> and <i>Current Quality</i>) and the Change in Quality BN, respectively. The probability distribution can be user-defined OR stored in the BC_OutPDT matrix.</li> <li>• calculates selected percentiles (0, 50th, 75th, 95th and 100th) and mode of the probability distribution</li> </ul> The LandscapelLink defines probability distribution for the input nodes in the Current Quality BN that are linked to nodes in the Landholder Actions (e.g. Summer Rainfall). |
|  | InterimNode  | LandscapelInterim<br>SitelInterim               | The LandscapelInterim and SitelInterim codes: <ul style="list-style-type: none"> <li>• defines the probability distribution for <b>interim nodes</b> in the landscape scale BNs (<i>Landholder Actions</i> and <i>Current Quality</i>) and the Change in Quality BN, respectively.</li> <li>• calculates selected percentiles (0, 50th, 75th, 95th and 100th) and mode of the probability distribution.</li> </ul>   |

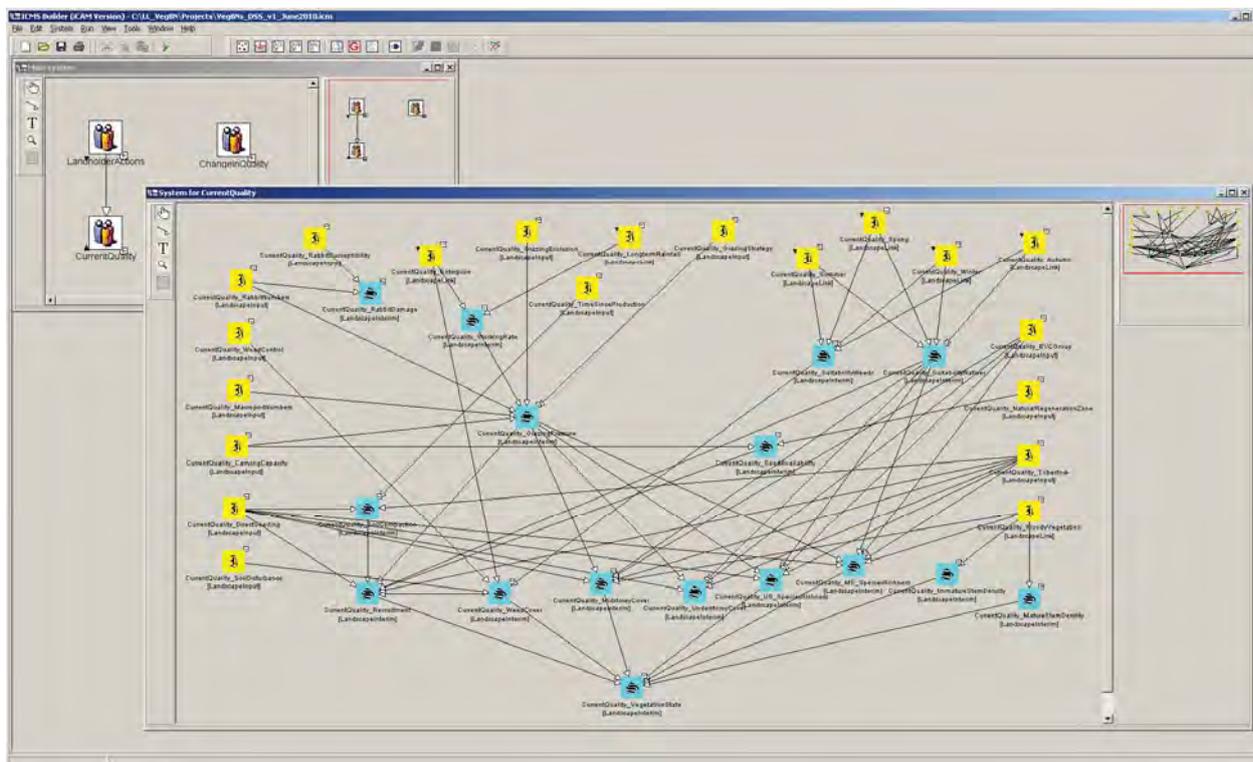


Figure 2. Structure of the Victorian Native Vegetation Condition DSS: showing the three component models (top left) and the Current Quality component.

## Opening the DSS

The software and files are contained within a folder named LL\_VegBN. These folders can be copied from the CD on to the top level of the local disk of your computer.

To open ICMS double-click on ICMSBuilder.exe which is located in LL\_VegBN folder (Figure 3).

To open a project click on **File**, scroll down the menu and click **Open**. This will bring up a screen which you can use to browse for the project you want to open. All projects are stored in the Projects folder: (e.g.) LL\_VegBN\Projects\VegBN\_DSS\_v1\_November2010.icm.

To open the DSS interface click on the Plugins icon (🔌), click on LL\_VegBN (LL\_VegBN.dll) and then click on **Open** (Figure 4).

## Opening the DSS using a shortcut

The DSS has been provided with a shortcut to open the DSS automatically. These shortcuts have been set up to run the *VegBN\_DSS\_v1\_November2010.icm* project file.

To open a different project file or from a location other than (e.g.) C:\LL\_VegBN\Projects you will need to update the shortcut file. To do this right-click on the shortcut (e.g. LL\_VegBN.exe), select **Properties** and click on the **Shortcut** tab (Figure 5). To change the name of the project file you want to open in the **Target:** box and change the project file name at the end of the line.

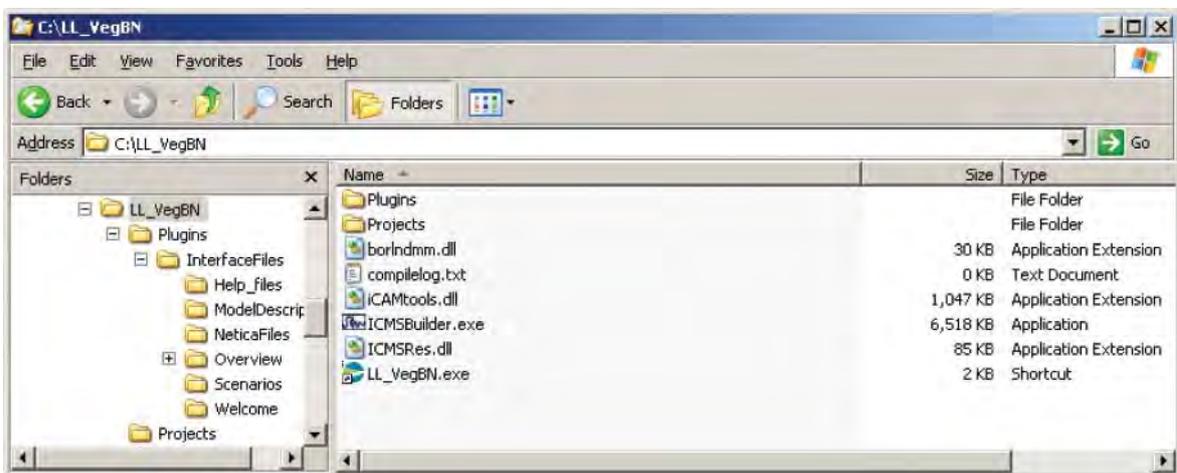


Figure 3. Opening the DSS.

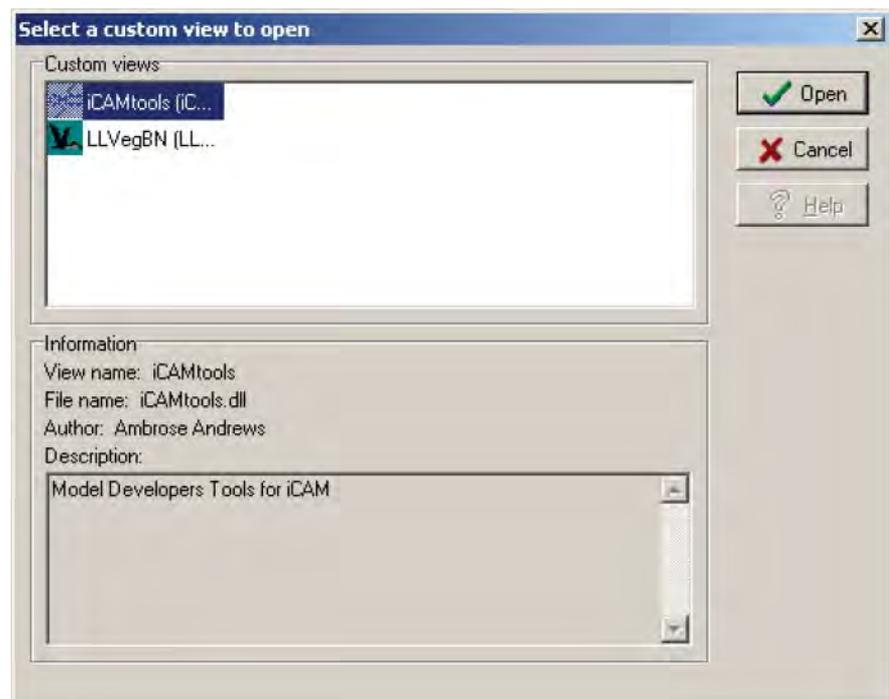


Figure 4. Custom view Plugin for the Victorian Native Vegetation Condition DSS.

## Using the DSS

This section describes how to use the DSS to explore the likely response in vegetation quality to landholder actions and environmental conditions.

The software consists of seven pages, which are activated by clicking on a tab. Information contained on each page in the software is shown in Table 2. General background to the project and the approach can be found on the Welcome and Overview pages. Details on the DSS and the component models are accessible from the Model Description page. Scenario construction and running of the model is done through the Scenarios page and the results from model runs can be viewed in the Results pages. Reports can be created and exported, from the DSS via the Reporting page. The Scenario Management page allows the deletion of scenarios from the Run Library of the DSS. A Help button exists to give you guidance on the use of the features on each page. It replicates much of the information in this User Guide.



Figure 5. Editing the shortcut for the Victorian Native Vegetation Condition DSS.

Table 2. Pages in the Victorian Native Vegetation Condition DSS.

| Page                | Status  |
|---------------------|---|
| Welcome             | <ul style="list-style-type: none"> <li>Contact details of the program leader and DSS/model developers</li> <li>Sources of artwork on Welcome Page</li> </ul>  |
| Overview            | <ul style="list-style-type: none"> <li>Overview of the Landscape Logic project</li> <li>Terminology used in the DSS</li> </ul>  |
| Model Description   | Overview of the Victorian Native Vegetation Condition DSS<br>Description of the Landholder Actions, Current Quality and Change in Quality BNs   |
| Scenarios           | <ul style="list-style-type: none"> <li>Construct scenarios for the Landscape Actions and Current Quality BNs (LANDSCAPE SCENARIOS)</li> <li>Construct scenarios for the Change in Quality BNs (SITE SCENARIOS)</li> </ul> |
| Results             | Display outputs for LANDSCAPE and SITE SCENARIOS. Results can be viewed as tables of data or graphs   |
| Reporting           | Generate reports in html format   |
| Scenario Management | Capacity to delete scenarios from the Run Library   |

## Welcome

Through the Welcome page (Figure 6) you can access contact details of the model and DSS developers and the Landscape Logic program leader

(Figure 7) as well as detail on the sources of the artwork and DSS design. At any point you when using the DSS you can click on the Help button to get hints on how to use the tool (Figure 8).

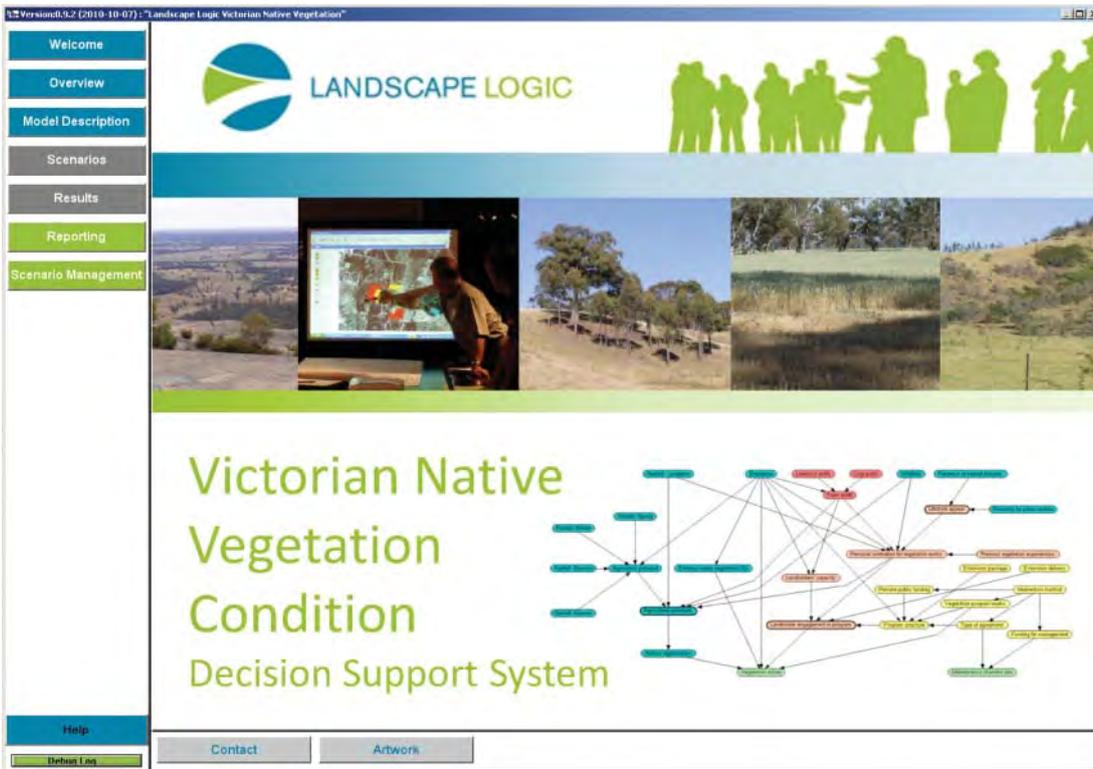


Figure 6. Welcome Page of the Victorian Native Vegetation Condition DSS.



Figure 7. Contact details documentation.

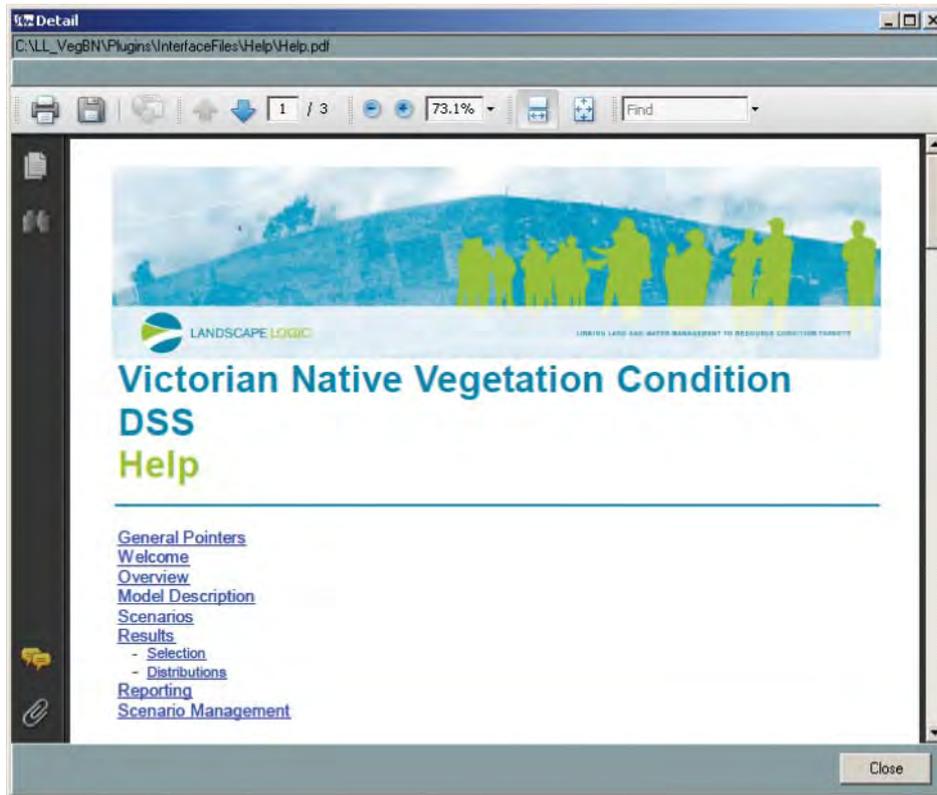


Figure 8. Help documentation for the Victorian Native Vegetation Condition DSS.

## Overview

The Overview page provides information on the Landscape Logic project and Products Library via the Landscape Logic sub-page (Figure 9).

The Terminology sub-page introduces key modelling/software, and native vegetation concepts (Figure 10).



Figure 9. Overview Page of the Victorian Native Vegetation Condition DSS: Landscape Logic sub-page.

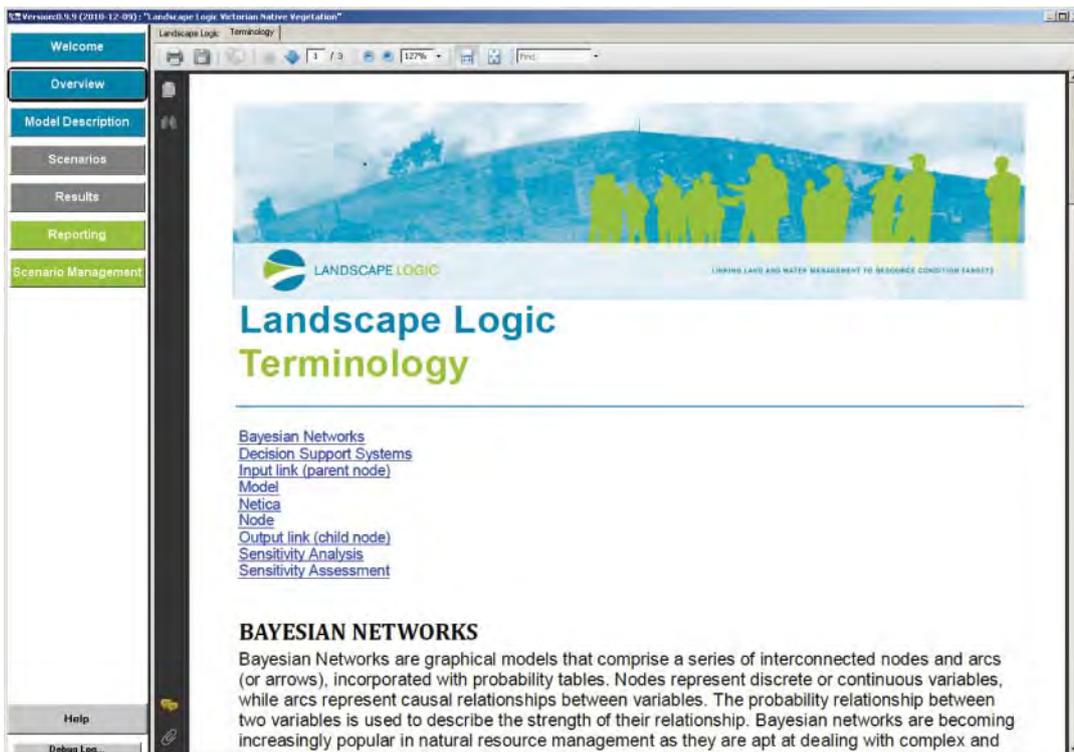


Figure 10. Overview Page of the Victorian Native Vegetation Condition DSS: Terminology sub-page.



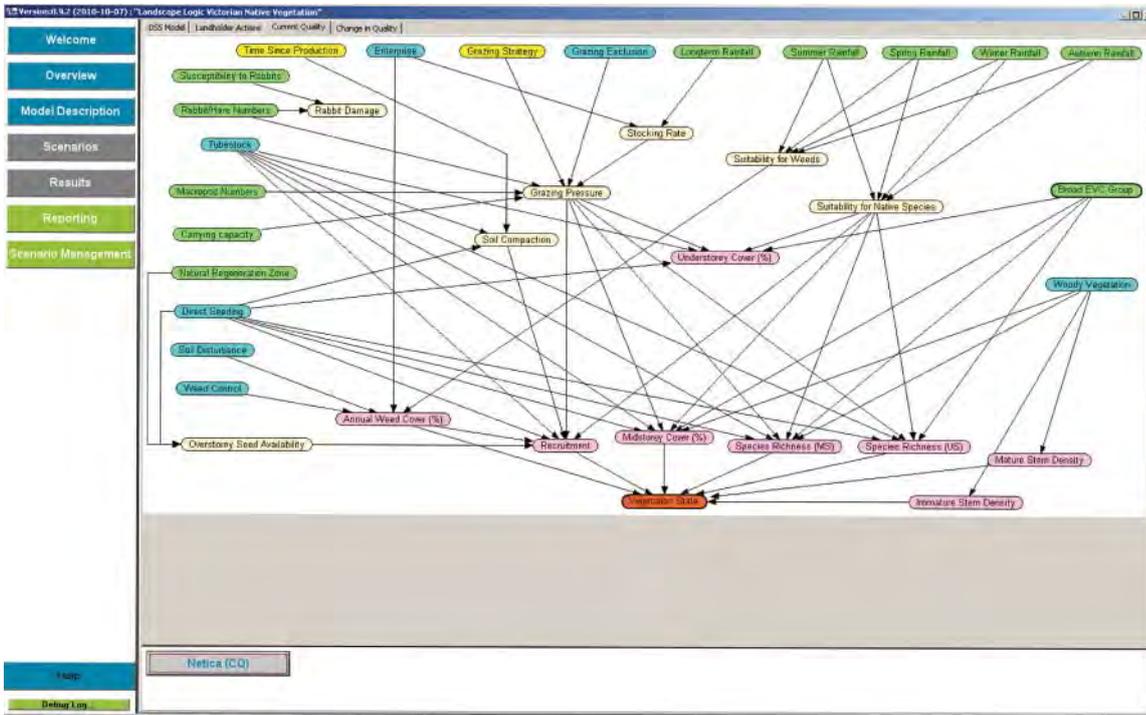


Figure 13. Model Documentation page of the Victorian Native Vegetation Condition DSS: Current Quality sub-page.

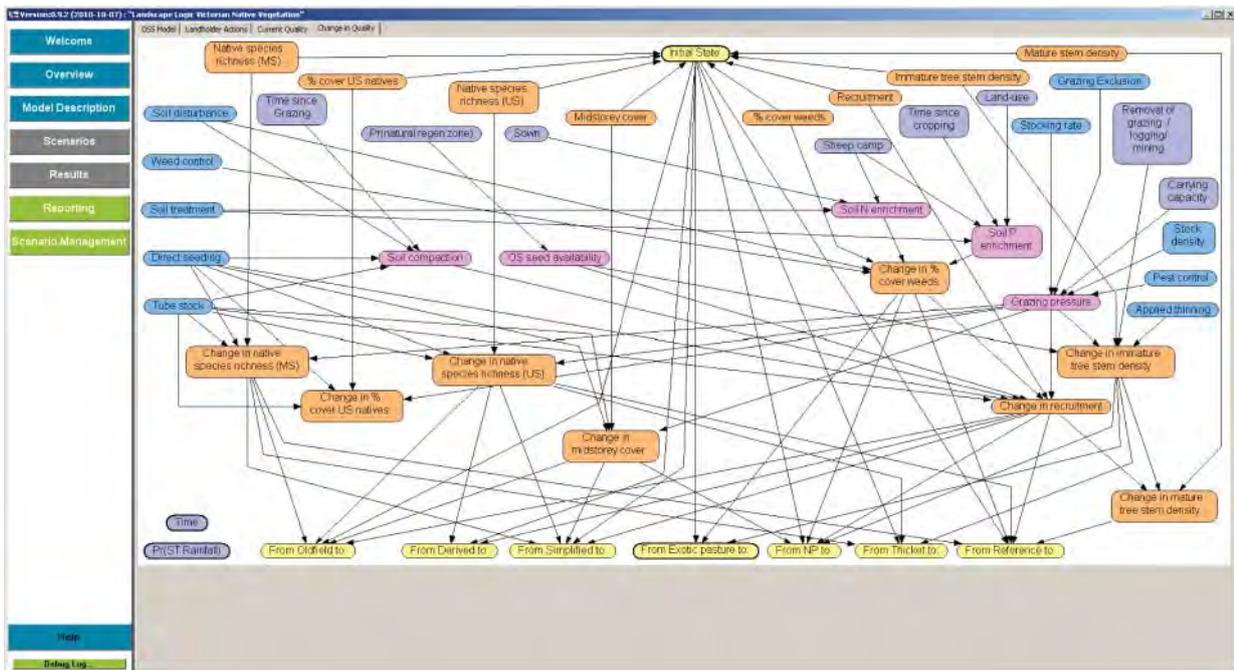


Figure 14. Model Documentation page of the Victorian Native Vegetation Condition DSS: Change in Quality sub-page.

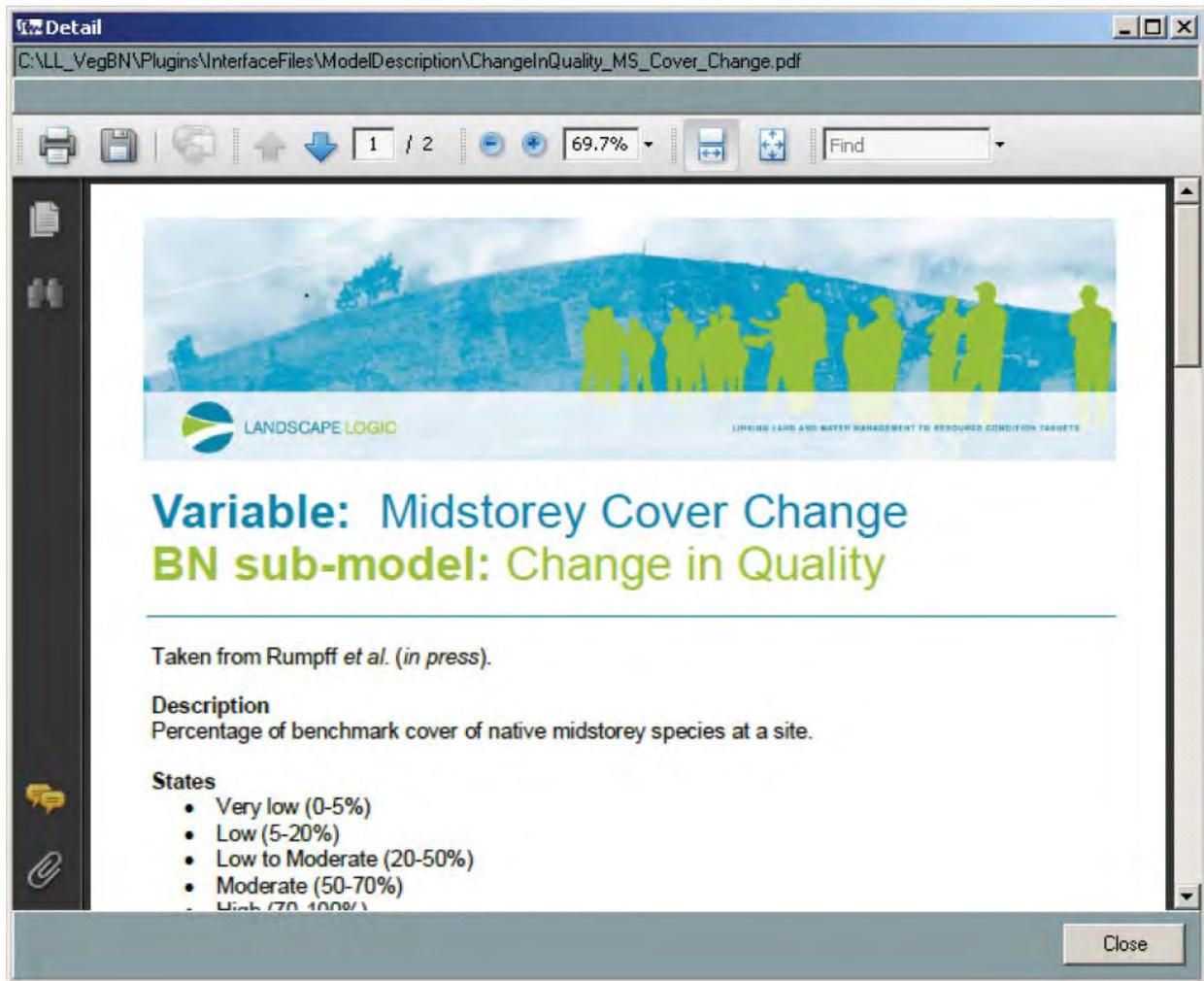


Figure 15. Documentation page for the Change in Midstorey Cover variable in the Change in Quality model.

## Scenarios

This page allows you to construct and run scenarios. Two types of scenarios can be constructed:

- **Landscape Scenarios:** Scenarios are defined for 'parcels' of land within the case study area. Climate, economic, landholder enterprise, aesthetic and NRM program scenarios can be defined in the Landholder Actions BN. The climate and enterprise settings are linked directly to the corresponding nodes in the Current Quality BN to ensure consistent scenarios. However, you can set a number of variable in the Current Quality BN including proximity to natural regeneration zone, rabbit numbers, and grazing strategy.
- **Site Scenarios:** The Change in Quality BN is an implementation of the state-and-transition model developed by Rumpff *et al.* (in press). You can set variables describing the current structure and composition of a site (e.g. very low understorey cover and understorey species richness) to define the current state of the vegetation and then examine the influence of management interventions on the vegetation state.<sup>1</sup>

The Scenarios page of the DSS is comprised of two sub-pages.

- **Selection:** here you can develop LANDSCAPE SCENARIOS or SITE SCENARIOS from scratch or base them on existing scenarios
- **Run and Save:** here you can name, save and run scenarios that you have defined in the Selections page

You can either modify the Base Case data<sup>2</sup> (via the Modify Base Case button) or an existing scenario (via the Run Lib Scenario or Load External Scenario buttons). Existing scenarios can be in two forms: a scenario run that you have created previously (which is stored in the Run Library) or an external scenario (that someone else ran on their copy of the DSS) which you need to run and save to your copy of the DSS. Clicking on the Modify Base Case or Run Lib Scenario buttons loads the Base Case or Run Library Scenario data, respectively, into the DSS data tables. You can then modify this data to set up your new scenario. Clicking on the External Scenario ... button opens a dialog box that prompts you to browse and select an external scenario (e.g. BN SCENARIO\_<Scenario Name>.txt).

- <sup>1</sup> In this version of the DSS, the implementation of the state-and-transition model has been constrained to consider average rainfall conditions and a timeframe of 5 to 20 years (post intervention). The model developed by Rumpff *et al.* (in press) considers other time periods and rainfall conditions. The DSS could be readily updated to include the capacity to examine different rainfall scenarios and time periods.
- <sup>2</sup> Base Case data reflects the current condition of the case study area. It is applicable for the *Landholder Actions* and *Current Quality* BNs where the input variable describes the likely distribution of each state in the node based on data collected from Landscape Logic or other sources.

Clicking on the Save Scenario to File button will save any settings you make to a text file. This file can be provided to other users of the DSS who can then load and run that scenario in their copy of the DSS.

By default, when you save a scenario it is saved to the path shown in the interface (C:\LL\_VegBN\plugins\Interfacefiles\Scenarios\). You can select an alternate place to save the scenario by Set Scenario Path Button and browsing to the directory of interest.

### Developing a landscape scenario

The screen shot of the Selections page in Figure 16 shows the set-up for a landscape scenario. The tree structure shows the models (Landholder Actions and Current Quality) and the list of variables that can be modified. Clicking on a variable name displays a table showing the current value. You can enter a new distribution into the "New Value" Column. Note that the sum of all rows must equal 100.

If you want to set an even (or uniform) distribution across all states click on the Even Distribution button.

To set a particular state to 100% (e.g. 'Grazing' in Figure 16) check that the Double Click Value is set to 100 and then double-click on the "New Value" cell corresponding to that state.<sup>3</sup>

Depending on the scale of the information used to define the variable you may be able to (and want to) define scenarios for different parts of the landscape (e.g. case study areas and/or broad vegetation groups). The current settings are shown in Table 3.

### Developing a site scenario

Site scenarios are set up in the same manner as all the landscape scenarios. Note however, that as the model relates to sites, you should define scenario as being 100% in one state (Figure 17). To set a particular state to 100% (e.g. 'Grazing' in Figure 16) check that the Double Click Value is set to 100 and then double-click on the "New Value" cell corresponding to that state.

### Running and Saving a Scenario

In the Run and Save sub-page, you can name and run the scenario you created in the Selections sub page (Figure 18). You must enter a name for the scenario and also an author name (e.g. your initials). Whilst optional it is recommended that you enter a short description of the scenario.

Once these details have been entered, click the Run Scenario button.

- <sup>3</sup> If the *Double Click Value* is set to a value other than 100 (e.g. 70%) then that value will be entered into the cell you are setting. The remaining 30% will be divided equally between the remaining states.

Table 3. Spatial definition of the input variables in the landscape-scale component models (Landholder Actions BN and Current Quality BN).

| Dataset                               | Description  | Variables   |
|---------------------------------------|--|---|
| Whole region (Region)                 | No definition between case study areas or vegetation groups* | Livestock profit<br>Crop profit<br>Wildfires<br>Previous vegetation experiences<br>Extension delivery<br>Intervention method<br>Time since production<br>Grazing strategy<br>Macropod numbers |
| Case Study Area (CSA)                 | No definition between vegetation groups                      | Presence of natural features<br>Proximity to urban centres  |
| Broad vegetation group (Veg)          | No definition between case study areas                       | Rabbit numbers  |
| CSA + Broad vegetation group (VegCSA) | All combinations of CSA and broad vegetation groups          | Susceptibility of native vegetation to rabbit damage<br>Natural regeneration zone<br>Carrying capacity  |

\*These definitions can be changed if you want to be able to set scenarios that differ between vegetation groups or case study areas (for example). The definitions are in the LLVegBN\_data.txt script file stored in \\LL\_VegBN\Plugins\InterfaceFiles. For the variable(s) that you want to change you will need to change the "dataset =" entry to match the setting you want (e.g dataset = Region, dataset = CSA, dataset = Veg or dataset = VegCSA).

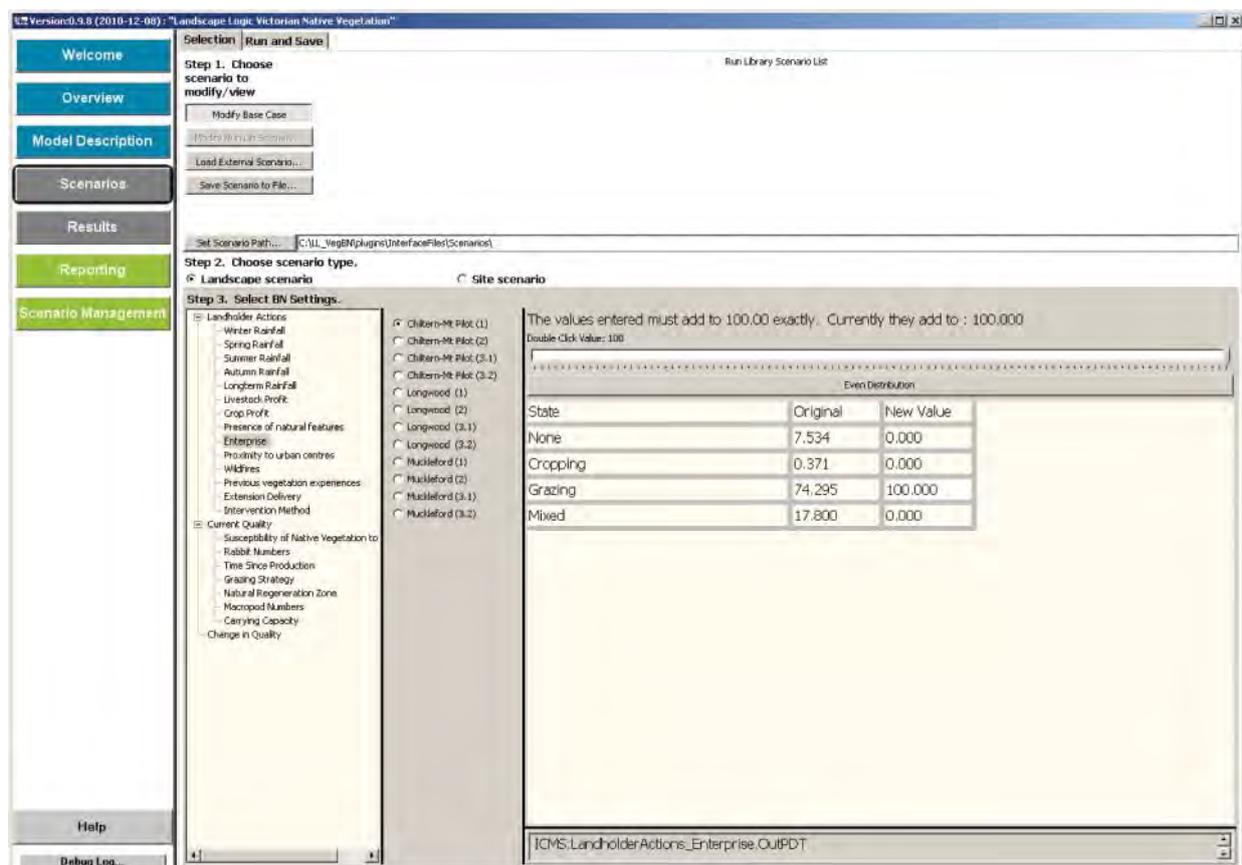


Figure 16. Scenario page of the Victorian Native Vegetation Condition DSS: Selection sub-page. This shows the set-up for creating a new landscape scenario based on modifying the Base Case data.

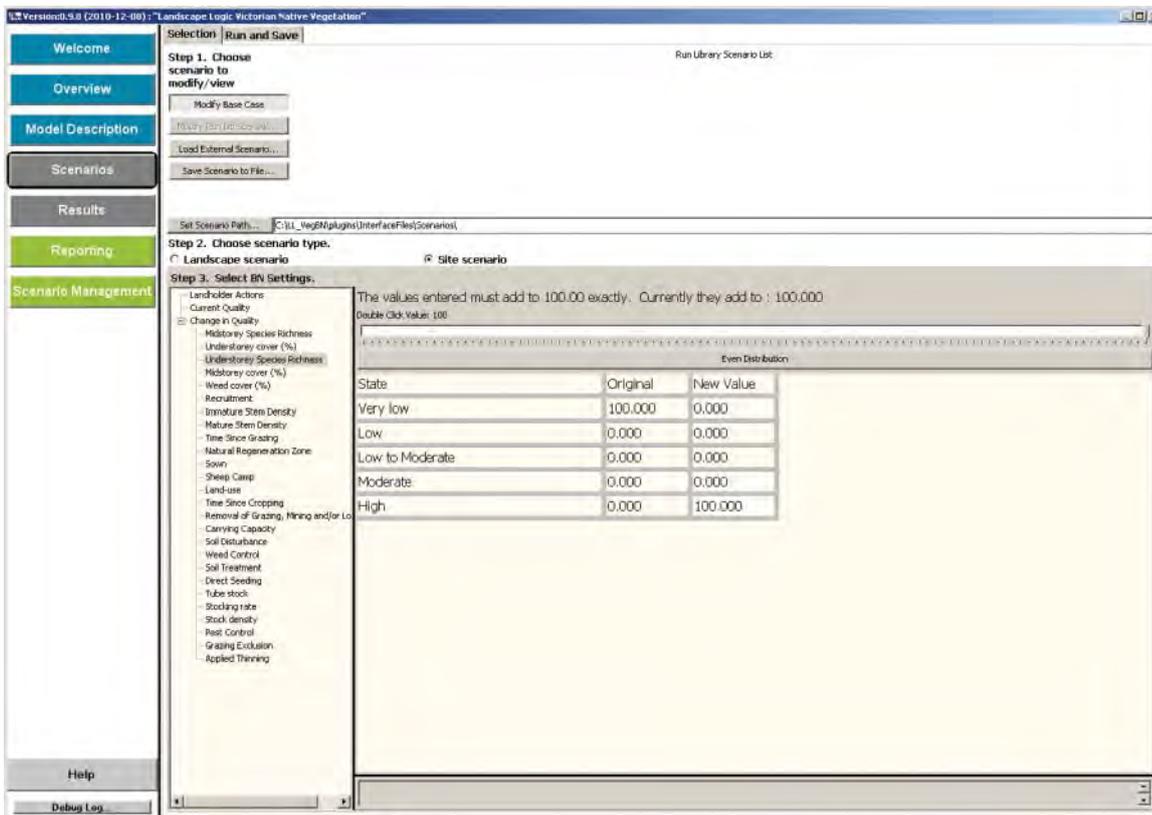


Figure 17. Scenario page of the Victorian Native Vegetation Condition DSS: Selection sub-page. This shows the set-up for creating a new site scenario based on modifying the Base Case data.

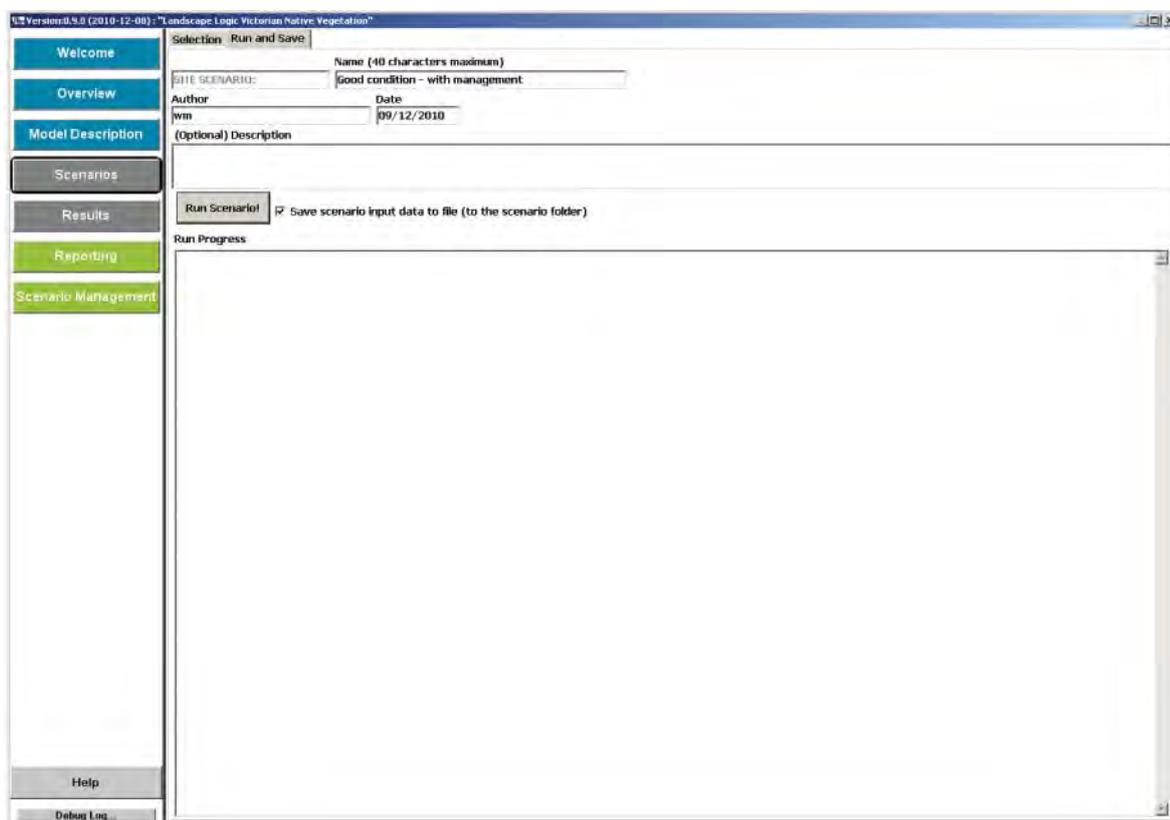


Figure 18. Scenario page of the Victorian Native Vegetation Condition DSS: Run and Save sub-page.

## Results

This page allows users to view results for scenarios. You cannot compare a SITE SCENARIO with a LANDSCAPE SCENARIO.

The Selection sub-page allows you to select scenarios to view and compare results (Figure 19).

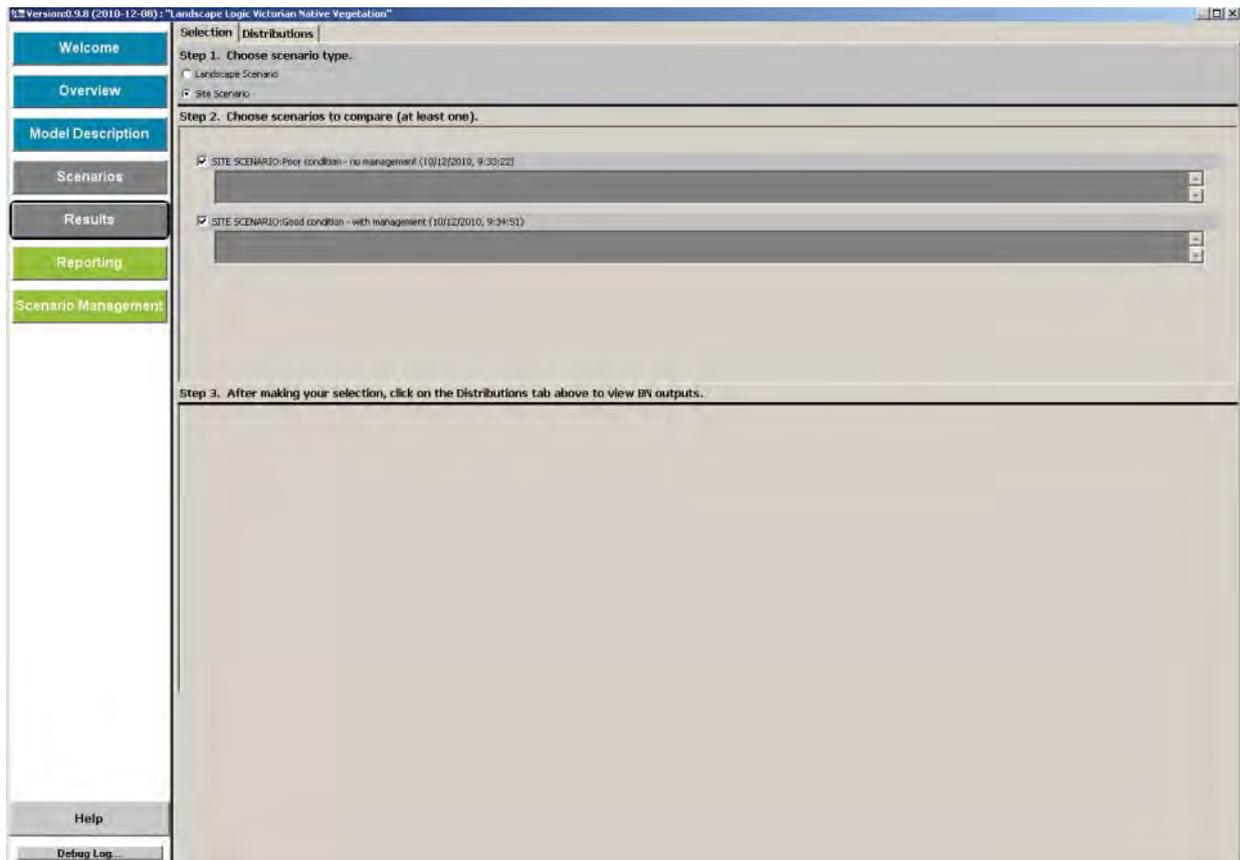


Figure 19. Results page of the Victorian Native Vegetation Condition DSS: Selection sub-page.

Once you have selected your scenario(s) of interest click on the Distributions subpage to view results. The Results page works in the same way for both SITE and LANDSCAPE SCENARIO, except that for landscape scenarios you can view results for all combinations of broad vegetation groups and case study area.

The top right of the panel lists the scenario you selected; you can select one variables at a time to view. By default, graphs showing the probability distribution are shown for the selected variables (Figure 20). You can also click on the Statistics tab at the top of this panel to display different statistics (e.g. the mode – most likely state) (Figure 21).

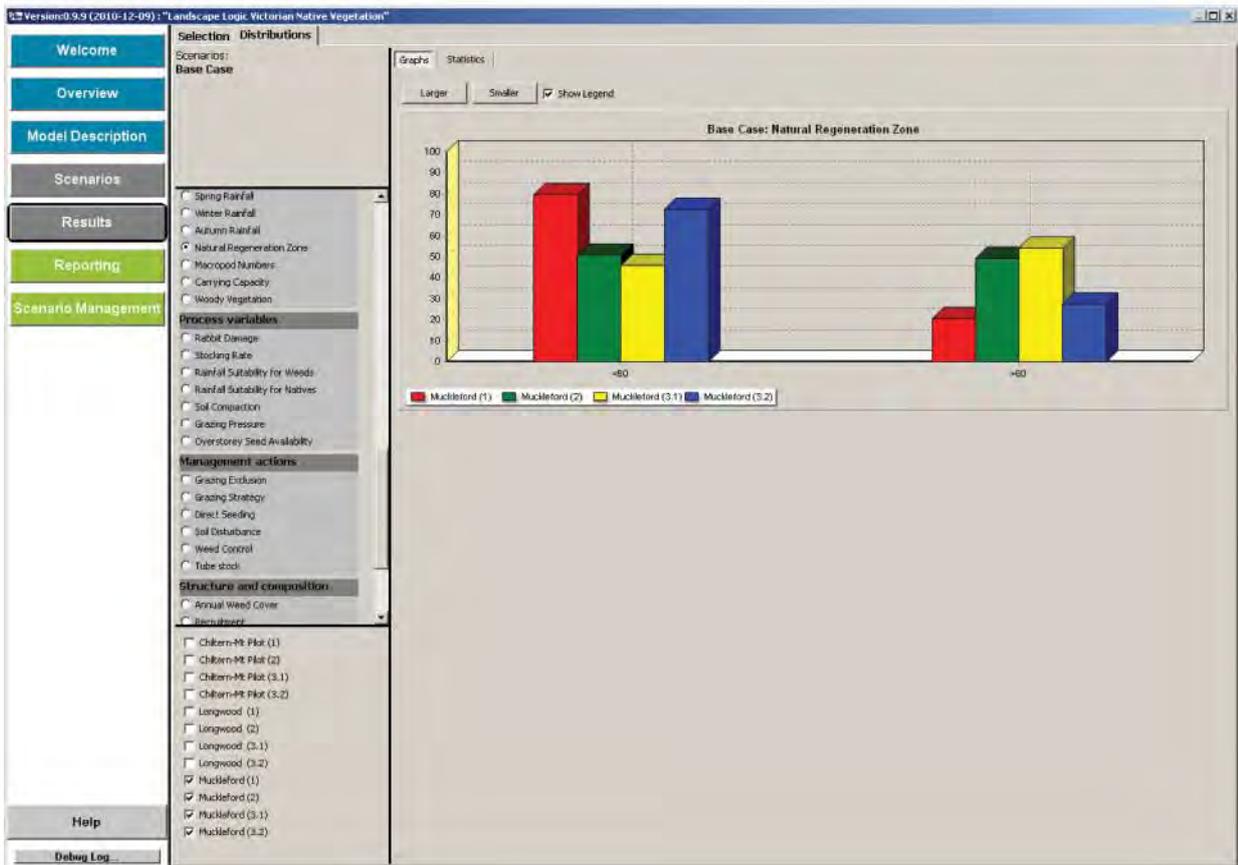
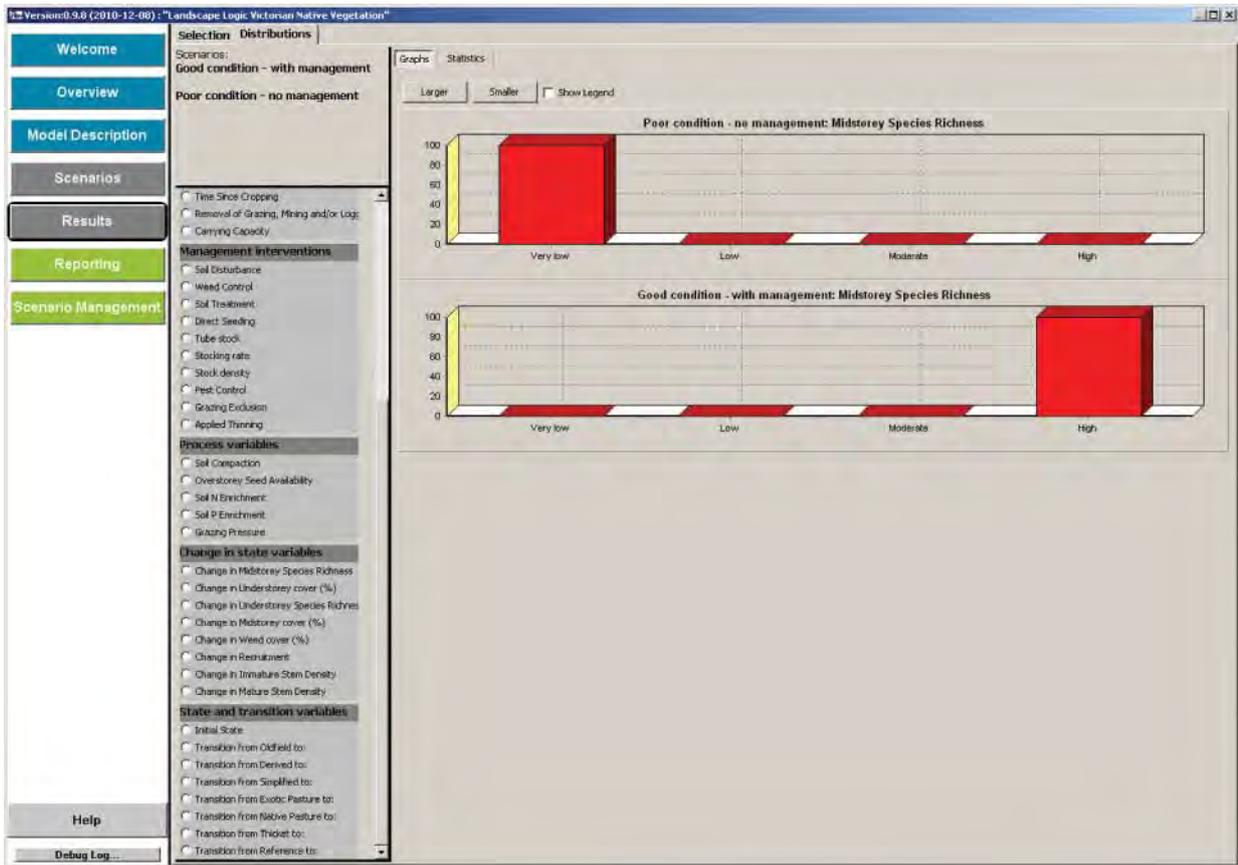


Figure 20. Results page of the Victorian Native Vegetation Condition DSS: Distributions sub-page (Graphs) (Top: site scenario, Bottom: landscape scenario).

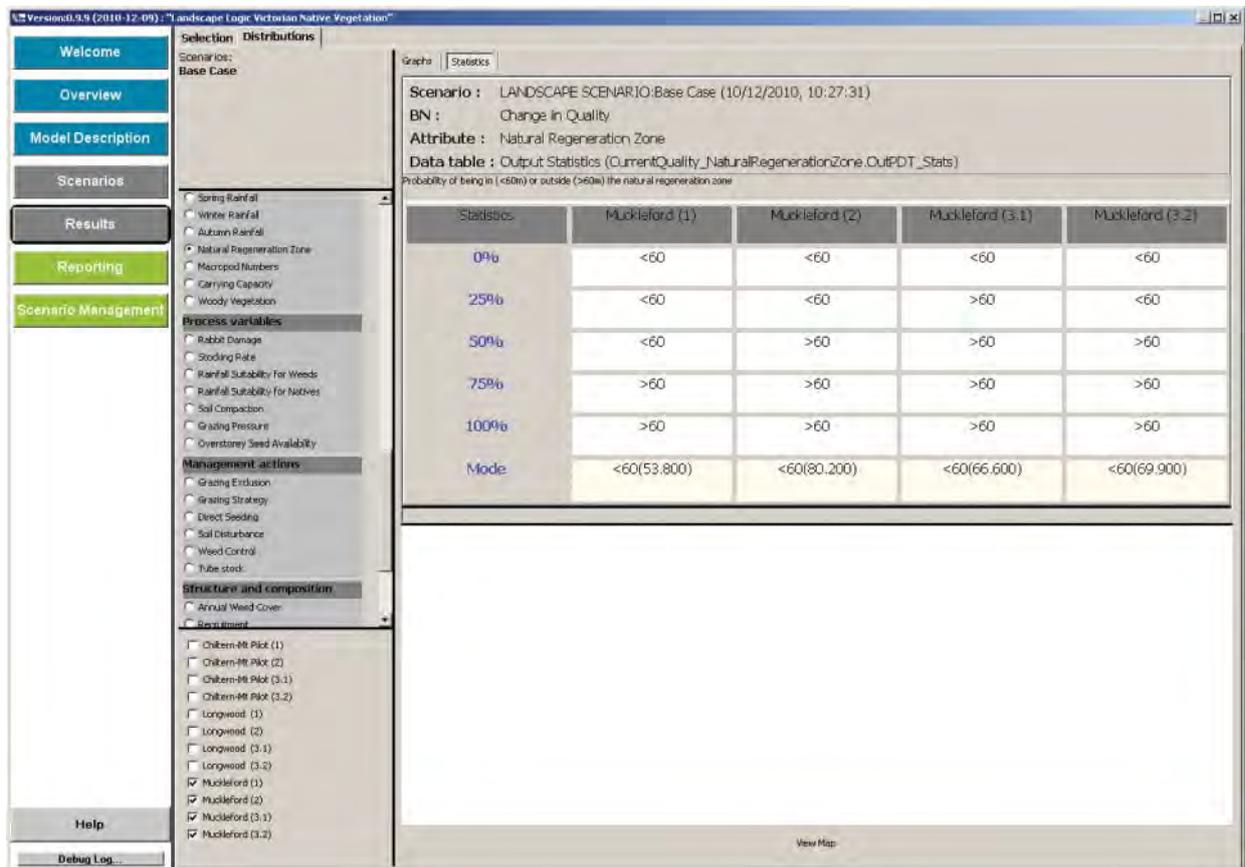


Figure 21. Results page of the Victorian Native Vegetation Condition DSS: Distributions sub-page (Statistics).

## Reporting

**This page is not yet free of bugs ... you can save reports but not without error messages. Just click OK and Yes to the error messages.**

This page allows you to create html reports. Figure 22 shows the Reporting page. To create a report

1. Enter a name, author and discussion points in the top left panel
2. Select whether you want to report on SITE Scenarios or LANDSCAPE Scenarios
3. Select whether to include source files, scenario descriptions, input attributes, and (all or a selected subset of) output attributes

4. If you wish to select a subset of attributes to report on, select those attributes from the bottom left panel (titled Output Attributes Selector)
5. Select the scenario(s) you want to report on
6. Click the Generate Report button at the bottom of the page.

When you click the Generate Report button, a pop-up will open that allows you to browse to the directory where you want the report to save to (Figure 22). You can change the default name of the zip file if you wish. This zip file contains the html report and all associated files. To view the report unzip the folder and double-click on the html.

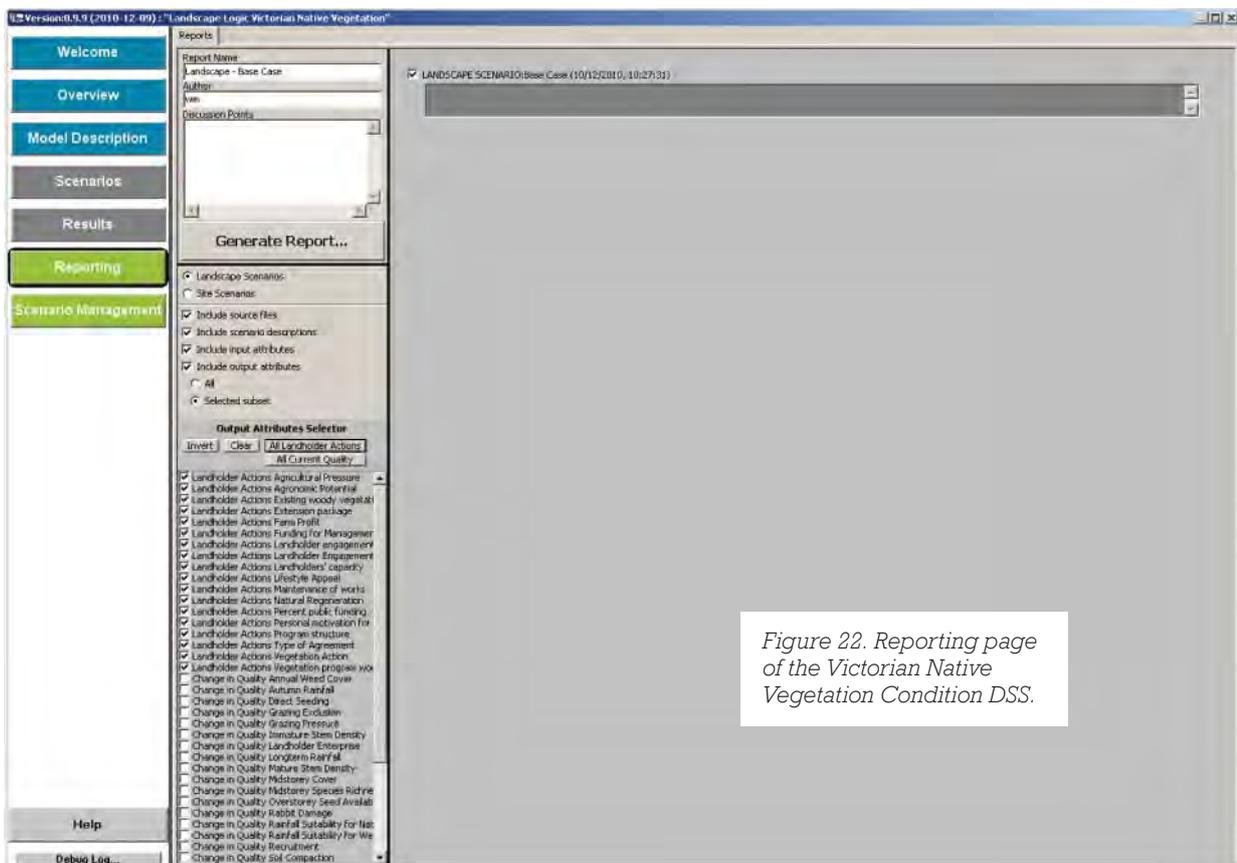


Figure 22. Reporting page of the Victorian Native Vegetation Condition DSS.

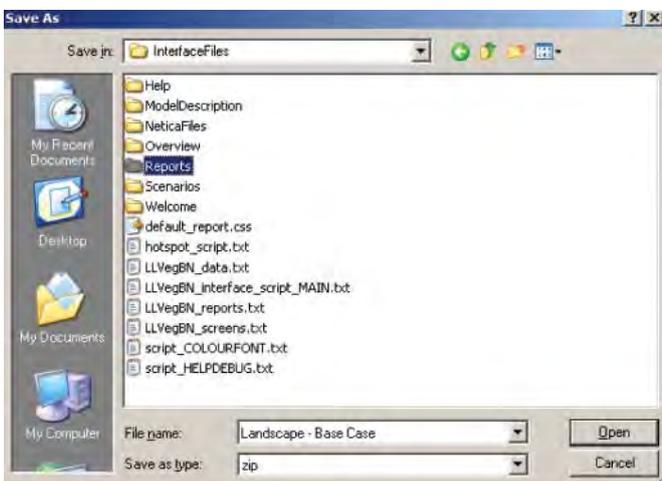


Figure 23. Pop-up to name and save a report generated in the Victorian Native Vegetation Condition DSS.

## Scenario Management

This page allows you to delete scenarios from the Run Library of the DSS (Figure 24). Select on the scenario you wish to delete, click on the Delete button. When asked if you meant to delete the scenario click Yes.

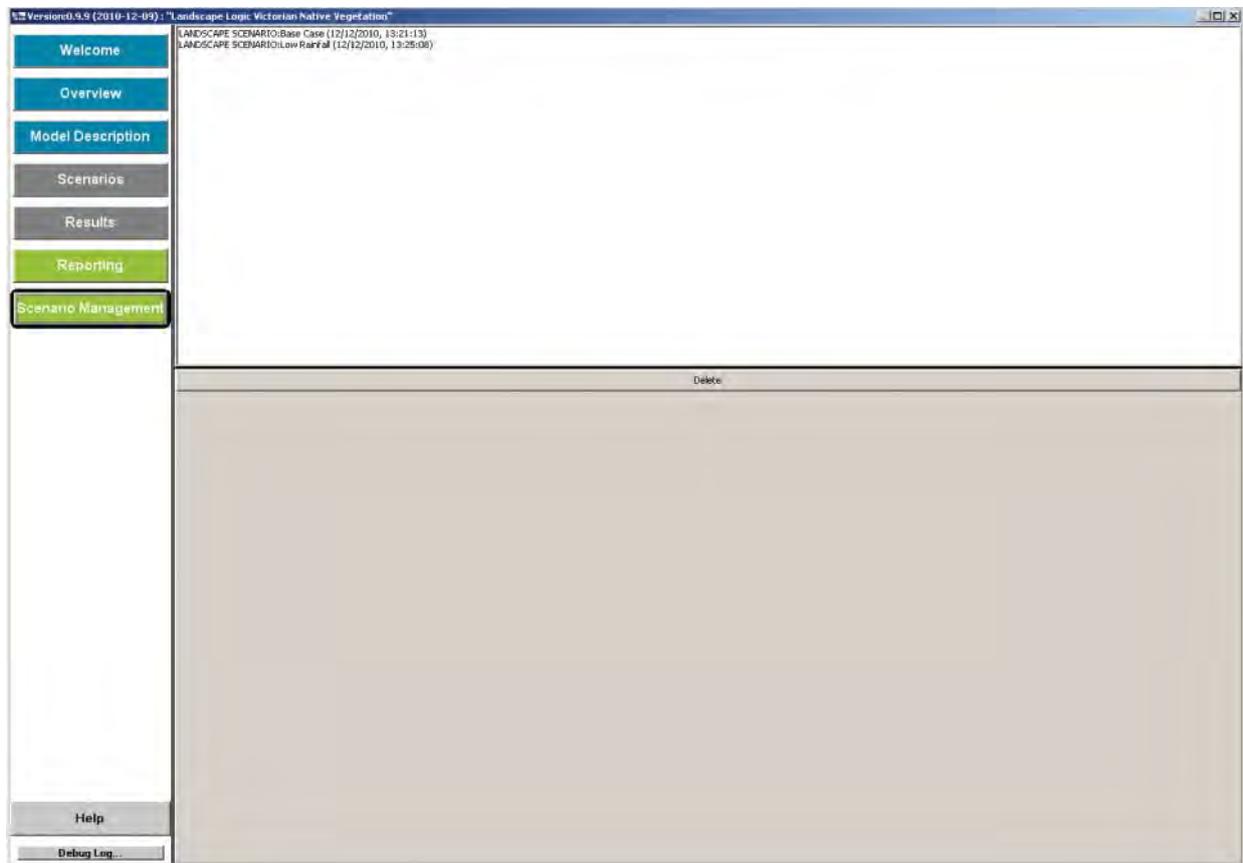


Figure 24. Scenario Management page of the Victorian Native Vegetation Condition DSS.

## **Updating a model application**

Updates to the DSS application can be to either the interface or to the underlying models (e.g. base data). The latter are made within the ICMS software platform. Modifications require some technical skills and an understanding of the data and models that underlie the DSS. It is recommended that you contact the DSS model developer (wendy.merritt@anu.edu.au) should you wish to update the models inside the DSS.

## **Updating the DSS interface**

The technical documentation in Appendix 1 details the files that together make up the Victorian Native Vegetation Condition DSS package. It is intended to aid those users who want to update or modify an existing application or who intend to develop a new application.

## References

- Cuddy, S.M., Letcher, R.A., Reed, M. (2002), In Rizzoli, A. E. and Jakeman, A. J., (eds.), *Integrated Assessment and Decision Support*, Proceedings of the First Biennial Meeting of the International Environmental Modelling and Software Society, vol. 3, pp. 300-305.
- Reed, M., Cuddy, S.M. and Rizzoli, A.E. (2000) A framework for modelling multiple resource management issues – an open modelling approach, *Environmental Modelling and Software*, vol 14, pp. 503-509.
- Rumpff L., Duncan D. H., Vesik P. A., Keith D. A. & Wintle B.A (in press). State-and-transition modelling for Adaptive Management of native woodlands. *Biological Conservation*.
- Ticehurst, J.L. and C.A. Pollino. (2007). Build collaborative models or capacity? Comparison of techniques for building bayesian networks for the Natural Resource Management regions of Australia. In Oxley, L. and Kulasiri, D. (eds) MODSIM 2007 International Congress on Modelling and Simulation. Modelling and Simulation Society of Australia and New Zealand, December 2007, pp. 274-880, 2007. ISBN: 978-0-9758400-4-7 [http://www.mssanz.org.au/MODSIM07/papers/5\\_s45/BuildCollaborative\\_s45\\_Ticehurst\\_.pdf](http://www.mssanz.org.au/MODSIM07/papers/5_s45/BuildCollaborative_s45_Ticehurst_.pdf)

## Appendix – Technical documentation (Version 1.0)

This document details the files that together make up the Victorian Native Vegetation Condition DSS. It is intended to aid those users who want to update or modify an existing application or who intend to develop a new application.

Three levels of a person's technical expertise can be considered which will define what level of changes to the DSS should be made by that person.

- *Programmer*: any changes to the ICMS software and the DSS interface source code need to be undertaken by a programmer. The source code for the DSS interface (and the ICMS software platform) has not been provided with the package and persons who are interested in such changes need to contact the relevant software developers (CSIRO and iCAM). For this DSS, the programmer was Peter Manger at iCAM.
- *Model developer*: Any changes to the underlying ICMS model should only be made by person familiar with model development and programming (particularly using the ICMS software). For this DSS, the model developer was Dr Wendy Merritt at iCAM.
- *User*: these users should not make changes to the software, underlying models and data, or the settings that collectively determine what files are expected to be found and what the DSS interface is expected to look like. They may make superficial changes to an application (e.g. replacing interface documents; creating, running and saving scenarios).

### Overview of DSS Files

The DSS is made up of various files that:

- manage interactions between the interface and the underlying model,
- define the look and features of the interface, and
- point to supporting documentation (Table 1).

The settings in these files collectively determine what files are expected to be found and what the DSS interface is expected to look like.

### DSS File Relationship

The text below summarise the function of some key files that make up the DSS package. It is recommended that you do not move or rename any of these files unless you are very familiar with the DSS or are responding to advice from the programmer and model developers.

### ICMS Builder

This DSS was developed using ICMS Builder version 2.2.0.9, developed by the CSIRO Land and Water, Copyright 2001, in collaboration with the ANU through its Integrated Catchment Assessment and Modelling (iCAM) centre.

ICMS Builder is the main application through which models (ICM Model Files) and customisations (LLVegBN.dll) the DSS has been built.

There must be a folder named "Plugins" in the same folder as the ICMSBuilder.exe file.

Table 1. Files that comprise the Victorian Native Vegetation Condition DSS and the minimum level of technical expertise required to change the file.

| File                              | Affects    | Can User Modify File? | Technical Expertise Required to change file <sup>1</sup> |
|-----------------------------------|------------|-----------------------|--|
| ICMSBuilder.exe (Builder)         |            | No                    | Programmer   |
| ICM Model Files (ICM)             | Builder    | Yes                   | Model developer  |
| LLVegBN.dll (DLL)                 | Builder    | No                    | Programmer   |
| LLVegBN.ini                       | Files, DLL | Yes                   | Model developer  |
| hotspot_script.txt                | DLL, Files | Yes                   | Model developer  |
| LLVegBN_reports.txt               | ICM        | Yes                   | Model developer  |
| LLVegBN_data.txt                  | ICM        | Yes                   | Model developer  |
| LLVegBN_screens.txt               | ICM        | Yes                   | Model developer  |
| LLVegBN_interface_script_MAIN.txt | ICM        | Yes                   | Model developer  |
| Script_COLOURFONT.txt             | ICM        | Yes                   | Model developer  |
| Script_HELPDEBUG.txt              | ICM        | Yes                   | Model developer  |
| various other files (Files)       | DLL mostly | Yes                   | User   |

## **ICM Model File**

The ICM Model File is

- the model used to explore likely response in vegetation quality to landholder actions and environmental conditions
- a collection of objects (matrices) that behave in particular ways as defined by the model code that hangs off an object.

All actions that happen in the DSS when dealing with scenarios, happen to an ICM file. Most of the files used expect certain knowledge of the matrices, but not necessarily knowledge of the underlying model code (i.e., the shape of data is important, but how that data is determined is not important).

The ICM files can be anywhere, but usually reside in a folder called "Projects".

## **LLVegBN.dll (the "plug-in")**

ICMS Builder can be customised by loading a specially made plug-in (the DSS interface). The plug-in can be used to "hide" the complexity of an ICM Model File, allowing an end user to use and interpret outputs of the tool more readily. To that end, the LLVegBN.dll can be seen as the heart of the DSS, gluing everything together into a user-friendly package. It allows users to navigate through the tool, run the model and view (and export) model outputs and supporting documentation.

The LL\_VegBN.dll file and LL\_VegBN.ini file must be inside a folder called "Plugins". The "Plugins" folder must reside in the same folder as the ICMSBuilder.exe file.

## **LLVegBN.ini**

This file must exist in the same folder as the LLVegBN.dll file. This file defines

- the default paths for interface files and scenarios,
- the name of the hotspot (Hotspot\_script.txt) and interface scripts (LLVegBN\_interface\_script\_MAIN.txt),
- and the location of the Netica program and the River Health and Estuary Netica files.

This is a standard Windows INI file, where you have sections denoted by a word in [square] brackets followed by a list of key=value entries, where key is a non-spaced series of characters.

All file names and folders are defined relative to the location of the Plugin folder .

## **LLVegBN\_interface\_script\_MAIN.txt**

This file defines the screens (pages) of the DSS, report groups that are used by the screens and actions associated with buttons in the DSS (i.e. opening documents, web pages or Netica files). The file also links to the following script files:

script\_COLOURFONT.txt, script\_HELPDEBUG.txt, LLVegBN\_screens.txt, LLVegBN\_reports.txt and LLVegBN\_data.txt.

This file is currently located inside a folder called "InterfaceFiles" located in the Plugins folder.

## **hotspot\_script.txt**

This file is used to manage how the page that require bitmap hotspots work.

- Model Description – Landholder Actions,
- Model Description – Current Quality, and
- Model Description – Change in Quality.

The ModelDescriptions folder located in the Plugins folder stores the visible and invisible bitmaps (of identical size) referred to in the hotspot\_script.txt as well as the documentation corresponding to each "hotspot".

This file is currently located inside the "InterfaceFiles" folder.

## **LLVegBN\_reports.txt**

This file defines reports displayed in the interface: namely information on the statistics shown in the Results page.

This file is currently located inside the "InterfaceFiles" folder.

## **LLVegBN\_data.txt**

This file contains information on each of the variables in the three BNs which is either used by the interface to select the correct input/output data to display or displayed in the interface (e.g. name and description of variables, states and units).

This file is currently located inside the "InterfaceFiles" folder.

## **LLVegBN\_screens.txt**

For each screen defined in LLVegBN\_interface\_script\_MAIN.txt, this file specifies sub-pages (e.g. the Landscape Logic and Terminology sub-pages of the Overview page) and the look and functionality of each screen.

This file is currently located inside the "InterfaceFiles" folder.

## **script\_COLOURFONT.txt**

This script defines colours that can be used for the buttons in the DSS

This file is currently located inside the "InterfaceFiles" folder.

## **script\_HELPDEBUG.txt**

This script manages the *Help* and *Debug* buttons.

This file is currently located inside the "InterfaceFiles" folder.