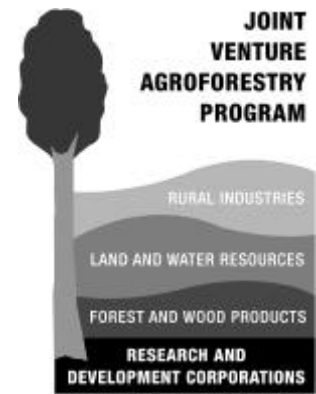




Agroforestry Calculator

User Manual

**A report for the RIRDC/LWRRDC/FWPRDC
Joint Venture Agroforestry Program**

by Agriculture Western Australia
and Campbell White & Associates Pty Ltd

January 2000

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Researcher Contact Details

Peter Eckersley
Agriculture Western Australia, Bunbury, Western
Australia

Phone: 08 9780 6204
Fax: 08 9780 6136
Email: peckersley@agric.wa.gov.au
Website: <http://www.agric.wa.gov.au>

RIRDC Contact Details

Rural Industries Research and Development Corporation
Level 1, AMA House
42 Macquarie Street
BARTON ACT 2600
PO Box 4776
KINGSTON ACT 2604

Phone: 02 6272 4539
Fax: 02 6272 5877
Email: rirdc@rirdc.gov.au
Website: <http://www.rirdc.gov.au>

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1.

3. Description of the Model

The AGROFORESTRY CALCULATOR is designed to support the decision making of landholders who are considering an investment in agroforestry. Its objective is to provide an economic evaluation of agroforestry projects in comparison with existing agricultural land uses. This is achieved through provision of a framework that stores data about a range of forestry enterprises and an interface for users to access and use this information. The model calculates a discounted cashflow for both the 'proposed' (with agroforestry) and 'current' (continuation of existing agriculture) scenarios and displays these in terms of a range of summary statistics and graphs.

The AGROFORESTRY CALCULATOR is not a simulation model because it does not contain functions that will define the tree growth through the life of the agroforestry rotation. Such models require extensive calibration for application outside of their design areas and should be operated by skilled and experienced farm foresters or advisers to ensure that model outputs remain relevant to the local situation. Instead, the calculator draws heavily on the expertise of local advisers who can provide a 'best bet' estimation of how trees will perform in a variety of local conditions.

When economists carry out an evaluation of any long-term project they must make assumptions about what values the key variables will take in the future. This is particularly difficult with agroforestry because of the long period of forestry rotations (relative to agriculture) in addition to uncertainty about how trees will perform in any particular situation and the prices that will be received by the landholder. Given the framework for storing and evaluating agroforestry information, 'on the ground' stakeholders can combine their experience and knowledge of local conditions to make 'best bet' guesses on key values whilst using the calculator to carry out the calculation and present the results.

The AGROFORESTRY CALCULATOR requires the user to select from predefined forestry enterprises that already have production, cost and management information associated with them. The major strength of this approach is its reliance on having data input by, or checked by, professional foresters or consultants who are experienced with local conditions and the performance of trees in these conditions. These professionals should also be able to provide the best estimates of prices received and management required to ensure the best chance of success.

The model is released with a range of forestry enterprises already included, these relate to the growth of *Eucalyptus globulus* for production of wood chips, *Pinus radiata* for production of multiple forest products and *Eucalyptus* spp. establishment for production of sawlogs. Values in these enterprises are relevant to the south-west of Western Australia, but may be of value to other stakeholders as a template for entering locally relevant information for other enterprises and areas. It is not easy within the calculator to 'swap' or import forestry enterprises with other users, although this can be achieved relatively quickly by manually entering the values. The idea of the calculator is for each farmer or adviser to develop the information stored within it over time, so that the database evolves relative to each users experience and knowledge of the local environment.

Providing enough flexibility to store a wide range (up to 450) of separate enterprises means that there is risk of the user choosing an inappropriate forestry enterprise e.g. one that has production values that are inappropriate for the site being considered for revegetation. This is

the major problem of any decision support tool that carries out an evaluation of an agroforestry project and can only be overcome by seeking the advice of locally experienced forestry specialists.

It is very important to recognise that choice of inappropriate assumptions will invalidate the results of any evaluation. Users should always recognise that the results will only reflect the data within the selected forestry enterprise and other assumptions made in the process of evaluation.

This calculator is not a substitute for seeking sound advice from a professional source who has experience with local conditions.

Two versions of the model have been developed, the first AFCALC95 is developed within Microsoft Excel Version 7 (Windows 95) and has received some testing in Excel 5 for Windows 3.11, to give access to a wide range of users and to make use of the spreadsheet style interface that many users will find familiar. The second version of the model AFCALC97 is developed for Microsoft Excel97. Both versions are designed to provide reasonable performance on a 'medium' range Pentium (P150) based machine; model operation will be slower on machines with lower specifications.

4. Using the AGROFORESTRY CALCULATOR

The calculator assumes that you have already done some research and planning and have an idea about the area you will plant, configurations you will use etc.

The inclusion of 'Help Tips' will help users correctly interpret the information they should put into the different sections of the calculator. Accessing this information is accomplished by holding the mouse pointer over a red dot in the relevant cell. Information contained within the help tips is not reproduced within this manual, except where additional discussion is needed to clarify important concepts.

Using the calculator to carry out an evaluation of an agroforestry project consists of the following steps:

1. Opening the model and entering appropriate values in each of the questions (Questions 1 to 10) by entering data in the relevant cells or using the controls down the left hand side of the screen.
2. Pressing the "NEXT >>" button which opens the right hand side of the main screen and allows the user to choose an appropriate forestry enterprise and to specify alternative establishment options (if any) in Questions 11 and 13.
3. If the user has chosen to include degradation effects in the evaluation (Question 12), press the "NEXT >>" button and complete Questions 14 to 19.
4. Otherwise, calculating the model by pressing "CALCULATE".
5. Reviewing the results by pressing "GOTO RESULTS".

4.1 Opening the Model and Entering Values

The current enterprise selected is:

Complete the following questions

1	Run Name (optional)	adsl
2	Farm (optional)	NEW
3	Paddock (optional)	NEW
4	Start Year (Site Prep)	1999
5	Discount Rate	6%
6	Gross Margin (\$/Ha)	\$ 100
7	Paddock Area (ha)	30
8	Area to be planted (ha)	10
9	Fencing Required (m)	100
10	Fence Cost (per km)	\$ 1,000

Questions 1 to 10 complete?

NEXT >>

AGRO-FORESTRY CALCULATOR

For HELP on using this model refer to the manual (AFMAN.DOC) accompanying the model.

Tips on the meaning of variables are available by holding your mouse pointer over the red dots in cells

Joint Venture Agroforestry Partners and their agents (including Campbell White & Associates Pty Ltd) accept no responsibility for information contained within or arising from the use of this model. Prospective farm forestry investors are strongly advised to seek expert advice from a professional forestry consultant.

Image 1: Model Main Screen

The model automatically opens to the first data entry screen, consisting of a series of controls and open (bordered) cells in which the user can enter information relating to the project before pressing the “NEXT >>” button at the bottom of the screen.

The user should complete each question by entering information in the relevant cells, selecting an appropriate value from the drop down boxes or selecting check boxes. A red dot in a cell indicates that there is a ‘cell tip’ explaining the information to be entered in that cell.

4.1.1 Discount Rate

Question 5 in the first screen requires the user to select the Discount Rate. Discounting is a procedure which accounts for the ‘time value of money’ by discounting future costs and returns to a present value equivalent. The further into the future that costs and returns occur the less they are worth in terms of today's dollars. To simplify the evaluation we have assumed that returns from both grazing and agroforestry will remain constant over the life of the project (i.e. no inflation). A real discount rate is used in this evaluation because of this.

Real Discount Rate = (rate of interest - rate of inflation) / (1 + rate of inflation)

The choice of interest rate to use may be confusing because there are numerous possible ‘interest rates’, however, we are trying to decide whether agroforestry is a good investment and so should compare it with the next best available investment option (the ‘opportunity cost’ of the investment). The interest rate to use will be the one corresponding to your next best alternative investment that has similar characteristics in terms of tax, risk and liquidity.

If inflation is low, the denominator (1 + rate of inflation) will be close to one and the real discount rate will be approximately equal to the rate of interest minus the rate of inflation.

Forecasting rates of interest and inflation into the future is difficult, however, economists often use the existing interest and inflation rates as an estimate for future levels. This approach would be best for users who are not experienced in the conduct of economic analyses. Because of the pattern of costs and benefits over time for most agroforestry projects, the use of a higher discount rate in evaluation will have the effect of making agroforestry less attractive when compared with agriculture.

During 1998, Money Market rates for 10 year Commonwealth bonds have generally been close to 5%. Since this is the market's estimate of returns for a safe 10 year investment, it is a good benchmark to guide the selection of discount rate.

4.2 Entering the Forestry Enterprise and Establishment Options

The current enterprise selected is:		Bluegum pulplogs, 2 rotations in 19 yrs, 700mm, 100km to port, Western Australia																					
Complete the following questions		11 Change Enterprise																					
1 Run Name (optional)	asdf	Comments: Typical fertile site in Southern W/A; former establishment to industry standard; good coppice survival; management/supervision cost not included; ref: TreeNotes on bluegums. Source: Peter Eckersley, Agriculture W/A, January 1999																					
2 Farm (optional)	NEW	12 ☒ Include Degradation effects																					
3 Paddock (optional)	NEW	13 Establishment Options																					
4 Start Year (Site Prep)	1999	☒ Do-it-Yourself ☒ Lease of Annuity ☒ Sharecropping																					
5 Discount Rate	6%	Land Contribution %: 45% Total Revenue Share (%): 50%																					
6 Gross Margin (\$/Ha)	\$ 100	Q'tly Payment (per ha): \$ 40																					
7 Paddock Area (ha)	30	<table border="1"> <thead> <tr> <th>Enterprise Info</th> <th>Clearfall Production & Price</th> </tr> </thead> <tbody> <tr> <td>Row Space</td> <td>Part 0 \$ -</td> </tr> <tr> <td>4 m</td> <td>Chip 200 \$ 25.00</td> </tr> <tr> <td>Tree Space</td> <td>Sm. Sawlog 0 \$ -</td> </tr> <tr> <td>2 m</td> <td>2nd Grade 0 \$ -</td> </tr> <tr> <td>Enterprise length</td> <td>1st Grade 0 \$ -</td> </tr> <tr> <td>20 yrs</td> <td>Peeler 0 \$ -</td> </tr> <tr> <td>MAI</td> <td>Firround 0 \$ -</td> </tr> <tr> <td>21</td> <td>Other 0 \$ -</td> </tr> </tbody> </table>		Enterprise Info	Clearfall Production & Price	Row Space	Part 0 \$ -	4 m	Chip 200 \$ 25.00	Tree Space	Sm. Sawlog 0 \$ -	2 m	2nd Grade 0 \$ -	Enterprise length	1st Grade 0 \$ -	20 yrs	Peeler 0 \$ -	MAI	Firround 0 \$ -	21	Other 0 \$ -		
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8 Area to be planted (ha)	10	This is a summary of results, Choose "Goto Results" to view a detailed report																					
9 Fencing Required (m)	100	<table border="1"> <thead> <tr> <th></th> <th>NPV</th> <th>ANNUITY</th> <th>BCR</th> </tr> </thead> <tbody> <tr> <td>Current</td> <td>\$ 35,292</td> <td>\$ 2,830</td> <td>1.00</td> </tr> <tr> <td>DIY</td> <td>\$ 46,871</td> <td>\$ 3,743</td> <td>1.65</td> </tr> <tr> <td>Strop</td> <td>\$ 43,489</td> <td>\$ 3,577</td> <td>9.47</td> </tr> <tr> <td>Lease</td> <td>\$ 41,897</td> <td>\$ 3,360</td> <td>74.82</td> </tr> </tbody> </table>			NPV	ANNUITY	BCR	Current	\$ 35,292	\$ 2,830	1.00	DIY	\$ 46,871	\$ 3,743	1.65	Strop	\$ 43,489	\$ 3,577	9.47	Lease	\$ 41,897	\$ 3,360	74.82
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Questions 1 to 10 complete?		Questions 11 to 13 complete?																					
		NEXT >>																					
		Create enterprise or edit an existing one																					
		Define/ Edit Enterprises																					

Image 2: Main Screen: Summary results, Forestry enterprise and Establishment Options

Pressing the “NEXT >>” button after completing Questions 1 to 10 will display the full screen containing Questions 11 to 13. Completing these requires you to select an appropriate forestry enterprise (Question 11) and to select and define the alternative establishment options, if any (Question 13). You should ensure Question 12 displays a check mark if you wish to incorporate land degradation impacts within the evaluation.

Choosing the forestry enterprise from the drop down box in Question 11 will display comments and key values associated with the chosen enterprise. It is very important to read the comments and check the assumed values in the table at bottom right of the screen. If the values do not accurately represent your estimate of prices and production for the project, you can select an enterprise with more appropriate values, edit the values in the existing one or create a new forestry enterprise (see section 4 for help on how to do this). A column of zero values in the production values (to right of the forest product descriptions) means that the rotation length has been specified wrongly and should be corrected (see section 4).

Following completion of Questions 11 to 13, if you have specified to include the impacts of degradation, the button will read “NEXT >>”, otherwise by pressing the “CALCULATE” button, the model will calculate, and display summary results at the bottom of the screen. You can view detailed results from the evaluation by choosing the “GOTO RESULTS” button. If you have chosen to include degradation effects within the analysis (Question 11) you will move to Questions 14 to 19, where you can define the degradation scenario.

4.2.1 Alternative Establishment Options

One of the main barriers to investment in Agroforestry is that these projects generally have a pattern of income and expenditure where large establishment and management costs occur in the first years of the enterprise and the investor must wait for a relatively long time before collecting income from the trees. As a result, there are a number of schemes that have been developed to support land managers in planting trees by underwriting part or all of the establishment and ongoing management costs. In Western Australia the two ways this is achieved is through an annuity or lease agreement and through a 'profit-a-prendre' or sharecropping arrangement. In Western Australia these are available through the Department of Conservation and Land Management and a range of private investment companies. They are available only in certain areas and relate only to specific tree crops.

Annuity/ Lease agreements

A quarterly payment is made to the farmer in return for providing access to fenced land suitable for revegetation with *Eucalyptus globulus*. The amount paid is determined by the firm offering the agreement and depends on their assessment of the productivity and risk associated with each particular site.

When the lease / annuity option is activated, the quarterly payment must be entered in the space that appears when the input box is checked. The model assumes that the annuity is first paid in the planting year, and continues into the final harvest year. That may differ slightly from actual commercial arrangements.

The payments are indexed to inflation and although this is not reflected in this evaluation (because of the assumption of constant prices), it adds to the attractiveness of the agreement because it guarantees the real value of the quarterly payment over the life of the agreement, whereas the returns from agriculture are more uncertain over time. Another major advantage of these agreements is that the firm offering the agreement assumes all of the risk, the landholder is responsible for providing the land, however, these agreements do have provisions for the firm to pull out of the investment at any stage. At this point ownership of the trees and also responsibility for site rehabilitation returns to the landholder.

Profit-A-Prendre/ sharecropping agreements

Crop share agreements differ from the annuity agreements because the landholder can choose to assume more of the risk associated with the project in return for a greater share of the profits. In a simple crop share agreement the landholder shares in the harvest proceeds of the project but doesn't receive regular payments through the life of the project. The plantation company decides a rental value of the land and determines how much that is as a percentage of the total tree crop costs. In the model this figure is entered as a "Land Contribution" percentage. In the first years of these schemes it was typically 30%. This relates to the percentage of final returns the landholder will get for providing access to the fenced land on which the trees are established.

The landholder can also choose to contribute an additional percentage of establishment and ongoing management costs which increases their share of final receipts. For example, if the landholder wishes to provide half of the total resources for the tree crop, the user would enter 50% in the space marked "Total Revenue Share", which includes the land contribution.

If the user enters a higher value for “Total Revenue Share” than for “Land Contribution” the model assumes that the landholder contributes a constant share of all of the inputs other than the land. The model is not designed to allow the landholder to select particular operations to carry out (e.g. firebreak maintenance), but these may be individually specified and costed in the agreements with some plantation companies.

The model assumes the same project cost structure for the sharecrop option as for the do-it-yourself option. In practice the sharecrop option may well involve coordination and supervision by the plantation company, and it may also include certain corporate overheads. If that were so, the land contribution percentage would be smaller, and the landholder’s total revenue share would also be smaller.

Some plantation companies offer a range of “hybrid” agreements which are a combination of crop share and annuity. The AGROFORESTRY CALCULATOR does not attempt to model these arrangements.

4.3 Defining “Include Degradation” Assumptions

NOTES ABOUT THIS MODEL'S TREATMENT OF LAND DEGRADATION.		Complete Questions 14 to 19, calculate the model and view the detailed results																																					
Users wishing to incorporate the effects of trees on land degradation should consult the user manual for definitions of the terms and questions used in this section. The treatment of land degradation is simplistic in that it assumes a 'straight line' increase in amount of degraded land over time. Land is either 'undegraded' or 'degraded'. All degraded land is assumed to have agricultural yields less than degraded land (Question 16). The value of the trees for reducing the rate of land degradation will be shown in the detailed results screen.		Guidelines for completing Qu's 13 to 18 <table border="1"> <tr> <td>14</td> <td>Area Currently Affected</td> <td>*</td> <td> 2 </td> <td>ha</td> <td>less than 20 ha</td> </tr> <tr> <td>15</td> <td>Final Area without Trees</td> <td>*</td> <td> 5 </td> <td>ha</td> <td>greater than or equal to 2 ha</td> </tr> <tr> <td>16</td> <td>Agricultural yield on affected area</td> <td>*</td> <td> 30% </td> <td></td> <td>less than or equal to 100%</td> </tr> <tr> <td>17</td> <td>Time to reach max (without trees)</td> <td>*</td> <td> 10 </td> <td>yrs</td> <td>less than or equal to 20 years</td> </tr> <tr> <td>18</td> <td>Final Area with Trees</td> <td>*</td> <td> 3 </td> <td>ha</td> <td>less than or equal to 5 ha</td> </tr> <tr> <td>19</td> <td>Time taken to reach max (with trees)</td> <td>*</td> <td> 5 </td> <td>yrs</td> <td>less than or equal to 11 years</td> </tr> </table>		14	Area Currently Affected	*	2	ha	less than 20 ha	15	Final Area without Trees	*	5	ha	greater than or equal to 2 ha	16	Agricultural yield on affected area	*	30%		less than or equal to 100%	17	Time to reach max (without trees)	*	10	yrs	less than or equal to 20 years	18	Final Area with Trees	*	3	ha	less than or equal to 5 ha	19	Time taken to reach max (with trees)	*	5	yrs	less than or equal to 11 years
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		<table border="1"> <tr> <td>Go Back to Previous Screen</td> <td>Questions 14 to 19 complete?</td> </tr> <tr> <td><< BACK</td> <td>GOTO RESULTS</td> </tr> </table>		Go Back to Previous Screen	Questions 14 to 19 complete?	<< BACK	GOTO RESULTS																																
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<< BACK	GOTO RESULTS																																						

Image 3: Defining the assumptions relating to land degradation

The AGROFORESTRY CALCULATOR allows a limited inclusion of benefits that may arise from the effect of trees in reducing the rate or amount of land degradation. These effects are not automatically simulated, it is the responsibility of the user to enter appropriate values within the calculator.

If the user chooses to define a scenario for including land degradation the calculator will present these results alongside the standard evaluation (which does not include the effect of land degradation). The amount of degraded and undegraded land in each year is calculated based on the information entered in question 14 to 19.

The rate at which land degrades is assumed to be ‘straight line’ and no effects outside the project area or timeframe are included. The calculator simply applies a flat rate yield penalty to the degraded land in each year of the project. Note that this part of the model provides only for the effects of the trees on agricultural production beyond the planted area, within the

paddock. Agricultural production within the planted area (i.e. the understorey) is provided for within the agroforestry enterprise (see section 4.3).

The model assumes that land which is already degraded is unsuitable for planting of commercial trees.

Example in Image 3:

The 30 ha paddock contains a 2 ha patch of saline/ waterlogged land which produces only 30% of normal agricultural yield. Without the forestry enterprise this is expected to spread to reach a maximum of 5 ha in 10 years. With trees planted on 15 ha the patch of saline/ waterlogged land is expected to reach a maximum of 3 ha in 5 years.

5. Edit/ Define New Enterprise

The applicability of the calculator to any region or agroforestry enterprise will depend on having appropriate predefined forestry enterprises stored within the database. These must reflect enterprises that are appropriate for local conditions and contain relevant tree production, management and price information.

The model contains a set of routines and screens for developing these enterprises. The user can choose to create a completely new enterprise or edit an existing one to update its values. The process of defining a new enterprise or editing an existing one consists of.

1. Pressing the “Edit/ Create New Enterprise” button on the models main screen, to display the “Crop Definition Dialog Box” (see below).
2. Choosing to edit an existing enterprise or create a new enterprise and choosing a template on which to base the values.
3. Working through a series of screens entering or changing the new information.
4. Pressing the “FINISH” button which will take you back to the main screen where you can select the new or edited enterprise in an evaluation.

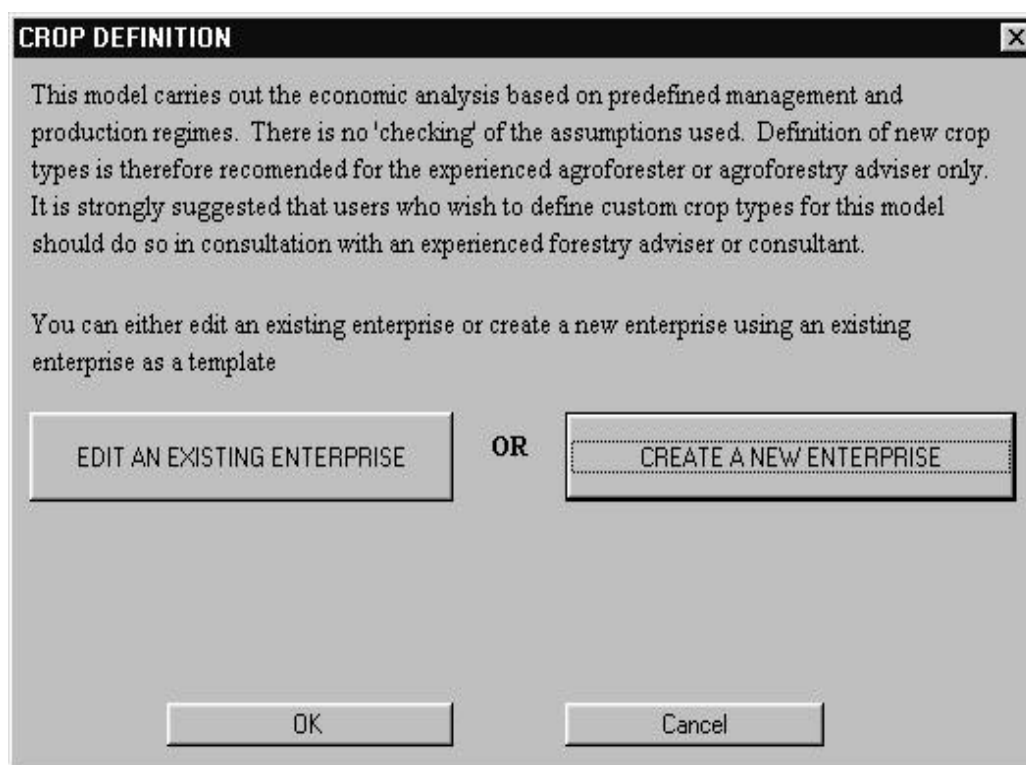


Image 4 Crop Definition Dialog Box

You must select a template for the model to transfer into the crop definition worksheets. If you choose to edit an existing enterprise, then the new values you enter will replace those in the chosen template, choosing to create a new enterprise will not modify values for the enterprise chosen as a template. The new enterprise will appear at the bottom of the Forestry Enterprise Drop down box (Question 11) on the main screen.

5.1 Entering Enterprise Characteristics

A6 [X] [Y] [Z] 'Bluegum pulplogs,2rotations,700mm,100km to port,WA			
NEXT>>		CANCEL	
FINISH & UPDATE			
You can edit values in yellow cells with blue text, red dots indicate tips to tell you what the values mean			
Enterprise Name		Farmer Cost	
'Bluegum pulplogs,2rotations,700mm,100km to port,WA	Site Prep	495	
Default Rows	Establishment	460	
10	Fertiliser	50	
Row Spacing	Insect control	10	
4	Weed control	100	
Tree Spacing	Pruning	0	
2	Coppice thinning	500	
Age of Trees at Final Clearfall	Pest control	10	
20	Annual costs	35	
SPH	Non-comm thin	0	per unit
1250	COMM. THIN	0	per unit
MAI	CLEARFALL	0	per unit
20.0			
Site Quality			PRICES (STUMPAGE)
good	Post		0
Comments	Chip		25
WA; industry standard establishment method; grown	Small Sawlog		0
	2nd Grade		0
	1st Grade		0
	Peeler		0
	Firewood		0
	Other		0
If stumpage prices are quoted at right, ensure that farmer cost for Comm. thin and Clearfall (above) are set to 0 otherwise sharecropping analysis will be incorrect.			
Stumpage Price = mill door price minus freight costs minus harvest costs = price/unit (m3 or t) for standing timber			

Image 5: Edit/ Create New Enterprise

You should be as descriptive as possible when entering names and text definitions for the new enterprise. The calculator is able to store up to 450 enterprises and as you store more information into the database you will need some way of differentiating between enterprises to allow you to choose the most appropriate enterprise.

There is not any easy way within the model to 'index' the forestry enterprises, it is suggested that if you have multiple species or requirements for providing advice at many sites, you should make multiple copies of the calculator and use these to store information separately. For example you may have a 'Pines' version and a 'Eucalyptus' version of the calculator. Alternatively you may use a separate version for each district or region.

5.2 Entering Costs and Timber Prices

You should enter the cost to the landholder for each class of costs. There are 12 classes of costs. It is possible to redefine the descriptions of these classes, however, some aggregation may be necessary and you should keep the components of each class in mind when entering the management information in the third screen.

The first 10 classes of costs are defined as 'per ha' costs. The calculator will incorporate these as COST times AREA within the cashflow. The last two costs are defined as "per unit" costs.

The calculator includes these as COST times PRODUCTION within the cashflow. This is because commercial thinning and clearfall are usually charged according to the volume of logs removed from the site.

Users may need to allow for ‘overhead’ costs, such as coordination of establishment and harvest operations, which are ‘per project’, by using higher ‘per ha’ costs for small projects.

IMPORTANT: You would only enter a value in the last two cells if the product prices quoted on the screen are not ‘STUMPAGE’ values i.e. you would need to enter the cost of harvest and haulage to the mill in these cells if you were quoting a ‘MILL DOOR’ price. Otherwise these cells should be set to 0.

5.3 Entering Production Values and Agriculture Within Belts

NEXT>>	Enter production values in this section, remember to keep units consistent with those that																		
<<BACK	you used to define the prices in the previous screen																		
	"0"= Year before establishment (year of site preparation)																		
	"P"=Year of establishment																		
Production	0	P	P+1	P+2	P+3	P+4	P+5	P+6	P+7	P+8	P+9	P+10	P+11	P+12	P+13	P+14	P+15	P+16	P+17
Post	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chip	0	0	0	0	0	0	0	0	0	0	0	200	0	0	0	0	0	0	0
Small Sawlog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2nd Grade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1st Grade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Peeler	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Firewood	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Production in Belts	0.9	0	0.1	0.1	0	0	0	0	0	0	0	0	0.2	0.1	0	0	0	0	0
	Enter a value for each year of the tree rotation. You should enter a proportion of land use gross margin. ie for 50% production in a year, enter 0.5 The model will incorporate a value of 0.5* rotational gross margin*stand area into the cashflow																		

Image 6: Edit /Define New Enterprise: Screen 2

In this model, year 0 is the year in which site preparation occurs. Establishment occurs in year “P” (Planting), therefore for a 10 year rotation, you should enter clearfall production values in Year P+10. There is no cross-checking within the model to ensure that results are entered correctly, therefore extreme care must be taken to ensure that the values are entered in the correct years. You can check that rotation length has been specified correctly by viewing the cashflow graph at the top of the “Detailed Results” page. The final harvest/ clearfall of the stand should result in a cashflow ‘peak’ at the extreme right of the graph.

You can store production values for up to eight wood products in each year of the rotation. Enter production values directly into the cells in the appropriate year. The units used do not matter except that you should be consistent in using the same units when you define the price of that product.

The model assumes that all expenses are incurred and all income received at the end of the year in which they are shown. In reality, many of these transactions may occur at different times of the year. In particular, planting expenses are usually incurred early in the ‘P’ year.

If trees are harvested at 10 years of age, that occurs exactly 10 years after the time of planting. As planting occurs just after the start of year ‘P’, these trees are deemed to be harvested in year P+10. Thus although the financial transactions are deemed to occur almost 12 months later, planting and harvesting transactions are treated consistently by the model. This minimises any distortion of profitability by the discounting process.

Many agroforestry project evaluations include some form of agricultural production within the revegetated area. You are able to include agricultural production within the belts for each forestry enterprise by entering values at the bottom of this screen in the section ‘Production in Belts’. Values entered in this section operate directly on the Rotational Gross Margin entered in the main screen. For example, entering a 0.9 (representing 90% of normal agricultural production on that land) in the year 0 (Site preparation), for a revegetation project of 15 ha, with a rotational gross margin of \$100 per hectare, the model will enter a value of $0.9 \times 100 \times 15 = \1350 into the project cashflow in year 0.

5.4 Entering Management Information

<<BACK	This screen tells the model what management you will perform and the year in which it occurs.																						
FINISH	Marking a 1 in the cell will incur costs in that year for the activity																						
	If costs for different operations are not constant across years you can use fractions eg 1.1 or .75																						
	0	P	P+1	P+2	P+3	P+4	P+5	P+6	P+7	P+8	P+9	P+10	P+11	P+12	P+13	P+14	P+15	P+16	P+17	P+18	P+19	P+20	
Site Prep	1																						
Establishment		1																					
Fertiliser								1			1			1									
Insect control		1																					
Weed control	0.2	0.5	1																				
Pruning					1		2			3													
Root ripping																							
Pest control					1																		
Annual costs																							
Non-comm thin																							
COMM. THIN							1																
CLEARFALL																	1						

Image 7: Edit /Define New Enterprise: Screen 3

Entering information here is similar to the previous section, values entered in this section will include a cost for that activity multiplied by the area of the belt in which it occurs. It is possible to manipulate the values by entering a value other than “1” in the appropriate area. This can be seen in the above example where in years 0, P and P+1, the cost of weed control is 0.2, 0.5 and 1 respectively.

Once you have completed entering the information in this screen you have the choice of either going back to previous editing screens or you can press the “FINISH” button to automatically update the database in the model and return to the main screen. Accessing the new information is merely a matter of selecting the new or edited enterprise in the stand definition dialog box.

5.5 Printing Enterprise Details

Use the MS Excel commands “Set Print Area”, “Print Preview” and “Setup” to define and arrange the sections you wish to print. Alternatively, you can select the cells you wish to print and select the “Selection” option in the “Print What?” section of the MS Excel Print Dialogue Box.

6. Interpreting the Results (NPVs vs BCRs)

The decisions of agroforestry investors are based on expectations of future timber income in addition to the range of other benefits, both monetary and non-monetary that revegetation may bring to the farm e.g. water use, shelter or aesthetic improvement. In most cases a forestry project consists of a series of expenses starting in the year of site preparation or establishment and continuing until clearfall when the majority of cash inflow occurs. Of course, commercial thinning of the stand throughout the life of the rotation can provide some income in the intervening years to offset expenses incurred in the ongoing management of the stand.

Other benefits of forestry such as the impact of trees on groundwater levels and complementary shelter effects as the trees grow may also provide a monetary benefit to the farmer throughout the life of the project. However, the decision to invest in agroforestry must be made now and the investor must compare the value of expected future timber income with other possible investments. To make a decision on forestry investment on purely economic grounds becomes a question of the worth of expected future income against these alternatives. Economists use the concepts of present value and discounting in an attempt to equate the various project alternatives.

The two measures used within this analysis to describe the chosen forestry project in relation to agriculture are Net Present Value (NPV) and the Benefit Cost Ratio (BCR).

6.1 Net Present Value (NPV)

The NPV of a project is the sum of net discounted cashflows that occur in each year of the project. In this evaluation, if the project NPV is greater than that which applies to the continuation of agriculture on the site, then the project will make a profit after repaying capital and interest costs. An NPV that is less than the NPV for agriculture implies that the project is not profitable under the assumptions defined within the calculator.

Given project NPV's for a range of alternative investments it is possible to rank the alternatives on the basis of NPV. The project with the highest NPV becomes the most preferred. However, the selection of the discount rate to apply to the project is a critical factor in the calculation of project NPV and in the ranking of alternative projects (refer to section 3.1.2 for more discussion about the choice of discount rate).

Another limitation of the project ranking based on NPV is that it is an absolute measure. It can not be used to interpret the efficiency with which scarce investment funds are allocated between alternative projects. For example, a project which requires relatively small capital investment, but which creates impressive investment returns (relative to its cost) may not be chosen over a very large, marginally acceptable project that has a larger NPV. See the table below for an illustration of this principle.

Despite its limitations NPV is the preferred method for choosing between projects, however we have included a relative measure of project worth, the BENEFIT COST RATIO (BCR).

6.2 Annuity

The equivalent net annual return (i.e. annuity equivalent) is calculated by the model. The project ranking is identical to NPV ranking, but this annuity measure of profitability is more comparable with traditional farming enterprises. When divided by paddock area it makes a reasonable comparison with long-term enterprise gross margins.

6.3 Benefit Cost Ratio (BCR)

The BCR provides a relative measure of project worth (relative to the amount invested in the project). It is calculated by taking the present value of gross benefits minus 'associated costs' and dividing this value by the present value of 'project economic costs' (Price Gittinger, 1982, p. 345)¹. The BCR has the disadvantage of being sensitive to the conventions used to separate project costs and benefits. Its advantage is that it can provide a guide to the most 'efficient' projects in terms of returns per dollar invested.

6.4 Sensitivity Analysis

The sensitivity analysis introduces an extra feature of the model and is in two parts, a breakeven analysis and a graph. Breakeven analysis shows:

1. how much wood returns (i.e. the product of price x yield) would have to change for the project to break even, and
2. how much the trees would have to affect agricultural productivity (expressed as gross margin per hectare) in the remainder of the paddock for the project to break even.

The effect of the trees on agricultural productivity is otherwise assumed to be only through their effect on the extent of land degradation. The sensitivity analysis introduces the notion that the trees might, by competing with adjacent agriculture, or by sheltering adjacent agriculture, lower or raise the average productivity uniformly over the life of the project. This is simplistic in the sense that it does not reflect the changes over time, but it at least indicates how much net shelter benefit or competition loss would be needed to make the project break even.

The graph shows how NPV is affected by varying either wood returns or the combined competition/shelter effects of the trees on agricultural productivity, within the range of 50 per cent to 150 per cent of the assumption used in the standard.

¹ Price Gittinger J, 1982, Economic Analysis of Agricultural Projects (2nd Ed), John Hopkins University Press, BALTIMORE and LONDON

7. What Should I Base My Decision On?

Ultimately the decision to invest in agroforestry will be made on the basis of a host of factors, some economic and others not. However, the ‘bottom line’ for this evaluation is that if the forestry project has a NPV greater than that of agriculture it will be profitable if the assumptions about future production and prices hold.

The BCR can be used to decide between alternative forestry enterprises (requiring separate evaluations and comparisons of results) as it gives a reasonably technically ‘robust’ indication of the expected returns per dollar of the landholders money invested. BCR can also be of use when looking at the attractiveness of the alternative establishment options. The BCR of the annuity will always be high relative to the ‘do it yourself’ scenario, because there is very little investment required by the landholder, therefore the ratio of returns to cost is high.

The table below shows a lease/ annuity payment that gives an increase in project NPV over existing agriculture. Both the ‘do it yourself’ (DIY) and the annuity agreement are profitable investments compared with existing agriculture, but the DIY scenario has a significantly higher project NPV than does the annuity agreement.

The BCR of the two alternatives, however, shows a different pattern. The Annuity agreement has a relatively high BCR (i.e. the ratio of returns to costs is high) because the costs of an agroforestry project under the lease/ annuity option are very low. The DIY scenario requires significant capital investment by the landholder in establishment and management. It is not possible to say from these results which option is best for the farm business. The analyst must decide which option will fit best into the overall structure and financial position of the business. The landholder’s objectives and vision for the forestry project and the farm as a whole are vitally important factors to consider.

	NPV	ANNUITY	BCR
Current	\$35,292	\$2,830	1.00
DIY	\$46,671	\$3,743	1.65
S/crop	\$43,489	\$3,577	9.47
Lease	\$41,897	\$3,360	74.82

For an explanation of the process of cost benefit analysis for agroforestry projects, refer to “Design Principles for Farm Forestry - A guide to assist farmers to decide where to place trees and farm plantations on farms” published by the Rural Industries Research and Development Corporation.