Farm Economic Analysis
Warrangong Catchment

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Executive summary

The *Tools to Achieve Landscape Redesign Giving Environmental /Economic Targets Project* (TARGET) is a cornerstone project of the NSW Salinity Management Strategy, which is jointly funded by the Commonwealth and New South Wales Governments under the National Heritage Trust Murray-Darling 2001 program. A major objective of the TARGET project is to facilitate large-scale land use change in the Lachlan and Macquarie catchments and the Little River, Mid Talbragar, Weddin and Warrangong sub-catchments.

A key component of the TARGET project is to analyse the financial consequences of current farming practices and proposed management actions in the four focus sub-catchments. The proposed management actions are based on no regrets" biophysical principles and processes relating to natural resource and environment management, particularly salinity management. This report presents the farm level economic analysis results for a hypothetical reference farm that is broadly typical of properties in the Warrangong catchment.

Six management actions have been selected for the Warrangong farm level analysis.

1. Farm forestry
2. Saline agroforestry
3. Remnant vegetation conservation
4. Riparian zone conservation
5. Perennial pastures
6. Saline pastures

The farm level analysis involves using a constructed 'reference' farm to analyse the relative profitability of each selected management action as well as two combinations of management actions. This report presents the farm level economic analysis results for a hypothetical reference farm that is broadly typical of properties in the Warrangong catchment. The physical characteristics (such as farm size, crop/pasture areas and enterprise types) of the reference farm are based on the average results from the Warrangong producer profiles study. While broadly representative of farms in the catchment there are nonetheless important differences between the reference farm and the average of catchment farms.

The Warrangong reference farm is assumed to be 640 hectares in size with 280 hectares devoted to grain crops (wheat, canola and triticale) and 345 hectares to pasture.

A model was developed specifically for the analysis. The TARGET model is a multi-enterprise, multi-period, whole-farm analysis tool with an emphasis on 'what if' types of analysis.

The economic analysis involves comparing the Net Present Value (NPV) of farm costs and returns from a base scenario with costs and returns from each management action. The base or "business as usual" scenario is simply the reference farm assuming no further implementation of any management action.

In this study, the analysis focuses solely on the effects of the management actions on producer's incomes and future financial sustainability at the farm level. No quantitative attempt is made to determine the catchment-wide or down-stream biophysical, social or economic effects of implementing management action.

The TARGET project provides a variety of assistance measures—such as financial assistance, training courses and provision of technical advice—as incentives for landholders in the Warrangong catchment to implement management actions. The direct financial impacts of these assistance measures are estimated as part of the analysis.

Analysis results

1a. Forestry – hardwoods

Planting 60 hectares of land (around 10 percent of total area) to a commercial hardwood forest results in a reduction in NPV of around $113,000 (no assistance) and around $57,000 (with assistance). The provision of assistance makes a significant difference to the profitability of hardwood forestry.

1b. Forestry – pine

This second forestry scenario, planting 60 hectares to commercial pine, reduces NPV by around $122,000 with no assistance and about $67,000 with assistance.

The major factor behind the relatively low profitability of forestry is the long wait until a return is realised.

2. Saline forestry

Planting 20 hectares of salt tolerant trees around saline discharge sites results in a reduction in NPV of about $16,800, with no assistance. The assistance provided under TARGET would reduce the loss to $800. Given the total base value of NPV is $741,000, saline forestry in Warrangong would impose almost no cost on farmers if they access the assistance on offer.

3. Fence-off remnant vegetation

Fencing off remnant vegetation reduces NPV by about $7,500 without assistance and $3,800 with assistance. By accessing the assistance available under this management action, producers would be within half a percent of the base scenario (not accounting for any environmental benefits).

4. Fence-off creeks/rivers

Fencing off creeks and rivers reduces NPV by about $13,500 without assistance and $7,900 with assistance.

5a. Increase area of perennial pasture– reduce annual pasture

Replacing 75 hectares of annual pasture with perennial pasture reduces NPV without assistance by $6,600. After taking account of the assistance available, establishing perennial pasture is more profitable than the base scenario by around $1,000. This is the only management activity that increases NPV largely because the assistance available covers most of the costs of making the change.

5b. Increase area of perennial pasture – reduce crop area

In contrast to the above scenario, replacing 75 hectares of crop area with perennial pasture has a serious effect on NPV. The results indicate that NPV falls by about $72,000 without assistance and $62,500 with assistance. This is because profitable crops are being replaced with less profitable pasture.

6. Utilise saline pastures

Fencing off 20 hectares of saline areas and planting them to relatively salt tolerant pasture species reduces NPV by around $3,000 without assistance and $700 with assistance. The provision of assistance results in estimated NPV being almost the same as for the base scenario.

7a. Combination – Saline forestry + saline pastures

Establishing saline forestry in conjunction with saline pastures produces a NPV of almost $20,000 without assistance and around $1,500 with assistance. Utilising the assistance measures provided for each management action brings this combination very close to the NPV produced under the base scenario.

7b. Combination – Forestry (hardwoods) + increase perennial pastures

The second combination of an increase in perennial pasture in conjunction with establishing 60 hectares of forestry (hardwood species) results in an estimated

reduction in NPV of about $135,000 without assistance and $73,000 with assistance. Even with assistance provided, this combination is among the least profitable.

All management actions were run at higher and lower discount rates to test the sensitivity of the results. Discount rates are key variables in long-term analysis such as this. It was found that a number of the management actions were sensitive to discount rates although the ordering was not significantly altered.

The sensitivity of NPV to tree growth rates was also tested. All the management actions with large financial consequences involve forestry and the yield of trees in the Warrangong catchment is uncertain. The results were shown to be sensitive to assumed tree growth rates. Since actual growth rates in the catchment are not known this uncertainty is an additional cost to be taken into account in planning forestry activities

Summary of analysis

- Almost all the management actions considered would reduce NPV from the base scenario level.
- Except for farm forestry and the substitution of crop area with perennial pasture, all actions produce NPVs within three percent of the base scenario NPV even without assistance being taken into account.
- The reductions in NPV may be offset by environmental gains and greater future productivity of farms.
- The benefits of most of the management actions would not need to be large to make them worth adopting given the assistance available.
- Results are affected by changes in discount rates; the main effects are on the plantation forestry activities. The ordering of activities by NVP is unchanged by changes in discount rate.
- Changes in tree growth rate significantly affect NPV. Tree productivity in the catchment is a key variable in determining the profitability of plantation forestry for salinity management.

The analysis takes no account of environmental benefits that may flow from implementation of any of the management options. In some cases the benefits of management actions accrue to the broader community (eg. biodiversity benefits). Hence, the difference between the NPV of the base scenario and the NPV of a management action can be interpreted as the environmental break-even value. That is, if the NPV difference is $2,000 then any environmental benefits resulting from implementation of that management action would only have to be $2,000 for the

action to be economically justified. Consequently, there is a need to identify the nature of producer and community environmental benefits.

Analysis in this study indicates that the lack of appropriate policies and programs to reward producers for the environmental benefits received by the community is currently a significant impediment to the adoption of management actions by producers. There is an urgent need for further research and the development of cost sharing mechanisms to ensure the adoption of management actions designed to achieve integrated catchment management objectives.

1

Introduction

A recent assessment of salt trends in the Murray-Darling Basin (Williamson et al. 1997) highlighted the severity of salinity problems confronting the Central West Region of New South Wales (catchments of the Macquarie, Lachlan and Castlereagh Rivers). For example, it is predicted that the Macquarie River at Narromine will be unfit for human consumption 30 percent of the time by 2020, and 55 percent of the time by 2050.

It is increasingly being recognized that significant efforts are required to halt and eventually reverse salinity and water quality problems. In many cases, a change at an individual farm level is unlikely to result in much change to what is usually a regional scale problem. Effective solutions may require changes to land use practices and production activities over whole catchments drainage basins (Hajkowicz, Hatton, Meyer and Young 2001). This concept of large-scale land use change is sometimes referred to as "landscape change or redesign."

The *Tools to Achieve Landscape Redesign Giving Environmental /Economic Targets Project* (TARGET) is a cornerstone project of the NSW Salinity Management Strategy that is jointly funded by the Commonwealth and New South Wales Governments under the National Heritage Trust Murray-Darling 2001 program. A major objective of the TARGET project is to facilitate large-scale land use change in catchment areas that have been identified as being major contributors to Murray-Darling Basin salinity. These areas are the Lachlan and Macquarie catchments and the Warrangong, Mid Talbragar, Weddin and Little River sub-catchments.

A number of on-farm management actions have been proposed by the Department of Land and Water Conservation (DLWC) to target natural resource and environmental problems, primarily salinity, in each of the four sub-catchments. These are largely no regrets actions which cause no harm if implemented and include increased use of native, perennial and saline pastures, establishment of farm forestry and saline forestry plantations, increased use of conservation farming practices, intercropping and, increased fencing off of waterways and regenerated/remnant vegetation. In the second year of the TARGET project the range of options has been widened to encourage more farmer based initiatives to be implemented. The proposed management actions are based on generally accepted biophysical principles and processes relating to the management of natural resource and environment problems, particularly salinity problems.

What is not as well known is how economic factors influence land use change. In particular, there is little existing information on the relative profitability at a farm level of proposed alternative management actions.

A key component of the TARGET project is to analyse the financial consequences of current farming practices and proposed management actions in the Lachlan and Macquarie catchments and the four focus sub-catchments. This report presents the farm level economic analysis results for a hypothetical reference farm that is broadly typical of properties with salinity management problems in the Warrangong catchment. Results of similar analyses for properties in the other three focus catchments are available in related TARGET project reports.

The farm level analysis complements the producer profiles work carried out as part of the TARGET project. Producer profiles are a survey based approach to assessing socio-economic and biophysical sustainability and involves collection of data on the social, economic and biophysical characteristics from a selected sample of farms. In particular, the profile project identified impediments to producers' participation in community based strategic management actions. Data collected as part of the producer profiles project has been used to construct the hypothetical farm model.

The Integrated Catchment Assessment and Management (iCAM) Centre has prepared a separate report on the producer profiles study for the Warrangong catchment.

2

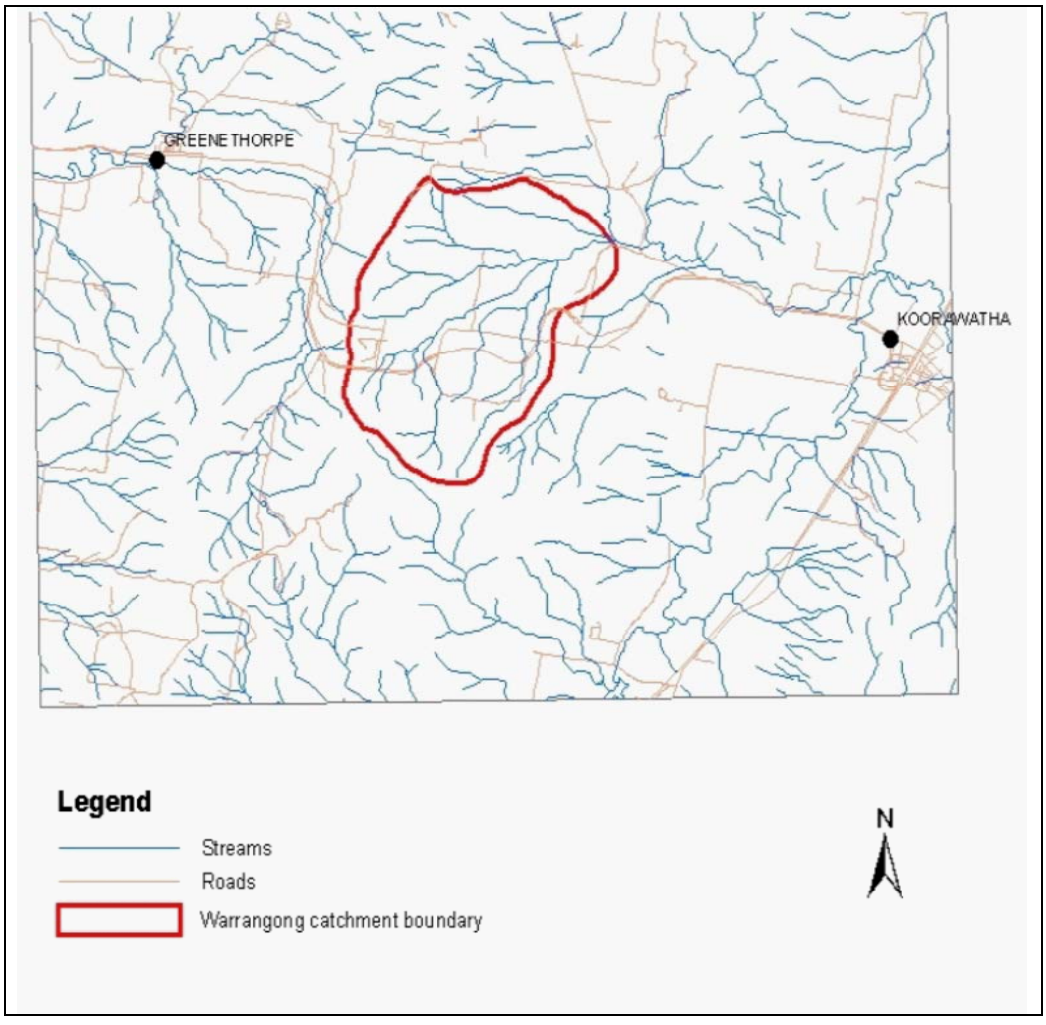
Warrangong Catchment

Location

The Warrangong catchment is part of the greater Lachlan catchment that is situated in the central part of NSW. The creek, from which the Warrangong catchment takes its name, rises just east of the town of Greenethorpe and flows into the Crowther Creek which in turn joins the Lachlan River downstream of Cowra.

The Warrangong catchment covers an area of approximately 2,100 hectares and lies midway between the towns of Koorawatha and Greenethorpe (Figure 1).

Figure 1. Catchment location



Catchment overview

The following summarises the important findings from the Warrangong producer profiles report that was based on a survey of all seven farms in the catchment.

The main primary production enterprises in the Warrangong catchment are dryland winter cropping and prime lamb and wool production—all farms undertook both cropping and sheep production. A small number of farms had other livestock enterprises. On average, about 60 percent of property area was under pasture, predominantly improved perennial pasture. The average area devoted to farm forestry, revegetated land and remnant vegetation was relatively small at 4 percent of total farm area. The average areas of remnant vegetation, revegetated land and farm forestry were 16 hectares, 5 ha and nil respectively.

In the 1999-2000 financial year, about 28 percent of total cash income came from livestock sales and 18 percent from wool sales. A further 32 percent of cash receipts came from grain sales. All farms grew wheat and six farms grew canola and triticale. Smaller areas of barley, oats and lupins were also grown.

The owner-operators supplied the majority of farm labour – an average of 17 months out of a total of 25 months from all labour sources. An average of six months per farm was worked off-farm. The reliance on family labour suggests that there may be little flexibility in labour supply and the high proportion of off-farm work indicates that there is probably little owner-operator labour reserve available for new work.

The land condition problems of most overall concern to property owners were salinity/high water tables and waterlogging. The average area affected by salinity and high water tables was estimated at 18 ha with around 20 ha waterlogged on occasion. In more severe cases, up to about 60 ha were affected.

In the 1999-2000 financial year, property cash receipts averaged about $230,000 per farm with cash costs of around $215,000. Net cash income averaged just under $18,000. Average value of assets was over $1.6 million and average debt per farm was about $260,000.

3

Project management actions

TARGET is both a research and an implementation program. The implementation is focussed on managing natural resources in general and salinity in particular, in each of the four catchments by applying on-farm management actions. A cost sharing protocol for each action has been devised by the DLWC. This chapter provides background information as well as producers' usage of the six management actions selected for the Warrangong farm level analysis.

The management actions are:
1. Farm forestry
2. Saline agroforestry
3. Remnant vegetation conservation
4. Riparian zone conservation
5. Perennial pastures
6. Saline pastures

Outline of management actions

1. Farm forestry

Planting trees can help manage salinity by reducing infiltration of rainfall to the groundwater; interception of lateral flows; and, drawing down of shallow aquifers. However, tree planting for salinity management in the Warrangong catchment may need to be on marginal areas for commercial timber production where it is expected to be less profitable under forestry than under farming.

The importance of forestry for salinity control is that there is considerable scientific support for its effectiveness in recharge management. However, there are a number of possible impediments at the farm and regional scale to implementation of forestry based salinity management. These impediments, outlined in appendix A, include climate, timing and uncertainty regarding long term returns, capital costs, distance from market, tree growing skills and relative enterprise profitability. A report entitled "Forestry Economics for the Lachlan and Macquarie Catchments" discusses these in more detail (Hall 2002).

2. Saline agroforestry

Saline agroforestry is the growing of trees in or near saline areas to remove the excess water. Trees cannot survive indefinitely on very saline sites because the tree extracts the water and leaves the salt behind. Thus, the site around the tree will become saltier until the tree eventually dies.

There is also a place for interception planting to control inflows of shallow groundwater that are not saline themselves but contribute to salinity in other

areas. Under these circumstances the tress will be highly productive because of the extra water that they draw from the shallow watertables. Such trees are likely to be much more profitable than other trees planted in the same areas where growth is limited by low rainfall.

3. Remnant vegetation conservation

Remnant vegetation conservation is the retention and fencing-off of significant stands and areas of remaining native scrub and forest. Remnant vegetation conservation encourages greater biodiversity and depending on its area and location, may also assist in salinity mitigation.

4. Riparian zone conservation (fence off creeks/rivers)

Riparian zone conservation is primarily the fencing-off of watercourses to protect them from damage by stock. Fencing off creeks and rivers encourages greater biodiversity, decreases stream bank erosion and may also assist in improving water quality.

5. Perennial pastures

Perennial pastures provide ground cover and at least some transpiration throughout the year in contrast to annual pastures that die off in summer after setting seed. Hence, perennial pastures provide interception of rainfall and at least some removal of water throughout the year so that they can reduce rainfall infiltration to the groundwater, particularly at the times when annual pastures have died off.

6. Saline pastures

Discharge sites and saline soils require special management because they are a source of salt in the system as a result of wash-off processes. If discharge sites are not managed carefully with judicious grazing pressure, then the surface of the soil may become exposed and even worse erosion of the topsoil may occur which severely complicates the nature of and time for rehabilitation and often results in a deterioration of water quality.

Plants vary in their ability to flourish under saline conditions. Where the soil is very saline there may be no possibility of establishing any productive plant species but in less saline areas suitable selection of species may provide both ground cover and profitable land use. Such species include Tall Wheat Grass, Puccinella and Strawberry clover. In some areas saltbush can also be a productive fodder crop on saline land.

Recent national and state salinity management strategies have identified the inevitability that salinity will never be totally eliminated (ie. producers will always have to live with salinity). Consequently, considerable effort is now being devoted to the identification and development of productive uses of saline land. It

is likely that in the near future a number of new options will be discovered which significantly increase the productivity and profitability of saline lands (eg. salinity tolerant lucernes species and salt wort—an oil seed crop).

Overall implementation of actions

Table 1 summarises Warrangong respondents' past implementation and their likely future implementation of the six management actions based on information collected as part of the producer profiles project (refer to appendix B for more details). The table shows that for most actions there was a positive correlation between extent of past implementation and likely extent of future implementation. In general, management actions that have been implemented to a large extent in the past are likely to continue to be implemented. The management actions that are least used are unlikely to be implemented in the short to medium term.

A majority of respondents had, and were likely to, increase perennial pasture area and increase saline pasture area.

Around 50 percent of respondents had, and were likely to, fence off remnant vegetation and fence off creeks and waterways.

The measures of least popularity were farm forestry and saline agroforestry. Less than 15 percent of respondents had, or were likely to, implement either of these two measures.

Table 1. Past and future implementation summary

Salinity mitigation measure	Past implementation		Future implementation
Increase perennial pasture area	86%	HIGHER	57%
Increase saline pasture area	57%		57%
Fence off remnant vegetation	50%		50%
Fence off creeks/waterways	29%		50%
Establish farm forestry	14%	LOWER	14%
Utilise saline agroforestry	0%		14%

Note: Past implementation refers to the percentage of respondents who had implanted the measure to some extent during the past five years and future implementation refers to the percentage of respondents who did not rule out implementing the measure in the next five years.

4

Farm analysis methodology

The farm level analysis involves using a constructed 'reference' farm to compare costs and returns from each selected management action. This reference farm has been constructed to be broadly representative of properties in the Warrangong catchment. An actual property was not used because of confidentiality issues. The reference farm implicitly assumes that some management actions have already been implemented to varying extents. The reference farm is discussed in more detail later in this chapter.

Two approaches are used for the comparison of costs and returns—economic analysis and financial feasibility analysis. Both approaches involve comparing farm costs and returns from a base scenario with costs and returns from each management action. The base or "business as usual" scenario is simply the reference farm assuming no further implementation of any management action.

In this study, the analysis focuses solely on the effects of the management actions on producer's incomes and future financial sustainability at the farm level. No quantitative attempt is made to determine the catchment-wide or down-stream biophysical, social or economic effects of implementing management actions.

Economic analysis

The economic analysis method used to evaluate the profitability of each management action is Discounted Cash Flow (DCF) analysis. Investments in some of the management actions under consideration (eg. farm forestry) are characterised by sizeable initial costs followed by returns in future years. To determine an investment's profitability therefore requires the comparison of costs and returns from different times. To do this, all dollar amounts are converted into today's or "present" dollar terms. This conversion process is referred to as discounting (Gittinger 1984).

The DCF procedure comprises two main steps. The first is to construct a yearly cash flow budget for the term of the investment period. The second step is to multiply the net cash surplus/deficit for each year by a discount rate that discounts all future cash flows back to their equivalent present day values.

The discount rate used is normally either the interest rate on relevant bank loans, or, where investors use their own funds, the earning rate on investments. For this report, the discount rate used is 7.5 percent.

The DCF criteria used in this report is Net Present Value (NPV). The NPV is the sum of the annual discounted net cash surpluses/deficits throughout the life of the project. If the NPV is greater than zero the investment is normally considered

profitable. More detailed information on NPV and other DCF criteria can be found in, for example, (Ross et al. 2000) and (Makeham and Malcolm 1998).

The period for the analysis is dictated by the longest production cycle for an enterprise. Some forestry investments may need up to 40 years before the trees are ready for harvest, therefore the maximum modelling time frame is 40 years. In this study, the final harvest date for farm forests is assumed to be 30 years after planting therefore the NPV is calculated over 33 years (allows for tree plantings over the first three years and not just year one).

While not used for this study, the annuity equivalent approach provides another means of comparing enterprises with different production cycles. An annuity equivalent is the average amount of net revenue that an enterprise generates every year to produce the total NPV for that enterprise.

The economic analysis simulates the decisions facing a farmer at the beginning of the modelling period. It is not a forecast of producers' actual behaviour and experiences in the future. Although, costs and prices are held steady over the analysis period – other assumptions are possible and could be simulated but constant prices and costs are more readily interpreted. There is also the fact that increases in farm productivity over time tend to compensate for falling terms of trade.

A further assumption is that the analysis is done on a pre-tax basis. The complexity of individual producers' tax situations is such that modelling tax for the representative farm would significantly increase the number of assumptions to be made and in particular would assume that taxation arrangements would be constant over the entire analysis period.

A financial feasibility budget is also calculated to highlight the extent of borrowings and the amount and timing of peak debt. In effect, it asks the question can the farm business pay its way if any of the management actions are implemented on a first time or ongoing basis. It is theoretically possible for an investment to be economically profitable (ie. NPV > 0) yet not be feasible (eg. short term debt may increase to such an extent that the farm becomes unviable).

Farm level model

Farming systems typical to the TARGET catchment areas comprise a mixture of broadacre crop and livestock enterprises. The alternative management actions proposed to mitigate environmental and particularly salinity impacts—in some cases already at least partly implemented—have been discussed in Chapter 3.

Given the considerable research and extension efforts into dryland salinity on farms throughout Australia it was possible that a farm level model suitable for the

TARGET project economic modelling component was already available. Accordingly, a scoping study (Oliver, Hall and Watson 2002) was undertaken to determine if such a model was available. The scoping study revealed that none of the models reviewed was ideal for the TARGET project and those that were possibilities, would still require significant adaptation. It was therefore decided that a new model be developed for the TARGET project.

Model outline

The TARGET model was developed primarily as a multi-enterprise, multi-period, whole farm analysis tool with an emphasis on 'what if' types of analysis. Most financial inputs (eg. prices and costs) and production inputs (eg. yields, lambing rates) can be readily varied on a yearly basis.

The model platform is Excel, version 2000, and consists of seven main worksheets that accommodate a broad range of integrated farm enterprises including a cattle enterprise, two sheep enterprises, up to six broadacre winter crops, fodder crops and fodder production, up to four pasture types and two forestry enterprises. There is also an ancillary worksheet comprising DSE assumptions. A diagrammatic structure of the model is presented in Figure 2.

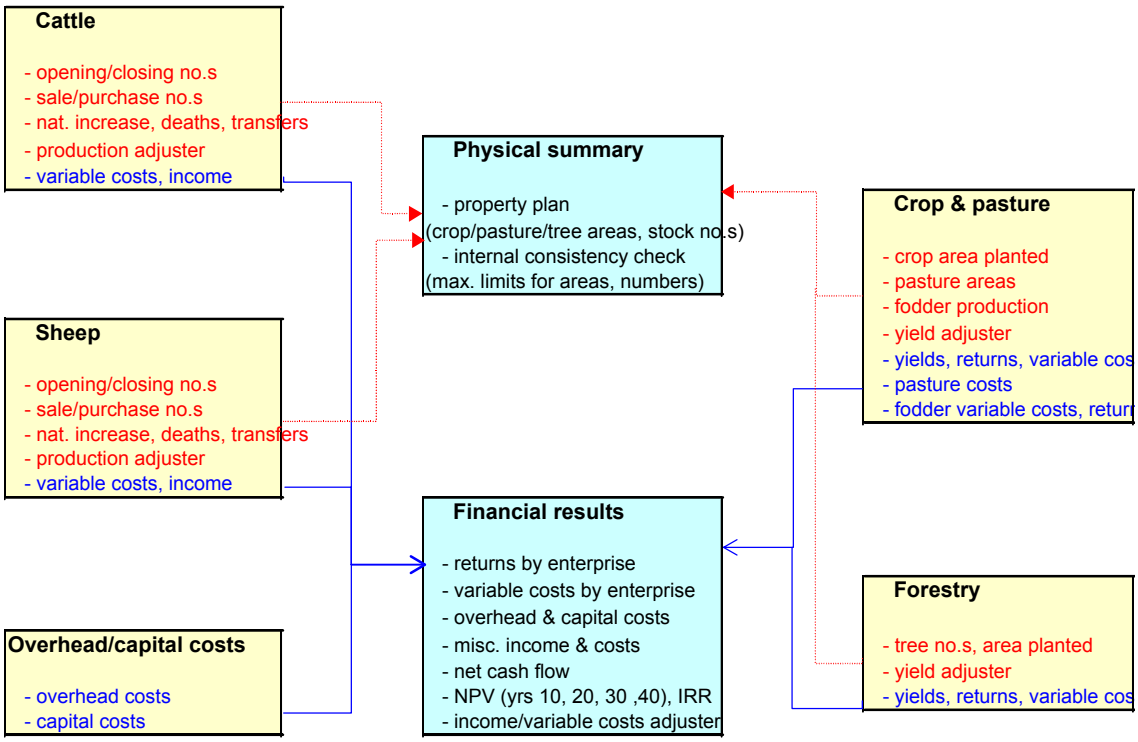
The production, costs, prices and financial measures as inputs or outputs are:

- Prices, variable costs, overhead costs and capital (including development) costs;
- Production yields, stocking rates, tree growth rates;
- Profitability measures, discounted cash flow criteria, debt levels.

As stated above, most of the enterprise production coefficients, input costs and prices can be varied on a yearly basis if necessary. This capability allows the user to take account of feedback from environmental degradation over time as well as test key variables for sensitivity analysis.

Production and financial data are generated on a yearly basis for each selected enterprise and/or development scenario. In order to account for long-term enterprises such as farm forestry, the model's analysis time frame extends to 40 years. The analysis viewpoint is effectively that of a property manager looking forward into the future. That future will include uncertainty with respect to prices, weather and government policies; therefore, the actual outcomes will not necessarily correspond to the expectations now held. This model does not have an endogenous biophysical subsystem including soil, water and vegetation components and their associated forms of degradation. A detailed description of the model is provided in appendix C.

Figure 2. Model structure



Reference farm

As discussed earlier, a reference farm, broadly representative of properties in the Warrangong catchment, has been used to analyse the relative profitability of each selected management action as well as two combinations of management actions.

While a reference farm provides an approximation to an 'average' farm there are some drawbacks—in particular, aggregation error. Aggregation error is a technical problem with using an average farm. In any group of actual farms, each is likely to have a different resource limitation. For example, one farm may be short of land, another short of capital and a third short of labour. These limitations help to determine the cropping and management decisions for each individual farm. In the case of a constructed average farm however, these shortages are evened out because the average is simply the total for all farms divided by the number of farms. Hence the abundant capital of one farm supplies the shortage of another, most likely leading to different management decisions. This problem needs to be acknowledged but is unavoidable unless a wholly

imaginary farm is made up in place of the average. However an imaginary farm is likely to be even less useful than an average farm.

The physical characteristics (such as farm size, crop/pasture areas and enterprise types) of the reference farm are based on the average results from the Warrangong producer profiles study.

While broadly representative of farms in the catchment there are nonetheless important differences between the reference farm and the catchment 'average' farm. Foremost is the selection of enterprises. Only enterprises used by a majority of respondents were incorporated into the reference farm. Livestock and crop enterprises used by a minority of producers were not included.

Some of the financial characteristics (such as debt level and capital expenditure on plant and improvements) were also derived from the producer surveys. Enterprise specific information, particularly variable costs, was based on gross margin data published by the NSW Department of Agriculture (NSW Agriculture 2002 various). Forestry information was gathered from a number of sources including individuals working as extension agents and industry bodies. In many cases, empirical data for forestry in the Warrangong, particularly long-term growth rates, does not exist and therefore the data and assumptions used are on a "best estimate" basis.

The reference farm is constructed on a "business as usual" basis for the base scenario. That is, cattle and sheep opening and closing numbers, stocking rates and crop/pasture areas are relatively constant year-in, year-out and no additional enterprises are introduced or major additional costs incurred. Subsequently, for each of the management actions, the relevant parameters in the reference farm are adjusted to assess the long-term impacts (eg. stocking rates are progressively reduced to accommodate a decrease in pasture area because of a forestry plantation).

The Warrangong reference farm is assumed to be 640 hectares in size with 280 hectares devoted to grain crops (wheat, canola and triticale) and 345 hectares to pasture. Both a mixed merino flock and a crossbred flock are run at a stocking rate of about 12.9 dry sheep equivalents (DSEs) per hectare for the pasture area. Opening year debt is assumed to be $260,000. Refer to Boxes 1, 2 and 3 for further details on the reference farm.

Box 1. Reference farm assumptions

***Total area**:*	640 ha		
***Remnant vegetation area**:*	15 ha		
***Crop area**:*	280 ha		
***Pasture area**:*	345 ha —	Improved perennial	225 ha
	—	Improved annual	75 ha
	—	Native	45 ha
Saline affected area:	20 ha —	2 main sites around creek/river	
***Sheep – ewes**:*	1,340 head		
***Water resources**:*	1 creek	— Periodic flow	
	11 dams	— 10 megalitres	
	2 bores		
***Family labour**:*	25 months		
***Costs**: **	Fixed	— $40,000 pa	
	Capital (net)	— $16,000 pa	
***Debt**:*	$260,000	— at year 1	

* *Variable costs and income are generated via the modelling exercise.*

Box 2. Livestock enterprise assumptions

Stocking rate maximum

12.9 DSEs per hectare of pasture area
4,450 total DSEs

Self-replacing mixed merino flock

Maximum breeders:	630 head	Lambing:	75 %
Ewe replacements:	178 ewe hoggets	Deaths:	4 %
Major sales:	194 cfa wethers 143 cfa ewes 60 ewe hoggets		

Cross-bred flock producing 2nd cross lambs

Maximum breeders:	710 head	Lambing:	100 %
Ewe purchases:	189 1st cross ewes	Deaths:	4 %
Major sales:	698 lambs at 6-10 months 160 cfa ewes at 5 yo		

Notes: *Assumptions relating to variable costs, selling age, turn-off percentages and mortality percentages for both flocks are based on NSW Agriculture Farm Enterprise Budgets (please refer to References for titles). Total livestock numbers, wool cuts and lambing/branding percentages are largely based on profiles survey data.*

Box 3. Crop, pasture and forestry assumptions

Average crop/pasture area per year

Wheat	140 ha	Triticale	35 ha
Canola	105 ha	Pasture	345 ha

Average crop yield per year

Wheat	4.5 t/ha
Canola	1.8 t/ha
Triticale	3.1 t/ha

Forestry operations and yields

	Pine	**Eucalypts**
Area (ha)	60	60
Pruning (yrs)	5, 7, 9	3, 5
Thinning (yrs)	15, 22	4, 8
Final harvest (yr)	30	30
Roading (yr)	15	30
Haulage to mill (km)	60	60
Mean annual increment (m3/ha/yr)	15	8.8
Total wood available (m3/ha)	450	264
Wood - sawlog grade 1 (%)	54	92
- sawlog grade 2 (%)	4	0
- posts, etc. (%)	7	0
- pulp wood (%)	35	8

Notes: *Assumptions relating to pasture establishment costs and crop and pasture variable costs are based on NSW Agriculture Farm Enterprise Budgets (please refer to References for titles). Total crop and pasture areas, crop average yields and average pasture rotation length are largely based on profiles survey data. Average perennial and annual pasture life is assumed to be five years therefore around 60 hectares are renovated each year. It is assumed that a timber mill is established in the region (see appendix A, impediments to farm forestry).*

Analysis scenarios

Base scenario

This is the business as usual scenario. It is simply the yearly results for the reference farm assuming no change. Results from the Base scenario provide the benchmark with which results from all management actions are compared.

1a. Forestry – hardwoods

Under this scenario, it is assumed that 60 hectares of land (around 10 percent of total area) is diverted from pasture (all from improved annual pasture) to commercial forestry plantings. In the first of two forestry scenarios, the 60 hectares is planted to eucalyptus species. The planting period is three years—20 hectares are planted in each of the first three years. With a reduction in pasture area, maximum stocking rate is therefore also reduced from 4,450 DSEs to around 3,680 DSEs (both sheep flocks are downsized proportionally).

The 60 hectares is based on the total catchment planting area that is likely to be needed to sustain a small regional forestry industry. A study by Race (1999) estimated that a small hardwood specialty timber industry would require a total planted area of 450 – 900 hectares. An area this size would allow a sustained harvest of 15 – 30 ha/year for a local sawmill.

In general, the greater the capacity to provide processors with adequate and sustained timber supplies, the greater the chance of attracting capital investment and employment associated with timber processing.

1b. Forestry – pine

This second forestry scenario is the same as the previous scenario with the exception that Radiata Pine replaces the eucalyptus species.

2. Saline forestry

This scenario is based on salt tolerant trees (hardwood species) being planted around saline discharge sites. For the reference farm, the total area planted is assumed to be 20 hectares. Plantings are done over a two-year period with 10 hectares planted each year. A commercial contractor does the planting. The saline forestry plantings are not intended for direct commercial gain (ie. sale of wood). While it is possible that some use of the plantation could be made in the medium term for firewood, this option is not included in the analysis. A total of 2.5 kilometres of fencing by a contractor is also assumed in the first year.

3. Fence-off remnant vegetation

Under this scenario, any more thickly wooded areas of remnant vegetation, particularly those on recharge sites, are fenced off. In Warrangong, remnant vegetation is usually scattered such that fencing is not feasible in many situations.

However, for purposes of this report, a length of 2 km of fencing is assumed with all fencing done by a contractor in the first year.

4. Fence-off creeks/rivers

This scenario is based on fencing for the one creek that is assumed to run through the middle of the property with a total length of 3 kilometres. This creek, with periodic water flow, is totally fenced-off.

A fencing contractor does the 3 kilometres in the first year. With direct stock access to the creek no longer available, water is pumped to a 10,000-litre tank and then gravity-fed to a trough. Installation of the new watering system is by family labour in the first year.

5a. Increase area of perennial pasture – reduce annual pasture area

Under the first of two perennial pasture scenarios, the 75 hectares of annual pasture are converted to perennial pasture. It is assumed that perennial species are sown down in place of annual species at time of pasture renovation—in this case at year 5.

5b. Increase area of perennial pasture – reduce crop area

This second perennial pasture scenario is the same as scenario 5a with the exception that 75 hectares out of 280 ha (27 percent) of cropping land are converted to perennial pasture. The areas of each crop are progressively reduced over the first three years. Total flock numbers are progressively increased in proportion to the increase in total pasture area.

6. Utilise saline pastures

This scenario is based on fencing-off the 20 hectares of saline areas (two sites – 10 hectares on annual pasture and 10 hectares on a perennial pasture paddock) and planting them to relatively salt tolerant pasture species. The areas would not be used for regular grazing but may be used in dry times as a small fodder reserve. A total of 2.5 kilometres of fencing by a contractor is assumed in the first year. The areas are also sown down to salt tolerant pasture species in the first year.

7a. Combination – Saline forestry + saline pastures

The first combination scenario involves establishing saline forestry in conjunction with fencing-off and establishing saline pastures. The assumptions are the same as outlined above for the individual management actions.

7b. Combination – Forestry (hardwoods) + increase perennial pastures

The second combination scenario involves an increase in perennial pasture in conjunction with establishing 60 hectares of hardwood species. The 60 ha for

forestry is diverted from native pasture (45 ha) and annual pasture (15 ha). The remaining 60 hectares of annual pasture is replaced with perennial pasture. All other assumptions are as outlined above for each individual management action.

TARGET assistance measures

The TARGET project provides a variety of assistance measures—such as financial assistance, training courses and provision of technical advice—as incentives for landholders in the Warrangong catchment to implement management actions. In order to be eligible for the assistance measures, landholders must usually agree to certain conditions that may involve, for example, some cost sharing, monitoring and maintenance responsibilities or allowing access to sites for field days and extension activities.

For purposes of this report, only the assistance measures that provide a direct monetary contribution are incorporated into the farm level analysis (a full list of TARGET assistance measures is available from the DLWC). The measures providing direct monetary assistance are:

Forestry

- Up to $1,500 per hectare for costs of site ripping and mounding, purchase and planting of trees and initial application of fertiliser.

Saline forestry

- Up to $1,500 per hectare for costs of site ripping and mounding, purchase and planting of trees and initial application of fertiliser.

Remnant vegetation conservation

- Up to $2,000 per kilometre for costs of erecting a stock proof fence around remnant conservation.

Riparian zone conservation (fence-off creeks/rivers)

- Up to $2,000 per kilometre for costs of erecting a stock proof fence around riparian zones.

Increase perennial pasture area

- Up to $150 per hectare for perennial pasture establishment costs (for areas in addition to existing perennial pastures).

Utilise saline pastures

- Up to $450 per hectare for saline pasture establishment costs.

5

Results

Base scenario

The reference farm financial profile (for the base scenario) is presented in Table 2. This base scenario financial profile has been designed to approximate the average farm financial profile based on the producer profiles report. Results from this scenario provide the benchmark with which results from the management actions are compared.

Total cash receipts (including off-farm income) are assumed to be around $268,000 while total cash costs are assumed to be about $222,000. A net cash receipt, being the amount remaining to meet personal costs and principal repayments, is about $46,000. The NPV over 33 years (at a 7.5 percent discount rate) is around $742,000. Under the base scenario, the reference farm makes positive net cash income in all years. Opening year debt is assumed to be $260,000.

Table 2. Base scenario financial profile

	$
Cash receipts	
Sheep sales	58,000
Wool sales	50,000
Grain sales	131,000
Off-farm income	29,000
Total receipts	268,000
Cash costs	
Variable	156,000
Overhead	40,000
Interest	10,000
Net capital	16,000
Total costs	222,000
Net cash receipts	**46,000**
NPV over 33 years	**741,600**
Opening debt – amount	**260,000**

Notes: Net cash receipts are the surplus available for personal costs and principal repayments.

Table 3 summarises the results for each scenario. Shown are the NPV and any increase in debt above $260,000.

Table 3. Analysis results summary

Scenario	NPV (over 33 yrs) ($)	Increase in debt ($)
Base scenario	741,600	
1a. Forestry – hardwoods ▪ with assistance ▪ no assistance	 684,200 628,600	
1b. Forestry – pine ▪ with assistance ▪ no assistance	 674,800 619,200	
2. Saline forestry ▪ with assistance ▪ no assistance	 740,800 724,800	
3. Fence-off remnant vegetation ▪ with assistance ▪ no assistance	 737,800 734,100	
4. Fence-off creeks/rivers ▪ with assistance ▪ no assistance	 733,700 728,100	
5a. Increase perennial pasture (less annual) ▪ with assistance ▪ no assistance	 742,800 735,000	
5b. Increase perennial pasture (less crop) ▪ with assistance ▪ no assistance	 679,100 669,800	
6. Utilise saline pastures ▪ with assistance ▪ no assistance	 740,900 738,400	
7a. Saline forestry + saline pasture ▪ with assistance ▪ no assistance	 740,100 721,600	
7b. Forestry (hardwoods) + perennial pasture ▪ with assistance ▪ no assistance	 668,200 606,300	

The results in Table 3 are discussed in detail below.

1a. Forestry – hardwoods

Planting 60 hectares of land (around 10 percent of total area) to a commercial hardwood forest results in a reduction in NPV of around $113,000 (no assistance) and around $57,000 (with assistance).

Clearly, the provision of assistance makes a significant difference to the profitability of hardwood forestry—NPV is about $56,000 higher. The assistance provided offsets the site establishment and tree planting costs incurred in the first three years.

1b. Forestry – pine

This second forestry scenario, planting 60 hectares to commercial pine, reduces NPV by around $122,000 with no assistance and about $67,000 with assistance.

The major factor behind the relatively low profitability of forestry is the long wait until a return is realised. Effectively, discounting at reasonable rates reduces the cash flows beyond about 25 years to very little. The first receipts from timber sales occur after year 30. To illustrate this issue another way, $100,000 received in year 31 is worth about $10,000 (or around 10 percent) in today's dollars using a discount rate of 7.5 percent.

2. Saline forestry

Planting 20 hectares of salt tolerant trees around saline discharge sites results in a reduction in NPV of about $16,800 with no assistance. The assistance provided under TARGET would reduce the loss to $800. Saline forestry in Warrangong would therefore impose almost no cost on farmers if they accessed the assistance on offer.

3. Fence-off remnant vegetation

Fencing-off remnant vegetation reduces NPV by about $7,500 without assistance and by around $4,000 with assistance. By accessing the assistance available under this management action, producers would be within half a percent of the base scenario (not accounting for any environmental benefits).

4. Fence-off creeks/rivers

Fencing-off creeks and rivers reduces NPV by about $13,500 without assistance and $8,000 with assistance. The outcomes for this action are again improved through the provision of direct assistance. By using the assistance provided under this management action, producers would be within around one percent of the base scenario (not accounting for any environmental benefits).

5a. Increase area of perennial pasture– reduce annual pasture

Replacing 75 hectares of annual pasture with perennial pasture reduces NPV without assistance by $6,600. After taking account of the assistance available, establishing perennial pasture is more profitable that the base scenario NPV by around $1,000.

This is the only management activity that increases NPV. If the 75 hectares were left as annual pasture it would incur establishment costs as part of the usual pasture renovation program. However, by converting the 75 ha to (extra) perennial pasture the first time establishment costs are effectively zero because of the assistance.

5b. Increase area of perennial pasture – reduce crop area

In contrast to the above scenario, replacing 75 hectares of crop area with perennial pasture has a significant effect on NPV. The results indicate that NPV falls by about $72,000 without assistance and by $62,500 with assistance. This is because profitable crops are being replaced with less profitable pasture.

6. Utilise saline pastures

Fencing off 20 hectares of saline areas and planting them to relatively salt tolerant pasture species reduces NPV by around $3,000 without assistance and $700 with assistance. The provision of assistance results in estimated NPV being almost the same as the base scenario outcome. Even without assistance, NPV is still within half a percent of base scenario results (without accounting for environmental benefits).

7a. Combination – Saline forestry + saline pastures

Establishing saline forestry in conjunction with saline pastures reduces NPV by almost $20,000 without assistance and around $1,500 with assistance. Utilising the assistance measures provided for each management action brings this combination very close to the NPV produced under the base scenario.

7b. Combination – Forestry (hardwoods) + increase perennial pastures

The second combination of an increase in perennial pasture in conjunction with establishing 60 hectares of forestry (hardwood species) results in an estimated reduction in NPV of about $135,000 without assistance and $73,000 with assistance. Even with assistance provided, this combination is among the least profitable.

There is an important caveat attached to the above results. The analysis takes no account of environmental benefits that may flow from implementation of any of the management options. In reality these benefits are difficult to quantify and will vary from farm to farm according to the existing biophysical situation and

proneness to environmental hazards. In some cases the benefits of management actions accrue to the broader community (eg. biodiversity benefits).

It follows that the difference between the NPV of the base scenario and any management action can be interpreted as the environmental break-even value (ie. if a NPV difference is $2,000 then any environmental benefits resulting from implementation of that management action would only have to be at least $2,000 for the action to be more profitable than the base scenario).

Results summary

The results indicate that all management actions (except replacing annual pasture with perennial pasture) would reduce NPV both with and without assistance. However, all management actions, with the exception of those involving farm forestry, and replacement of crops with perennial pastures, produce NPVs within a three percent range of the base scenario. Saline pasture, saline forestry, increasing perennial pasture at the expense of annual pasture, and a combination of saline forestry with saline pasture can be considered to be almost no-regrets actions. Farmers' expectations with respect to the individual management actions are shown in Appendix B. They are compared with NPV changes in Table 4.

Table 4. NPV changes and likely implementation of management actions

Salinity mitigation measure	Planned implementation	NPV change (from base scenario)			
		No assistance	With assistance	No assistance	With assistance
Increase perennial pasture area	57%	– $6,600	+ $1,200	– 0.9%	+ 0.2%
Increase saline pasture area	57%	– $3,200	-$700-	– 0.4%	– 0.1%
Fence-off remnant vegetation	50%	– $7,500	– $3,800	– 1.0%	– 0.5%
Fence-off creeks and waterways	50%	– $13,500	– $7,900	– 1.8%	– 1.1%
Establish farm forestry (hardwood)	14%	– $113,000	– $57,400	– 15.2%	– 7.7%
Utilise saline agroforestry	14%	– $16,800	– $800	– 2.3%	– 0.1%

Note: Future implementation refers to the percentage of respondents who did not rule out implementing the measure in the next five years. NPV change is the difference between the NPV for the base scenario and the relevant management action (eg. implementing farm forestry results in a NPV that is around $113,000 and 15 percent (no assistance) and $57,400 and 7.7 percent (with assistance) **less** than the base scenario NPV).

Plantation forestry on the scale proposed significantly reduces NPV. These losses are mitigated by TARGET assistance but are nevertheless still large. This is consistent with the farmers' past and intended actions. Only one producer in the Warrangong catchment had established forestry in the past five years and six out of seven were not intending to plant forestry in the next five years. Of those giving a specific reason, around a third thought forestry was unprofitable. This suggests that farm forestry is unlikely to make a major contribution to salinity control in this catchment even with financial support.

Most farmers in Warrangong also rejected saline agroforestry as an option. A third of those not intending to implement this action stated they did not have a significant watertable problem. The results of the analysis suggest that profitability is not significantly reduced if this action is implemented using available assistance.

In saline areas there is sometimes a clear need for saline pasture establishment. Around 60 percent of respondents did not rule out the future use of this management option and the NPV loss was relatively small.

Sensitivity analysis

The purpose of sensitivity analysis is to determine how variations in key variables may affect the profitability of implementing each management option. Sensitivity analysis provides a guide to the risk associated with an investment.

The key variables varied are the discount rate and growth rate (for the forestry scenarios only). All management actions were run at higher and lower discount rates because the discount rate is a key variable in long-term analysis (Table 5). In addition to discount rate, the sensitivity of NPV to tree growth rate was also tested as all the management actions with large financial consequences involve forestry (Table 6).

The NPV of all scenarios is sensitive to the discount rate used. The NPV of the base scenario is 35 percent greater at a 5 percent discount rate than at 7.5 percent and is 22 percent lower at a 10 percent discount rate. The sensitivity of the individual management actions to the discount rate varies between actions. The management actions involving significant areas of forestry (1a, 1b and 7b) are more sensitive to interest rates than the others. The inclusion of assistance in the calculation of NPV makes little difference to the sensitivity to discount rate.

Plantation forestry is shown to be sensitive to tree growth rate—the NPV of hardwood plantations is decreased by about $47,000 by a 50 percent reduction in assumed tree growth. A 25 percent increase is still not enough to make the change in NPV from the base positive.

Table 5. Sensitivity of NPV to discount rate

Scenario	NPV at 5% ($'000)	NPV at 7.5% ($'000)	NPV at 10% ($'000)
Base scenario	1,000.6	741.6	576.1
1a. Forestry – hardwoods			
▪ with assistance	998.0	684.2	502.8
▪ no assistance	939.8	628.6	449.6
1b. Forestry – pine			
▪ with assistance	965.2	674.8	502.7
▪ no assistance	906.9	619.2	449.5
2. Saline forestry			
▪ with assistance	1,002.5	740.8	573.6
▪ no assistance	986.0	724.8	558.2
3. Fence-off remnant vegetation			
▪ with assistance	996.8	737.8	572.5
▪ no assistance	993.0	734.1	568.8
4. Fence-off creeks/rivers			
▪ with assistance	992.5	733.7	568.4
▪ no assistance	986.8	728.1	562.9
5a. Increase perennial pasture (less annual)			
▪ with assistance	1,000.5	742.8	578.0
▪ no assistance	991.7	735.0	571.1
5b. Increase perennial pasture (less crop)			
▪ with assistance	923.4	679.1	523.6
▪ no assistance	913.6	669.8	514.8
6. Utilise saline pastures			
▪ with assistance	1,002.7	740.9	573.7
▪ no assistance	1,000.1	738.4	571.3
7a. Saline forestry + saline pasture			
▪ with assistance	1,004.9	740.1	571.0
▪ no assistance	985.8	721.6	553.1
7b.Forestry (hardwoods) + perennial pasture			
▪ with assistance	974.6	668.2	491.4
▪ no assistance	909.3	606.3	432.6

Table 6. Sensitivity of NPV to tree growth rate

Scenario	**NPV** at 7.5% over 33 years ($'000)			
	MAI 50% lower	MAI 25% lower	MAI standard	MAI 25% higher
1a. Forestry – hardwoods				
▪ with assistance	637.3	660.8	684.2	707.7
▪ no assistance	581.7	605.1	628.6	652.0

Note: MAI stands for Mean Annual Increment and is a standard measure of tree growth rate.

A

Appendix

A. Impediments to forestry

Climatic limitations
The Warrangong catchment has an average rainfall of 600 millimetres. The minimum limit used by the Department of State Forests of NSW to define areas suitable for joint venture forestry is 700 mm.

Uncertainty about eventual returns
All farming involves some uncertainty about yields and prices. These are magnified for timber because of the long wait for a return. This is not especially a problem with the Warrangong catchment per se but markets for timber should be considered as an important factor in farm forestry development.

Time scale for costs and returns
This is not especially a problem for the Warrangong catchment where there are a substantial number of younger people on properties compared to other areas.

Capital cost
Tree establishment costs range from around $1,000 to $2,500 per hectare (Southern Tablelands Farm Forestry Network 2002a, 2002b). The profiles study revealed that property cash flow and debt level might be important constraints to obtaining capital funds. Some properties may be unable to safely take on the cost of planting a large area of trees without endangering their credit arrangements. The TARGET project will contribute to the cost of land preparation and tree establishment for forestry.

Distance from market
There is currently no major timber mill in the Warrangong catchment. The nearest facilities are at Bathurst and Oberon—distances by road of approximately 160 kilometres and 200 km respectively.

Lack of skill in tree growing
The profiles study indicated that the majority of property owners surveyed had little if any, experience in farm forestry. The TARGET project provides funds for training in forestry skills.

B. Producers' adoption of management actions

1. Farm forestry

The findings of the producer profiles study indicated that only one farm had established some forestry in the last five years and the majority were not intending to establish farm forestry in the next five years as they thought it was not profitable or productive (Table 7).

Table 7. Producer responses to plantation forestry

Number of respondents who *had* established farm forestry in the past 5 years	**1**
Number of respondents who were *not* intending to establish farm forestry in the next 5 years	**6**
Reasons for *not* intending to implement measure:	
▪ Not profitable or productive	33%
▪ Other reason	33%
▪ Simply not interested	17%
▪ Don't know enough about it	17%

2. Saline agroforestry

Table 8. Producer responses to saline agroforestry

Number of respondents who *had* established saline agroforestry in the past 5 years	**0**
Number of respondents who were *not* intending to establish saline agroforestry in the next 5 years	**6**
Reasons for *not* intending to implement measure:	
▪ No or insignificant salinity/watertable problem	33%
▪ Not profitable or productive	17%
▪ Simply not interested	17%
▪ Don't know enough about it	17%
▪ Other reason	17%

No respondent in the producer profiles study indicated that they had implemented saline agroforestry in recent years and 6 respondents indicated that they were not going to establish saline agroforestry in the next five years (Table 8).

3. Remnant vegetation conservation

Fencing off remnant vegetation was a relatively popular option among the profiles sample properties (Table 9). Almost fifty percent of respondents had fenced-off remanent vegetation in the past five years and the same number had not ruled out the possibility in the next five years.

Table 9. Producer responses to fencing-off remnant vegetation

Number of respondents who *had* fenced-off remnant vegetation in the past 5 years	**3**
Number of respondents who were *not* intending to fence-off remnant vegetation in the next 5 years	**3**
Reasons for *not* intending to implement measure:	
▪ Not interested	33%
▪ Not applicable	33%
▪ Already doing as much as intend to	33%

4. Riparian zone conservation

About a quarter of properties surveyed had taken action in the last five years and around 50 percent had not ruled out the possibility of doing so in the next five (Table 10).

Table 10. Producer responses to fencing-off creeks/rivers

Number of respondents who *had* fenced-off creeks/rivers in the past 5 years	**2**
Number of respondents who were *not* intending to fence-off creeks/rivers in the next 5 years	**3**
Reasons for *not* intending to implement measure:	
▪ Simply not interested	33%
▪ Already doing as much as intend to	33%
▪ Not applicable	33%

The main reasons given by those who did not intend to implement this measure was a lack of interest, that it was not applicable (eg. no riparian zone to fence) and that it had already been done to a required extent.

5. Perennial pastures

Table 11 shows that perennial pastures are already well accepted by properties in the Warrangong catchment. Most respondents had increased their area of perennial pasture in the past five years and a majority had not ruled out the option for the next five years.

Table 11. Producer responses to perennial pastures

Number of respondents who *had* increased area of perennial pasture in the past 5 years	**6**
Number of respondents who were *not* intending to increase area of perennial pasture in the next 5 years	**2**
Reasons for *not* intending to implement measure:	
▪ Already doing as much as intend to	50%
▪ No need for it	50%

6. Saline pastures

Table 12 shows that over half the properties had established saline pasture species in the last five years and most had not ruled out doing so in the next five years.

Table 12. Producer responses to saline pastures

Number of respondents who *had* established saline pastures in the past 5 years	**4**
Number of respondents who were *not* intending to establish saline pastures in the next 5 years	**2**
Reasons for *not* intending to implement measure:	
▪ No or insignificant salinity/watertable problem	50%
▪ No need for it	50%

It appears that this practice is relatively well accepted and that most properties that would benefit are already planning to establish saline pastures. The principal cost involved is payment for seed of salinity resistant species; otherwise, the costs are similar to those for establishing other sown pastures.

C. Model description

The seven main worksheets in the TARGET model are cattle, sheep, annual crop (including pasture and fodder), forestry, overhead and capital costs, physical summary and financial results.

Cattle worksheet:

- Calculates opening and closing numbers by stock category (eg. steer) as well as by age group. Sales, purchases, joinings, births and deaths can be adjusted on a yearly basis if required;
- Calculates total stock sales revenue as well as sales revenue by age group and category;
- Calculates up to nine categories of variable costs. Total variable costs are calculated as well as costs by age group and category;
- All physical coefficients can be varied on a yearly basis for the first 15 years, thereafter the herd structure is held constant.

Sheep worksheet:

- Allows for two sheep flocks with the capability to transfer stock between the two flocks;
- Calculates opening and closing numbers by stock category (eg. wether) as well as by age group. Sales, purchases, joinings, births, deaths and transfers can be adjusted on a yearly basis if required;
- Calculates total stock sales revenue as well as sales revenue by age group and category;
- Calculates up to nine categories of variable costs. Total variable costs are calculated as well as costs by age group and category;
- All physical coefficients can be varied on a yearly basis for the first 15 years, thereafter the flock structures are held constant.

Crop (and pasture) worksheet:

- Allows for 6 winter and 6 summer crops as well a fodder crop. This worksheet also allows for 4 pasture types as well as fodder production;
- Calculates crop and fodder production based on areas and yields;
- Calculates total crop and fodder revenue as well as revenue by crop type;
- Calculates up to nine categories of variable costs for each crop, fodder and pasture type. Total variable costs are calculated as well as costs by crop/pasture type. Each pasture type also differentiates between routine maintenance costs (variable) and pasture renovation costs (capital);
- All physical coefficients can be varied on a yearly basis for 40 years.

Forestry worksheet:

- Allows for 2 forestry types (eg. hardwoods and pine);

- Calculates timber production based on areas, tree growth rates and recoverable yields;
- Calculates total timber revenue as well as revenue by tree age;
- Calculates up to nine categories of variable costs. Total variable costs are calculated as well as costs by tree age group;
- Worksheet has provision to calculate overhead and capital costs associated with forestry. This means the worksheet can be used as a stand-alone model for a forestry only farm;
- All physical coefficients can be varied on a yearly basis for 40 years.

Overhead & capital worksheet:
- Calculates overhead costs and capital costs associated with the broadacre enterprises;
- All physical coefficients can be varied on a yearly basis for 40 years.

Physical summary worksheet:
- This worksheet is linked to the cattle, sheep, crop/pasture and forestry worksheets;
- Summarises totals for sheep and cattle numbers, DSEs, crop, pasture and tree areas;
- Summary data are presented on a yearly basis over 40 years;
- Provides an internal consistency check to ensure maximum areas and stock numbers set by the user are not exceeded.

Financial results worksheet:
- This worksheet is linked to the cattle, sheep, crop/pasture, forestry and overhead/capital worksheets;
- Summarises sales revenue and total variable costs for each livestock, crop/pasture and forestry enterprise;
- Capacity to adjust enterprise prices and variable costs for any individual year;
- All physical data is summarised on a yearly basis over 40 years;
- Provides a summary yearly cash flow budget over 40 years. This whole farm cash flow budget shows income from each enterprise as well as other sources, variable costs for each enterprise, overhead and capital costs as well as other costs;
- Calculates NPV at user defined rates for 10, 20, 30, 33 and 40 years;
- Calculates yearly cumulative debt level.

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