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Land Use Decision Tool (MyFarm)
Final Contract Report

Attn: Gerald Rys
Ministry of Agriculture and Fisheries - SLMACC
Contract ID: C04X0813

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Executive Summary

MyFarm is a decision support tool for assessing the financial and environmental benefits of land use options by providing:

- Integration of multiple land uses at the farm and paddock level
- Modelling land use productivity and environmental impacts
- Web access, with easy to use map interface
- Underpinning geospatial engine of land resource information
- Decision process and graphical reporting
- A strategic and long term view of land management (30+yrs)

MyFarm is a collaborative development by Scion and AgResearch during the contract period 1 Jan 2009 and 30 June 2011. It has been guided by a Stakeholder Steering Group who sees great potential for the approach and encourages further development of functionality and options.
The current version is a web enabled prototype with a geospatial interface that provides modelling of Sheep breeding for store lambs and Forestry for carbon, with impacts on financials and environmental indicators. Further development of the system is expected to include other land use options such as Dairying and Deer, and other environmental impacts. Also greater linkages are expected with other land use tools and databases.
Suggestions are made on the next stages for the tool and potential costs for maintenance are estimated.

Background

MyFarm is a Ministry of Agriculture and Forestry (MAF) funded Sustainable Land Management and Adaption to Climate Change (SLMACC) project (Contract CO4X0813 – Land Use Tools) managed through the New Zealand Ministry for Science and Innovation (MSI). It is led by Scion with strong collaboration from AgResearch. The project funding was $560k (exc GST) per year for 2.5 years and ended on 30 June 2011. As a reporting and review requirement, this report describes the findings and results of the research.

Introduction

Land management decisions affect long term financial, social and environmental outcomes, on and off the property; therefore land owners would like assistance to make more strategic and holistic decisions about their land management. Land owners are very independent and wish to make their own decisions or be advised by a small select group of trusted experts. MyFarm is intended to reach a large number of users, quickly, and to place the tools in the hands of property owners to enable them to make decisions to achieve financial and environmental outcomes.

To guide the development of the tool, a Steering Group was set up with members from appropriate industries. Membership has changed over the two years but the project has been well served by voluntary contributions of considerable expertise. The table below gives past and present members of the Steering Group.

Name	Role	Organisation
Present		
Patrick Milne	Previous National President	Farm Forestry Assn
Ian Millner	Senior Advisor, Land Management	HB Regional Council
Simon Stokes/John Douglas	Senior Land Management Officer	BOP Regional Council
John Simmons	Group Manager Biosecurity & Heritage	Waikato Regional Council
Phil McKenzie	National Manager Marketing & Procurement	L and Corp
Russell Dale	CEO	Future Forest Research
Peter Gorman	Senior Operational Policy Adviser	MAF
Past		
Chris Perley	Senior Advisor, Land Management	HB Regional Council
Ric Vallance	CEO	Ngati Whakaue Tribal Lands
Collier Isaacs	Strategic Development Manager	L and Corp
Con Williams	Senior Economist	Beef & Lamb NZ

A series of workshops were held in 2009 with the Steering Group and research team. The focus of these workshops was to develop ideas and demonstrate an early prototype of the land use decision tool. Unanimous agreement was reached around critical aspects of the tool, and the group has met regularly to provide feedback and guide development.

MyFarm has been developed to the Alpha stage (testing stage, two further stages before release) with the following core functionalities:

1. Mapping and visualisation
2. Goal setting for farm and paddocks
3. Decision process guidance
4. Physical and financial modelling
5. Reporting and graphical display of results.

Use Cases

Considerable analysis was undertaken to understand the user's requirements and expectations of how they would interact with the software tool. To do this the best practice is to develop "Use Cases" that describe the process in a step by step fashion and is driven by the user perspective and not a technical or modelling perspective. The use cases were then used to develop a technical specification for the engineering of the software.

Modelling

Livestock modelling

The livestock enterprise is represented using a basic stock reconciliation model, described by user set total stock units, offspring percentage and years breeding livestock are retained (see figure 1). The stock reconciliation model then calculates the number of livestock retained in the breeding group, offspring sold and replacement stock purchased. This information is linked to the MAF Monitoring Farm report for farms with appropriate enterprises to calculate key physical and financial statistics

Purpose:

- To calculate annual cash flow related to sheep and beef finishing and breeding enterprise production of stock, wool, .and grazing.
- To calculate measures of enterprise value and profitability derived from discounted cashflow analysis

Inputs (and sources):

- Total number of beef stock units on the farm (SU)
    - user specified
- Total number of sheep stock units on the farm (SU)
    - user specified
- Stock reconciliation parameters for culls, deaths, births, wool production, etc
    - set to default values, but likely to need to be user specified
- Farm working expenses ($/ha, $/SU)
    - MAF Monitoring Farm Reports by enterprise and region
- Farm-level costs ($) and factors used to derive them
    - MAF Monitoring Farm Reports
- Purchases of ewe, wether, and ram lambs(number by stock class)
    - user specified
- Purchases of heifer calves, steer calves and weaner bulls (number by stock class)
    - User specified
- Stock sale and purchase prices per head, by stock class
    - AgriFax
- Wool production (kg/head) by stock class and price ($/kg)
    - MAF Monitoring Farm Reports
- Discount rate
    - Default value
- Rates for inflating costs and/or prices (optional)
    - Estimated from historical trends

Outputs:

- Annual sheep revenues and purchases
- Annual wool revenue
- Annual cattle revenue and purchases
- Annual grazing income
- Annual net cash income (= sum of sheep, wool, cattle and grazing revenues minus sheep and cattle purchases)
- Annual farm working expenses
- Annual cash operating surplus (= net cash income minus farm working expenses)
- Annual stock asset value
- Annual farm profit before tax (= cash operating surplus minus sum of interest, rent, stock value adjustments and depreciation)
- Net Present Value (sum of discounted annual farm profit before tax)
- NPV expressed as an annuity
- All cash flows assumed to be pre-tax.

Stock Class Information:

For each stock class the following variables are identified (derivation of each of these variables is presented below):

- Herd Age Structure value
- SU value
- Number of head
- Cull rate
- Number of culls
- Death rate
- Number of deaths
- Number of sales
- Number of purchases
- Price ($/hd)
- Fleece weight (kg/hd)
- Shearing frequency (shearings/yr)

Stock Reconciliation Calculations

Stock reconciliation is the process of systematically estimating the numbers of animals in different stock classes that are expected to be purchased, born, sold, die, culled, or kept on hand within the year. This is to ensure that at the end of the year total stock Purchases + Births = Sales – Deaths – Culls.

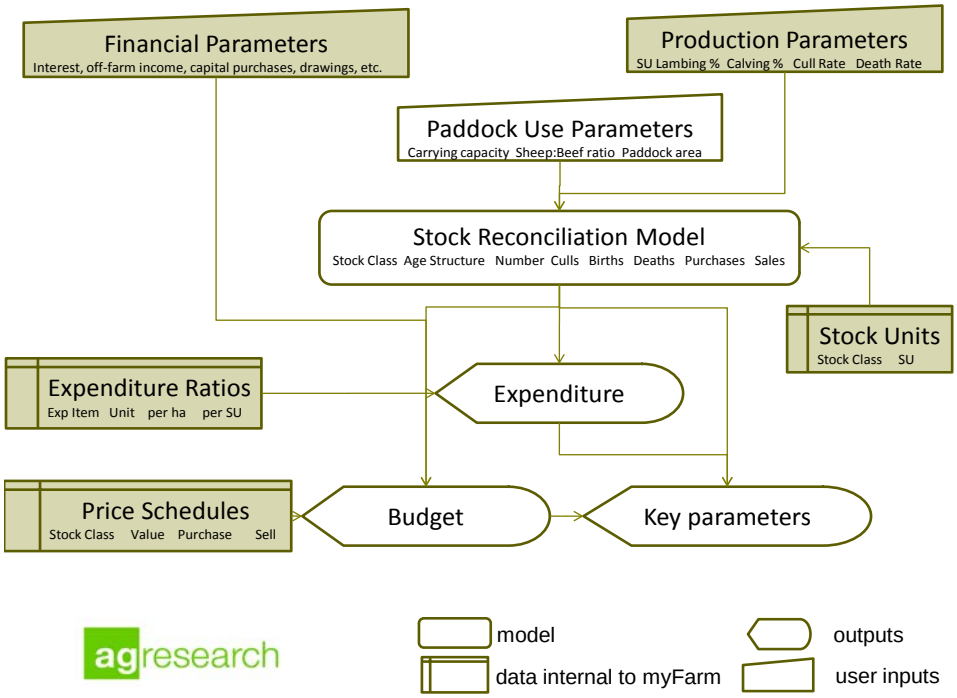
Stock reconciliation is central to the representation of the sheep and beef enterprises in MyFarm for several reasons

- It enables estimation of a hypothetical allocation of total farm sheep (beef) stock units to the different stock classes that fit with the farm enterprise, without the user having to provide this detail
- It forms the basis for estimating cash flows by calculating stock sales and purchases, and hence is the basis for estimating farm enterprise finances
- It determines the physical and financial feasibility of alternative management options, e.g. will replacements need to be purchased
- It enables calculation of the farm annual stock asset value, and any changes in this value

General comments on how the herd age structure and stock reconciliation equations have been presented

1. Equations are organised by stock class and then how Purchases, Births, Sales, Deaths, Culls and total number are calculated within each stock class
2. Stock classes are generally ordered by females of successive ages, non-breeding males of successive ages, and breeding males of successive ages
3. Where Purchases, Births, Deaths, Sales or Culls are used as an equation variable within a stock class, these refer to the equivalent Purchase, Birth, etc. for that stock class.

Figure 1: Sheep and Beef Model and information flows



Forestry Modelling

Forestry yields have been derived from a matrix of runs (site class, regime, rotation age) using the Forecaster modelling system to produce production volumes of radiata pine log grades and carbon sequestration. Meta models have been fitted to these outputs to derive equations for MyFarm. Default costs and prices have been set but are changeable by the user. Discounted cash flow analysis is then applied to calculate a range of economic metrics.

Purpose:

- To calculate annual cash flow related to normal "fibre forestry" (ie. forestry for the production of wood products), the additional cash flow related to carbon trading and the combination of the two.
- To calculate measures of forest value and profitability derived from discounted cash flow analysis (see figure 2).

Inputs:

- Operation costs ($/ha)
- Farm-level costs ($) and factors used to derive them
- Harvest yields and log prices
- Carbon yield table, carbon costs and carbon prices
- Discount rate
- Rates for inflating costs and/or prices (optional)

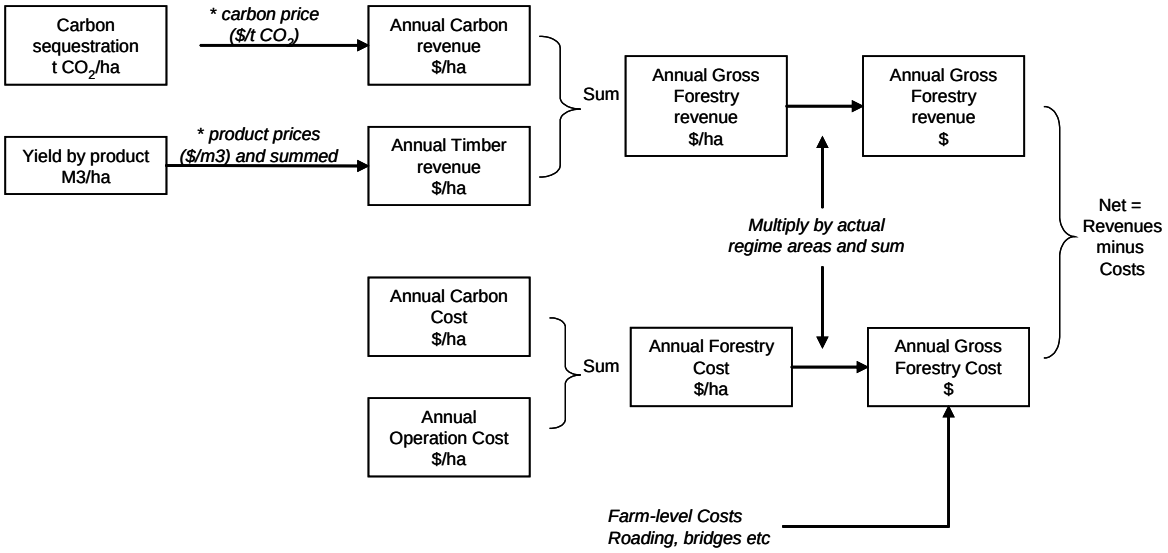
Outputs:

- Annual carbon forestry revenues, costs and net revenues
- Annual fibre forestry revenues, costs and net revenues
- Annual Forestry (carbon+fibre) costs, revenues and net revenues
- Discounted annual forestry net revenue from establishment to rotation.
- Net Present Value (sum of discounted annual net revenue)
- NPV expressed as an annuity
- Annual forest asset value (= NPV at current age based on sum of future discounted net revenues).
- Land expectation value
- All cash flows assumed to be pre-tax.

Revenue calculations:

Revenues are calculated by multiplying a forestry product (eg. logs, carbon sequestered) by a price. Prices are in $/m3 or $/tonne CO2; products are specified as m3/ha or t CO2/ha. Revenue is therefore calculated as a $/ha value before being multiplied by the area concerned.

Figure 2: Forestry Model and information flows



Using the tool

The following are the key steps involved for a user to get results from MyFarm:

1. Login to website (this creates privacy of information entered, ie stored on computer)
2. Find own property in a map interface (search facility provided)
3. Digitise paddock or block boundaries of some or all of farm (mapping tool provided)
4. Enter current land use and physical conditions of paddocks that may influence production and economics, eg livestock carrying capacity (LCC), slope, tree species.
5. Set goals for farm enterprise, eg Minimum net profit, cash flow, maximum nitrates, minimum CO_2 sequestered.
6. View results and compare with Goals
7. Create new scenarios and change paddock/block land use to achieve goals.

A User Guide for the MyFarm (Alpha release 1 version) has been supplied separately to MAF.

Next stages:

Discussions with the Steering Group and other stakeholders have identified a number of technical and business issues that need further development.

Technical issues:

1. Modelling other significant land uses
   While the prototype has given proof of concept that the approach taken works, further functionality is needed to add other types of Sheep or Beef farming, eg fattening or trading stock, to provide a complete range of farming entities currently practiced. Extending the range of forestry species and regimes modelled is also required. Dairying, Deer farming, Cropping, and Horticulture are also possible provided the underpinning models are developed for production, economics, and environmental impacts.

2. Modelling additional environmental impacts.
   Modelling emissions that may be needed for the ETS is likely to be a first priority, modelling erosion, water quality, biodiversity, and animal welfare would also be very useful to trade-off against economic drivers.

3. Providing better decision process and option taking with the current matrix.
   To help in constructing useful and practical scenarios, better guidance on choice of tree species or animal production system would improve the uptake of the modelling system.

4. Risk modelling and price forecasting.
   Strategic modelling is driven by assumptions on future prices and costs. Assistance with risk analysis and price forecasts is important for useful scenario analysis.

5. Greater linkages with other land use tools and databases.
   Greater detail can be modelled in specialised tools such as Overseer, Farmax, and Forecaster. Databases managed by third parties (particularly if web enabled) could be linked and proved the latest version of results or updates.

Business issues:

Several stages of development are required to formally develop the business relationship around MyFarm, the following is an outline of some of the issues to be addressed.

Management and funding

While the contractual IP agreement places the IP with Scion (with a free license to MAF) there is a desire for the tool to be widely used for the betterment of New Zealand.
To achieve this, criteria to guide the formation of the management structure should be developed and considered carefully, eg enduring, simple, cost efficient.
For the tool to be enduring, key land use stakeholders will need to be fully engaged. Further development should be driven by those prepared to co-fund, particularly if it fits with their strategic goals and policies.
Funding mechanisms are needed to get the tool to an operational state that would allow some potential commercial model to be initiated to create a self funding entity.
The management structure needs to be simple to reduce costs and several existing examples (Overseer, Farmax, and Forecaster) can be studied to guide this.

Maintenance

For the tool to be operational a number of maintenance issues need to be addressed:

1. Web hosting – probably best provided by specialised third party providers - expected to cost approximately $40k/yr
2. Licensing third party tools and data, eg GIS and aerial imagery. GIS is currently licensed by Scion at no additional cost while pre-commercial, but expected to cost approximately an additional $50k/yr to become commercial.
3. High resolution aerial photography is needed to underpin the farm mapping at a paddock level. This is available at $100k to purchase, or alternatively an annual license - approx $120k/yr.
4. Technical user support and maintenance of data and software – some level of help desk support could be expected and updates to data and software code is likely to cost $100k/yr
5. Marketing and training to get user awareness and uptake – to launch the product and get uptake will take considerable marketing and promotion. Training of key stakeholders would be advised in the first year. Expected to costs are approx $80k/yr

The above costs total approximately $270 – 370k/yr, depending on licensing options, a complete business plan would be needed to formalise this. The above costs do not include further development of functionality or the addition of new land use systems. These issues will be costed and discussed with all stakeholders in the next few months.

Graham West
Project Leader
Scion
31 August 2011