



An Australian Government Initiative



Farm Forestry Toolbox

Version 5.0

Helping Australian growers to manage their trees

A report for the RIRDC/L&WA/FWPRDC
Joint Venture Agroforestry Program

by Andy Warner

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Foreword

Many private landholders, in many regions of Australia, are planting trees for commercial harvest and to improve active management of their land. This involves decisions on species, management and desired harvested products. To inform these decisions, landholders and extension officers need information on forest measures such as growth rates, tree trunk form or taper, stand yield, and the effect of management on financial returns.

A wide range of possible eucalypt and conifer species provide commercial wood products in Australia. Taper and growth models for these species are important in evaluating regional options for species, regime and products, and can also be used to analyse site-specific tree measurement data to aid in silvicultural management. However, farm foresters have had very limited access to these models, and many models also require integration into a decision support system to be of practical and widespread use.

The Farm Forestry Toolbox is a computer package containing user-friendly tools that help forest growers to better handle the wide range of issues in growing trees successfully. Through this project, the Farm Forestry Toolbox has been substantially updated. Version 5 of the Toolbox (Toolbox 5) provides simple conversion tools, as well as more sophisticated tools that now incorporate newly-available regional tree growth models. These will assist the grower to model tree growth and integrate financial and tree products information. The Toolbox also includes assistance with area surveying and mapping and identifying tree pest and disease problems.

Fourteen regional workshops were held in March 2007 to obtain feedback on Toolbox 5, and to provide regional training for a range of users. As well, 5,000 copies of the Farm Forestry Toolbox version 5 CD have been produced and are being distributed freely through the national network of Private Forestry Development Committees (PFDCs) in the main plantation regions of Australia.

As a result of this project, there is expected to be increased empowerment of regional plantation growers to better quantify current and future tree growing options, and to appraise potential for their land. Based on the strong positive regional feedback from the workshops, further development of the Toolbox package is recommended. This should include modules designed to facilitate the import and export of relevant input and output data for further analysis.

This project was funded by the Joint Venture Agroforestry Program (JVAP), which is supported by three R&D Corporations — Rural Industries Research and Development Corporation (RIRDC), Land & Water Australia (L&WA), and Forest and Wood Products Research and Development Corporation (FWPRDC), together with the Murray-Darling Basin Commission (MDBC). The R&D Corporations are funded principally by the Australian Government. State and Australian Governments contribute funds to the MDBC.

This report is an addition to RIRDC's diverse range of over 1600 research publications. It forms part of our Agroforestry and Farm Forestry R&D program, which aims to integrate sustainable and productive agroforestry within Australian farming systems. The JVAP, under this program, is managed by RIRDC.

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- downloads at www.rircd.gov.au/fullreports/index.html
- purchases at www.rircd.gov.au/eshop

Peter O'Brien

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Executive Summary

What the report is about

This report describes the modules and capabilities of the Farm Forestry Toolbox version 5. The Toolbox is a CD-based tool to assist landholders and extension staff to map, measure and manage woodlots and tree yield. The Joint Venture Agroforestry Program (JVAP) funded the expansion of the Farm Forestry Toolbox to include data from a broader range of species and regions of Australia and to update some features. This has extended the Toolbox applicability and availability to more regions of Australia – where plantations are now being grown and managed on private land.

Who is the report targeted at?

This report is targeted at extension staff, farm forestry coordinators, and researchers who wish to use software packages to assist appraisal and presentation of farm forestry related activities to landowners and their advisors. It is also useful background reading for farm foresters who are interested in using the Toolbox, and increasing their own skills at farm forestry project appraisal and management.

Background

Many private landholders, in many regions of Australia, are planting trees for commercial harvest and to improve active management of their land.

However, because the rotation length for most tree species often exceeds 15 to 25 years, many private land owners and growers lack the experience they have developed for their shorter-term crops often harvested on an annual basis.

A decision tool such as the Farm Forestry Toolbox can assist with data handling and analysis, and with assessing management scenarios. Optimising grower returns requires the ability to manipulate and integrate data on the land area, growth rate, management options and log products, and to carry out meaningful financial analysis, taking into account a range of possible scenarios.

Farm foresters have very limited access to either taper or growth models for the wide range of possible eucalypt and conifer species that form the major source of commercial wood products in Australia. Such models are important in evaluating regional options for species, regime and products, as well as providing analysis of site-specific tree measurement data to aid in silvicultural management.

The Farm Forestry Toolbox is a user-friendly computer package that helps forest growers to better handle a wide range of issues that must be addressed to grow trees successfully. The Toolbox was originally developed for Tasmania, but has had considerable interest from farm foresters and extension staff to expand its relevance to other regions. This project provided that opportunity.

Aims/Objectives

The objectives of this project were to:

- substantially update the Farm Forestry Toolbox through the addition of regional equations and models for plantation species in areas relevant to regions in mainland Australia
- incorporate regional feedback into the Toolbox
- provide training to regional farm forestry extension staff in the use of the updated Toolbox
- demonstrate how the expanded range of tools in the updated Toolbox can help empower farm foresters and technical advisors through user-friendly access to decision making tools

Methods used

The project involved canvassing forestry and research organisations to obtain access to relevant models. These models were then programmed into the user-friendly systems developed in the Toolbox. The specific form and coefficients of the models are “blackboxed” in the Toolbox and not accessible to the user, to protect intellectual property to the satisfaction of the model providers. However the function of the models is available to Toolbox users.

A number of other features were programmed and added to the Toolbox. These are described in the Results section below.

The project also included delivery of regional workshops to obtain feedback on the Toolbox, and to train regional officers in the use and functions of the Toolbox. The Toolbox is available on CD, with the potential for download of web-based updates in the future.

Results

Through this project, the Farm Forestry Toolbox has been substantially updated. As well as providing simple conversion tools (e.g. common on-farm and tree conversions such as acres to hectares), the Toolbox provides more sophisticated tools that assist the grower to model tree growth and integrate financial and tree products information.

There has been a substantial increase in the number of regional taper and growth models, with a choice of over 40 models relevant to regions in Queensland, NSW, ACT, Victoria and Tasmania. The AGGRO physiological model developed under an earlier JVAP funded project has been added to the Toolbox. AGGRO predicts potential plantation growth rates from user-supplied site data and Toolbox-provided climatic data for Australia's major plantation regions from West Australia through to Queensland.

There are improved mapping capabilities to allow landowners to easily record and quantify areas that have been planted.

The financial management tool has been substantially improved as cost and revenue analysis can now be analysed on a daily basis instead of only annually as in the previous version. This tool is now suitable for any type of discounted cash flow analysis.

There are enhanced data viewing, importing and exporting capabilities to link with other packages and report formats.

There is extensive on screen Help. Further assistance for users is provided on the CD via a manual and short video clips as well as a Workbook that uses the tools to provide assistance in addressing realistic tasks associated with managing a woodlot on a farm. Both the manual and Workbook can be printed from the CD and are written to provide stand alone help to an untrained Toolbox user.

5,000 copies of the Farm Forestry Toolbox version 5 compact disk have been produced and are being distributed freely to private growers and their advisors through the national network of Private Forest Development Committees (PFDCs) in the main plantation regions of Australia.

The PFDCs have contributed to the project through facilitating regional workshops attended by over 130 people in March 2007. These workshops obtained feedback on Toolbox 5 and provided regional training for a range of users who provide support for private growers in their regions.

Implications for stakeholders

As a result of this project, there is expected to be increased empowerment of regional plantation growers to quantify current tree growing options on their land, and appraise future potential.

The wide range of regionally-specific models in the Toolbox will facilitate a better quantitative understanding and consideration of value-adding options for the integration of plantations with other environmental and social benefits.

Recommendations

Based on the strong positive regional feedback from the workshops, further development of the Toolbox package is recommended. This should be based on consultation with the PFDCs to assist in the identification of priority areas for further development.

There would be little practical benefit in attempting to develop a mega software package that combined aspects of the Toolbox with other related agroforestry software products such as Imagine or AFFFM. However, future programming in all products should aim to make it easier to move information between these different packages.

Introduction

Many land owners now plant trees for both commercial and non commercial outcomes. While the aesthetic and shelter benefits are often equally important, in many cases the trees are being managed primarily to maximise the financial return from the wood products harvested through the rotation.

Because the rotation length for most tree species often exceeds 15 to 25 years, many private land owners and growers lack the experience they have developed with short-term crops that they harvest on an annual basis. In particular, to optimise grower returns requires the ability to manipulate and integrate data on the area, growth rate and possible regimes and log products and carry out meaningful financial analysis, often taking into account a range of possible scenarios. A decision tool such as Farm Forestry Toolbox can assist with data handling and analysis, and with assessing management scenarios.

Many farm foresters have very limited access to taper and growth models for the wide range of possible eucalypt and conifer species that form the major source of commercial wood products in Australia. Such models are important in evaluating the regional options involving species, regime and products, as well as providing analysis of site specific tree measurement data to aid in silvicultural management. While some regions have started to provide public domain access to models (eg Tasmania where strong industry support has been obtained for earlier versions of the Farm Forestry Toolbox), many models require integration into a decision support system to be of practical and widespread use.

The Farm Forestry Toolbox is a user-friendly computer package that helps forest growers to better handle a wide range of issues that must be addressed to grow trees successfully. The Toolbox is a collection of programs (called tools) for assisting managers of shelter belts, plantations or native forests. Among other things it offers ways to estimate:

- how much wood might grow in a pine or eucalypt plantation
- how much standing volume is available for sale now or in the future
- the volume of cut logs
- areas of current or future development.

The Toolbox was originally developed for use in the Tasmanian farm forestry context, but has had considerable interest from farm foresters and extension to expand its relevance to other regions. Many of the versions 1-4 tools are suitable for use anywhere, whilst others can be useful but need to be used with a knowledge of local conditions. This JVAP project provided the opportunity to add data and models from a broader range of regions of Australia.

The Toolbox is managed by Private Forests Tasmania, a state government authority whose objectives under an Act of Parliament include to work in partnership with private forest owners by providing advice on all aspects of forest management. The ongoing support provided by Private Forests Tasmania for the maintenance and further development of the Toolbox has been a major factor in the successful evolution of the original concept over the last decade.

The Toolbox has evolved over the past decade through four versions that have progressively expanded the tools and their level of sophistication. However, the primary focus was to provide support specifically for Tasmanian conditions. The more complex inventory equations and growth models were derived from Tasmanian datasets.

With the release of Version 4 in 2003, there have been over 5000 CDs circulated. General feedback from users outside Tasmania indicated the Toolbox was favoured because of the general usefulness of the tools and the lack of suitable alternatives. However, these users also identified the lack of suitable models for regions outside Tasmania as a shortcoming.

Consequently funding was sought from JVAP through this project to specifically expand the range of regional models and equations included in the Toolbox. There was strong support for the project provided from many of the Private Forestry Development Committees that make up the national representative network of regional farm forestry interests. In addition, models and equations were provided from a range of state forestry agencies, research organisation, industrial forestry companies and universities.

Objectives

The objectives of the project were to:

- develop – via the Farm Forestry Toolbox framework – relevant, robust and cost-effective regional decision making tools that can be used by farm foresters and their advisors
- expand the number of existing regional tree taper and growth models for as broad a range of commercial species as possible
- modularise the Toolbox framework to facilitate cost-effective distribution via the world wide web as well as via compact disk
- incorporate technology transfer as an integral part of the project through the development of on screen help and worked examples
- use structured workshop training to demonstrate the new tools via the Private Forest Development Committee staff and relevant state agency staff involved in delivering private forestry extension in the regions where the new tools will be applicable
- consider the merits of developing a single package incorporating the Farm Forestry Toolbox with two other packages - Imagine and AFFFFM. These packages are discussed in a little detail later in this report.

Methods

The innovative input/output interfaces have proven to be a critical component of the success of the earlier versions of the Toolbox as a means of making complex but essential models available to farm forestry growers and other end users.

The project involved extensive discussion with organisations and individuals who have been responsible for the development of taper or growth models that are used to provide regional volume estimates for major plantation species. A principle of the discussions was that any models provided would be encoded within the compiled version of the Toolbox so that the models could only be accessed via the Toolbox input and output screens and the model format and more specific mathematical equations would not be accessible to users. Any contribution to the project would be solely restricted to inclusion in the compiled version of the Toolbox version 5.0 generated under this project with no implied further commitment to allow access to the models.

To maintain compatibility with the Windows operating system that was announced after the original project submission had been completed, the programming for Toolbox 5 was changed from VB6 to VB.NET 2005 implementing .NET Framework 2. This provided improved programming capability with respect to the input and output screens and the use of graphical user interface, but did entail a complete rewriting of the Toolbox code.

Consequently, Toolbox version 5 has many similar screen handling operations that are consistent with those in the Windows operating system and associated Windows Office products. Feedback from the Toolbox 5 workshops held around Australia during March 2007 has confirmed that this change is welcomed by most Toolbox users.

In addition to major changes detailed in the Results below, a number of other features were programmed and added to the Toolbox. These were: an expanded set of conversion factors; addition of the Brereton method for log volume calculation in response to a user request; increased clarity and updating of graphic displays; an enhanced stocking calculator; increased reporting capability for inventory measurements; and the additional use of graphics for reporting.

The project also included delivery of regional workshops to obtain feedback on the Toolbox, and to train regional officers in the use and functions of the Toolbox. The Toolbox was to be made available on CD, with the potential for download of web-based updates in the future.

Results

Toolbox features and capabilities

This project has produced the Farm Forestry Toolbox version 5. This is a substantial update. Table 1 summarise the range of tools in version 5 (see also Figure 1). As well as providing simple conversion tools (e.g. common on-farm and tree conversions such as acres to hectares), the Toolbox provides more sophisticated tools that assist the grower to model tree growth and integrate financial and tree products information.

Substantial updates are:

- the Survey tool allows an image (such as a scanned aerial photo or map) to be easily positioned with its correct eastings, northings and scale and then used in the background, so that areas can be digitised quickly from the image (see Figure 2). Areas are calculated easily and a scaled map can be annotated and printed
- there has been a substantial increase in the number of regional taper and growth models that can be used with the Inventory and Stand Manager tools, with a choice now of over 40 models relevant to regions in Queensland, NSW, ACT, Victoria and Tasmania. Table 2 lists the species for which volume equations are available in Toolbox version 5.
- the Stocking tool will now handle a wide range of simple or complex layouts
- the PROMOD site productivity tool has been replaced by AGGRO, a model developed under an earlier JVAP funded project. This is a physiological model that predicts potential plantation growth rates using user-supplied site data (Hensken et al. in press) and Toolbox-provided climatic data for Australia's major plantation regions from West Australia through to Queensland
- cost and revenue events can now be specified to the day enhancing the sophistication of financial management regardless of whether a suitable growth model is available, as the user has the option to specify all the modelled costs (see Figure 3). This makes the financial analysis component of the Stand Manager suitable for any type of discounted cash flow analysis
- enhanced preview options for all print outs (see Figure 4)
- increased flexibility with data input and output via Excel spreadsheets to link with other packages and report formats
- updates to the Toolbox can be easily incorporated into Version 5 installed from the CD, by downloading a file from the Private Forests Tasmania website. This same update procedure has worked effectively as the primary means of updating previous versions of the Toolbox.

Figure 1 The main menu of Farm Forestry Toolbox version 5

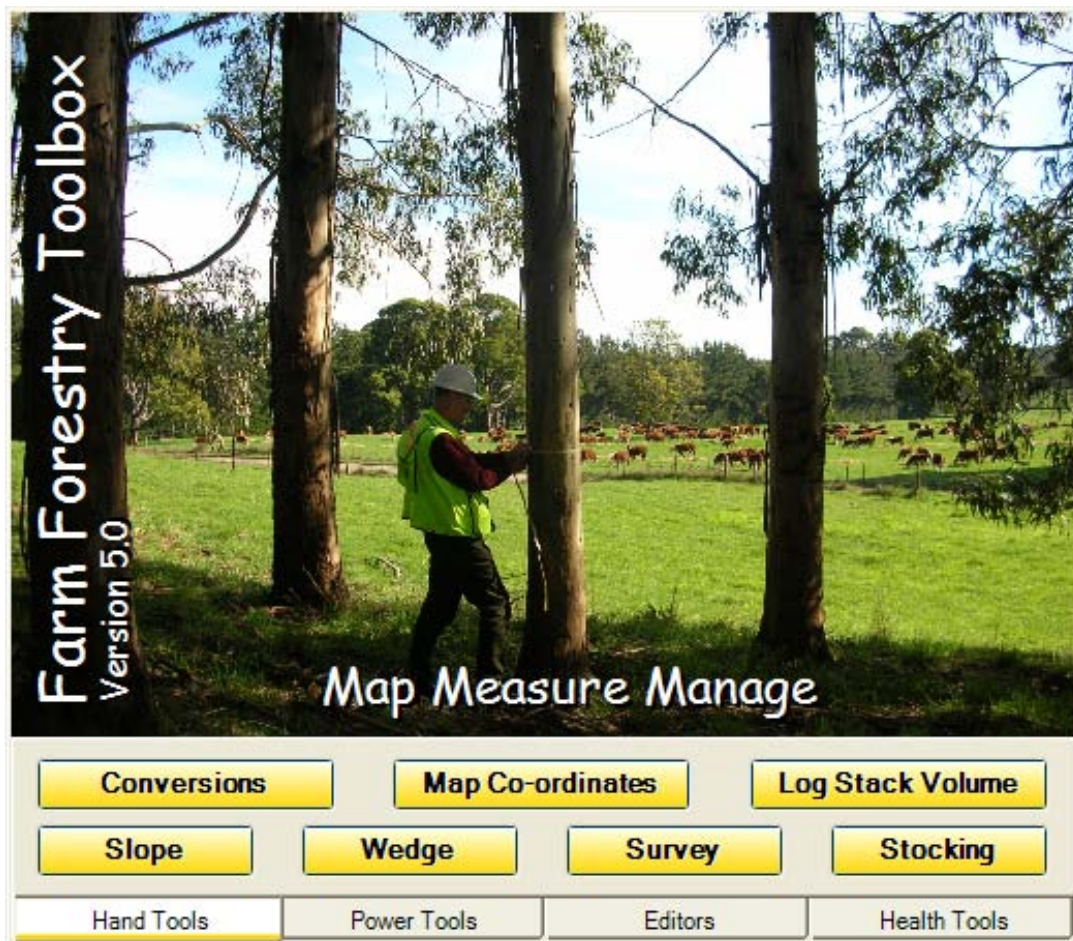


Figure 2 The Survey tool can be used to calculate and annotate areas using an aerial photograph or satellite image in the background



Table 1 General description of the tools in Farm Forestry Toolbox version 5

Hand Tools	
Tool	Description
Conversions	Converts common standard units of measurement including area, length, volume, weight and slope.
Map-Coordinates	Converts geographic and map grid coordinates on various datums.
Log Stack Volume	Estimates volume and weight of an individual log or a stack of logs. Calculates and presents a statistical report for a stack of logs. You can save and print the output.
Slope	Resolves slope distance into horizontal and vertical components.
Wedge	Allows you to calibrate an angle gauge instrument in order to undertake an angle count inventory as part of a statistically-based assessment process to estimate the standing volume of timber.
Survey	Enables you to map, annotate and calculate areas, using either traverse or GPS coordinates, or by directly digitising onto the screen over a background image or scanned map.
Stocking	Calculates the number of trees per hectare using the distance between trees and between rows. It can also account for complex block planting.
Power Tools	
Site Productivity	Estimates (for selected species) site quality and indicates plantation growth over time. You can save and print the output.
Inventory	Find out how much wood and what log grades there are in a single tree, a plot of trees, or your whole forest. This tool operates at (1) a single tree level in which data may be printed but not saved to computer and (2) plot level in which data may be saved and printed. The tool also allows you to display information graphically and to import and export data.
Stand Manager	Uses information from various sources to track income and expenditure over the rotation of your forest. It calculates both Net Present Value (NPV) and the Internal Rate of Return (IRR). The tool allows you to test the many different management scenarios you may be considering, thus assisting you in strategic management decision making. Information may be saved, printed and exported.
Editors	
Log Grade	Used to specify the sets of log grade specifications.
Default Data	Sets system-wide default values for various parameters.
Regime	Used to construct a sequence of forest operations.
Health Tools	
Incorporates three tools to help you identify health problems in (1) plantation grown eucalypts, (2) plantation pines and (3) other native forest.	

Table 2 Species for which a volume equation is provided in Farm Forestry Toolbox version 5

Species	Common Name
<i>Acacia dealbata</i>	Silver Wattle
<i>Acacia melanoxylon</i>	Blackwood
<i>Araucaria cunninghamii</i>	Hoop Pine
<i>Corymbia gummifera</i>	Red Bloodwood
<i>Corymbia maculata</i>	Spotted Gum
<i>Eucalyptus agglomerata</i>	Blue-leaved Stringybark
<i>Eucalyptus amygdalina</i>	Black Peppermint
<i>Eucalyptus badjensis</i>	Big Badja Gum
<i>Eucalyptus camaldulensis</i>	River Red Gum
<i>Eucalyptus cypellocarpa</i>	Mountain Grey Gum
<i>Eucalyptus dalrympleana</i>	Mountain Gum
<i>Eucalyptus delegatensis</i>	Alpine Ash
<i>Eucalyptus elata</i>	River Peppermint
<i>Eucalyptus fastigata</i>	Brown Barrel
<i>Eucalyptus fraxinoides</i>	White Mountain Ash
<i>Eucalyptus globoidea</i>	White Stringybark
<i>Eucalyptus globulus</i>	Tasmanian Blue gum
<i>Eucalyptus grandis</i>	Flooded Gum
<i>Eucalyptus muelleriana</i>	Yellow Stringybark
<i>Eucalyptus nitens</i>	Shining Gum
<i>Eucalyptus obliqua</i>	Stringybark
<i>Eucalyptus paniculata</i>	Grey Ironbark
<i>Eucalyptus pauciflora</i>	Snow Gum
<i>Eucalyptus pilularis</i>	Blackbutt
<i>Eucalyptus piperita</i>	Sydney Peppermint
<i>Eucalyptus regnans</i>	Swamp Gum
<i>Eucalyptus saligna</i>	Sydney Blue Gum
<i>Eucalyptus scias</i>	Large-fruited Red Mahogany
<i>Eucalyptus sieberi</i>	Tasmanian ironbark
<i>Eucalyptus smithii</i>	Gully Gum
<i>Eucalyptus viminalis</i>	White gum
<i>Nothofagus cunninghamii</i>	Myrtle Beech
<i>Pinus caribaea</i> var <i>hondurensis</i>	Caribbean Pine
<i>Pinus radiata</i>	Radiata Pine
	Oil mallee

Figure 3 The Regime Editor tool used to set up a regime of costs and revenues over time

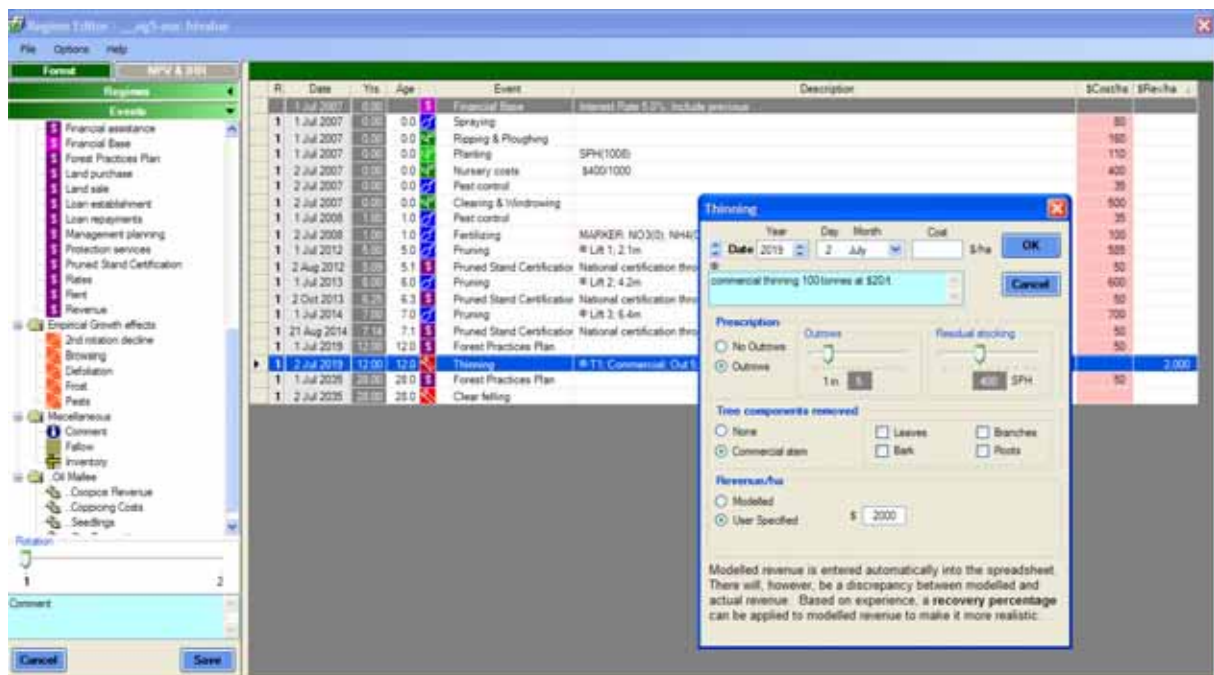


Figure 4 The print preview option in the Survey tool helps get the right output



Obtaining copies of the Toolbox

5 000 copies of the Farm Forestry Toolbox version 5 compact disk have been produced and are being distributed freely to private growers and their advisors through the national network of Private Forestry Development Committees (PFDCs) in the main plantation regions of Australia.

Because of the modular development of Toolbox 5, updates will be able to be downloaded from the Private Forests Tasmania website in a similar manner to that used for previous Toolbox versions. This may provide a means for supplementing the models should suitable additional models become available. The large size of image libraries and datasets required by some of the tools precludes offering the Toolbox package by web downloads. The difficulty of high speed download access by many farm foresters in more remote rural areas also contributed to the decision to provide the Toolbox on a CD that was self sufficient.

Instruction on use of the Toolbox

The Toolbox must be installed from the CD onto the hard disk of a computer, via a self managing install program that is commonly used for most Windows-based applications. In every day use, the Toolbox opens up to the screen as shown in Figure 1. This shows the four main tabs (Hand tools, Power tools, Editors and Health tools). On each tab screen there are labelled buttons that take the user to a specific tool. The tools and their main function are outlined in Table 1.

There is extensive on screen Help. There is further assistance for users on the CD with a manual and short video clips as well as a Workbook that uses the tools to provide assistance in addressing realistic tasks associated with managing a woodlot on a farm. Both the manual and Workbook can be printed from the CD and are written to provide stand alone help to an untrained Toolbox user.

The on screen help together with the manual, video clips and Workbook on the CD, make it easy for anyone with a basic knowledge of computers and farm forestry to use the Toolbox. Even non-foresters will find the Toolbox useful, as the Conversion tool, the Survey tool and the farm financial calculator in the Stand Manager are generic and able to be used for other farm purposes. Feedback from users of earlier versions suggests that very little, if any knowledge of either farm forestry or computing is necessary to use many of the Hand tools.

The Workbook provides detailed instructions that take the user through each step in a practical example that demonstrates how some of the more sophisticated tools can help with on farm tree management. There are worked examples covering:

- drawing a map and calculating areas on the farm using an aerial photograph or satellite image
- keying out major pest, disease and nutrient problems for some of the major eucalypt and pine species planted in SE Australia. Information on the identified problem can be printed out with detailed colour images
- calculating potential wood products from a woodlot based on measuring some trees in a plot and entering the information into the Inventory tool. This can be combined with data on the value of different log products entered to provide detailed revenue information on the stand
- financial analysis (Net Present Value, Internal Rate of Return and cash flow) for information entered on the costs and revenues for any range of information. This is particularly useful for comparing different land use options that involve costs and revenue streams over different time periods.

Regional delivery and training

5 000 copies of the Farm Forestry Toolbox version 5 CD have been produced and are being distributed freely through the national network of Private Forestry Development Committees (PFDCs) in the main plantation regions of Australia. PFDC contact details are available on the web at <http://www.daff.gov.au/forestry/plantation-farm-forestry/pfdc>

Fourteen (14) regional workshops were held in March 2007 to obtain feedback on Toolbox 5 and to provide regional training for a range of users who provide support for private growers in their regions. The PFDCs contributed to organisation and advertising of these workshops. The PFDCs provide a national network of staff who have excellent links within their region to private growers. They also have, as a major component of their goals, to support the expansion of plantations on private land through better management practices, marketing and grower understanding.

The Workshops were held in Tasmania (2), Victoria (3), South Australia (2), Western Australia (4) and NSW/ACT (3), with 2 PFDC representatives from Queensland attending the Melbourne Workshop. In total over 130 people attended the Workshops including PFDC representatives, farm forestry extension staff and growers. See Appendix for details on the Workshop locations.

Discussion of the Results

The Farm Forestry Toolbox version 5 has been successfully developed as a compact disk computer package. It contains user-friendly tools that help forest growers to better handle a wide range of issues that must be addressed to grow trees successfully. As well as providing simple conversion tools, there are also more sophisticated tools that assist the grower to model tree growth and integrate financial and tree products information, as well as assist with area surveying and mapping and identifying tree pest and disease problems.

The concept of “**Map Measure Manage**” has been a key driver behind the development of the enhanced capability that this project has been able to build into Toolbox version 5. This concept was endorsed by the many extension staff who attended the regional Toolbox version 5 workshops held during March 2007.

The Farm Forestry Toolbox version 5 provides a suite of tools to assist the user to:

- **Map** the areas of interest and automatically have the area calculated. The Survey tool can annotate the map, display and print it at a wide range of scales, and shapes can be transferred to and from GIS packages for integration into regional or other farm plans
- **Measure** the trees and analyse the information on volume and value. The Inventory tool can calculate the volume of user-defined log grades and their value for a tree, a plot or a stand using a wide range of equations that cover most of the major commercial plantation species common in farm forestry in most states.
- **Manage** the financial analysis to help identify the impact on grower returns from different options. There are growth and yield models that can help identify the financial impact of pruning and thinning decisions, although seeking professional advice may be necessary to ensure the analysis of more complex output is accurate and based on sound assumptions.

Integration of Toolbox 5, Imagine and AFFFFM packages

There are a range of farm forestry decision tools available, and it is not always clear how they differ, or in which situations each should be used. Funding organizations such as JVAP are also interested in how each tool differs, whether the toolboxes can be combined, and whether there are cost-efficiencies in doing so. This section addresses the different capabilities of the Farm Forestry Toolbox 5, Imagine and AFFFFM packages.

The following discussion provides some context for the final project objective. This was to consider the merits of integrating two existing farm forestry packages into the Toolbox framework.

The overview comments relate to some aspects of Imagine (based on the software and the User Manual Version 1 September 2002 by Amir Abadi and Don Cooper) and AFFFFM (based on the software and the Manual for Australian Farm Forestry Financial Model, July 2004 by Nick Emtage and John Herbohn) with respect to the Farm Forestry Toolbox version 5 (cited as the Toolbox in the discussion below). The comments should not be regarded as a detailed appraisal of any of the packages. Each package occupies a substantially different part of the spectrum of packages that aim to help manage farm enterprises that involve trees. All three packages can provide useful assistance to users who have the necessary input information required by each package.

Imagine

Imagine was developed in a West Australian context and is defined in the Overview to the package as “... a business analysis tool for the evaluation of various agricultural and agroforestry land use systems.” It provides a modelling environment rather than models and this underlines an important difference from the Stand Manager tool in the Farm Forestry Toolbox that generally achieves the same outputs as Imagine, but only for user defined wood products.

Imagine provides a framework for the user to enter specified costs and revenues and also user-defined yields for user-defined products. As such it allows for a wide range of data to be manipulated for both woody and herbaceous crops, without including any growth or yield models in the package. However, for most commercial plantation forestry applications, the user will often not be able to predict the likely log types or specific yields and how these will vary depending on rotation length and site quality. The Toolbox incorporates a range of regional models to assist the user in quantifying the volumes and values for a specified regime, species and site quality.

The Toolbox has a set of interacting tools involving site quality, regime, log grade, financial data and an infinite number of user-defined costs and revenues that combine to provide a sophisticated financial management analysis tool subject to the availability of suitable data.

Imagine has the capability to carry out sensitivity analysis to a more sophisticated degree than the Toolbox. While Toolbox version 5 includes enhanced ease of incorporating data to and from other packages via a spreadsheet interface, the complexity of developing more seamless data exchange with Imagine would require substantial additional programming.

Imagine uses the extensive inbuilt functions of the Excel spreadsheet package that must be purchased from Microsoft in addition to the operating system, whereas the Toolbox is a fully self contained executable program that does not require any such additional software to run under Microsoft's operating system. The complete Imagine package would need to be re written to run in Toolbox - it is not simply a matter of "bolting" Imagine on to the Toolbox framework.

Imagine also uses Excel for user input and output and while this format is good for tabular data entry and analysis, Toolbox uses high level graphical interfaces to facilitate user input and also understanding of output.

Imagine will only allow up to 5 user defined parameters to be included in certain cost and revenue classes, whereas the Toolbox already has the capability for an infinite number of user defined categories and associated costs and revenues.

As noted in the Manual, Imagine is well suited to "evaluating alternative land use strategies that can be specified for a block of land. The block may be one or several farm paddocks. It is possible to allocate land to any sequence of cropping or livestock enterprises. The structure of the database of *Imagine* and its computational framework is designed to allow a broad range of agro-climatic or edaphic situations. In *Imagine*, project life, or evaluation period for the specified land use strategy, can range from one to 50 years. Enterprises can vary from annual species of crops or pastures, such as wheat, to perennial species such as lucerne or tree crops. Alternative land uses can be arranged in alley or block configurations."

AFFFM – The Australian Farm Forestry Financial Model

Based on the documentation in the Manual, the AFFFM was designed "to account for the financial effects of timber plantation development or of developing forestry activities in native forests on an individual farm, taking into account changes that occur to agricultural activities due to those developments and the financing costs and revenues of the farm enterprise." It includes livestock, crop and other farm-based financial data as well as forest-based data. It is written in Visual Basic 6.

The AFFFM provides a different window into managing a mix of trees and agricultural activities from Imagine. It allows the integration of forestry and farm activities, with a % change determining the interaction, or by user entered values for either tree growth or livestock DSE.

AFFFM uses defined products and growth (merchantable MAI) rates for a selected range of species in the area of interest (northern NSW/SE Qld). It has built-in allocations of products that can be changed manually by the user – prices must be entered by the user. There are some limitations on the flexibility – eg plantations in a scenario are all of the same size. The user must provide detailed data on MAI and other species and site dependent parameters that may be difficult to obtain. Variations in

these parameters may have a substantial impact on both the timing and magnitude of returns and this may limit the usefulness of the package to some users. There is considerable freedom for the user to define the impacts associated with interrelated activities such as grazing under trees etc.

The merchantable MAI approach and the use of % of harvest or logs to identify product volumes is again a generalised approach that does not take into account the variation in tree size or allow for sensitivity analysis associated with model predictions that grow a tree an extra year or so.

Analysis of roles

The Toolbox provides farm forest management analysis at a more detailed level than either Imagine or AFFFFM. The Toolbox incorporates specific models that have been statistically developed and are incorporated into tools that can include analysis based on taper changes. This is important as taper changes can have a major influence on high value product recovery and consequently on grower returns. Some models also take into account the impact on product output that may result from changing pruning or thinning management. Changes to these factors are important to a grower as they can help in understanding the financial implications of different management regimes.

The Toolbox approach uses models to provide useful information to help the grower identify the financial and product implications that can substantially influence the timing of and revenues from harvest. For example, determining the impact of letting the trees in the stand increase their diameter by a few centimetres may increase the financial return by moving some logs in the lower part of the tree into a more valuable product. This can be carried out as an individual action and the results considered by the user in a simple interactive manner, or this information can be based on actual measured plot data or on stand growth models that can then be incorporated into the total stand financial analysis via the Stand Manager tool.

Imagine, AFFFFM and the Farm Forestry Toolbox all aim to help land managers better understand the complex growth and financial interactions associated with growing trees (e.g. Abadi et al. 2006; Harrison and Herbohn in press).

However, they are all based on providing assistance with respect to different components of the agroforestry spectrum. The integration of these three products into one package would require substantial changes to the input and output screens and a large amount of additional programming, as the Toolbox is written in VB.NET 2005 implementing .NET Framework 2. This would be challenging if the aim were to design an integrated user-friendly interface as each of the packages is inherently different in the way that it interacts with the user. In addition the overheads in setting up the base information may mean that the aggregated package would require a greater amount of data storage and processing speed that could restrict some potential users who only had access to more limited computing hardware. It is probable that there would be only a limited number of users that would be able to comprehend and successfully utilise the combined package, thus restricting the usefulness of the package.

The cost to combine the models based on the above considerations is very difficult to estimate. It would depend on the availability of specialist staff with good experience and an understanding of each package (preferably members of the original development teams), but would be expected indicatively to exceed \$75,000+, based on planning and development (\$10,000+), programming (\$50,000+), Beta testing and workshopping (\$10,000+) and some travel expenses (\$5,000+) for the relevant specialists to meet with the Toolbox programmer in both planning and testing phases. A more detailed budget estimate would require consultation between specialist staff associated with each package.

Based on this overview, from the perspective of the Farm Forestry Toolbox, it would appear that there would be little practical benefit in attempting to develop a mega package that tried to combine aspects of the three packages. However, future programming in all packages should aim to make it easier to move information between different packages. It may be possible to develop user friendly modules that convert the wood product output from say the Toolbox so that it can be used as part of the input for Imagine. However, it may be more cost effective and practical for agroforestry packages to have

the built in capability to export or import data into a common data package such as Excel (for spreadsheets) or Access (for more complex databases). Enhancements in Toolbox 5 have substantially increased the ability to easily export information to Excel from all of the more sophisticated Power tools (Inventory, Stand Manager, Site Productivity).

In summary,

- The Farm Forestry Toolbox
 - provides a powerful mapping tool to make it easier to include accurate area information in scaled maps and financial analysis
 - incorporates many regional models to assist users to quantify wood products and their value at the tree, plot or stand level
 - can link the area and wood product results with financial information to provide analysis that takes into account different cash flows over time for multiple rotations.
- Imagine
 - provides a framework for the user to enter specified costs and revenues and also user-defined yields for user-defined products. As such it allows for a wide range of data to be manipulated for both woody and herbaceous crops, without including any growth or yield models in the package.
- AFFFM
 - has built-in allocations of products that can be changed manually by the user – prices must be entered by the user. The user must provide detailed data on growth and other species and site dependent parameters
 - has considerable freedom for the user to define the impacts associated with interrelated activities such as grazing under trees etc.

Implications

As a result of this project, there is expected to be increased empowerment of regional plantation growers to better quantify current and also appraise potential future tree growing options for their land. The interest from the 13 regions who have already participated in workshops, and from national agencies such as DAFF, AFG and Greening Australia bodes well for ongoing support by farm foresters and their extension support systems for user friendly tools – as a means of enhancing the uptake and use of technology transfer from farm forestry research.

The common platform provided by the Toolbox, together with its wide range of regionally specific models, will facilitate a better understanding and consideration of value-adding options for the integration of plantations with other environmental and social benefits.

Recommendations

Based on the strong positive regional feedback from the workshops, further development of the Toolbox package is recommended based on consultation with the PFDCs to assist in the identification of priority areas for further development.

There would be little practical benefit in attempting to develop a mega software package that tried to combine aspects of the Toolbox with other related agroforestry software products such as Imagine or AFFFM. However, future programming in all products should aim to make it easier to move information between different packages.

References

Abadi, A., Lefroy, T., Cooper, D., Hean, R. and Davies, C. (2006) Profitability of Agroforestry in the Medium to Low Rainfall Cropping Zone. RIRDC Publication No 05/181, Rural Industries Research and Development Corporation, Canberra.

Hensken F.L., Battaglia, M. and Ottenschlaeger, M.L. (in press) Silvicultural Decision Support for Farm Forestry: predicting tree growth in farm forestry and following thinning. A report for the Joint Venture Agroforestry Program, RIRDC

Harrison, S. and Herbohn, J. (eds) (in press) A Whole-Farm and Regional Agroforestry Decision-Support System. A report for the Joint Venture Agroforestry Program, RIRDC

Appendix

List of regional toolbox workshops held during March 2007.

Workshop Location	State	No. of Attendees
Launceston	Tasmania	10
Launceston	Tasmania	14
Melbourne	Victoria	12
Ballarat	Victoria	11
Traralgon	Victoria	8
Albury	NSW	6
Lismore	NSW	7
Canberra	ACT	11
Esperance	WA	7
Albany	WA	9
Bunbury	WA	8
Northam	WA	12
Adelaide	SA	8
Mt Gambier	SA	9