

FINAL REPORT

ON THE PROJECT

THE EXTENSION OF THE GRASSGRO[®] MODEL AS A DECISION SUPPORT TOOL IN ASSISTING PRODUCERS TO MANAGE CLIMATE VARIABILITY

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A REPORT TO THE AUSTRALIAN DEPARTMENT OF
AGRICULTURE, FISHERIES AND FORESTRY



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Executive Summary

Grazing systems are very complex and it is very difficult for producers, land managers and advisors to accurately predict without the use of simulation modelling the management changes due to changing economic conditions or climate.

This project aimed to use the decision support system (DSS) GrassGro[®] developed by CSIRO to assist producers to manage climate variability.

The project conducted by the Monaro Farming Systems group used GrassGro[®] to develop and publish Seasonal Outlooks for their members outlining the likely seasonal conditions for the following months, the options available to land managers and the financial and sustainability consequences to their farm business.

MFS trained a group of their members in how to use GrassGro[®] with the future aim being that these farmers will share the results of their modelling with their peers.

A survey of MFS members was conducted to evaluate the success of the project. The results of the survey showed that the farmers thought that the project was a success with all farmers wanting to receive the seasonal outlooks in the future with a minority prepared to pay for this information. Two farmers had changed their management as a result of the project and one said that this financially was a benefit of \$50,000.

The project has achieved its goal of having farmers trained in the use of GrassGro[®] and these farmers have made a commitment to continue using the program into the future and share ideas with their peers which has increased the community capacity of the region in the use of Decision Support Systems.

NSW DPI has indicated it intends to expand seasonal outlooks for various parts of NSW based on the quality of information that had been presented in this project to MFS members by Doug Alcock.

Introduction

Grazing systems are very complex and due to variable economic conditions and climate it is very difficult for producers, land managers and advisors to accurately predict the impact of management changes without the use of simulation modelling.

CSIRO has developed a unique Decision Support System (DSS) program called GrassGro[®] which examines strategic management decisions on farming systems or can be used to examine the effect of anticipated weather conditions within a growing season. GrassGro[®] provides powerful facility for analysing risk (climatic, economic and environmental) over both the short and long term. CSIRO have updated the GrassGro[®] model to include the impact of increasing atmospheric CO₂ and developed a new weather generator that will allow the impact of projected climate change on pasture systems to be modelled.

The use of decision support tools can play an integral role in ensuring a viable farm management system to allow landholders to manage in a changing climate. This project aimed to increase the number of landholders with the skills and knowledge to incorporate GrassGro[®] as a management tool to examine strategic, operational land management decisions based on sound risk management principles.

GrassGro[®]'s strength is that it enables land managers to see the “big picture” and take a holistic approach to land management. Producers are able to evaluate the impact certain management decisions will have on their business enterprise before committing resources. The project created confidence in land managers and encourage ownership of the process by directly engaging individual producers to utilize their own climate and production records. This direct involvement was more likely to result in appropriate practice change. Properly trained individuals can run simulations unaided thereby becoming self-sufficient and increasing the skilled resource base for Monaro farmers which will contribute to the shift of the wider farming community to increased self-reliance.

Initial research work conducted by NSW DPI with assistance from the Southern Rivers CMA has now validated the GrassGro[®] model for native pasture systems in the Monaro environment and this project has allowed graziers to utilise the model in real situations and on-farm applications as a planning tool.

Project objectives

This project had the following objectives;

(1) Develop and deliver interactive, educational sessions to Monaro landholders at critical/strategic times of the year (March and Aug/Sept) to analyse and evaluate GrassGro[®] simulations. These sessions will assist landholders to make enterprise shift choices, identify strategies to plan for increased seasonal uncertainty as well as manage stock numbers and supplementation based on pasture growth predictions during these critical periods of the season. Overall, these sessions aim to encourage landholders to make more informed and tactical decisions as well as respond constructively to atypical seasonal events such as prolonged drought and variations in rainfall seasonality;

(2) Deliver a public Climate Change Forum in conjunction with Monaro Farming Systems (MFS) partners who will discuss and explore future climate change predictions at a local level as well as the possible consequences for production and management. The Forum will demonstrate the applications of decision support tools like GrassGro[®] to help farm businesses adapt and prepare for change while also capturing productivity gains.

(3) During the final phase of the project, be able to electronically transfer relevant GrassGro[®] “farm system files” to members which will deliver relevant/targeted reports of predicted pasture growth curves and animal performance for the representative soil types, based on climate/weather data inputs;

(4) Deliver training sessions to increase the number of landholders on a regional basis who are able to utilise this software directly into their farm enterprise systems and also then demonstrate the benefits of this technology to other landholders.

(5) Use the GrassGro3[®] model to analyse MFS research trial data which will value add onto existing experimental trials.

An aim of the project was that all education and training related activities, one-on-one discussions, group discussion/feedback, individual interaction and workshops and problem solving sessions will be documented and disseminated to stakeholders and the wider community via regular reports, newsletters, publications, and print media outlets. Findings from the project were to be presented at MFS field days and local NSW DPI field days as well as regional Landcare meetings and potentially through consultant networks. MFS will also disseminate its findings via links to other farming systems groups. The training component will also give producers the skills and the confidence to assist and encourage other landholders to utilise GrassGro3[®] modelling as a planning tool. Given the strong and expanding track record of technology uptake by Australian farmers, the conversion to practical solutions should be excellent.

Method

GrassGro[®] is based on decades of field experimentation from across Australia. Behind the GrassGro[®] interface, inputs of historical daily weather data drive models of the interacting processes of pasture growth and animal production. Day-to-day changes in water content of soil, pasture growth and decay and responses to grazing are simulated for a chosen enterprise. Validation studies have helped to refine the models over time, and have generally indicated that the models underlying GrassGro[®] accurately reflect the key processes and outcomes in real grazing systems of temperate Australia. GrassGro[®] is composed of a number of **sub models** which interact together to produce evidence based analysis;

1. **Historical daily weather database** -data for sunlight, rainfall, temperature, evaporation, wind speed;
2. **Soil Physical parameters** such as depth, water holding capacities, bulk densities etc. These feed into the water balance in the soil.
3. **Soil Water Balance model** -measures rainfall, transpiration rates, soil evaporation, interception run-off, infiltration, and drainage capacities for the different soil horizons;
4. **Pasture model** which is biomass based allows multiple species to coexist. The processes modelled include; temperature responses, water use, light capture, general soil fertility, plant growth patterns, and stress responses to factors (e.g. frost, water logging).
5. A **Ruminant model** - Based on the *Feeding Standards for Australian Livestock: Ruminants* (Freer 1990; Freer *et al.* 1997) which incorporates potential and relative daily feed intakes, energy and protein needs and mortality;
6. **Management & Economics** models which for five livestock enterprises, identify **key** profit drivers, for example Stocking rate, Reproductive management etc. This model also has the capacity for Gross margin calculations which factors in long-term average and year-to-year variability.

Involvement of MFS members in the project

The project approach was;

- to select a core group of interested Monaro Farming System (MFS) members who would be trained to use GrassGro[®] so that they would be able to model their farm systems and to be advocates within the rural community for GrassGro[®]
- all MFS members would receive seasonal updates in the MGFS Newsletter and be invited to meetings to be updated on the GrassGro[®] project and presentations of the Seasonal Outlooks.

The project was endeavouring to use the principles of the Capacity Building Framework/ladder (Noya *et al.* 2009) which provides a structure for on-going motivation and change management by optimising information access, programmed learning, empowerment, mentor guidance and technology development.

Chronology of events

a. Core Group

- January 2010
Deep Soil Pits Dug and soil samples collected by Doug Alcock & Luke Pope, NSW DPI, Cooma to enable local soils to be categorised for depth, water holding capacities, bulk densities for use in GrassGro® simulations for local areas.
- 1st March 2010 Official start date of MFS GrassGro® Project.
- April 2010
Analysis results of all deep soil cores received back from laboratory.
- 2010/2011 (ongoing)
SILO weather data sets bought from SILO for core group GPS coordinates.
- May 2010
GrassGro® software purchased from Horizon Agriculture
 - 10 individual CD installations (12 month license)
 - 2 site licenses (owned by MFS, 3 year license)
 - 1 MFS master copy of GrassGro3® (unlimited license)
- May 7th 2010
A GrassGro® breakfast was held at Nimmitabel where the project was introduced and model applications explained by Doug Alcock, NSW DPI, Cooma and expressions of interest were received for training in how to use GrassGro® training. 34 people attended this breakfast.
- May 24th and 25th 2010
A training workshop was held at Cooma delivered by Andrew Moore and Neville Hermann, CSIRO, Canberra with assistance from Doug Alcock, NSW DPI, Cooma.
- Starting June 2010 and completed Dec 2011
Setting up “farm systems” for core group using deep soil core information, A one-on-one with Doug Alcock with core group members.
- Core group meetings with Doug Alcock
 - July 29th 2010, Nimmitabel
 - 30th March 2011, Nimmitabel

In the three months prior to these meetings Doug Alcock had one-on-one visits with all “core-group” farmers to get their GrassGro® farm systems established for their soil and pasture type.

At the 30th March meeting, Doug Alcock had discussed the Climate change capabilities which are built into GrassGro® (12 attendees).
- 4th May 2012
Breakfast meeting at Nimmitabel - Doug Alcock, including discussion of best way forward to extend GrassGro® messages

b. MFS members

- 14th September 2009
Dr Andrew Moore, CSIRO, Canberra showed how GrassGro® could use the data from the Monaro grasslands trials for his presentation entitled “Modelling Monaro Native Pastures”
- May 14th 2010
A GrassGro® presentation which explored the issue –“What is the future role of the ewe on the Monaro”. This session used GrassGro® to critically analyse different strategies to assist decision making regarding ewe enterprises from a profitability perspective and to examine profit drivers within current ewe enterprises. Attendance 40

- September 2010 – Official Launch of Project GrassGro® presentations by Stuart Burge, Private Agronomist, Cooma (prospects for spring) and Oli Cay, Farmer, Bungarby (Time of lambing). Hon. Dr Mike Kelly, AM MP, Parliamentary Secretary for Agriculture, Fisheries and Forestry(DAFF) officially launched the MFS GrassGro® project with the Hon. Steve Whan, NSW Minister for Primary Industries launched the MFS Research & Development Plan. Approximately 20 people attended the launch.

c. GrassGro® Seasonal Outlooks

- 20th May 2011 – Stuart Burge – Workshop presentation plus Newsletter
- 31st October 2011 - Stuart Burge – Newsletter
- 8th September 2011 - Doug Alcock – Workshop at MFS Annual General Meeting
- 29th November 2011 - Jim Shovelton – Workshop presentation.
- December 2011 - Doug Alcock – Newsletter.
- March 2012 – Doug Alcock – Newsletter (a meeting had been planned but had to be cancelled due to heavy rain).

d. Other Meetings

- MFS hosted a Climate Change/Carbon Pricing Forum, entitled “Carbon Day Out 2” held on the 29th June 2011 at which there were over 200 attendees.
- At the 2010 MFS AGM – Doug Alcock and Phil Graham, NSW DPI presented an Enterprise analysis using a Grassgro® simulation which had used a Monaro farm systems for relevancy to MFS members.

Evaluation

It was decided to evaluate the MFS GrassGro® project in three ways;

- By surveying all MFS members about the GrassGro® Project from their experience at MFS Meeting or MFS newsletters
- By surveying MFS Core group members on their experience of the training and use of GrassGro®.
- Holding a discussion at the Core Group meeting on the 4th May 2012 as to the best way to extend GrassGro® into the future.

Survey of all MFS members

The survey was mailed on the 8th April 2012 to 43 members of MFS with a request that the survey be returned by the 27th April 2012. Surveys were also sent to the three presenters of Seasonal Outlooks to gauge the project from their perspective. Doug Alcock was the only presenter to complete the survey.

The survey was of nine questions in length and aimed to acquire both quantitative and qualitative data, with the majority of questions being open to allow respondents to answer as honestly as possible.

The number of respondents from both groups was disappointing given the value that the MFS have already and will gain into the future.

Results

The survey results are presented with some comments as well as comments from respondents wherever possible.

- Replies
10 MFS members replied to the survey which was 27.9% of possible replies. Two members who replied stated that they were unable to complete the survey as they were new members of MFS and therefore were not sufficiently briefed on the GrassGro[®] to complete the survey.
- Q1. Could you briefly explain your understanding of the MFS GrassGro[®] project?
Most of the respondents had a good understanding of the GrassGro[®] project and the aims of the project.
 - *The project was to assist land managers in management choices of land management and financial opportunity via comparing currently/or recent climatic and seasonal conditions against historical data to help predict probabilities of certain seasonal conditions to unfold, assisting decisions with each possible scenario.*
 - *To give access to computer simulated farm system with economic and sustainability outcomes.*
 - *Try to match farm management goals with seasonal variability and land types across the Monaro using the GrassGro[®] Program to simulate data.*
 - *Extension of GrassGro[®] as a support tool on the Monaro.*
- Q2. One aspect of the GrassGro[®] project was to provide Seasonal outlooks to MFS members and presented at an MFS meeting and/or published in the MFS Newsletter.

a. In the following table can you please tick when the seasonal outlooks were presented or receiving them via the MFS Newsletter and whether you remember them or not?

Seasonal outlooks were prepared by 3 persons. Members remembered some seasonal outlooks better than others with the highest rated seasonal outlook (December 2011) being the one most remembered

Date	Presenter	Meeting	Newsletter
May 2011	a	5	4
Sept 2011	b	7	3
Oct 2011	a	1	4
Nov 2011	c	5	5
Dec 2011	b	No meeting	10

b. Could you rate the usefulness of the seasonal update on a scale of 1-10 where 1 was not useful and where 10 was extremely useful?

Date	Presenter	Rating
May 2011	a	5.1
Sept 2011	b	7.3
Oct 2011	a	5.6
Nov 2011	c	3.5
Dec 2011	b	7.4

It can be seen that MFS members clearly differentiated between what they considered better seasonal outlooks which can also be seen in the comments on the rankings. Clearly the ranking for presenters was for presenter b followed by presenter a and then presenter c with the December 2011 seasonal update being the highest ranked of five the seasonal outlooks.

- Q3. Could you please explain the reasons for your ranking of the Seasonal rankings?
The respondents valued timely, in-depth and relevant seasonal outlooks. Detailed use of GrassGro[®] to develop these outlooks was important and presenters who used their experience only were marked down.
 - a. Your highest ranking
 - *Timely information that gave an in-depth analysis of what was likely to happen in the next 3 months.*
 - *Very thorough and precise use of the GrassGro[®] program with some useful “What-if” scenarios.*
 - *Sept 11 – well presented on how information was derived and gave a range of different scenarios.*
 - *Well documented and presented, sound understanding of the program and well explained in newsletter*
 - *Excellent presentation, timely with good examples.*
 - b. Your lowest ranking
 - *Useless waffle that didn’t use the computer programme and showed a lack of understanding and laziness by the presenter.*
 - *Not using the programme to the full potential.*
 - *Was not relevant information.*
 - *Unprepared, not in touch with local issues or situation, diverted from topic and a waste of my time!*
 - *Did not prepare for meeting.*

Q4. Did you change any management practices as a result of these seasonal outlooks?

Yes = 3

No= 8

Please detail these management changes including any financial advantage you received:

- *Decided to retain wethers that would have been sold. They are still being held but if sold now would realise \$50,000 gross income more.*
- *Used bigger mobs to try to graze and knock down paddocks for the predicted autumn break and bought in some trade cattle.*
- *Checked livestock numbers and pasture capability more carefully pre winter, the financial advantage was not being forced to feed livestock.*
- *Kept steer calves to grow out.*

Q5. Would you like to receive these seasonal outlooks in the future?

All bar one of the respondents would like to receive the Seasonal Outlooks. The one exception said they were not applicable to him as he was primarily agisting cattle.

Q6. How would you like to receive them?

Eight of the respondents said that email was the preferred delivery method, with two also suggesting some presentations at meetings and field days.

Q7. What time of the year would you like to receive them?

Five respondents would like the reports in Spring, Summer and Autumn, two would like them quarterly and another when they are topical for example – animal health problems or other opportunities.

Q8. What information would you like to receive in these seasonal updates?

Respondents were requesting information which would assist in their management decisions for the next 3-6 months in relation to pasture and animal production and any animal health issues.

- *How the farm system currently looks, what the likely scenarios are for the next 3 months and what are the management options.*
- *Probabilities and best bet scenarios for next 3 months and possible options for livestock production, trading, carrying capacity, is feeding (purchased feed) worthwhile, how hard do we want to drive our farm business?*
- *Expected growth targets given rainfall, time of year and existing pasture measures.*
- *Current seasonal conditions combined with predictions for spring and autumn.*
- *Similar to Doug Alcock's last email Autumn 2012 - Brief, well-constructed – main topics covered.*
- *The amount of DM that will be grown or will not be grown.*

9. Would you be prepared to pay for these updates and if so how much?

Yes = 3 No = 4 Good Question = 1 Unsure = 1

- *If prepared to the standard that Doug Alcock set = \$50 per report.*
- *Not much.*
- *Not sure – depends on how accurate and timely they are.*
- *Only if I can use the information for the whole farm!*
- *Unsure, I think I have the same resources to get this information but I do appreciate the informed input from presenters and am always happy to pay for good information. Probably worth \$100 per quarter.*
- *Part of the membership.*

Q9. Could you please rate the success of the MFS GrassGro[®] project on the following scale?

Poor	Moderately successful	Very Successful
1	5	10

The average of all ranking was 6.4 with a range from 3 to 8.

b. Survey of GrassGro® Core group

The survey was mailed on the 8th April 2012 to the 10 members of the core GrassGro® group with a request that the survey be returned by the 27th April 2012. Surveys were also sent to the three presenters of Seasonal Outlooks to gauge the project from their perspective. Doug Alcock was the only presenter to complete the survey.

The survey was of nine questions in length and aimed to acquire both quantitative and qualitative data, with the majority of questions being open to allow respondents to answer as honestly as possible.

Results

The survey results are presented with some comments as well as comments from respondents wherever possible.

- Replies

Ten farm families were surveyed with 4 responses representing a 40% return rate which is disappointing as the members of the Core GrassGro® group had expressed a desire to be part of this group, had a greater knowledge of the project and attended a number of GrassGro® training days and should therefore have been more informed about the project.

- Q1. Could you comment on the GrassGro® training you attended?

Respondents were satisfied with the training they received.

- *Very well run with good follow up support.*
- *Training delivered by CSIRO was pitched at the right level and was well delivered with all information required. The manual was also very well set out and put together and user friendly.*
- *1 day course was the initial training, 1 or half day courses as follow up.*
- *The Training was good.*
- *Excellent*

- Q2. How difficult did you find learning to use GrassGro® and why?

Given the age and educational level within the group you would expect there to a range of difficulties in learning a detailed software package such as GrassGro®.

- *Mostly easy because of the drag & drop options in setting up a farm system. The data drills could be made more user friendly.*
- *GrassGro® concepts and the software program itself was not that difficult to learn although imperative that user has quite good computer skills beforehand (also because I have reached a certain level of computer skills already to work from).*
- *Program was good except soil data for my area not that accurate so difficult to have full confidence in output. Lack of time to put towards evaluating and using program fully.*
- *My age, 66 years, may not be a help! I am quite computer literate, however I found GrassGro® very complicated compared to GrazFeed™ and slowly getting my mind about the concepts and small changes in the physical being represented by numbers.*
- *Moderate.*

- Q3. Were you able to understand the outputs (graphs and tables) from a GrassGro[®] simulation and were they useful?
 - *Yes, very useful. They could be made more user friendly to create and label.*
 - *Yes could understand about half of them, the rest you needed help from Doug to understand what they were saying, about a third of the graphs produced are useful information.*
 - *Yes*
 - *Yes, mildly so.*
 - *Yes.*

- Q4. Do you like the concept of using GrassGro[®] to examine your farming system and why?
 - *Yes. It allows the user to run scenarios with immediate results that could take years to do in real time.*
 - *I understand the concept and can see how it would be useful IF you had the correct and quality information to put into the model SPECIFIC to your systems otherwise I think the outputs would be too generic and not tailored enough to make decisions (involving \$\$, time, resources) based on just general information. However I think it is very good to get farmers to start asking the right questions about their farming systems and examining profit drivers etc more closely.*
 - *Yes & No - I think the concept is good although the goalposts are always moving, particularly good going into winter when a rainfall event will have a smaller immediate impact.*
 - *Yes – The next step up from GrazFeed™ - I need to work on a whole farm evaluation!*
 - *Yes – Seasonal outlook, new enterprises, fine tuning current enterprises and look for profit drivers.*

- Q5. What difficulty is there in farmers using GrassGro[®]?
 - *Thinking of the right questions to ask and having the time.*
 - *Main factor is having the TIME to familiarise with GrassGro[®] and also prioritising the time available to work on the model. I think it is a mindset, some farmers relate to the concept, others never will. Many farmers prefer the traditional way of gathering info and making decisions ie. consultants, attending info days, gathering information from other sources.*
 - *Second constraining factor is lack of computer skills to drive the model and again not reinforcing how to use it by not having the time to spend.*
 - *Time constraints and data entry accuracy. The complex wholeness of the information which makes up farming. The fact that the whole farm has to be split up into uniform sections to evaluate each (This combination of this information from the different section needs work).*
 - *Time and the need to use GrassGro[®] all the time.*

- Q6. How can these difficulties be overcome?
 - *More commitment from the producers to learn how to use the program.*
 - *Can't be overcome for percentage of producers who will never see the value in software models. Unsure how to make model more use friendly as I know CSIRO already spent a lot of time on this.*

You can't force people to allocate more time to this, they have to see the value in doing so which they won't see unless they have embraced GrassGro[®] fully.

Some of the core group overwhelmed, prefer Doug to do the work and come and listen rather than do it themselves.

- *By using (paying) someone to do the input and provide logical and time specific output (i.e. seasonal outlooks). I can see a real benefit in the Program but I can't allocate enough time resources to implement it properly.*
 - *Repeat small information days and creating the real pressing need to use GrassGro[®] (Fear of not succeeding if you do not use this aid).*
 - *One or two professionals using the software, maybe?*
- Q6. Could you please rate your ability to perform a GrassGro[®] simulation after this training?

Unable to start	Able to commence	Competent to produce outputs
1	5	10

Average = 6.4

Range = 2 - 10

- Q7. Did you attempt to perform a GrassGro[®] simulation on your property and what was the result?
 - *Yes. Very interesting over lots of scenarios. It illustrated to me how much my weaner sheep suffer production loss from worms, water, feet, flies, and others.*
 - *Yes, but as a lot of my time was in the coordination of the project again, I didn't allocate the time to my own use of the model. Never managed to sit down with Doug and set up my own farm system however, am confident I could if I had the relevant information.*
 - *Yes. Had trouble getting right soil data for my farm. I could run a simulation but was not overall happy with the result.*
 - *Yes with Doug Alcock beside me not on my own!*
- Q8. Did you change any of your farm management as a result of the GrassGro[®] Project and what were the affects?
 - *Changed to a much higher % of sheep making up the stocking rate and it has put a lot more pressure on management.*
 - *No, but I would be willing to change when using the model confidently*
 - *No*
 - *No – as we are having maybe top 90% season and rebuilding stock numbers. It is hard to find a pressing need except to purchase more stock. We have kept our steer calves to grow out.*
 - *No because of problem with Silo weather data*

- Q9. Is there anything that you would change in how the GrassGro[®] project was conducted?
 - No
 - *No, it was done in collaboration with various people in the Industry, think the training system was the right idea, again came down to the time farmers had to commit and as usual, most farmers are overcommitted. Did not have a realistic expectation of how long it takes to familiarise with program.
MFS struggled to find the right presenter/extension professional to deliver GrassGro[®] activities because as Doug Alcock was the obvious choice, due to his own work commitments we didn't feel able to ask Doug for the duration of the project.
Experimentations with using Stuart Burge and Jim Shovelton were disappointing because of lack of knowledge on their part with the tool and also expectations of MFS of these presenters were perhaps unrealistically high.*
 - *No - In my case at the age of 66 years and our son and daughter away building careers elsewhere. I am thinking of using GrassGro[®] to evaluate some whole farm change of operation to make life easier and look at possible options*
 - *More one-on-one with experts*

c. Options for the future extension of GrassGro[®] on the Monaro

At a Breakfast meeting of the Core GrassGro[®] on Friday 4th May 2012, a discussion on ways to extend Seasonal Outlooks Based on GrassGro[®] scenarios to MFS members.

The main points agreed upon were;

- MFS Facilitate a process whereby members identify management questions/issues and email them to Doug Alcock (or equivalent technical person) who would create GrassGro[®] “issues” suited to answer these questions. These issues would be circulated for all members of the core group to use in analysing the impact on their own farm system files. After analysis the results would then distributed to a wider audience.
- Continue with one-on-one technical support/mentoring to individuals in the core group by farm visits from Doug Alcock to enable core group members to continue in the development of their own farm systems upon which they will then be able to conduct analyses This will be to develop a relevant farm system for each of the farmers within the core group.
- Once core group producers reach a level of confidence, MFS will facilitate farmer meetings where core group farmers will make presentations to other MFS members and other farmers on an issue they have analysed using GrassGro[®] and encourage discussion and debate between peers on this issue.
- That the publication of seasonal outlooks be continued on a timely basis with issues of relevance to the MFS membership and wider community.
- MFS use data from other MFS Projects as a basis to run scenarios and generate useful data. For example fertilizer that Oli Cay ran after the Soil Club Session looking at impact of increasing fertility scale on all other aspects of business. Another example would be to use the data collected in wether trials to look at the impact of bloodline on the financial return of the farm business.

Discussion

Project Objectives

This project had three objectives which will now be discussed individually;

- 1. Develop and deliver interactive, educational sessions to Monaro landholders at critical/strategic times of the year (March and Aug/Sept) to analyse and evaluate GrassGro[®] simulations.**

Seasonal Outlooks based on GrassGro[®] outputs published in MFS Newsletters and also presented at 3 meetings open to all of the MFS membership.

The survey data showed that all the respondents would like to continue to receive the Seasonal Outlooks even allowing for the variation in the satisfaction with the different presenters varied. For this response it is obvious that the Seasonal Outlooks had information of relevance to their management and was helpful in their decision making processes, for even if they did not change any of their practices they had to think about their management options to come to that conclusion. That two of the respondents made changes to their management based on the September 2011 Seasonal outlook is a good outcome considering the length of time that they have been exposed to GrassGro[®] with one estimating the financial gain at \$50,000.

The Seasonal Outlook which was published in March 2012 is included as Appendix 1.

- 2. Deliver a public Climate Change Forum in conjunction with Monaro Farming Systems (MFS) partners who will discuss and explore future climate change predictions at a local level as well as the possible consequences for production and management.**

The Climate Change Forum held in June 2011 attracted over 200 people which was indicative of the interest in the Monaro in this topic. Outputs from GrassGro[®] simulations were used to demonstrate how decision support tools such as GrassGro[®] are able to be used to help farm businesses to prepare and adapt for climate change.

In addition to this at the MFS AGM in 2011 a presentation of an Enterprise Analysis between differing sheep ewe enterprises was presented by Doug Alcock and Phil Graham, NSW DPI. GrassGro[®] had been used to conduct the analysis comparing five ewe breeds and production systems at differing stocking rates under a Monaro simulation to compare potential stocking rates, financial returns and sustainability issues including groundcover. This presentation also demonstrated how GrassGro[®] can be used to compare different management options available to farmers.

- 3. During the final phase of the project, be able to electronically transfer relevant GrassGro[®] “farm system files” to members which will deliver relevant/targeted reports of predicted pasture growth curves and animal performance for the representative soil types, based on climate/weather data inputs.**

With the release of GrassGro[®] version 3 the ability to transfer farm system files between GrassGro[®] users has been possible. Due to the variation in the use of GrassGro[®] within the core group this transfer has only had a limited use but as the Core group continue to develop their skills this will be used much more frequently to transfer farm system files between this group.

4. Deliver training sessions to increase the number of landholders on a regional basis who are able to utilise this software directly into their farm enterprise systems and also then demonstrate the benefits of this technology to other landholders.

The project has delivered GrassGro[®] training to the 10 members of MFS who expressed an interest in learning how to use GrassGro[®]. The initial two day training was run by CSIRO staff from Canberra and was very professional but was of a theoretical nature and therefore lacked a little context for farmers. Follow-up training consisted firstly of follow-up one-on-one visits to all members to get their GrassGro[®] farm system established followed by four half day workshops. This follow-up training was conducted by Doug Alcock, NSW DPI, Cooma who is an experienced GrassGro[®] user having worked with the CSIRO Grazplan group in Canberra during 1997 and 1998 on the development of GrassGro[®] prior to its release and on the training of new users. He has used GrassGro[®] extensively in a NSW DPI DAFF funded Climate Change Program as well as in other projects related to methane production from livestock.

The feedback from the Core Group farmers from the training was that it was well run and the manual was well set out and that the follow-up was excellent.

The goals of the project were ambitious when one considers the scale of what the project was trying to achieve in relations to the use of GrassGro[®]. The complexity of the GrassGro[®] program should not be understated and when this is combined with the age, education and computer skills of the Core group of farmers the project has progressed well in a short period of time of approximately 18 months. Within any group there will be a range of ability and experiences to the ease of learning a new subject and in this instance with GrassGro[®] it would have related even more to individuals thought processes and learning styles. The objective, analytical and data hungry personalities would have been more comfortable whilst the people who traditionally use their experience and impressions or gut feel would have found it more difficult.

The members of the Core group by agreeing to one-on-one technical support/mentoring of farm visits from Doug Alcock to enable them to continue in the development of their own farm systems upon which they will then be able to conduct analyses is very encouraging and indicative of their desire to be involved in continued learning after the project.

When adult learning principles are applied to this project the progress can be considered as good when you consider how adults learn (Collins 2004; Egle 2009; Foley 2001; Javadi and Zandieh 2011; Knowles 1992; Wegener) and the time scale that is required to achieve practice change.

Knowing how and why adults learn and how these principles are relevant to the outcomes of this project. There are three important principles which we need to consider when considering adult learning;

- Adults bring a lot of experience with them to training sessions and they therefore have something to contribute and something to lose.
- Adults prefer to focus on real life, immediate problems rather than on theoretical situations.
- Adults are accustomed to being active and self-directing.

We also need to remember that;

- adult learning is unique to each individual.
- adults are internally motivated and self-directed.
- adults are goal oriented.
- adults each learn at their own pace and in their own way.
- adult learning is unique to each individual.
- adults bring life experiences and knowledge to learning experiences.
- you cannot force an adult to change, and
- adults are practical.

When these factors are taken into account the practice changes and level of use of the GrassGro[®] in this project is exceptional as the participants have gone from a little or very general understanding to being able to use the program or having an understanding of the sort of conclusions which can be derived from GrassGro[®].

The suggestions for extension arising from the meeting of the Core group on the 4th May 2012 indicates that the members of that group want to continue their learning journey and indicate a commitment to continue to increase their knowledge and use of GrassGro[®] and are prepared to present the findings from these GrassGro[®] simulations to public meetings of their peers.

5. Use the GrassGro3[®] model to analyse MFS research trial data which will value add onto existing experimental trials.

GrassGro[®] has been used to model the data from the Monaro Grassland R & D project conducted by NSW DPI with funding from the Southern Rivers CMA to develop a native pasture parameter set for use by participants within this project.

Options for the future extension of GrassGro[®] on the Monaro

In the survey all members who replied expressed a desire to receive the seasonal outlooks in the future with a preference to receive this information by email, but leaving open the possibility to have them presented at a public meeting where appropriate. This methodology is consistent with wanting to learn from each other.

There was consistency between both groups surveyed in that most members wanted the seasonal outlooks distributed on a seasonal basis although some members did not want them in winter. This is most likely be that winters on the Monaro tend to be very consistent and with the most limiting factor of plant growth being temperature.

The commitment from the Core GrassGro[®] group members to submit management questions/issues again shows that they have some understanding and willingness of how they can use outputs from GrassGro[®] in their farm management decision making process.

The willingness to use data from other MFS Projects as a basis to run scenarios is very encouraging and indicates that the members of the Core group can see the potential of using GrassGro[®] in different areas and shows that they are prepared to broaden how they see that GrassGro[®] can be used to examine the financial and sustainability effects of new management decisions on their farm business.

The decisions arising from the core group provide clear direction as to the means of extending the GrassGro® project on the Monaro. However to be successful in this aim, MFS will need to ensure the following occur;

- MFS establish a process whereby management questions/issues are identified,
- MFS needs to be sure that all members of the core group are committed to modelling scenario's on their property and sharing their experiences and results with their peers,
- MFS should engage a technical person who is prepared and able to generate GrassGro® issues to answer these questions. The experience within the project would suggest that this person should be very familiar with the use of GrassGro® ,
- MFS members run the management questions/issues on their own farm systems using GrassGro® ,
- MFS understand that core group members will need to be trained and mentored in preparing their presentations,
- MFS should publish seasonal outlooks and other findings in the MFS newsletter,
- MFS should host/coordinate farmer meetings across the Monaro for the presentation of the outcomes from GrassGro® modelling,
- To ensure they reach this extended audience, MFS will have to be prepared to spend time in bringing farmers who have not been involved with the GrassGro® project to an understanding of GrassGro® and its potential to assist their on-far decisions,
- So that the progress established from this project is not lost, MFS should commit to conducting at least 1-2 farmer meeting across the Monaro each year. MFS farmers will present GrassGro® issues they have examined for discussion by their peers. This approach is consistent with the desire to use the principles of the Capacity Building Framework .
- MFS should establish a relationship with local newspapers to allow the publication of information presented at these farmer meetings to reach a wider audience and continues to raise the profile of the GrassGro® project.
- If unable to achieve all of these outcomes, MFS should enter into a partnership with appropriate people to ensure the above actions occur.

General

Due to the complexity of farming systems and the number of issues which need to be considered in the management of a farming system, the use of decision support tools can assist farmers to develop a viable farm management system in the face of a changing climate including the financial and sustainability consequences. Using a decision support system such as GrassGro® allows farmers to see the “big picture” and take a holistic approach to land management.

The lack of time was an issue for some respondents in the Core group and the need to see the value that they are able to receive for the investment of this time to learn and use GrassGro®. Apart from the earliest adopters of a new technology farmers usually rely upon others farmers as examples prior to changing management practices. This project was endeavouring to get a group of farmers to use the outputs from GrassGro® and discussion within the group without being able to observe or talk to other farmers who had made these management changes. As the early adopters in the group change their management practices and decisions based on GrassGro® simulations this will increase the adoption of similar changes by their peers.

One issue which affected the uptake of the use of GrassGro® was the lack of local weather and soils data available which was required to run GrassGro®. This reduced the relevance of the outputs for

some members because they wanted to be able to analyse their own farm system not a generic farm system.

Conclusion

When the timeframe and scale of the MFS GrassGro[®] project is considered compared to the outcomes and attitudinal changes which have occurred it has been an undoubted success.

MFS need to put processes and practices in place to ensure that the momentum from the project is not lost as they endeavour to assist their members increase their financial and sustainable viability.

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