

Improved Seasonal Forecasts for Wool Producers in the South Australian Pastoral zone



Land Water & Wool Climate sub-project



Report for Milestone 8: Final Report
Climate Sub Program: Land Water and Wool
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Improved Seasonal Forecasts for Wool Producers in the South Australian Pastoral zone.

**Report for Milestone 8: Final Report
Climate Sub Program: Land Water and Wool**

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Budget 2005/06

Land Water and Wool	\$15,000	SARDI	\$22,718	Total	\$37,718
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Project Objectives:

To minimise financial loss and maximise profits, and improve plant biodiversity and land management in southern rangeland wool producing areas by;

1. Using climate risk management workshops to train producers to respond to climatic trigger points.
2. Utilising applicable tools and services for the South Australian pastoral region, including AussieGrass SOI and SST forecasts and early season rainfall to deliver timely information on seasonal forecasts and climate risk to wool producers.
3. Generating case studies to highlight examples of effective use of climate risk management tools by pastoralists.

Objectives of extended project (April 2005).

To increase the adoption of seasonal climate forecast information by wool producers to 60% by;

- a) Updating the draft seasonal climate forecast (SCF) pocket guide for wool producers and printing up to 500 copies,
- b) Delivering the SCF pocket guide, use of ongoing tools and services and case study examples of good use through climate risk management workshops, and
- c) Keeping producers informed of seasonal climate forecasts and risk management information through newsletters and district specific forecasts.

Executive Summary

There are approximately 155 wool producers in the SA pastoral zone that manage about one quarter of the South Australian Landscape. These producers have a highly variable income, it is estimated that they make about 80% of their profit from the best three years in 10 and the worst three years in 10 they make a loss. Through this three year LWW project we have improved the knowledge and understanding of seasonal climate forecasts so that wool producers can better recognise the chances of good and bad seasons in advance in order to maximise their profits in the good years and minimise their economical, biological and social losses in the bad.

The Map Arranger facility designed for the LWW Managing Climate Variability program (Henry, 2004) was used to assess the skill in operational Seasonal Climate Outlooks forecasting rainfall and pasture growth using the SOI 5-phase system (Stone et al, 1996) and the SST 9-phase system (Drosdowsky, 2002). A review committee met in April 2005 and suggested that we no longer use the SST 9- phase system due to a degree of phase locking caused in part by a warming of the Indian Ocean. The review also made a series of recommendations on appropriate statistical tests. Therefore the forecast skill of the SOI 5 – phase system was re tested specifically for the SA rangeland wool producing regions using recommended statistical tests (LEPS, KW and KS) for each phase.

Producers had previously indicated that their management decisions were not significantly influenced unless there was a 70% or more probability of a wetter or drier outlook. The pocket guide was developed to focus wool growers on the times of year that this criteria could be met. In other words, the pocket guide shows busy decision makers the times of the year that the ocean and atmosphere indices could possibly lead to a 70% or more probability of increased or decreased rainfall or pasture growth. We stress that at other times of the year they should use long term climate records.

We initially showed the pocket guide to case study producers, before making a few changes and then showing it to 34 more producers for comment during workshops. The wool producers reacted positively and identified significant economical, biological and social benefits by being exposed to this pocket guide. They described the management changes they would make in the wetter or drier seasons.

The feedback from wool producers, the LWW committee and the review committee was used to re produce a new pocket guide listed in Appendix 1. This has been delivered to 60% of producers in the SA rangeland wool producing regions as well as other wool producers in marginal areas.

Over the course of this project we have developed and enhanced further tools to deliver climate risk management information, including newsletters, books and workshops. We have also developed an innovative and sustainable way to continue to deliver this information through the SARDI Climate Support program

This Final Report details the results of our research and extension to achieve our project objectives: to minimise financial loss and maximise profits and improve plant biodiversity in the southern rangeland wool producing areas. It addresses the milestones we set out to achieve in the extended project milestone 8 for project SRD4.

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There has been no alteration to any objectives.

Milestones and achievement criteria

Milestone 8 - Final Report

Provide to LWA a Final Report addressing the following:

1. Pocket Guide: An evaluation of the Pocket Guide, based on the relevant evaluation questions from the Climate Sub-program M&E Plan, including activities with Bestprac groups, as well as enclosing a copy of the final version of the Pocket Guide.
2. Workshops: A brief summary of the workshops with wool producers in the SA rangelands and an evaluation, based on the relevant evaluation questions from the Climate Sub-program M&E Plan, including activities with Bestprac groups. This evaluation should include a comment on whether the target of 60% of rangeland producers was achieved.
3. On-going support: brief summary of arrangements for on-going delivery of seasonal climate forecasts to wool producers.
4. Appendix: An Appendix consisting of a Technical Guide consolidated from previous Milestone reports, which will serve as a record of the technical approaches used during the project.
5. Response to Review: actions taken by the Project in response to each recommendation in the Climate Sub-program Review (Indooroopilly, April 2005).

1. Pocket Guide: An evaluation of the Pocket Guide, based on the relevant evaluation questions from the Climate Sub-program M&E Plan, including activities with Bestprac groups, as well as enclosing a copy of the final version of the Pocket Guide.

Through the Land Water and Wool project, we have developed innovative methods for delivering seasonal climate forecast information. The main outcome of this project has been a pocket guide that explains which forecast method is skilful, and when it can be applied. A final version of this is attached in (**Appendix 1**). The pocket guide should be demonstrated in climate risk management workshops. A workshop program has been developed and implemented for wool producers in the SA rangeland regions. Once producers attend a workshop they automatically receive a year's free subscription to our seasonal climate outlook newsletters (**page 2 Appendix 2**). They can also choose to subscribe to district specific reports which provide 3 month outlooks for their closest district based on the SOI (**page 5 and 6, Appendix 2**). Producers can find out what the current SOI is by reading it in our weekly Stock Journal article (**page 10 Appendix 2**). We do have other services and all are outlined in our latest climate support brochure (**Appendix 2**).

The relevant questions from the Climate Sub-program M & E program are addressed in table 1.

Table 1. Evaluation summary sheet for the Land, Water and Wool Climate Sub Program project in South Australia (April 2005-April 2006).

EVALUATION SUMMARY SHEET

<i>LEVEL</i>	<i>EVALUATION QUESTION</i>	<i>ANSWER</i>
Resources	Funds and personnel	<ul style="list-style-type: none"> • \$15,000 from LWW and \$22,718 inkind from SARDI
	Innovative funding ideas	<p><i>FarmBis have subsidized 65% of workshops and SARDI have subsidized the remainder of the workshops with inkind funding.</i></p>
Activities	Sites, publications, field days, courses, workshops, briefings etc	<ul style="list-style-type: none"> • <i>Climate Risk Workshops explaining pocket guide at Wunkar June 05 and Orroroo November 05, Waikerie, Geranium, Minnipa (more planned)</i> • <i>Briefing held at Kulkami</i> • <i>Best Prac meetings held at Blinman 13th Jan, Hawker 12th Jan, Orroroo 13th Feb (more planned)</i> • <i>Field day at Paskeville Sept 05.</i> • <i>Web site launched Feb 06</i> • <i>Pocket Guide, Newsletter and District specific support developed, stock journal article, and climate risk management resource manual re printed. Climate Support brochure sent out.</i> • <i>Pocket Guides sent to producers that have attended a previous workshop and have had draft guide explained. A letter sent to producers to attend a briefing at Pt Augusta (end of May 06).</i> • <i>Best Prac facilitators trained in how to use pocket guide and powerpoint slides provided for delivery (Jan 06).</i> • <i>Project meeting Adelaide, November 2005</i> • <i>Mini climate forum Adelaide Feb, 2006</i> • <i>LWA decision support review August 2005.</i>
People	What is the level of demand for products from the program?	<p><i>Prior to milestone 8 we had trained 50% of producers in SA rangelands and raised awareness and need for a pocket guide on seasonal climate outlooks and the need for support material. Previous studies showed that many were aware of seasonal forecasts but few used them to support management decisions. Last year around 60% either subscribed to newsletters or were trained in workshops.</i></p>
	Woolgrowers attending field days, sites, training etc.	<ul style="list-style-type: none"> • <i>110 producers attended the workshops and a further 20 attended the best prac meetings. Most of these wool producers are in low rainfall wool regions however some are not from pastoral/perpetual leases. 16,000 read the stock journal weekly and we assume that this readership includes many of the low rainfall wool growers and those working in the industry. The Climate Support program has been active., 400 climate risk resource manuals were sold, 20 subscriptions to district specific forecast and 400 subscriptions to newsletters. Although many of these clients are outside of the wool growing regions, there is an impact on the wider agricultural community, some of which influences wool growers. Further workshops are planned, including in the low rainfall wool growing regions..</i>

<i>LEVEL</i>	<i>EVALUATION QUESTION</i>	<i>ANSWER</i>
	Service Providers attending workshops, field days, sites etc.	<ul style="list-style-type: none"> • 2 Consultants from Rural Directions have had training in delivery of the pocket guide and 4 research extension officers from SARDI and Rural Solutions SA. • 20 research and extension staff have attended workshops during 2005/6 and understand pocket guide. • 5 Staff have been briefed on pocket guide at field days and updates • A national mini forum was held in January 2006 with 30 representatives including consultants and farmers from cropping and livestock industries, LWW project leaders and farmers.
Reactions	Anecdotal feedback	<ul style="list-style-type: none"> • The district specific forecasts are utilized by other industries • Success is not just measured by numbers but by awareness and the stock journal has raised the awareness • Some producers may change management decisions around when they know the SOI is accurate. • Focussing attention on times when the SOI has an impact increases the usefulness of SCF
	Proportion of Woolgrowers satisfied with LWW investments	<ul style="list-style-type: none"> • Producers say they will use pocket guide to change management decisions. • Subscription numbers are growing
	Proportion of Woolgrowers satisfied with products and activities	We provided an evaluation sheet with workshops and over 80% of producers were extremely satisfied with information, delivery and support products. Others were well satisfied, and none were unsatisfied.
	What do institutions think about LWW?	<ul style="list-style-type: none"> • LWW have provided support for important work. The seasonal climate review committee provided feedback on the use of forecasts that will continue to apply to other projects including high rainfall forecasts. • LWW have made some significant steps toward improvement and application of forecasts • LWW programme gained a high level of outputs and outcomes for the research dollar invested.
	Are woolgrowers seeking additional NRM information compared to 2001? Why?	Yes because of the drought in 2002, some property degradation and loss of income. Also due to their increased awareness of the use of Seasonal Climate Forecasts to improve natural resources. Pasture growth forecasts of great use in conjunction with rainfall outlooks for water storage.
	Media interest	For this work alone in the last 6 months we have had one regional TV and one channel 7 TV appearance, 3 ABC interviews and countless ABC promotions of workshops and 2 stock journal articles. We have also promoted LWW projects roughly 3 times on the stock journal weekly weather page.

<i>LEVEL</i>	<i>EVALUATION QUESTION</i>	<i>ANSWER</i>
	Proportion of Woolgrowers who believe they have an increased ability to act	<ul style="list-style-type: none"> 60% of wool producers in SA rangeland regions have gained awareness to date and 50% of these previously surveyed all said they would change management decisions given increased chances of wetter or drier conditions. It is planned to train more wool producers so this number will grow. Comment from a woolgrower participant recorded at a workshop. "Now that I know when the SOI is accurate I may change the timing of decisions which will in turn increase my overall profitability"
Knowledge, Aspirations, Skills & Attitudes	Proportion of Woolgrowers who are aware of NRM issues and their importance.	<ul style="list-style-type: none"> As we have trained 60% of woolgrowers in the SA rangeland regions in workshops alone at least 60% are aware of NRM issues.
	Do woolgrowers have a greater understanding of NRM issues and is there evidence of motivation to adopt better practices?	<ul style="list-style-type: none"> Most woolgrowers in the rangeland regions of SA are aware of NRM issues, as their regions are very low rainfall. This project supported producers to make better decisions at appropriate times to ensure better practices. There is evidence of motivation to adopt better practices. One quote was " I will use the SOI to support stocking rate decisions as it supports my knowledge about how much water I will have"
Practice Change	On-farm	Roughly 50% of producers will use some seasonal climate information to re think and influence their decision making to incorporate practice change. Some producers will change the timing of decisions though we have not re surveyed producers in 2006.
	In extension community (Government, CMA, private)	The Best Prac groups' leaders will deliver the pocket guide to its producers then review their seasonal progress later in the year. This will ensure a further 10% of producers will utilize the pocket guide. Therefore the aim of 60% adoption will be exceeded.
	In research community	The pocket guide has been used as model to develop a new guide for delivery to high rainfall wool producers and cereal producers south of Goyders line in SA. A draft has already been developed. This project shaped our thinking into the timing, skill and application of seasonal forecasts. It helps tailor information specific to the wool industry and has gained credibility and respect from the research community as well as with producers.
Social, Financial & Environmental Impact	Real or estimated	It is estimated that 80% of profit is made from the best 3 years in 10 and the worst 3 years in 10 make a loss in the SA rangelands. The tools developed through this pocket guide will increase the ability of wool producers to maximize profits and minimize losses, increasing the profitability on average of \$15,000 per property per year.

2. Workshops: A brief summary of the workshops with wool producers in the SA rangelands and an evaluation, based on the relevant evaluation questions from the Climate Sub-program M&E Plan, including activities with Bestprac groups. This evaluation should include a comment on whether the target of 60% of rangeland producers was achieved.

As listed in table 1 there were a range of workshops held with wool producers since June 05 and the evaluation based on the relevant questions from the climate Sub – program M & E plan is included in table 1. The locations and numbers of attendees are further listed in Table 2 below. Since June, 2005, a total of 130 wool producers and 19 consultants were trained to use the pocket guide. Approximately half of the wool producers (65) are in the pastoral perpetual leased country above Goyder’s line and below the dog fence. The other wool producers are in marginal country just inside Goyder’s line and have mixed crop/wool enterprises.

A further 96 pocket guides were posted out to wool producers in the pastoral/perpetual leased country who have previously attended a climate risk management workshop. Thirty of these 96 people have previously had training on a draft pocket guide prior to June 2005. So this means a total of 65 plus 30 = 95 producers out of 155 wool producers in pastoral/perpetual leased country outside Goyders line, have been trained to use the pocket guide. This is a total of 61% .

The 96 producers were posted a pocket guide with a letter asking them to attend a workshop at Pt Augusta on 31st of May or attend a Best Prac meeting listed in table 3. Since 30 of the 96 have already had an explanation on how to use the pocket guide it is hoped that the remaining 66 will have it explained in a listed workshop this year. Unfortunately we could not invite producers who are non members to Best Prac meetings as this was not supported by David Heinjus and John Squires from Rural Directions. They suggested that the producers did not want new members to attend, even just for the pocket guide delivery session as the producers in the area are quite protective of the information shared. While this is understandable for the producer is it disappointing for Best Prac as there are limited opportunities for these groups to grow and share information and experience to people outside their groups

However we have reached our target of 60% trained to use the pocket guide and futhermore another large percentage of wool producers in marginal country have been trained to use the pocket guide. So we have exceeded what was planned and have future plans to continue this delivery.

Table 2: The locations and numbers of attendees at workshops aimed at wool producers in 05/06

Date	Location	No of Farmers	No of Consultants	Who Held it
June 05	Wunkar	35	5	SARDI
November 05	Orroroo	25	2	SARDI
Jan 06	Blinman	6	1	BesPrac – Rural Directions
Jan 06	Hawker	6	1	BestPrac- Rural Directions
Feb and April 06	Orroroo	8	1	BestPrac- Rural Directions
April 06	Waikerie	15	7	SARDI
April 06	Geranium	25	4	SARDI
April 06	Minnipa	10	1	SARDI
Total	8 Workshops	130	22	

Further workshops have been held for grain growers in Tumby Bay, Meningie and Millicent. A draft high rainfall pocket guide was shown to these producers. A total of 60 producers attended these workshops in April 06.

Table 3: The locations and estimated numbers of future planned workshops for explanation of the pocket guide

Location	Date	Content of Workshop	No's	Who Will hold
Orroroo	April (tentative)	Review seasonal progress	8	BestPrac – Rural Directions
Blinman	12 th May (tentative)	Distribute the pocket guide and discuss the process that we will use to review seasonal progress	5	BestPrac – Rural Directions
Hawker	11 th May (tentative)	Distribute the pocket guide and discuss the process that we will use to review seasonal progress	6	BestPrac – Rural Directions
Pt Augusta	31 st May	Explain pocket guide	25	SARDI
Blinman	July	Review seasonal progress	5	BestPrac – Rural Directions
Hawker	July	Review seasonal progress	6	BestPrac – Rural Directions
Orroroo	July	Review seasonal progress	8	BestPrac – Rural Directions
Blinman	August	Review seasonal progress	5	BestPrac – Rural Directions
Hawker	August	Review seasonal progress	6	BestPrac – Rural Directions
Orroroo	August	Review seasonal progress	8	BestPrac – Rural Directions
Orroroo	October	Review seasonal progress	8	BestPrac – Rural Directions
Blinman	November	Review seasonal progress	5	BestPrac – Rural Directions
Hawker	November	Review seasonal progress	6	BestPrac – Rural Directions

3. On-going support: brief summary of arrangements for on-going delivery of seasonal climate forecasts to wool producers.

The SARDI Climate Support program (previously called CRIMFA – Climate Risk Information Management Farmer Association) incorporates materials delivered through this LWW project and other projects run by SARDI. The Climate Support Program is commercial and runs on a cost recovery basis, we believe that this is a proven way for sustainable and efficient delivery of climate risk information to producers. In the past we have tried to ‘train the trainers’, while there are some successes with this approach, climate risk information requires a high level of expertise and regular updates of a dynamic science. We have built close relationships with BesPrac and Rural Directions and are working on ways that Climate Support can work with them. A brochure of the products and services available is listed in Appendix 5. The main products available to wool producers in the SA rangelands include;

- **Pocket Guide**

The aim of the pocket guide is to educate producers of the time period when seasonal climate forecasts are skilful in the SA rangelands (being June to November), the trigger points they should look out for to be more confident of an extremely wet or extremely dry 3 months and when to use these trigger points.

The pocket guide provides the ocean and atmospheric trigger points for wool producers to recognise 70% or more probability of increased rainfall or pasture growth or 70% or more probability of a decreased rainfall or pasture growth using the SOI 5-phase system. They then use the key in the pocket guide to look up the latest SOI, the key leads them to the appropriate

map to find the odds for a wet or dry season. The seasonal climate outlook maps relate to 3 month periods with lead times of 0 to 1 month. The seasonal climate forecasts provide outlooks for both rainfall and pasture growth. The pocket guide has a page which tells the wool producers about other trigger points to use in making their management decisions when the SOI is not skilful at predicting rainfall or pasture growth (December to May).

▪ **Climate Risk Management Resource Manual**

The climate risk management resource manual was developed primarily through SARDI, however it has been updated during the course of this project. During the workshops, producers receive a climate risk management resource manual. A resource manual sample can be found in **Appendix 3**. Producers refer to this manual during the workshops and also utilise it after the workshops to revise their understanding.

The resource manual contains an explanation of:

- attitudes to risk and actual climate risk
- understanding weather
- understanding seasonal climate forecasts
- how to access seasonal climate forecasts and information including Aussie Grass
- decision support tools to better manage risk
- price risk management

▪ **Newsletters**

Newsletters are available containing a seasonal climate outlook summary, current SOI values, state-wide rainfall and decile maps, the pasture growth outlook from Aussie Grass and total standing dry matter from Aussie Grass. Producers who attend a workshop are automatically subscribed to newsletters for a year, otherwise producers need to subscribe. Distribution is primarily by e-mail with a small number posted. The file is delivered in PDF format and is normally about 200 to 400 kb in size. We have conducted a survey during milestone 3 on the usefulness of information in the newsletters. We have improved/updated the information supplied in the newsletters. A sample newsletter can be viewed in **Appendix 2, page 2**.

▪ **Stock Journal weather page**

The Stock Journal is a rural newspaper that has 16,000 rural subscribers. Most wool producers in the SA rangelands receive it. Weekly, we write on the weather page which is the back page. On this page we provide a seasonal climate outlook summary, current SOI values and the probability of receiving 'x' amount of rainfall at various locations. Each week we also provide a different graphic. The pasture growth outlook map from Aussie Grass appears once a month, and total standing dry matter may also appear occasionally. We also put in the BOM rainfall outlook and temperature outlook graphics (**see page 8, Appendix 2**).

▪ **Australian Rainman CD Rom**

Australian Rainman CD Rom was produced by QDPI and its collaborators. We have promoted this during our workshops. It can perform climate analyses and forecasts for individual towns. The CD contains data principally historic monthly and daily rainfall for 3800 Australian locations. Users can;

- analyse records for individual locations for seasonal, monthly and daily patterns,
- forecast seasonal rainfall based on the SOI or SST,
- an updated version of RAINMAN will forecast temperature and pasture growth,
- print results as tables, graphs or maps,
- easily update data from the internet.

A picture of the CD can be viewed on **Appendix 2 page 8**.

▪ **District Specific forecasts**

Producers have the option of subscribing to district specific forecast information, e-mailed or posted to them, instead of getting information from Australian Rainman and the internet themselves. We have IP arrangements with QDPI for Australian Rainman and the BOM for data used. The district specific forecasts were originally designed for grain growers and we have made the same information available to wool producers for their district. The information sent includes;

- District specific seasonal climate outlooks using SOI to look at the probability of receiving rainfall
- Historical rainfall records and graphs
- Current rainfall decile range compared to historical rainfall for their closest town
- Probabilities of receiving a certain amount of rainfall by a certain date. An example is provided in **Appendix 2, page 6 and 7**.

▪ **Workshops**

We have developed climate risk workshops modules with the following programme

Module 1: Understanding climate risk

- Understand the various climate risks affecting wool producers' businesses
- Understand the actual risk of a particular climate event occurring
- Understand how farm business decision making is influenced by the actual climate risks occurring and personal attitude to risk

Module 2: Understanding Climate, Weather and Climate Change

- Discover what influences seasonal climate forecasts,
- Discover the influences of seasonal climate forecasts like SOI
- Is climate change real and what can we do about it?

Module 3 : Seasonal Climate and forecasting systems

- Understanding the seasonal climate forecast pocket guide for wool producers
- How to access other seasonal climate forecast information including the Aussie Grass web site, newsletters and district specific reports.

Module 4: Making Climate Risk Management Decisions.

- Formulate strategies to reduce the impact key climate risk events have on individual farming businesses

▪ **Web Site**

We launched a new web site in February 2006 which details our Climate Support program. It is work in progress and can be found at www.sardi.sa.gov.au and click on Climate Applications.

Apart from the workshops planned at the above dates, we will send wool producers our brochures on Climate Support (Appendix 2). Following 2006, we will only send annual brochures to those producers that subscribe to newsletters at \$20 e-mailed or \$40 posted annually. A climate risk management workshop can be organised for any group at any time provided we have 10 or more people. We are using FarmBis to subsidise the workshops. Each year we market our workshops through a range of mechanisms including agricultural bureau groups and BestPrac groups. So if producers subscribe to our newsletters they will have ongoing access to the Climate Support information available.

4. Appendix: An Appendix consisting of a Technical Guide consolidated from previous Milestone reports, which will serve as a record of the technical approaches used during the project.

See Appendix list below

5. Response to Review: actions taken by the Project in response to each recommendation in the Climate Sub-program Review (Indooroopilly, April 2005).

See Appendix 9

References

Drowdowsky, W. (2002). SST phases and Australian rainfall. *Australian Meteorological Magazine* 51: 1-12.

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Truscott, M and Hubbard D. (2003). Evaluation of the Application of Seasonal Climate Forecasts for the SA Rangeland Wool Producers. Milestone 2.3 report for LWW project SRD4.

Truscott, M and Hubbard D (2004). Improved seasonal climate forecasts for wool producers in the South Australian pastoral zone. Milestone 3 report for LWW project SRD4.

List of Appendices

Appendix 1 - Climate Risk Seasonal Outlook – Pocket Guide for Wool Producers in the Pastoral Rangelands of SA

Appendix 2 - Climate Support Brochure

Appendix 3 - Climate Risk Management Resource Manual

Appendix 4 - Extract from Milestone report 1

Appendix 5 - Extract from Milestone report 2

Appendix 6 - Extract from Milestone report 3

Appendix 7 - Extract from Milestone report 4

Appendix 8 - Extract from Milestone report 7

Appendix 9 - Response to Recommendations from SA and review committee further responses

APPENDIX – 4 Extract from Milestone 1 report

Milestone 1 - Forecast & toolkit report

1. Regional/national network contacted and forecast development established.
2. Seasonal climate forecast priorities for SA's pastoral zone identified and demonstrated.
3. SA Climate Risk Unit contribution to the NRM toolkit made.
4. Trigger points for the application of SOI and SST forecasts for the region are well understood by SARDI and its extension partners.
5. The outputs of AussieGrass are easily obtainable by SARDI and its extension partners.
6. The application of early season rainfall forecasts will be understood by at least 5 SARDI extension personnel in the SA region.

Results for achievement of Criteria 1

Regional/national network contracted and forecast development established

A workshop was held by the LWW climate subprogram on the 11th and 12th of December at the Natural Resource Sciences, QLD Natural Resources and Mines Centre in Indooroopilly, QLD. The workshop discussed priorities and lead times needed for forecasts for each state as well as trigger points to implement management decisions. It also evaluated seasonal climate forecasts systems and the provision of seasonal climate forecast information to pastoralists in each region.

Speakers at the workshop were the leading forecasters and climate extension personnel across southern Australia. Melissa Truscott attended on behalf of this project. A contact list has been provided to participants. This formed the regional/national network for forecast development of which the SA group is a part of.

Results for achievement of Criteria 2

Seasonal climate forecast priorities for SA's pastoral zone identified and demonstrated.

The sheep lessees were surveyed within SA by Department of Water, Land and Biodiversity Conservation (DWLBC) pastoral inspectors to find out the time of year that they join rams, mark lambs and shear. Within SA there are 9 sub regions.

The table below illustrates the most dominant months when joining rams, lamb marking and shearing occurs within each of the sub regions. These management practices do occur in other months, however the most common month for each region is nominated in the table. It also indicates the percentage of pastoral leases in these sub regions.

Sub Region of SA Pastoral Leases	% of total pastoral wool leases in SA	Joining	Marking	Shearing
Kingoonya	12	Dec, Feb	Jul, Aug	March
Gawler Ranges	23	Dec, Jan	Jul, Aug	March
North East Pastoral	39	Nov, Dec, Jan	Jul, Aug	Feb, March, Aug
Northern Flinders Ranges	45	Nov, Dec, Jan	Jul, Aug	Feb, March
Eastern Districts	11	Dec, Feb	July, Sept	Sept, Oct, Dec
Central Eyre Peninsula	3	Dec, Feb	Aug	Oct, Feb
Far West Coast	2	Dec	Oct	Apr
Marla Oodnadatta*	2	Dec, Jan	Sept	Apr
Marree*	4	Dec, Jan	Oct	May
* Denotes Primarily Cattle Enterprises				

It is clear that joining occurs in all sub regions over Summer with the most dominant joining month being December. Marking mainly occurs in Winter with some sub regions marking in Spring. Shearing appears to occur either in Autumn or Spring, with some regions taking it through until Summer. In summary if a priority time for forecast accuracy had to be chosen for SA it would be a 3 to 6 month outlook in December, because joining is the more important decision. Joining in December would change if a 3 to 6 month forecast at that time was accurate enough to say it was going to be drier or wetter than normal. This in turn alters time of lambing. Although joining in December is the most common time, decisions are made throughout the year in SA and forecasts are also needed for the entire year.

The lead time for forecasts was discussed amongst extension officers and pastoral inspectors for the regions. It was unanimous that a lead time of 3 to 6 months for forecasts was necessary to impact upon any of the above decisions.

During the December LWW workshop, forecasts and their skill and accuracy were discussed. It was decided that the SOI, SST's and the BOM SPOTA system should be used as a basis for forecasts in the SA region. The forecasts should be in the format of rain, growth and total standing dry matter as produced by Aussie Grass. It was also suggested that point basis forecasts could be produced using Win Grasp and Paddock Grasp.

Results for achievement of Criteria 3

SA Climate Risk Unit contribution to the NRM toolkit made

The Climate Risk Unit has developed a Climate Risk Management Workshop. This workshop will be utilised to train SA's sheep pastoralists in climate risk management. The workshop was developed in conjunction with researchers, forecasters and extension personnel across southern Australia and is regularly updated. It aims to teach participants about the tools and services applicable to their region. For example module 3 describes to participants the decision support tools applicable to their region including Aussie Grass, Win Grasp and Paddock Grasp, and how to access these and their outputs.

The participants also make climate risk management plans. The program is as follows;

Module 1 - Understanding Risk

Workshop 1 - Determining how attitudes to risk are formed

Workshop 2 - Estimating actual risk on individual properties

Module 2 - Understanding climate and weather in southern Australia

Workshop 1 - Weather map interpretation

Workshop 2 - Climate systems at the local level

Workshop 3 - Making planning decisions using Australian RAINMAN

Module 3 - Using decision support tools to manage climate risk

Workshop 1 - Using Rainfall deciles

Workshop 2 - Learning the appropriate decision support tools for your region

Module 4 - Developing management plans for climate risk

Workshop 1 - How to develop management plans for managing climate risk

Although not official these workshops or components of the Climate Risk Management Kit can contribute to the NRM toolkit. The Climate Risk Management Kit contains a copy of Australian Rainman, a facilitators guide, a powerpoint presentation CD rom, a climate risk management resource manual, masters of worksheets for the four teaching modules. The workshops are just weeks away from receiving the national accreditation from the Accreditation and Registration Council (ARC) as recommended by the VET Quality Branch.

Results for achievement of Criteria 4

Trigger points for the application of SOI and SST forecasts for the region are well understood by SARDI and its extension personnel

The SARDI climate risk management unit has trained 8 extension personnel in the use of Australian Rainman and Aussie Grass using the Climate Risk Management Kit. Within a region the SOI may have different applications for example, the SOI is unstable from Dec to May. During May the SOI usually sets into a phase and stays that way until December. Though it can have little significance on the rainfall in the Gawler ranges (for example) until September. However in May you can get an idea if the rainfall is likely to be above or below average at that time for Spring.

The extension personnel that understand this and how to access this information include;

Trent Scholz - Rural Solutions SA.

Jenny Cleary - Rural Solutions SA.

Chris Lynch - Rural Solutions SA.

Anna Traeger - SARDI climate risk

Melissa Truscott - SARDI climate risk

Ben Matson - SARDI - climate risk

John Maconochie - DWLBC

Chris Turner - DWLBC

These personnel assist and work specifically on this pastoral project

Results for achievement of Criteria 5

The outputs of AussieGrass are easily obtainable by SARDI and its extension personnel.

John Maconochie (DWLBC) has liaised with SARDI staff to ensure that they understand the outputs of AussieGrass and how to access it. At this point SARDI has been provided a username and password to access AussieGrass. SARDI also has also paid for a licence for SILO weather data. DWLBC will ensure this access is maintained.

Results for achievement of Criteria 6

The application of early season rainfall forecasts will be understood by at least 5 SARDI extension personnel in the SA region.

Early season rainfall has been identified by SARDI as an indicator for the remainder of the growing season in SA. SARDI have produced a series of maps for SA looking at the relationship of April Rainfall to growing season rainfall. April rainfall has varying implications for each subregion. As listed under criteria 4, the above people have been trained in Climate Risk Management using the Climate Risk Management Kit. These people have been provided with this list of maps. The latest version of Australian RAINMAN can further explore this for sub regions and individual recording stations. Furthermore the extension officers will provide individual analyses of early season rainfall compared to total standing dry matter where necessary. These people will also set up workshops with growers and train these growers in the use of early season rainfall. Ben Matson is undergoing some further research with the BOM to determine the relationship of early season rainfall to growing season rainfall in pastoral regions.

Appendix 5 - Extract from milestone report 2

Milestone 2 - Progress Report

1. Outputs from the seasonal climate forecasts delivered via a fax service and/or workshops presented by the 5 extension personnel to a trial group of 40 wool producers.
2. A low rainfall southern rangelands climate risk module included in the climate risk management kit.
3. Evaluation of the application of seasonal climate forecasts for the region at the end of the season.
4. Submission of case studies.

A report on progress with the above activities, including feedback from producers, completed and submitted to Land and Water Australia.

Results for achievement of Criteria

An extension of this Milestone 2 was sought at the signing of the contract, due to the late contracting date. The extension date was negotiated by LWW (Catherine Viljoen) and SARDI (Melissa Truscott) to 1/7/2003, apart from criteria 3 of milestone 2. The progress of all criteria is reported on. An updated milestone report will be provided at 1/7/2003, when Milestone 2 is fully completed.

Results for achievement toward Criteria 1

Outputs from the seasonal climate forecasts delivered via a fax service and/or workshops presented by the extension personnel to a trial group of 40 wool producers.

Two series of drought workshops were held between February and April. The first series of workshops focused on drought feeding and stress management and discussed the benefits and information delivered in climate risk management workshops, this included information on the Southern Oscillation Index, and how it affects rainfall.

In total, 75 people (holding pastoral and perpetual leases) attended the first series. At this time, people were intensely concerned with survival issues, including stock feeding methods. The second series of workshops presented information on drought recovery strategies, stress management, and again climate risk information was presented. This series was attended by 53 people - 47, had not previously attended.

Strong interest was shown in restocking strategies and much more interest was shown in the climate risk management information presented. Feedback from the presenters and participants was positive, as most in the region live with harsh climate realities and are very aware of the need for better management of climate risks. People would like to receive information on the longer term effects of climate and weather in the pastoral zone, including longer term forecasts, pasture predictions, effects on nutritional value of feed, and lambing percentages need to be clearly articulated.

Much other advertising for climate risk management workshops for the Months of May and June has occurred in the pastoral zone, with adverts in the Prosperity newsletter of the CNEFAP (Central North East Farm Assistance Program) 500 readers, in specific drought management newsletters across the Rangelands, in the stock journal (16,000 rural readers), and the attached flier has been made up specifically (Appendix 1).

As an outcome of the above communication, two climate risk management workshops have been planned for the 14th of May and the 20th of June, where roughly 40 low rainfall wool producers will attend. At these workshops we will do a whole day presentation where the above suggestions will be incorporated. This includes seasonal climate forecasting information using the SOI, SST, early season rainfall and outputs from Aussie Grass (pasture predictions) and Win Grasp, will be presented within the following 4 modules;

1. Understanding Risk
2. Understanding Climate and Weather
3. Decision Support Tools for Climate Risk
4. Making Climate Risk Management Decisions.

During the presentation of these modules we will discuss with growers, the timing of the decisions they make and how they value current seasonal forecasts. We will further then tailor forecasts to deliver to these producers. We have a list of producers in which we will begin e-mailing timely seasonal forecasts to, following the 14th of May workshop. A draft forecast is attached (Appendix 2).

Results for achievement toward Criteria 2

A low rainfall southern rangelands climate risk module included in the climate risk management kit.

The Climate Risk Management Kit has been prepared for delivery of climate risk management workshops. This has been adapted for delivery to low rainfall wool producers. The modules adapted, and the changes to these modules include; Module 3 "Decision Support Tools for Climate Risk". This module demonstrates Win Grasp and the use of Aussie Grass. Module 4 "Making Climate Risk Management Decisions" has also been adapted to look at major climate risks in the SA rangelands, and how management practices can be put in place to better manage these risks, strategically, operationally and tactically. The changes to the module have been made to the powerpoint presentation CD, and the climate risk management resource manual. A re print will be posted to LWW by July.

Results for achievement toward Criteria 3

Evaluation of the application of seasonal climate forecasts for the region at the end of the season.

Due to the early stages of this project, we can only evaluate how useful and accurate seasonal forecast would be to producers in these regions. Extension officers have indicated that wool producers would save hundreds of thousands of dollars, had they known it was going to be a drought in advance. They would have done this by selling their stock earlier receiving a better price, purchasing fodder earlier before price increased, preserving the impact on native vegetation for breeding stock reducing the need to sell them. Some producers will now have to purchase their stock back at double the price they sold it for. Some may not be able to purchase stock back, so they will have to breed back making it longer before they reach full production potential,

Timely long term forecasts with information on pasture growth, lambing percentages and relation to management decisions such as when to de-stock or in the current situation re-stock is all information that can be delivered in the near future. Information will be delivered at climate risk management workshops as discussed above, as well as through the e-mailed timely forecasts. These forecasts will be e-mailed from Mid May - 2003 for a season. At the

end of this season they will be evaluated and another group of producers will be chosen to send more information to. A broad cross section of producers will be chosen. A report detailing these results was submitted and is called: Evaluation of the Application of Seasonal Climate Forecasts for the SA Rangeland Wool Producers. August 2003. (See references).

Results for achievement toward Criteria 4

Submission of case studies.

Three producers were chosen as case studies. Two of them have utilised and evaluated seasonal climate forecasts and one producer is new to this sort of information. The producers will be asked how they would respond in to a perfect forecast for a good season and a bad season. This further helps us understand the economic and biological affects of seasonal conditions.

A report was submitted detailing the case studies titled: Use of Seasonal Climate Forecasting Information by Two Case Study Pastoralists.

Appendix 6 : Extract from milestone report 3

Milestone 3 - Progress Report

5. Re-testing of seasonal climate forecasts and Aussie Grass outputs
6. Initial regional project with original 40 producers and regional testing of forecasts complete
7. Revision of seasonal climate forecast information and delivery systems.
8. Delivery of revised system to a second trial group of 40 producers
9. A fax-back/email system set up for delivery for up to 300 subscribing producers
10. Networks for climate workshops established and utilised for ongoing updates and delivery of information.

A report on progress with the above activities, including feedback from producers, completed and submitted to Land and Water Australia (see attachment).

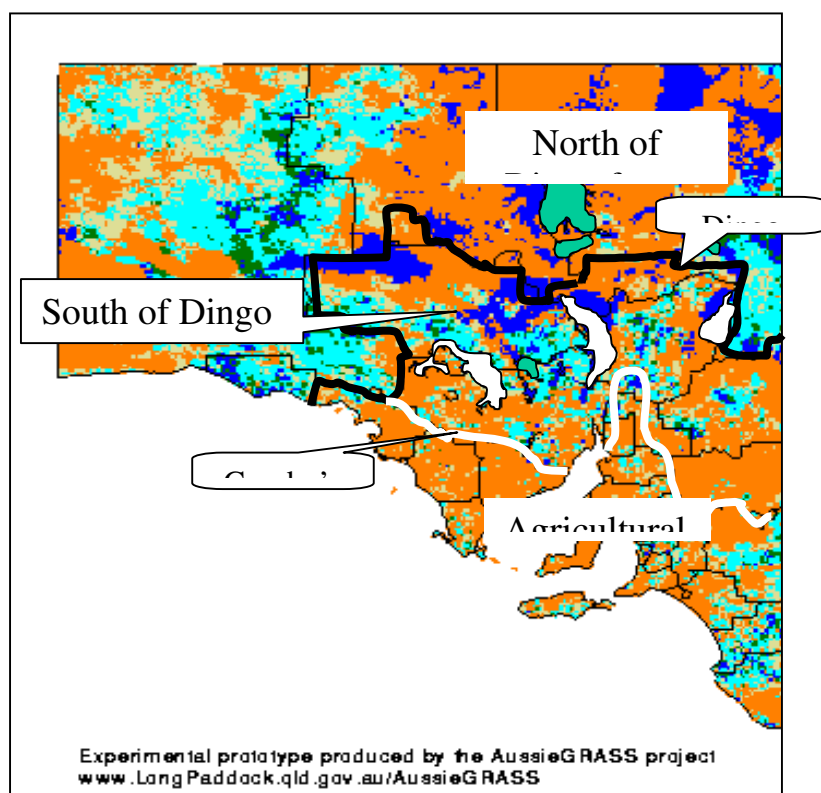
Results for achievement of Criteria

An extension of this Milestone 3 was sought at the signing of the contract; due to the late contracting date and landholder commitments. The extension date was negotiated by LWW (Catherine Viljoen) and SARDI (Melissa Truscott) to 30/6/2004. The extension has been verbally agreed upon as long as an interim report is submitted. This reports on the achievement toward milestone 3 to date.

Introduction

South Australian rangelands area comprises of two separate zones for sheep and cattle livestock production. The sheep (mainly for wool production) are inside the dog (dingo) fence on the southern side while cattle are on the northern side of the dog fence and this is shown in figure 1. In Queensland and Western Australia the sheep production areas are inside and outside of the dog fence.

Figure 1: The sheep and cattle rangelands zones of SA.



There are approximately 155 pastoral leases in the rangelands which all are located on the southern side of the dingo fence. Some producers may own more than one lease. There are 12 pastoral leases within the sheep zone that run cattle only and there are 14 which run no stock at all. There are also wool producers located in the rangelands that own properties freehold. It is estimated that there are 152 wool producers in the southern rangelands of South Australia.

Materials and Methods

Wool producer groups at Pt Augustus and Woolgangi have been receiving a range of seasonal climate forecasting (SCF) information put together by the SARDI Climate Risk Management Unit, through the LWW project (see Appendix 1). This group is referred to as group A. This has been posted or e-mailed for six months and four months (respectively). The total number of producers that have been receiving this information is 36. Previous workshops and surveys to this group have identified times of the year when forecasting information is of most use and the forecasts have been posted or e-mailed at these times.

The 36 producers from group A were asked to fill in a two part survey in return for receiving the seasonal climate forecast information. The aim of the survey was to find out how useful the seasonal forecast information was with respect to the management decisions they make. Part A of the survey asked the producers how useful they found the seasonal climate forecasting information that was posted or e-mailed (see Appendix 2). Part B of the survey asked the producers to comment on the usefulness of a range of seasonal climate forecast maps derived from Aussie Grass/ Map Arranger. These producer groups had not previously been exposed to these maps. These maps were developed by the Land Water and Wool Project - QNR30 (Queensland over arching project) and from now on will be referred to as Map Arranger. An example of how these maps were presented with the survey questions is shown in Appendix 3.

In an effort to better understand the usefulness of seasonal climate forecasting information for of wool producers in the rangelands of South Australia, further groups were invited to answer the two part survey. Two workshops were held at Leigh Creek and Quorn (with 22 participants attending). This group will be referred to as group B. At the workshops SCF information previously e-mailed or posted to group A was explained. Producers were then asked to fill in survey A. Due to lack of response to survey B from the first group producers (group A), the Map Arranger products presented were modified for the second group (group B). These Map Arranger outputs were also explained in the workshops.

The workshops followed the national accreditation process as set out in the Climate Risk Management Kit developed by SARDI – CRMU.

Workshop process

During module 1, wool producers are asked about their main climate risks. During module 2 producers were shown how these climate risk events can be forecast. During module 3, producers were shown previous seasonal climate forecasts formulated for wool producers, and further product outputs from Map Arranger. The producers were also presented with a survey to comment on how useful this information would be and how to best present the information. These modules and their aims were;

Module 1: Understanding climate risk

- Understand the various climate risks affecting wool producers businesses
- Understand the actual risk of a particular climate event occurring

- Understand variations in personal attitude to risk
- Understand how farm business decision making is influenced by the actual climate risks occurring and personal attitude to risk

Module 2: Understanding Climate and Weather

- Discover what influences seasonal climate forecasts like the ocean and atmosphere
- Discover the measurements of seasonal climate forecasts like the SOI and SST's
- Use the major climate influences and seasonal forecasts to make management decisions at a given location.
- Understand information contained in a weather map and make short term decisions based on a weather map

Module 3 : Seasonal Climate and forecasting systems

- Understand how to access seasonal climate forecasting information tools and services
 - The trial information packages SARDI provide to wool producers and reformulation of these to suit the group.
 - Seasonal climate forecast information presentation eg what format do producers prefer and at what times of the year
 - Aussie Grass and Map Arranger outputs.

Module 4: Making Climate Risk Management Decisions.

- Acknowledge the effects local key climate risk events have on the local industry

Formulate strategies to reduce the impact these climate risk events have on individual farming businesses

Surveys

Part A of the survey asked wool producers from group A and group B about the usefulness of seasonal climate forecasting information e-mailed, faxed or shown during the workshops. Each decision made was rated from 1 (of no use) to 10 (very useful). The options producers were asked to provide a rating to were as follows;

- *Buy more stock*
- *Breed up own stock*
- *Less joining*
- *Sell stock*
- *Feedlot*
- *Agist*
- *Purchase feed*
- *Stock up on reserves*
- *Increase watering points*
- *Cart water*
- *Monitor water*

The above questions were also used in survey B of the Map Arranger outputs.

The information that was considered in part A of the survey comprised of:

- Southern Oscillation index graph 1998 to 2003. (BOM)
- Map of Australia showing the chance of exceeding the median Rainfall (BOM)

- BMRC/NMC global SST Anomaly Week Ending 10 Aug 2003 Map (BOM)
- South Australian Rainfall Deciles map for a 3 month period (BOM)
- South Australian Rainfall (mm) for a 3 month period (BOM)
- Accumulated rainfall graph (Climate Calculator WA Ag)
- Deciles of Rainfall Graph with SOI phases Jun to July and Rainfall period of 3 months (Rainman)
- Aussie Grass outputs including 3 month pasture growth output and total standing dry matter in tdm/ha. In January 2004.

Producers were also asked about the presentation on the information including; format such as

- pie charts, tables graphs or written,
- suggestions for improvement,
- delivery method,
- timing of delivery
- which information they may pay for

A full detailed copy of survey A can be found in Appendix 2.

The Map Arranger outputs a range of seasonal climate forecast maps. These maps can be of any state of Australia or for the whole continent. Choices of outputs include the relationship of SOI (Southern Oscillation Index, 5 phases or SST (Sea Surface Temperatures, 9 phases), to rainfall and pasture growth. A 1 to 6 month lead time and forecast duration period needs to be chosen also.

Preferred forecast time periods were chosen by group A from Woolgangi and Pt Augusta. These time periods were described by producers as times of the year when forecasting information would be useful in supporting their decision making. A range of maps outputs from Map Arranger were produced based on these time periods. The times of the year selected through the groups were April - June and October - December. Five lead times (in months) were also chosen from a possible 6 lead times. As a result of these choices from Map Arranger, 280 probability of exceeding median rainfall or pasture growth maps were produced with 280 significance maps, these include;

- SOI Phases 1-5 for Growth April to June lead time 1,2,3,4,5
- SOI Phases 1-5 for Rainfall April to June lead time 1,2,3,4,5
- SOI Phases 1-5 for Growth Oct to Dec lead time 1,2,3,4,5
- SOI Phases 1-5 for Rainfall Oct to Dec lead time 1,3
- SST Phases 1-9 for Growth April to June lead time 1,2,3,4,5
- SST Phases 1-9 for Rainfall April to June lead time 1,2,3,4,5
- SST Phases 1-9 for Growth Oct to Dec lead time 1,2,3,4,5
- SST Phases 1-9 for Rainfall Oct to Dec lead time 1,2,3,4,5

Efforts were made to simplify the significance legend by removing the Chi Square valued and replacing them with simpler terms eg greater than 0.1 = none, 0.1 – 0.05 =poor, 0.05-0.01 =slight, 0.01-0.005 =moderate and greater than 0.005 = good , as shown in figure 2.

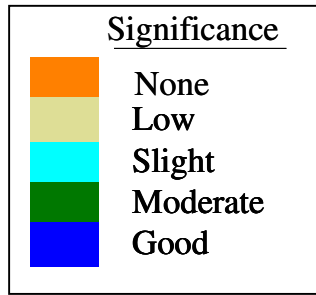


Figure 2 : The legend we attached to the Map Arranger Chi Square significance maps simplified for producer use. Chi Square valued as greater than 0.1 = no significance, 0.1 – 0.05 =poor significance, 0.05-0.01 =slight significance, 0.01-0.005 =moderate significance, and > 0.005 = good significance.

Two hundred and eighty maps were too many to show wool producers in group A for comment, therefore some culling of maps took place. Maps were culled if their corresponding significance map showed less than 0.005 chi squared in the sheep zone of SA. The salt lakes in SA often showed high significance to pasture growth in all phases of SOI and SST. These maps were culled if the salt lakes were the only regions in SA showing some significance to pasture growth. As a result 203 Map Arranger output maps remained. The resulting outputs Map Arranger maps that were shown to producers in group A are listed in table 1.

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SOI	Growth																
	Rainfall																
SST	Growth																
	Rainfall																

= the Phase time = the forecast period

Table 1: The list of the maps from MapArranger selected and shown to producers in group A for all SOI and SST phases (phases not shown in the table). Phase time and forecast period is shown in the table and the lead times were 1 to 5 months.

Five to Nine maps were printed per page with an explanation for each. Chi square maps showing the statistical significance (with the legend shown in figure 2) of rainfall and pasture growth to the SOI and SST were also printed on each page, for each rainfall and pasture growth probability map. An example of how the maps were presented to producer is shown in Appendix 3. Each of the wool producers from group A were asked to identify their property on the Map Arranger maps. The producers were then asked to comment on the usefulness of each of the 203 maps by ticking the options as to how they would use the information. The same questions were asked in survey A.

We did not have a great response rate from survey B of the Map Arranger outputs from group A. This may have been because, the two forecast time periods chosen for group A did not show much variation in rainfall or pasture growth probability. Furthermore, the significance with SOI or SST was patchy in the wool producing rangeland regions. As a result we chose 3

month forecast periods starting at each month of the year for the next survey group (B). Map Arranger was used to produce the range of output maps showing the probability of exceeding median rainfall or pasture growth using the SOI (5 phases) and SST (9 phases) using the 3 month forecast period for each month of the year with a 1 to 5 month lead time. As a result 490 maps were output. Maps were then culled which showed no significance in the Leigh Creek or Quorn regions.

Only 21 maps showed some chi squared significance of the SOI or SST with pasture growth in the Leigh Creek or Quorn areas and these are listed in Table 2. The map selection is shown in Appendix 4 . The Map Arranger maps did not show any significance with rainfall in the Leigh Creek and Quorn areas.

Phase		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SOI	5 Growth												
	4												
	3												
	2												
	1												
	5												
SST	9 Growth												
	7												
	7												
	5												
	3												
	1												
	7												
	9												
	5												
	3												
	1												
	1												
	1												
	2												

 = the Phase time  = the forecast period

Table 2: The 21 Map Arranger outputs selected and presented to group B. SOI and SST phases with some significance to pasture growth are listed as well as phase time and forecast period. The lead time is shown as the gap between the phase time and forecast period.

Results and Discussion

An earlier survey done as part of Milestone 2 of this project with 90 pastoral lessee holders in the southern rangelands showed that 67% of producers used seasonal climate forecasting information to assist them in the decision making activities on their property. The other 33% monitored seasonal climate forecasting as interest only. The majority of the responses appeared cynical of seasonal climate forecasting information and its use in decision-making.

New developments in seasonal climate forecasting information and outputs have since been sent and explained to wool producers. These producers were then surveyed to see how they utilised the new information and what they suggest for improvements in the future.

Survey A and B was sent to 36 producers and provided to a further 22 in workshops. The details of the surveys developed and delivered are shown in Table 3.

Table 3: The surveys and who and how they were presented

Survey A	Seasonal Climate Forecast Information from BOM web site, Australian Rainman, and Climate Calculator	Posted to Group A from Pt Augusta and Woolganig (36) and Shown to Group B from Quorn and Leigh Creek during a workshop (22)
Survey B	Seasonal Climate Forecast Information from Map Arranger – 203 maps produced	Posted to Group A from Pt Augusta and Woolgangi (36)
Survey B	Seasonal Climate Forecast Information from Map Arranger – 400 maps produced	Shown to Group B from Quorn and Leigh Creek during a workshop (22).

Survey A had a 46% response rate and survey B had a 38% response rate. The response rate to this survey was less than the response rate to a survey sent earlier in this project as part of milestone 2. In the first survey sent at the beginning of the project (Evaluation of the Application of Seasonal Climate forecasts for the SA rangeland Wool Producers Project Milestone 2.3) the response was 58%.

Most producers from group A did not answer survey B that was posted. Those that did not respond were contacted and asked the reasons for not replying. The following reasons were given;

- the survey was too long and there was too much information
- the Map Arranger maps had no significance for their property

During the 6 months between October 2003-March 2004, the rangelands sheep zone received around average rainfall. Figure 3 shows the rainfall and deciles between Oct 03 and March 04. Discussions with producers through workshops and phone conversations, indicated that in an average rainfall season they make little changes to their management.

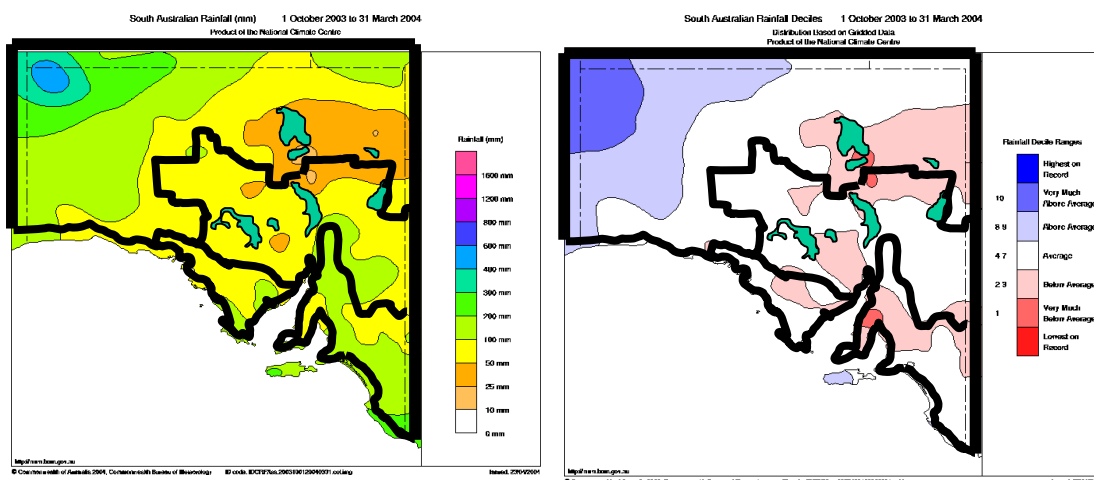


Figure 3: The actual rainfall received and the rainfall decile maps for SA from October 03 to March 04.

Results from Survey A - from group A and B

Delivery of the seasonal climate forecasting information has been previously sent to group A (from Pt Augusta and Woolgangi) via post or e-mail on a monthly basis for a period of 4 to 6 months. An example of the outputs of the seasonal climate forecasting information are shown in Appendix 1. Group B from Leigh Creek and Quorn were exposed to the seasonal climate forecasting information for the first time during workshops in February 2004.

Producers from group A and group B were asked to answer a survey on the usefulness of SCF information shown and the time of the year when this information would be useful. The survey (A) is shown in Appendix 2. The survey relates to the management decisions producers may make as a result of viewing the information. Producers were asked to tick boxes about the types of decisions they may make.

Comments from producers have been included though-out the paper as valuable insight into their understanding of seasonal climate forecasting information.

The usefulness of the SOI graph

A graph of the historical and current SOI values extracted from the BOM web site, was presented to producers, via post, e-mail or workshops. In response to the SOI graph (figure 4), 74% of producers indicated that the graph was useful, while 26% indicated it was not useful for supporting their management decisions.

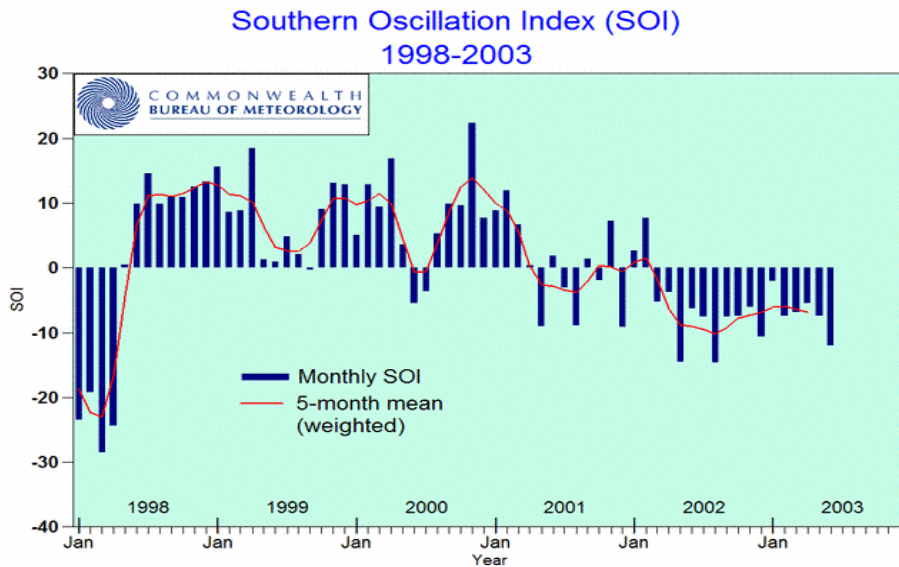


Figure 4: An example of the SOI graph showing the SOI values each for each month from January 1998 (source: BOM web site).

Producers were asked which month the SOI graph would be most useful. Each producers requirement varied. September was an overall higher priority for information than May and June, however all months of the year were considered important and this is shown in figure 5. It was suggested that the SOI graph only be sent at the times of the year the SOI has some significance for seasonal climate forecasting in the region.

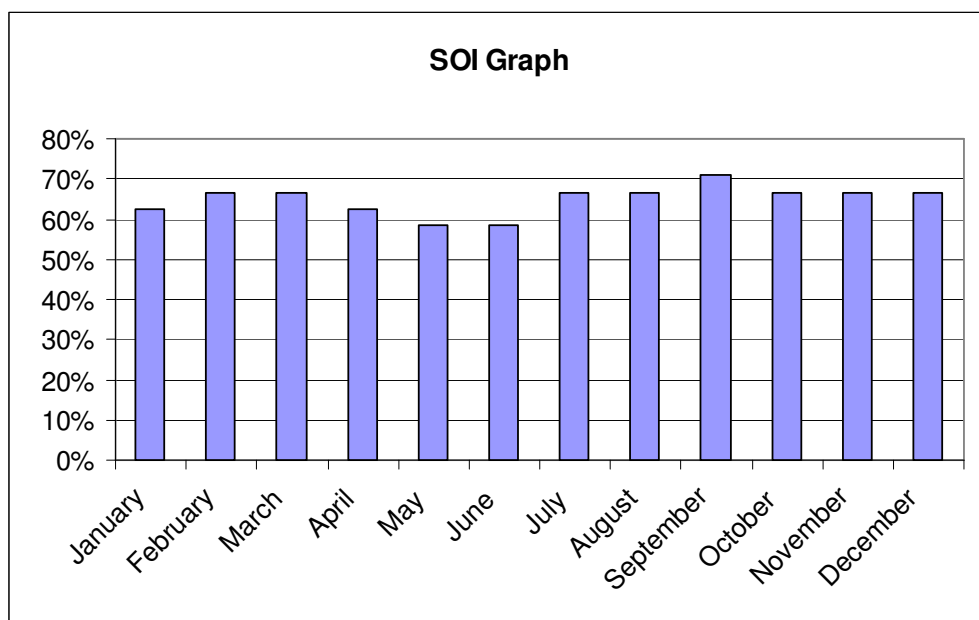


Figure 5: The times of the year when producers would prefer to receive the SOI graph. The percent of responents is shown on the y axis.

Producers were asked to tick boxes that indicated the decisions they may make when viewing the SOI graph. Forty nine percent of respondents indicated that the SOI graph may influence them to breed their own stock, 35% said they would sell stock, 26% said they would agist, 22% said they would join less sheep and 22% said they would purchase feed. This is shown in figure 6.

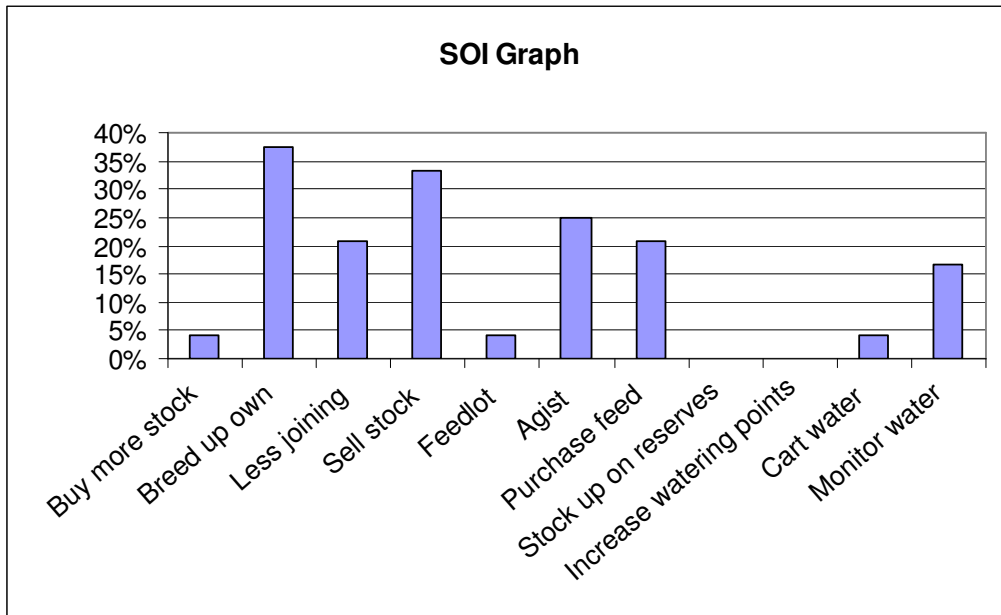


Figure 6: The decisions wool producers may make in response to the SOI graph. The percent of respondents is shown on the y axis.

Comments made by producers regarding the SOI graph shown in figure 6 were:

- We aren't convinced of the influence of SOI has on our weather- we've had some pretty good rains in EL Nino times as well as dry.
- No use
- As we are rebuilding flock numbers at Kokatha we are acting on actual rainfall and weather more that predictions or forecasts.

The Australian 3 month rainfall outlook map from BOM.

Producers were asked how useful they think the Australian 3-month outlook map from the BOM web site was, as illustrated in figure 7. Seventy percent of respondents indicated that the graph was useful and 30% indicated it was not useful.

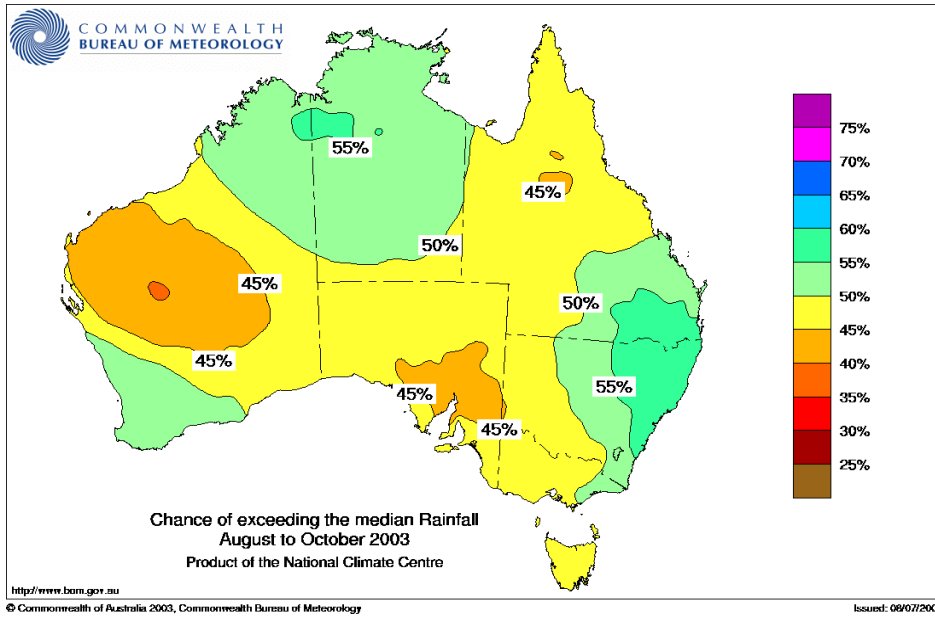


Figure 7: An example of the three month rainfall outlook map showing the chances of exceeding the median rainfall (Source: BOM web site).

The times of the year when the BOM 3 month rainfall outlook map was rated as most useful were January, July, August, September and December, however figure 8 illustrates that the other months of the year were also considered of similar importance.

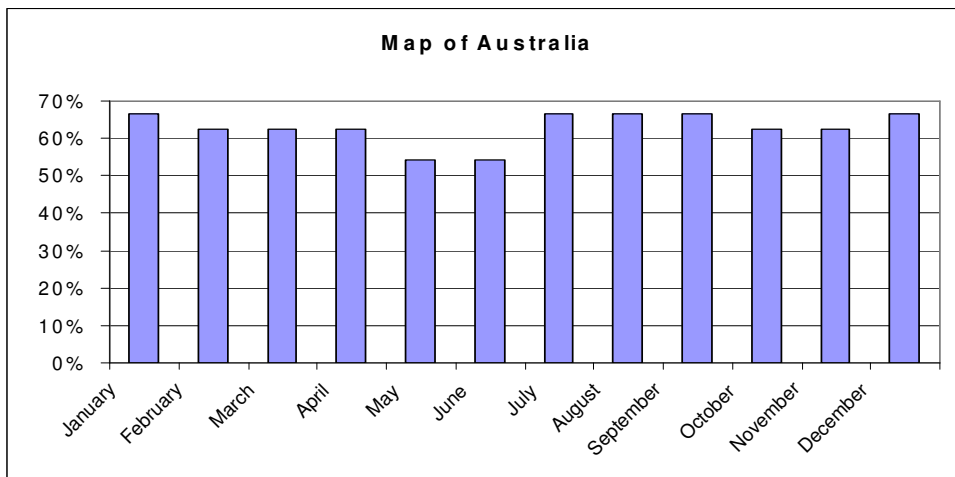


Figure 8: The months of the year when producers find the BOM rainfall outlook map most useful. The percent of respondents is shown on the y axis.

Producers were asked to rate the management decisions they would make using the BOM seasonal climate outlook map shown in figure 7. Thirty one percent of producers said they would sell stock, 22% said breed own stock, 17% said reduce joining and 17% said they would monitor water and this is shown in figure 9.

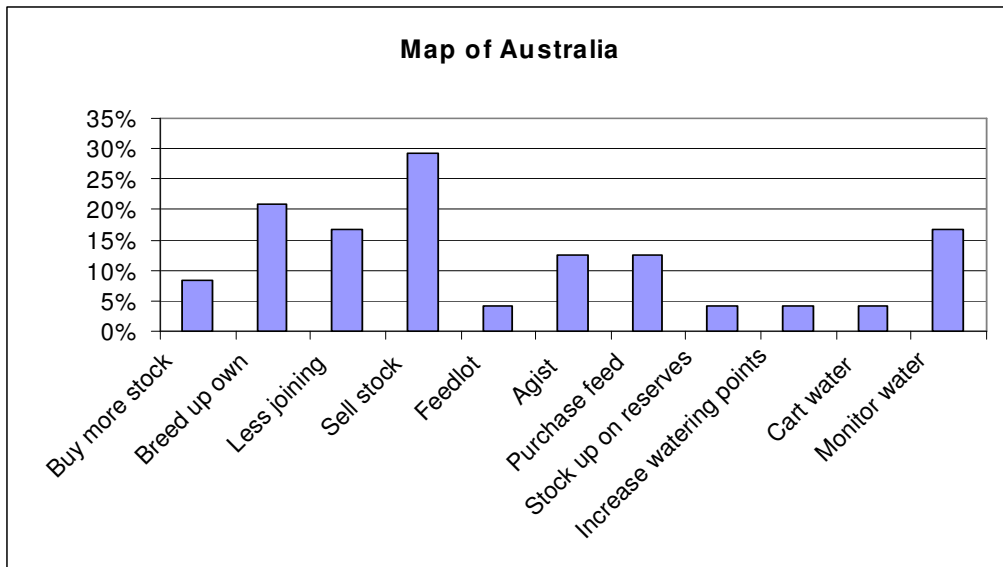


Figure 9. Shows the management decisions wool producers would make when viewing the BOM 3 month rainfall outlook map. The percent of respondents is shown on the y axis.

Comments made by producers regarding the BOM 3 month seasonal climate outlook map were:

- Don't have sufficient faith in forecast long term yet to make big decision would need to judge reliability over a longer period. So far all have indicated low probability of rain and this is what has happened – would like to see it work the other way as our chances of getting rain are less than those of getting it – ie it is easier to predict none or little to of getting good rain. .
- Our judgement and stock practices are not based on forecasted rainfall or temperature.
- Useful when probability high or low
- Other decisions made: not to sell stock prior to summer

The SST anomaly map

Producers were asked if they think the SST anomaly map produced by the BMRC as shown in figure 10 was useful. Fifty seven % of respondents said the map was useful and 43% said it was not useful.

BMRC/NMC Global SST Anomaly
 Week Ending 10 Aug 2003

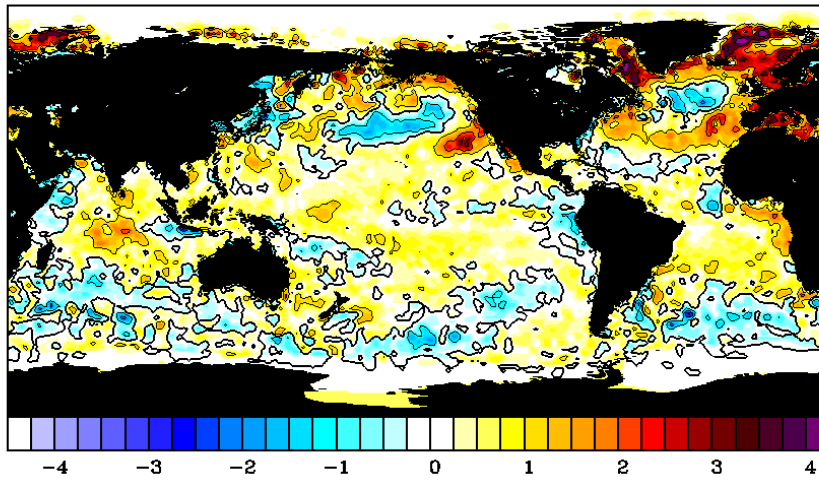


Figure 10: An example of the SST world anomaly map for August 2003 (source:BMRC web site).

Figure 11 shows the months in the year when producers would most like to see the BMRC SST anomaly map. July and October were the months when they would most prefer the map, however all months were of importance.

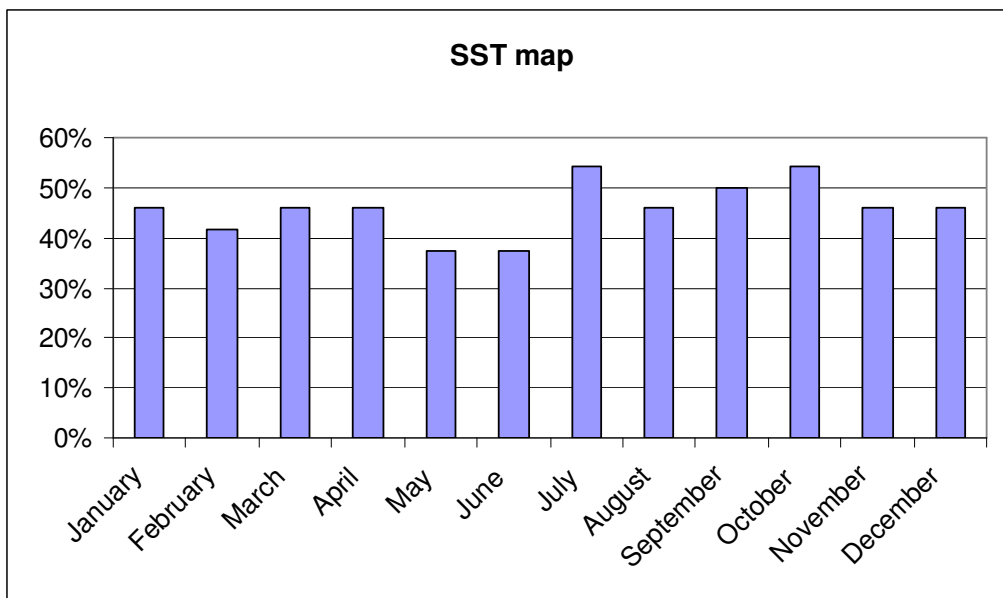


Figure 11: The months of the year when producers would most prefer to receive the BMRC SST world anomaly map. The percent of respondents is shown on the y axis.

The wool producers were asked about the management decisions they may make when viewing the BMRC SST world anomaly map shown in figure 10. Seventeen percent of producers said they would breed their own stock with 17 % saying they would monitor their water and these results are shown in figure 12.

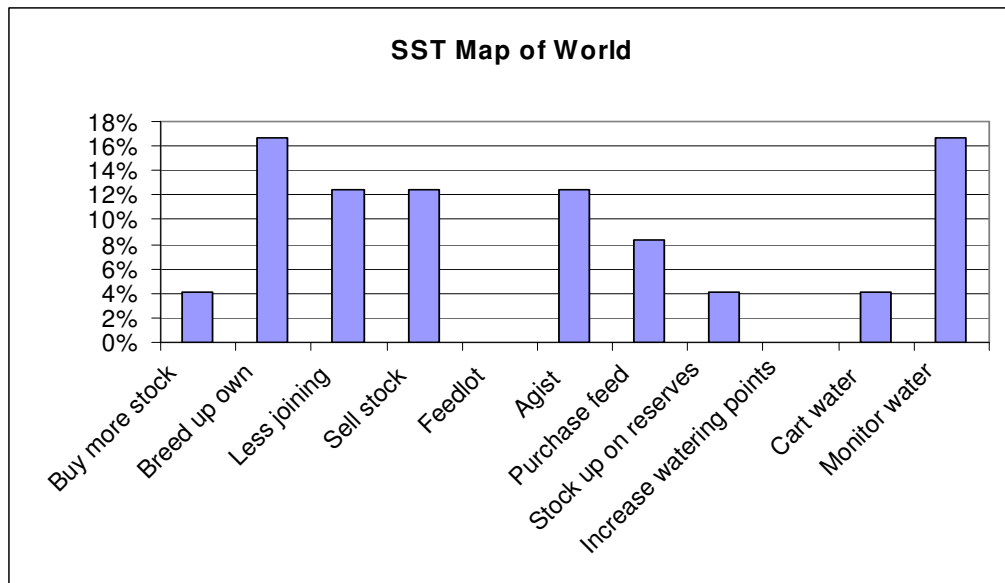


Figure 12: The decisions that wool producers may make when viewing the BMRC SST world map. The percent of respondents is shown on the y axis.

The BOM accumulative rainfall decile map of SA

The BOM accumulative rainfall decile map of SA was provided to wool producers and an example is shown in figure 13. Seventy eight percent of producers indicated that the map was useful and 28% indicated it was not useful to make management decisions.

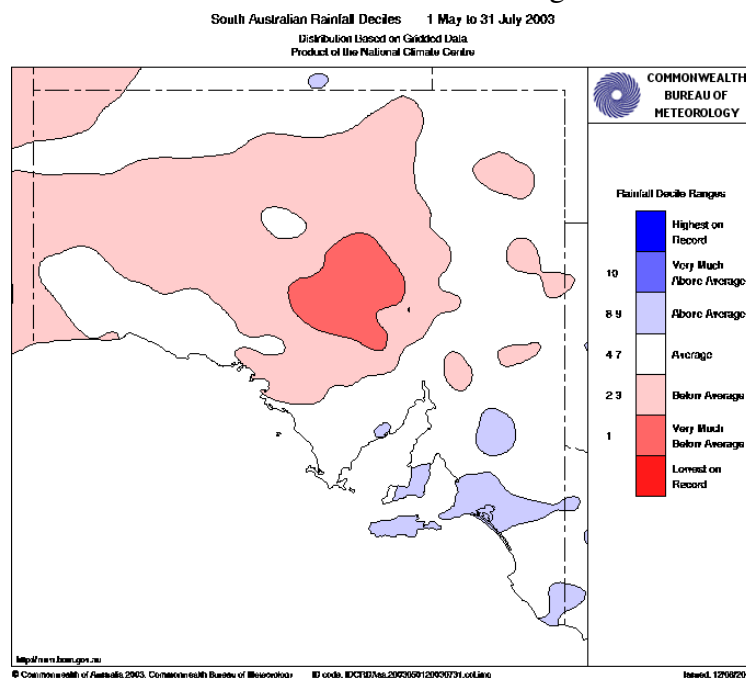


Figure 13: An example of the accumulative rainfall decile map for South Australia for a three month period. (Source: BOM Web site).

Seventy percent of wool producers indicated that September was the month when this map would be most useful with 55 to 65 percent of producers saying this map would be also be useful in all other months.

Wool producers were asked what decisions they may make when viewing the BOM accumulative rainfall decile map for SA. Thirty three percent of producers responded with the biggest decision being to sell stock and this is shown in figure 14.

Comments made by producers regarding accumulative rainfall decile map of SA were;

- We have attended several workshops on deciles and struggled with understanding them.
- We feel deciles are not relevant to our types of rainfalls.
- Hard to find our property. Can soil board districts or lakes/rivers be included.

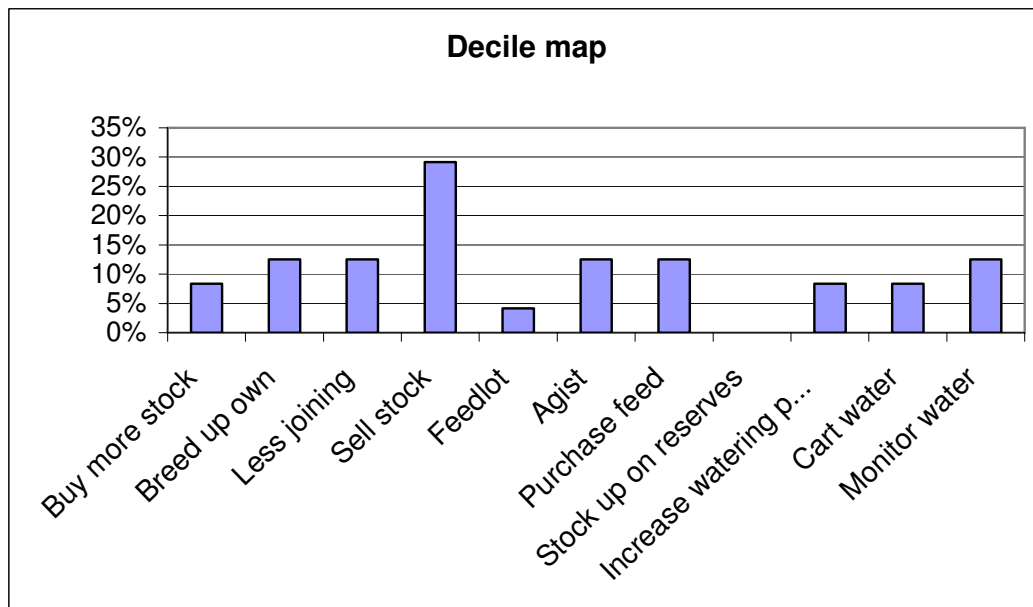


Figure14: The management decisions wool producers may make when viewing the BOM accumulative rainfall decile map. The percent of respondents is shown on the y axis.

The BOM accumulated rainfall map of SA.

The wool producers were asked how useful they think the accumulative rainfall map of SA may be (as shown in figure 15). Seventy four percent of producers indicated that the map was useful and 26% indicated it was not useful.

The producers suggested that the BOM accumulated rainfall maps would be useful in any month with no strong indication for any specific month/s.

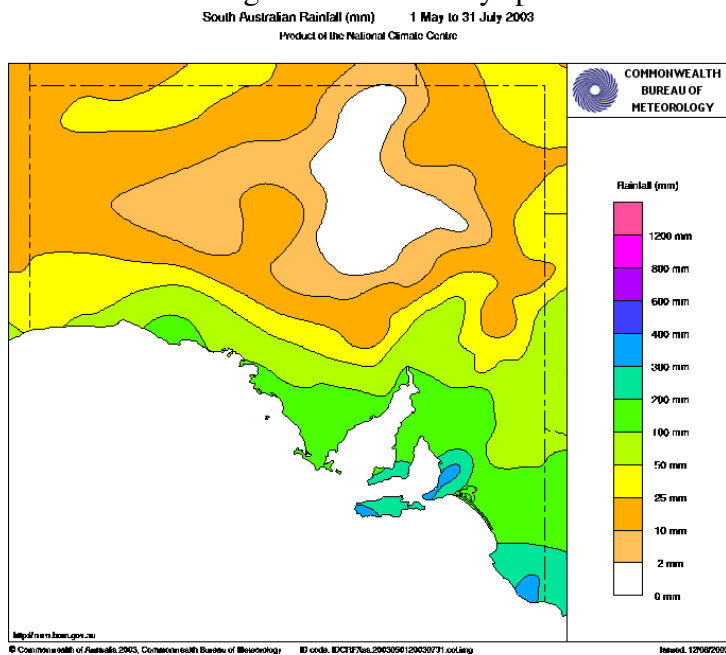


Figure 15: An example of an accumulated rainfall map of SA for 3 months (source: BOM web site).

The wool producers were asked about the management decisions they may make when viewing the accumulative rainfall map for SA. Twenty one percent of producers responded. The producers indicated the main decisions they may make when viewing the accumulated rainfall map and these include; sell stock 22%, less joining 17% and purchasing feed 17%. These responses are illustrated in figure 16.

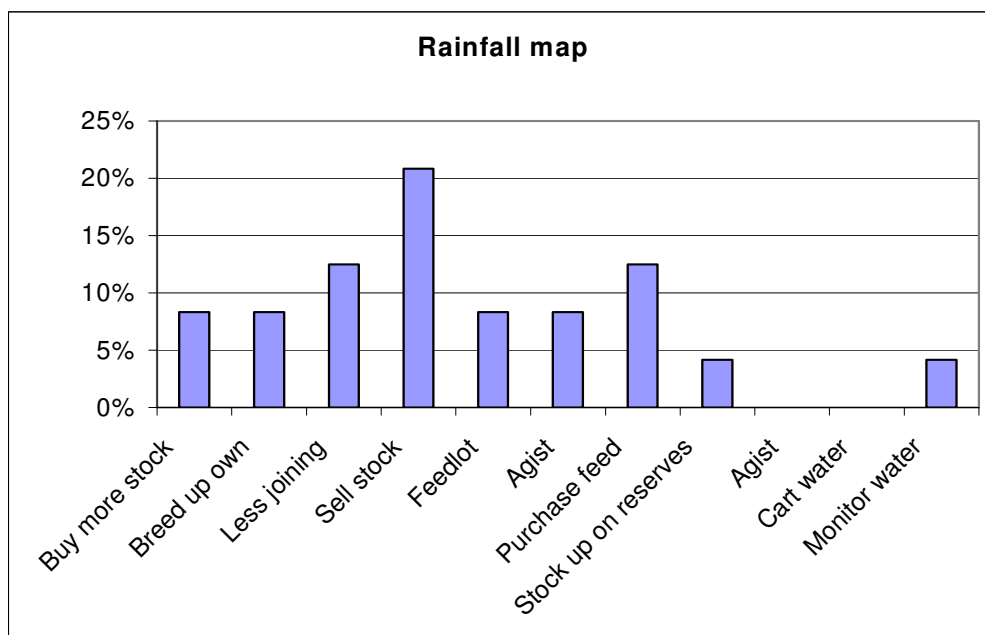


Figure 16: The decisions wool producers may make when viewing the BOM accumulative rainfall map of SA

Other comments in relation to the BOM accumulative rainfall decile map include;

- Other decisions whether to maintain numbers
- If accurate and probability high
- Compared with prediction for accuracy and to see how widespread rain was.

Accumulative rainfall and decile graph - (Climate Calculator, DAWA)

Producers were provided with an accumulative rainfall graph for their district, showing rainfall deciles. This graph is produced in Climate Calculator, a model developed by the Department of Agriculture WA, David Tennant. An example of the graph is shown in figure 17. The wool producers were asked how useful this graph was with 74% of producers indicating that the map was useful and 26% indicating it was not useful.

Producers said that this graph would be useful in most months with a slight preference for the months between April and October. One comment about the timing of this information was that they would like it any time of the year, especially after rain events.

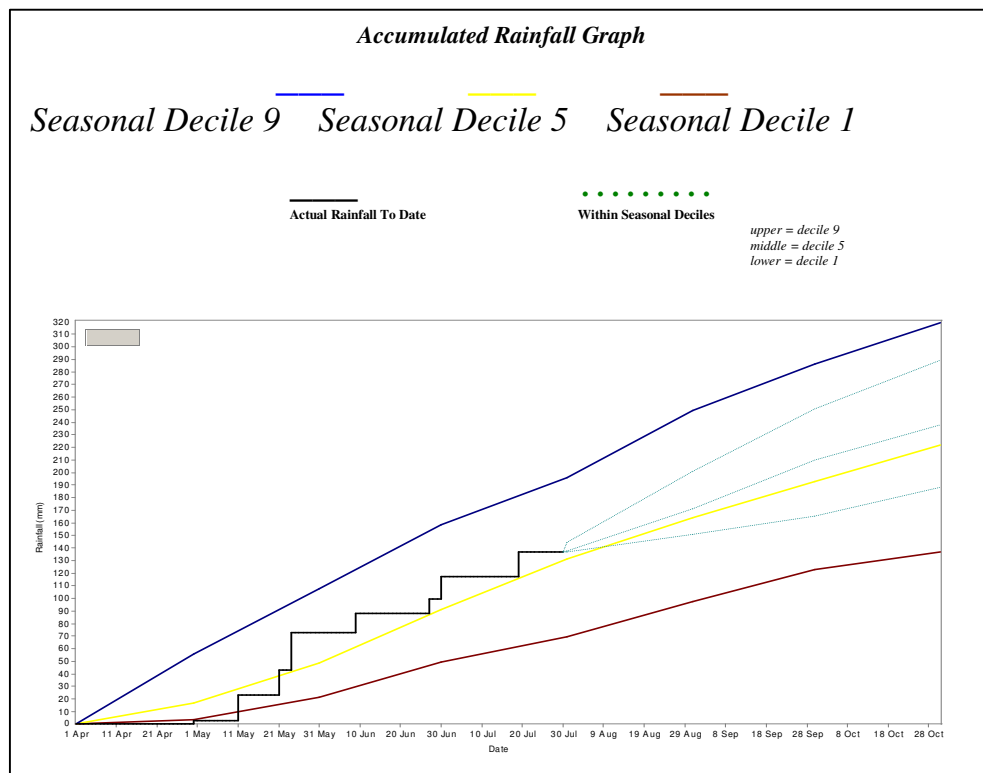


Figure 17. An example of the accumulated rainfall and decile graph produced using climate calculator a model developed by DAWA.

Producers were asked about the decisions they may make when viewing the accumulated rainfall decile graph. Sixteen percent of producers responded. The decisions they would make included selling stock, 17%, agist stock 13% and purchase feed 13% and these results are illustrated in figure 18.

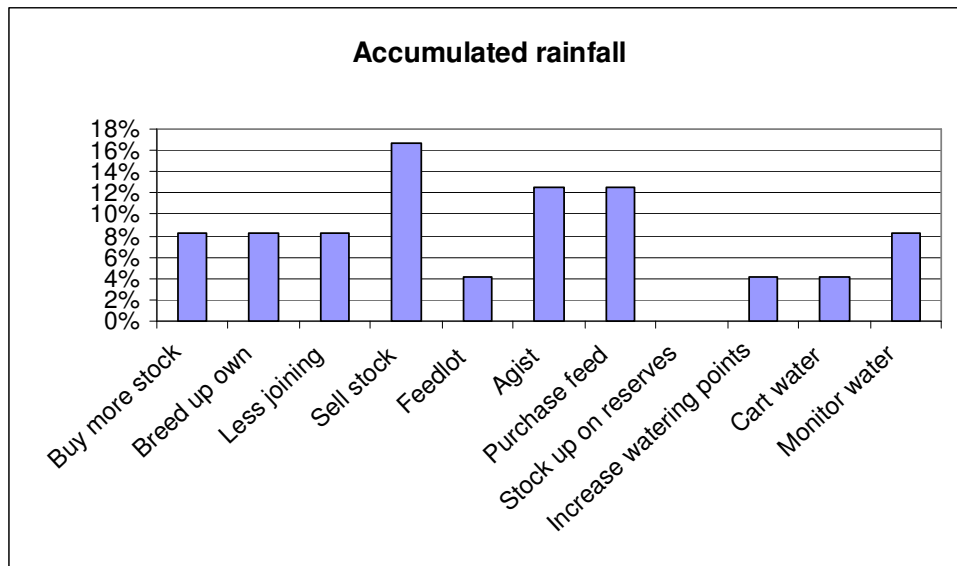


Figure 18: The decisions wool producers may make when viewing the accumulative rainfall decile graph. The percent of respondents is shown on the y axis.

Effect of SOI on decile graph (Australian Rainman, QDPI)

The wool producers were provided with a graph output Australian Rainman (produced by the Qld Department of Primary Industries). The graph generated showed how rainfall intensity varies dependant upon the SOI phase. The example below is for Canegrass in the SA rangelands. It shows the effect of the June-July SOI on Aug -Oct rainfall (figure 19). Forty eight percent of producers indicated that the map was useful and 52% indicated it was not useful.

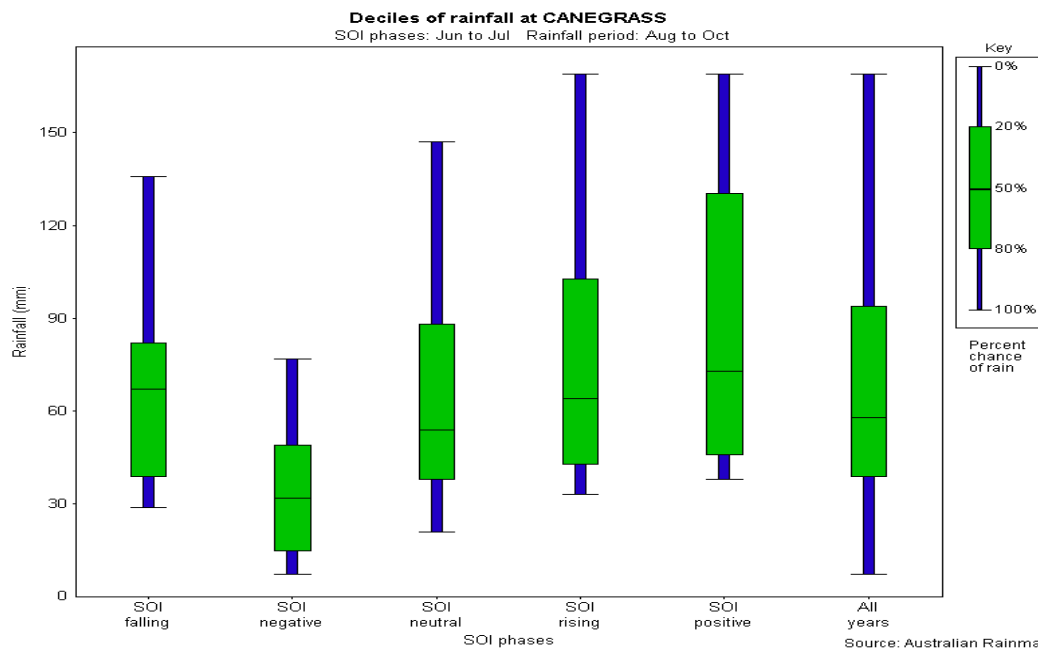


Figure 19: The deciles and rainfall range for Aug- October for the Jun-July SOI phase Jun, at Canegrass (Source: Australian Rainman, QDPI).

Up to 50% of wool produces indicated that they would prefer the SOI/decile graph in June - July, however 30-35% said every month is also useful and these results are shown in figure 20.

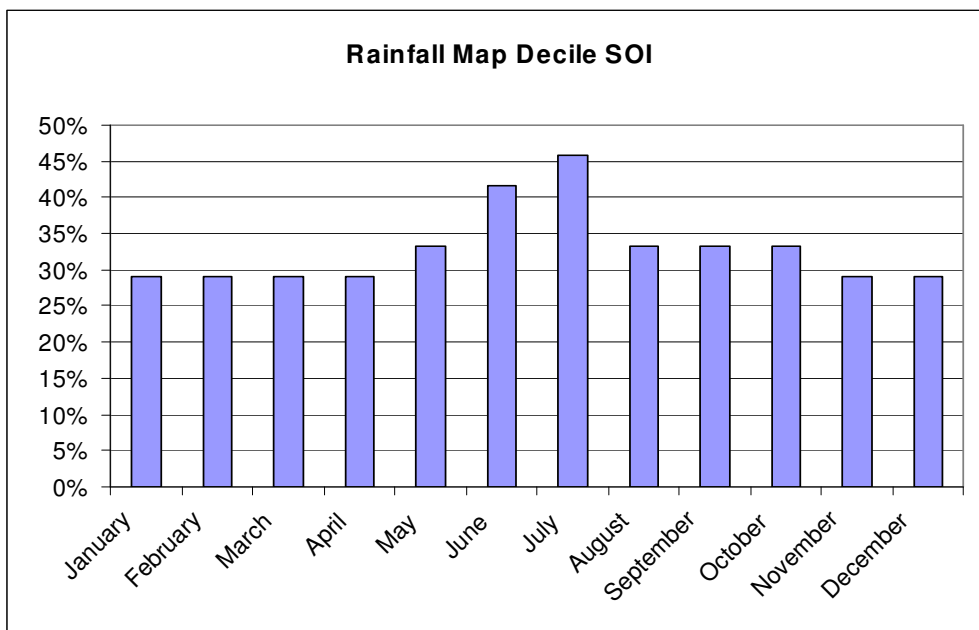


Figure 20. The times of the year when producers would most like to view the SOI/rainfall decile range graph for their own location. The percent of respondents is shown on the y axis.

Only ten percent of wool producers ticked the boxes about how they may use the SOI rainfall decile graph to make management decisions. The decisions they may make with reference to this graph included selling stock 22% and agist 17% (this is shown in figure 21). Producers said that this is another tool to make decisions and is of interest sake more than of use. One producer said he may use it to plan a shearing strategy.

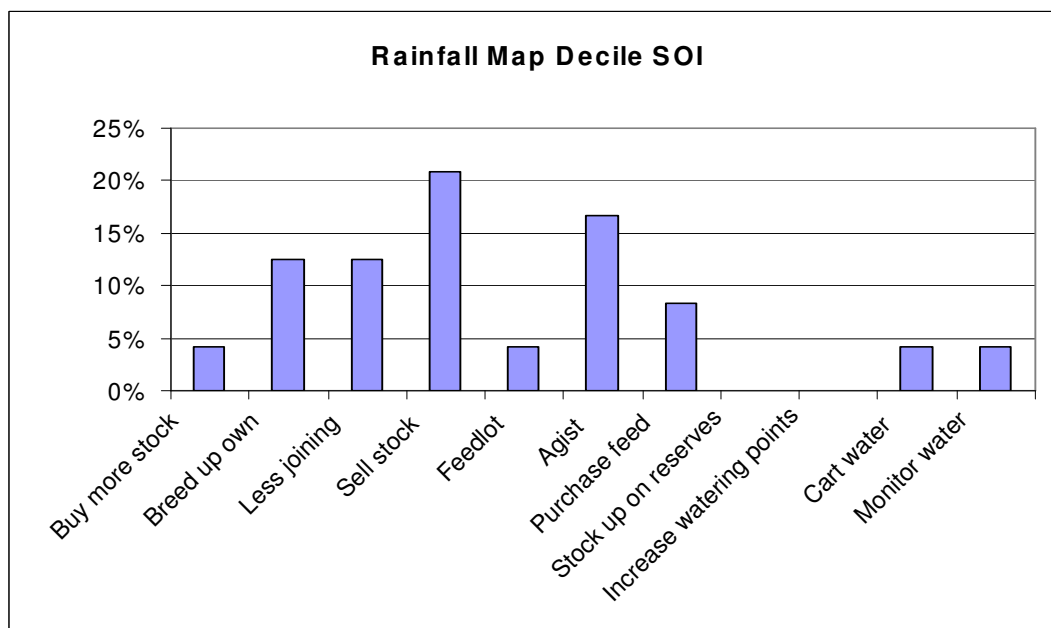


Figure 21: The decisions wool producers may make when viewing the rainfall decile graph/SOI phase graph (Australian Rainman).

Timing of delivery

Producers were asked what time of the year would they like to receive each individual piece of information shown above and also in Appendix 1. The producers responses to the preferred months for each individual piece of information was collated and the result is shown in figure 22. July and September were the most sought after months for individual pieces of forecasts information. Producers were asked at the end of the survey “for the seasonal climate forecast information combined, which months would you like to receive the information. This time the most sought after month indicated was January. However there was much similarity between months.

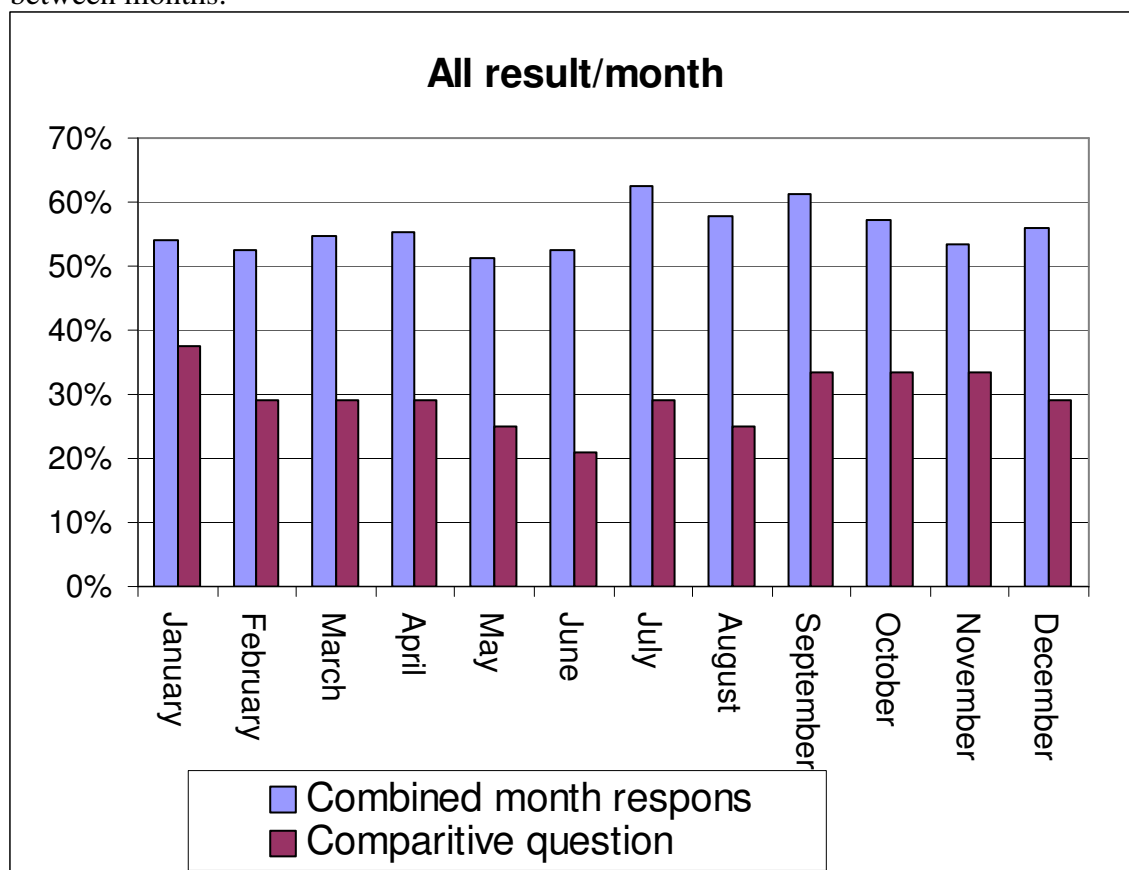


Figure 22: What time of the year producers would like individual aspects of information as compared to what time of the year producers would like to receive the combined SCF information shown above. The percent of respondents is shown on the y axis.

Overall management responses

Producers were asked what decisions they would make for each piece of information presented above. The management responses the producers may make in response to the individual aspects of information was illustrated above. We have collated their management responses to the seasonal climate forecasting information in figure 23. When this information is combined it illustrates that the biggest decision producers may make in response to the SCF information (demonstrated in Appendix 1) is to sell stock with 23 percent of produces suggesting they may do this. An overall 17 % would breed stock, 14% would join less sheep, 13 % would purchase feed, 2% would stock up on reserves and 2% said they would increase their watering points.

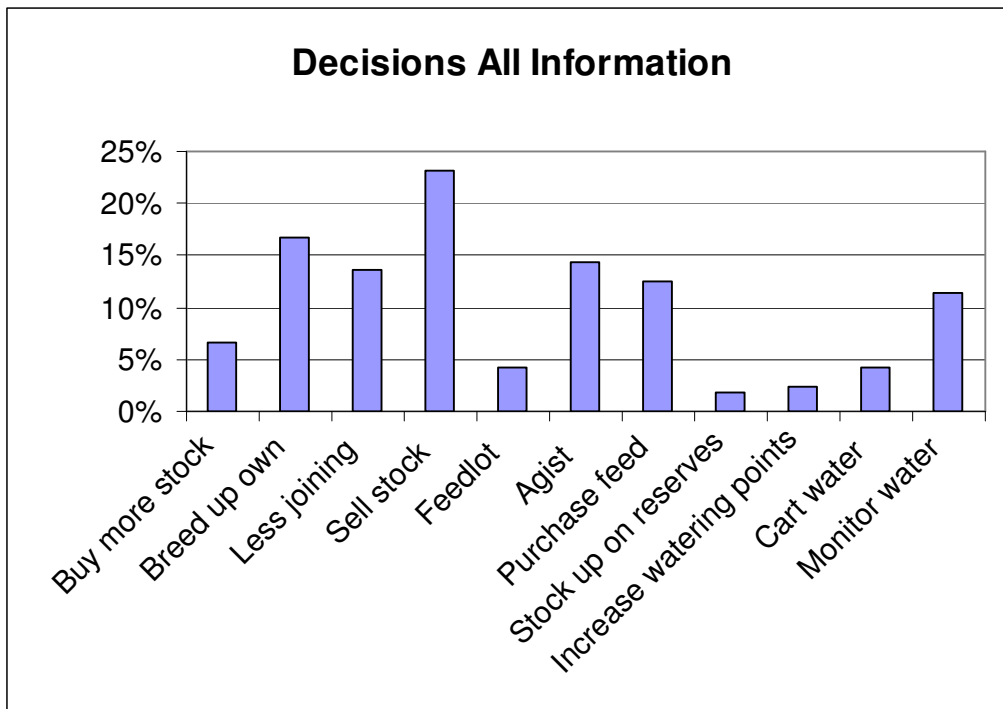


Figure 23: The coalated responses of management decsions wool producers would make in response to the SCF information shown above. The y axis shows the percent of producers.

Presentation of seasonal climate forecast information

Producers were asked how they would prefer the presentation of seasonal climate forecast information and the results are shown in figure 24. Fifty seven percent of producers indicated that they preferred graphs, 39% indicated tables and pie charts and 35% indicated that they preferred written information.

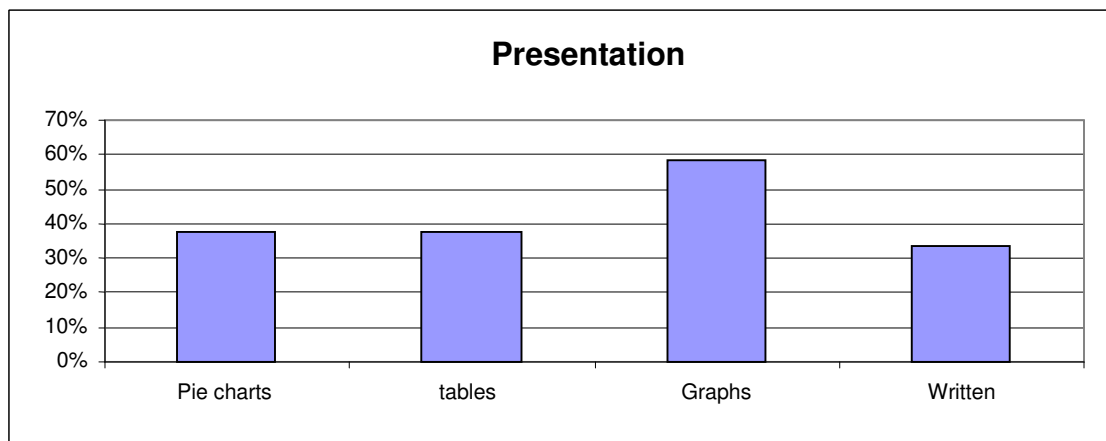


Figure 24: The format that producers would prefer seasonal climate forecasting informaiton to be presented in. The percent of respondents is shown on the y axis.

Producers were asked if they would prefer the information (pie chart, table, graph) to include an explanation/comments? Ninety six percent of producers indicated that they would like the information to include an explanation and 4% indicated that they did not want an explanation included with the information and this is shown in figure 25.

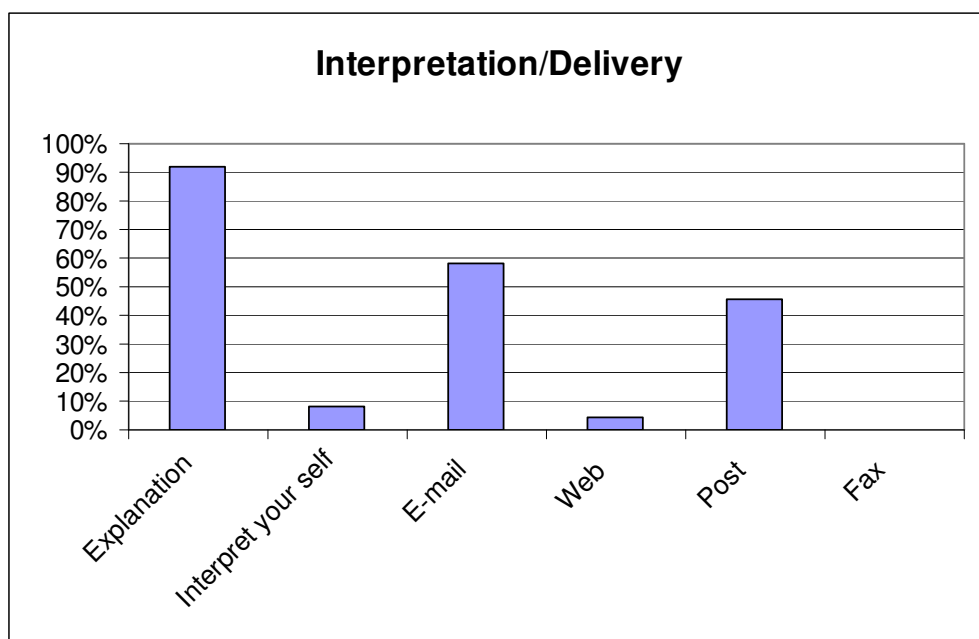


Figure 25: The preference of how the producers would like the seasonal climate forecast information interpreted and delivered. The percent of respondents is shown on the y axis.

Producers were asked how they would like the information delivered. Fifty seven percent of producers indicated that they prefer the information delivered by e-mail as long as the file size was not too big, and 48% said via post. Only 2% of producers would like to access the information via web.

About 33% of producers were previously sent the information by e-mail and 33% by post. The e-mail system had a number of issues with producers unable to open documents due to incompatible programs (as described by producer), file size was too big which clogged up the e-mail service or slowed it down. Producers terminated the e-mail process if it took too long to download the SCF.

Producers were asked how seasonal climate forecast information could be improved and presented in a way which is easy to understand. Their comments included;

- All these forecasts are interesting and as we act on actual rainfall and actual condition on the station we haven't found this trial forecast helpful
- Maybe a self help website
- Colours red/green blindness
- E-mail speed possible a email web combination
- Information could be used to lessen effects of drought. Soil boards/PIRSA to encourage land managers to de-stock and maintain land conditions. Land rehabilitation work – eg regrowth/spraying, seed germination form pipping, clearing or planting .

Results from survey B on the Map Arranger outputs

Two groups of producers were shown an arrangement of outputs from the LWW Map Arranger. These outputs produce maps showing the probability of exceeding median rainfall or pasture growth for a range of time periods using the SOI (5 phases) and SST (9 phases) for up to 6 months lead time. The two producer groups are referred to as group A (Woolgangi and Pt Augusta) and group B (Leigh Creek and Quorn).

Group A use of Map Arranger output maps

Two hundred and three output maps from map Arranger were posted to 36 wool producers in group A. Each map was arranged on a page according to the forecast system (see example Appendix 3). Overall 29 pages were sent. With each forecast map a significance map was included. Each page of maps was accompanied by a list of questions regarding the usefulness of each map to make management decisions. The producers were asked to rate the questions on the usefulness.

Only 12% of producers from group A responded to the Map Arranger survey. Therefore of the 203 maps sent to 36 producers from group A, 3% of the producers considered 153 maps to be useful, 3% considered 62 of these to be useful, 3% considered only 10 of these maps to be useful and 3% considered just one of these to be useful. This means that 12% of producers said that the Map Arranger outputs as they were illustrated in Appendix 1, were useful.

The other 82% indicated the information was not useful. Producers that did not respond to the survey were telephoned and questioned as to their lack of response. The reasons given for their initial lack of response included;

- Lack of understanding of the maps.
- Some producers struggled with the significance maps and what they meant.

Once the above maps were explained including the meaning of the significance maps, the producers were asked to provide answers to the survey over the phone. The producers did not find any use for the maps for the following reasons;

- It was difficult to find their property on the map
- Half of their property had good significance of SOI or SST to rainfall and pasture growth and the other half did not.
- Salt lakes are shown as highly significance for growth which often confused producers
- Variation in probability of exceeding the median rainfall over their property confused producers and their decision making

The wool producers were asked about the management decisions they may make utilising each map output they considered useful. As only 12% of producers from Group A at Woolgangi and Pt Augusta responded, we collated the management responses and then averaged them as shown in figure 26.

Producers gave a weighting to each decision they may make, a 1 meaning that the Map Arranger products were of no use in supporting management decisions and a 10 meaning the Map Arranger products were of most use to support management decisions.

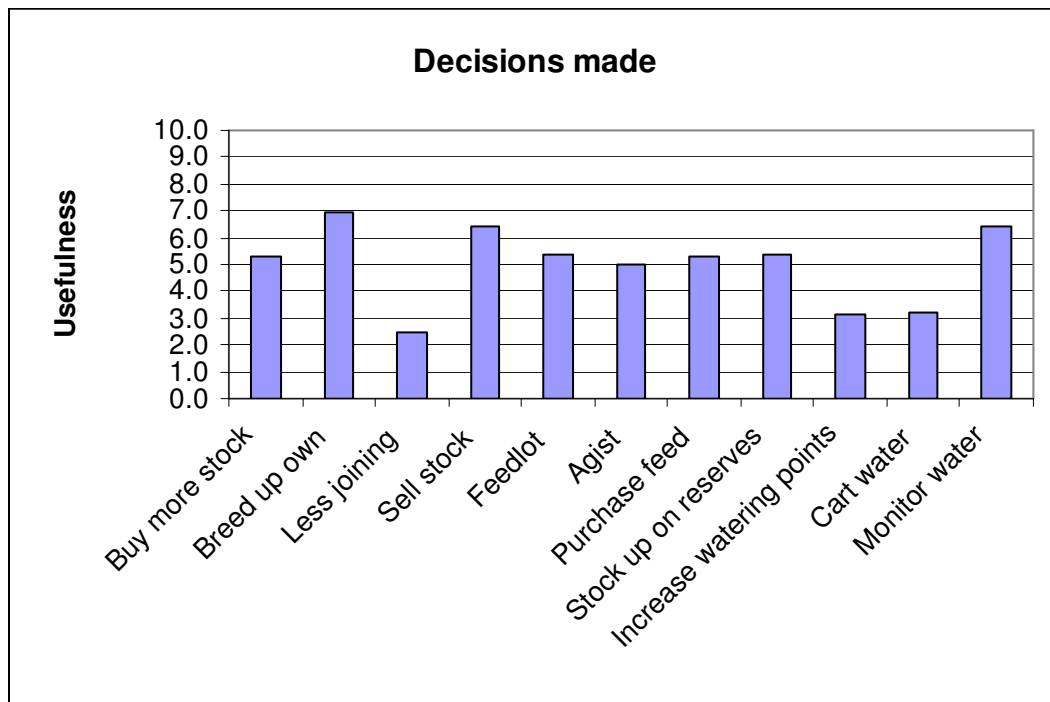


Figure 26: How the Map Arranger maps may be used to support the management decisions of 12% of the wool producers from a group of 36 at Woolgangi and Pt Augusta. The usefulness score has been averaged for the 12 producers. 1 is of least use and 10 is of most use.

When looking at the decision made and the average score given to each decision figure 26, wool producers indicated that the Map Arranger maps would most help them make a decision to breed up their own stock with selling stock and monitoring water also being changes they may be supported to make. The Map Arranger outputs were of average use for decisions to buy more stock, feedlot, agist, purchase more feed and stock up on reserves. The Map Arranger products were of least use to the decision to reduce joining as this has long term impacts. Group A had difficulty in interpreting the many maps from Map Arranger. Furthermore, many of the maps showed no significance of the SOI and SST to rainfall and pasture growth to SOI and SST for their region. The time period in which producers chose for forecasts, also showed not much significance of SOI and SST to rainfall and pasture growth in many cases. The time period chosen did not show up much differences in the probability of rainfall and pasture growth.

Group B use of Map Arranger output maps

Due to our experiences with Group A having difficulty in using any of the Map Arranger outputs produced, we decided to look at more outputs to find maps with meaning to producers in group B. Therefore, for group B (Leigh Creek and Quorn) we choose three month time periods for the entire year in which to produce rainfall and pasture growth maps. We used lead times of 1 to 5 months and used the SOI (5 phases) and SST (9 phases) to forecast the rainfall and pasture growth. As a result 490 maps were produced. From the 490 maps we culled all maps that did not show any significance in the Chi Square of rainfall or pasture growth to SOI or SST. We then culled any that did not show significance in the Liegh Creek and Quorn region. As a result we ended up with just 21 maps.

The 21 maps from Map Arranger were displayed with their corresponding significance map and then shown to 22 producers in the workshops. First the map outputs were explained during the workshops, and then a survey on the usefulness of the maps was provided to each producer to answer during the workshop. This enabled any questions to be answered during the workshops. Of the 22 producers, 71% found one or more of the maps useful. The other 29% indicated that no maps were useful. Sixty two percent of the maps were the maximum that any one producer found useful, as shown in figure 27.

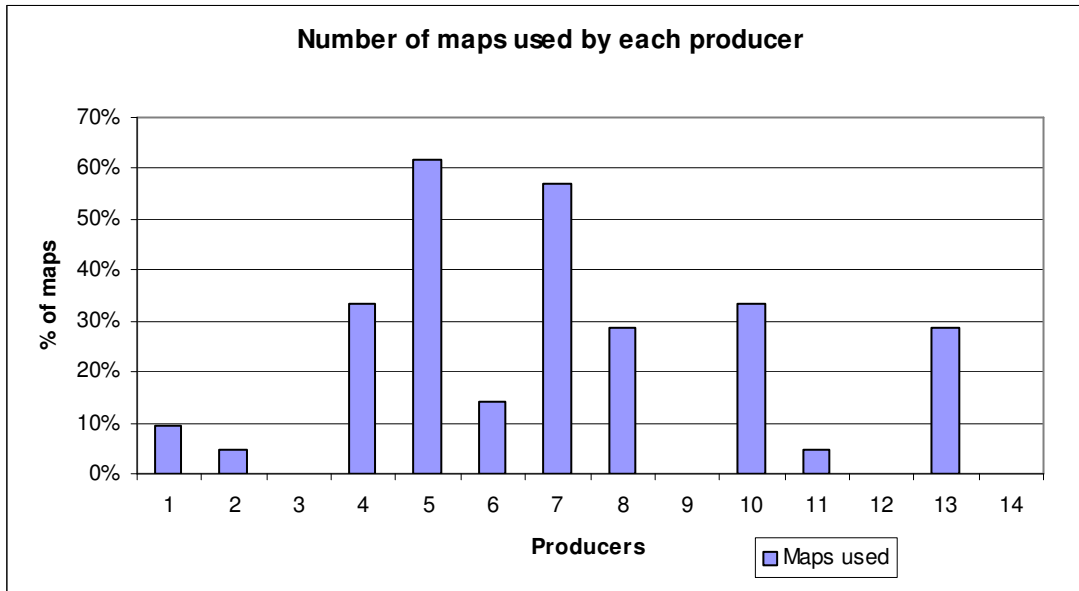


Figure 27: The number of Map Arranger maps found useful by each producer in group B (71%).

Survey B asked producers to rate the usefulness of the 21 Map Arranger outputs, with 1 being the least useful and 10 being the most useful. The results were collated and averaged. Figure 28 shows the level of usefulness of the each of the 21 Map Arranger outputs shown to producers in group B. It can be seen that 2 of the 21 maps were of no use. The Sep to Nov forecast period using SST Phase 5 and a lead time 3 months was the most useful.

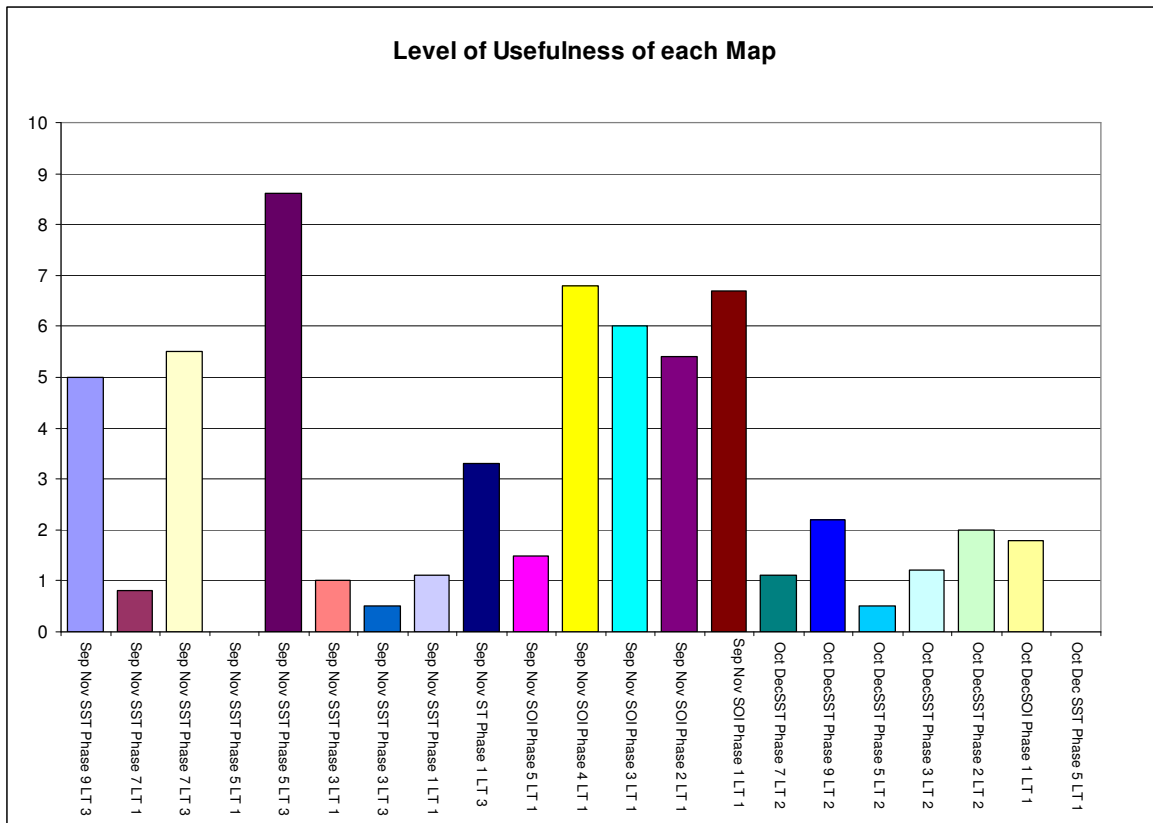


Figure 28: The average usefulness of each of the 21 Map Arranger maps presented to Group B. A score 9 means the map was of most use and a score of 1 means the map was of least use. The score is shown on the y axis.

Producers scored the Map Arranger map outputs and their influence on individual management decisions (out of 10). The results of each score for the 71% of producers that responded was averaged and is illustrated in figure 19. Group B indicated that the Map Arranger Maps would most help them make a decision to stock up on reserves and agist stock. The maps were also of average to below average use for other management decisions such as breeding, joining selling and purchasing stock, carting and monitoring water and purchasing feed.

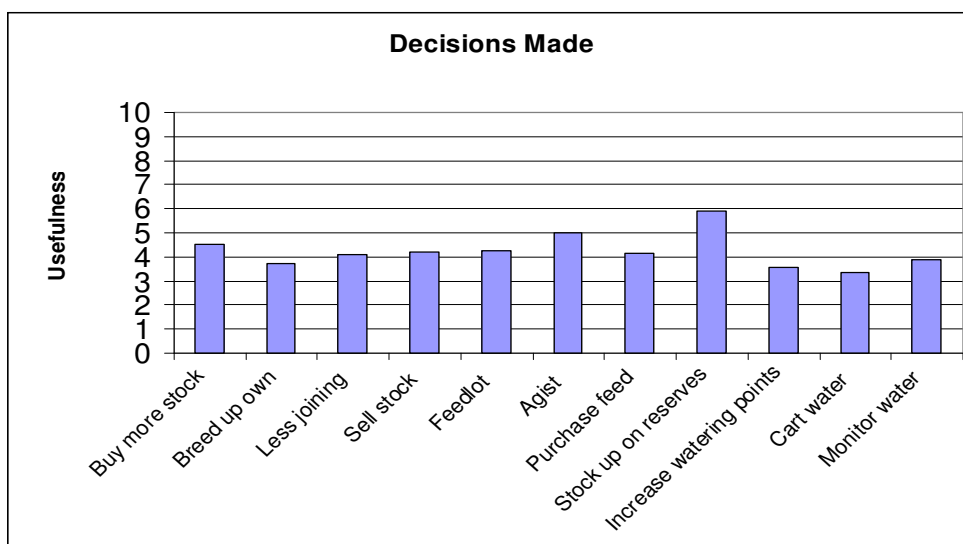


Figure 29: The average rating of the Map Arranger maps to influence particular management decisions for the Leigh Creek and Quorn wool producers. The average score of usefulness is shown on the y axis.

Of the original 490 maps produced, just 19 maps were used. One of those maps was considered useful by 61 % of participants. Depending upon the SST phase this map may only be used in 11% of years.

There were a large number of salt lakes and small areas (10 to 20 km in diameter) where the significance of pasture growth to the SOI or SST was high. Producers would often ask if a small area is something they should use or not. Producers often indicated that their property on the Chi square maps showed both high and low significance of SST to pasture growth, with one end of the property having a 0.05 significance and the other end having a 0.005 significance.

Conclusions

The rangeland wool producers found the current forecasting information to be interesting and some of it may influence their management decisions. Each piece of information from the first survey was of some use. The biggest decision that the information may support is to sell stock with 20% of producers suggesting the information provided would influence this decision.

Producers did report that the use of the Map Arranger maps depended upon what the maps were showing, eg there may be a high probability of rainfall in the next three months so we might buy stock, but feed reserves are low so we would not take the risk. The Map Arranger maps most supported the wool producers in group A to breed up their own stock. The Map Arranger maps most supported the wool producers from group B to stock up on reserves.

Producers were less interested in the average (50% probability of exceeding the median). It was found in workshops and surveys results producers wanted to know when something was different to the normal/average year. Telling producers that we were going to have an average year often resulted in them being less interested. Times of severe weather patterns eg drought appears to increase their interest and need for information on seasonal climate forecasting.

The rainfall and pasture growth probability maps showed significance (using the chi squared test) with rainfall and pasture growth in only a few areas in the wool producing rangelands of SA. Most of the time the significance only appeared in small areas of properties at any one time.

Producers had a lack of confidence in the rainfall and pasture growth probability Map Arranger outputs due to the lack of significance to SST and SOI on their own properties. It was clear that there were few producers in the Pt Augusta and Woolgangi (group A) area that found the maps of any use for the time periods of most use (April to June and October to December).

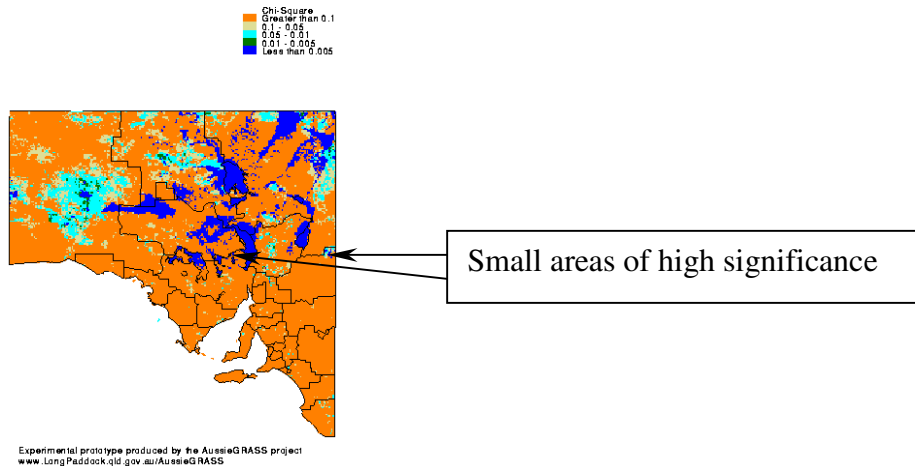
The forecasts used for the Leigh Creek and Quorn regions (group B) were selected across all times of the year in an effort to identify maps, which showed some significance of SOI and SST to rainfall and pasture growth for their area. This was expected to provide a more useful set of maps. The results from the survey for this group showed that only 4% found any of the maps to be of use with 490 maps being considered.

Areas of significance of rainfall and pasture growth to SOI and SST were shown to be high (> 0.005) outside of the wool producing regions of South Australia.

The Map Arranger maps showed salt lakes and often surrounding areas as having significance of the SOI and SST (> 0.005) with pasture growth. This increased producers frustration with the maps as those bordering these lakes were unclear of the accuracy of the information.

The Chi Square tests were showing significance of rainfall and pasture growth to all phases of the SOI and SST.

Growth Chi Square Values for the SST Phase System
For October - December with Apr phase i.e. 5 month lead



Most producers found too much new information (significance tests) at one time to be difficult to take in, especially when we expected them to make an informed decisions regarding the decision they might make when using forecasting information. Producers did not want to look through lots of maps to find the ones that are important to them. Locating their property on the maps was difficult for most producers and increases the difficulty in identifying those maps important to them. Despite careful presentation of the Map Arranger maps, producers were still confused by the meaning of the maps.

Recommendations

Seasonal climate forecasts could continue to be provided to wool producers on a monthly basis. These forecasts could include a combination of the information provided in Appendix A as well as Map Arranger outputs. The Map Arranger outputs should only be provided if they have significance of rainfall and pasture growth to individual phases of SOI or SST. The Map Arrange outputs should relate to three month time periods with no lead time.

The Chi Square significance maps provided from Map Arranger do not currently show the significance of rainfall and pasture growth to individual phases of the SOI and SST. Australian Rainman Streamflow (QDPI) does show the relationship of rainfall to individual phases of the SOI and SST using KW tests. It does not do this for pasture growth. The maps that we utilised from Map Arranger showed most significance using the Chi Squared tests with SST and pasture growth. We utilised Australian Rainman to look at individual phases of the SST and rainfall for the same time period that the pasture growth maps from Map Arranger showed significance. Using the KW tests, no significance was found using some SST phases with rainfall in the Leigh Creek and Quorn region. The practicality of this needs to be discussed with the colleagues from sister projects in other states of Australia.

In phone conversation with producers it was important to provide clear examples and explanations of the meaning of the maps with the seasonal climate forecasts.

Perhaps leading question to prompt producer to think more about the use of information could be provided with forecasts. For example if there is a probability of low rain forecast then a range of questions may follow the seasonal climate forecast for example;

- What are the other years where you have received low rainfall on your property for this time period?
- What did this low rainfall mean to your enterprise ?
- What decisions did you make in the low rainfall year?

Producers need help to become more confident in the decisions they may make in relation to a forecast. Perhaps self investigation of the use of the forecasts would give them this empowerment and self-confidence to conceptualise the information.

Future Directions

Results for achievement toward Criteria;

Delivery of revised system to a second trial group of 40 producers

Seasonal climate forecast reports were sent to this second group in the months of February March and April (Appendix 5). For the first report each producer received a range of site specific output from Rainman including

- Mean monthly rainfall graph and table
- A full historical record rainfall
- Probability of monthly rainfall table (Amount of rain (mm) received or exceeded in 100%, 90% ...0% of years)

They also received a range of forecasting information commonly used including:

- Southern Oscillation index graph 1998 to 2003. (BOM)
- Map of Australia showing the chance of exceeding the median Rainfall (BOM)
- BMRC/NMC global SST Anomaly (BOM)
- South Australian Rainfall Deciles map for a 3 month period (BOM)
- South Australian Rainfall (mm) for a 3 month period (BOM)
- Deciles of Rainfall Graph with SOI phases (Rainman)
- Chances of rain for the next three months without SOI (Rainman)
- Aussie Grass outputs including 3 month pasture growth output and total standing dry matter in TDM/ha in January 2004.
- Map Arranger output maps

Not all of the seasonal climate forecast information listed above was sent every month. This was varied based on whether the information was seen as useful by producers (from our survey results) at what time of the year the information would be useful.

There was a tendency to provide the wool producers less pieces of information with more explanation. Examples of what this might mean was also provided to producers, eg a 50% probability of exceeding median rainfall in the next three months, means that producers need to consider the management practices they put in place in years with average rainfall. These decisions include stocking rate, feed availability, shearing, mating. The aim is to get producers to consider the impacts of the season on their decisions.

An example of the seasonal climate forecasts sent are attached Appendix 5. The first forecast sent includes output from Australian Rainman and is specific to the producers' location. Subsequent forecasts are more general.

Results for achievement toward Criteria 5

A fax-back/Email system set up for delivery to up to 300 subscribing producers.

We will survey the Leigh Creek and Quorn group late June to gauge their response to the revised seasonal climate forecasting information sent. The results of this and discussions with peers in sister projects will help develop the fax/back e-mail system set up for delivery to the wool producers in the SA rangelands.

Results for achievement toward Criteria 6

Networks for climate workshops established and utilised for ongoing updates and delivery of information.

The climate risk management unit has developed a climate risk information management farmer association. The wool producers that have been a part of our trial forecasts are on the list. We also have a list of all rangeland wool producers in SA. There are best prac groups and extension officers that support wool producers in the SA rangelands that are part of our networks and are included in our farmer association.

Summary of Communication Achievements

- 91 letters were sent out to wool producers in the SA rangelands in October (2003)
- A second letter was sent in January to 91 wool producers
- 30 phone calls were made to the Leigh Creek area and 70 in the Quorn area.
- 22 wool producers attended Climate Risk Management workshops
- Trial seasonal climate forecasts were e-mailed or posted to 58 wool producers (for 6 months)
- Survey conducted to evaluate Seasonal Climate Forecasting information used and Map Arranger outputs.
- Updated seasonal climate forecasts were e-mailed or posted to 40 wool producers (for 3 months)
- Trial Aussie Grass outputs are provided monthly in the Stock Journal going to 16,000 readers.
- 10 radio interviews have been conducted providing seasonal climate outlook information to wool producers
- A Climate Risk Information Management Farmer Association has been developed.

Appendix 7 - Extracts from Milestone report 4

Milestone 3:

- 3.5 A fax-back/Email system set up for delivery to up to 300 subscribing producers.
- 3.6 Networks for climate workshops established and utilised for ongoing updates and delivery of information.

Milestone 4 - Final Report

- 11. Completion of forecast testing.
- 12. Assessment of resources required to increase regional adoption.
- 13. Recommendations on the forecast system to be utilised in SA.
- 14. Recommendations on ongoing delivery/communication systems, including timely fax-back or Email, websites, workshops, networks.
- 15. Submission of a complete set of producer case studies.
- 16. Assessment of benefit to the region.

EXECUTIVE SUMMARY

There are approximately 155 wool producers in the SA pastoral zone that manage about one quarter of the South Australian Landscape. These producers make about 80% of their profit from the best three years in 10 and the worst three years in 10 they make a loss. Through this two year LWW project we have improved seasonal climate forecasts so that wool producers can recognise the good and bad seasons in advance in order to maximise their profits in the good years and minimise their economical, biological and social losses in the bad.

The Map Arranger facility designed for the LWW Managing Climate Variability program (Henry, 2004) was used to assess the skill in operational Seasonal Climate Outlooks forecasting rainfall and pasture growth using the SOI 5-phase system (Stone et al, 1996) and the SST 9-phase system (Drosdowsky, 2002). The forecast skill was examined specifically for the SA rangeland wool producing regions.

We found (using the Chi-square test or the Kruskal-Wallis (KW) test) that the 3 month forecasts using SOI and SST on rainfall and pasture growth had considerable skill between June and November. If we use the SST with one month lead time we can begin to utilise forecasts in April. We decided to produce a pocket guide in order to demonstrate this to producers.

Producers had previously indicated that their management decisions were not significantly influenced unless there was a 70% or more probability of a wetter or drier outlook. The pocket guide also provides the ocean and atmosphere trigger points for wool producers to recognise 70% or more probability of increased or decreased rainfall or pasture growth.

We initially showed the pocket guide to case study producers, before making a few changes and then showing it to 34 more producers for comment during workshops. The wool producers reacted positively and identified significant economical, biological and social benefits by being exposed to this pocket guide. They described the management changes they would make in the wetter or drier seasons.

Over the course of this two year project we have developed and enhanced further tools to deliver climate risk management information, including newsletters, books and workshops. We have also developed an innovative way to continue to deliver this information through CRIMFA – Climate Risk Information Management Farmer Association.

Nearly 50% of producers in the SA rangeland wool producing regions have attended a climate risk management workshop. Nearly 100% of the SA rangeland wool producers have been exposed to climate risk management information through newsletters and the media.

With further funding we would increase the number of producers learning about improved seasonal climate forecasts in the SA rangeland regions and follow up producers that have attended workshops to ensure the seasonal climate forecast information continues to support them to make management decisions.

In the future we would hope to update the Seasonal Climate Forecast Pocket Guide – Draft to incorporate the changes suggested and further enhance other tools for delivery such as the SARDI web site.

This Final Report details the results of our research and extension to achieve our project objectives: to minimise financial loss and maximise profits and improve plant biodiversity in the southern rangeland wool producing areas. It addresses each of the milestones we set out to achieve during milestone 3.5, 3.6 and milestone 4 of this project SRD4.

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1. BACKGROUND

The sheep and wool grazing industry contributes about \$160 million to Australian production from about 2230 producers, of these there are 155 wool producers in the SA pastoral zone. These producers manage about one quarter of the South Australian landscape. The sheep (mainly for wool production) are inside the dog fence on the southern side while cattle are on the northern side of the dog fence and this is shown in figure 1. In Queensland and Western Australia the sheep production areas are inside and outside of the dog fence.

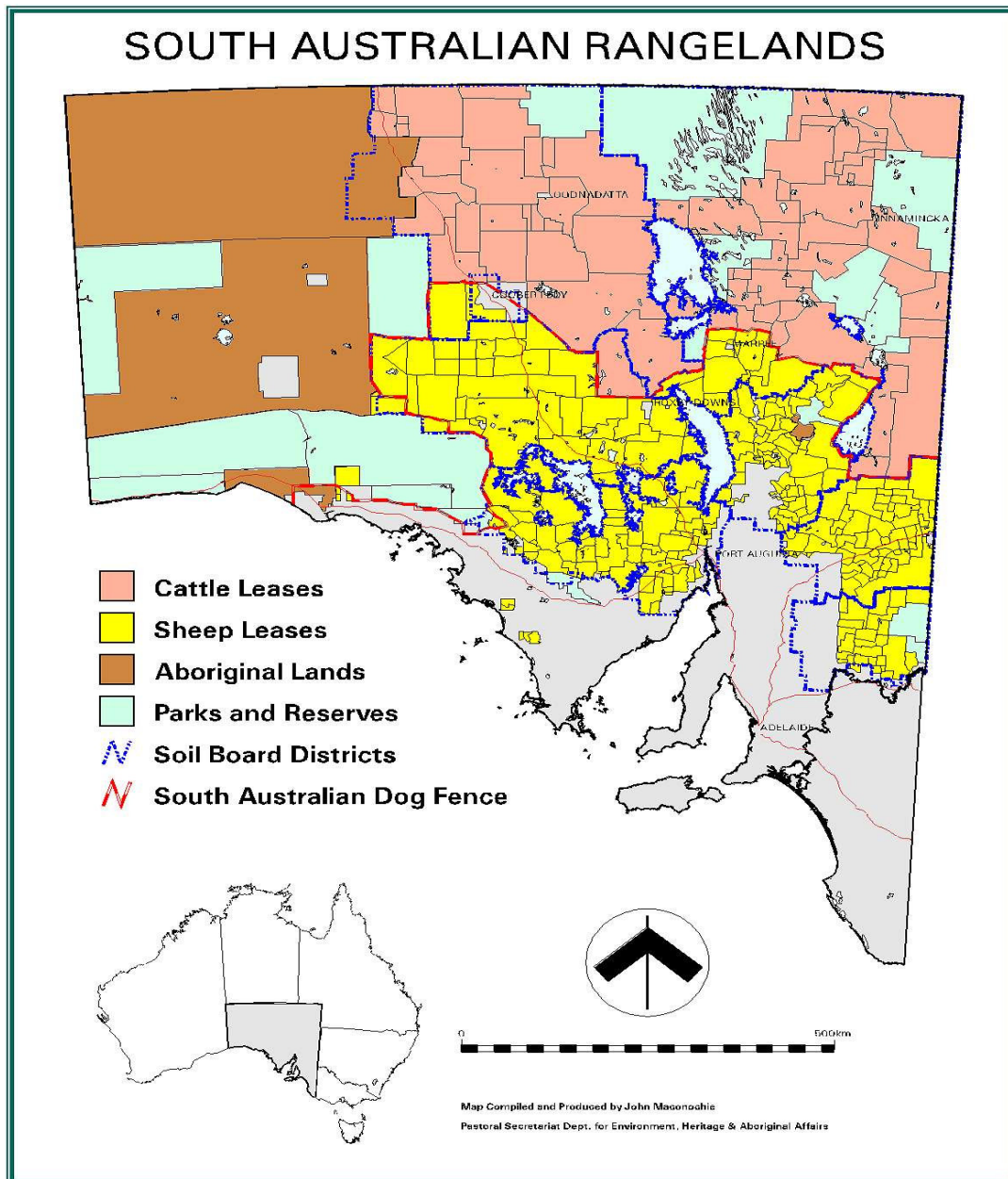


Figure 1: The sheep and cattle rangelands zones of SA.

The 155 wool producers manage 217 pastoral leases between them. From March 2002 until March 2003, there were 940 thousand sheep in the SA rangelands, and from March 2003 to March 2004, a smaller amount, 890 thousand sheep, were reported in the annual pastoral board stock returns. This is the calculated average figure of grazing pressure for the whole on each run. If this drop in numbers are breeding stock then this is significant, but if it is a drop in dry sheep (wethers it is not so significant). It will be interesting to see the sheep numbers in March 2005 due to the early parts of 2004 and previous years being relatively dry. In total SA has approximately 12 million sheep.

At the beginning of 2004 there was little stored soil water, and very small amounts of follow up rain. There were areas where producers were forced to sell stock earlier or sell a high number of stock because they had no run off to fill their dams. The rainfall this year combined with that of the last two years puts some wool producers in the decile 1 range for the last 36

months. The map below (figure 2) highlights the areas in SA that have received decile 1 rainfall for the last 36 months. Some districts have received low rainfall for three seasons in a row, and in these regions exceptional circumstances has been declared and support has been made available through the federal government drought assistance scheme.

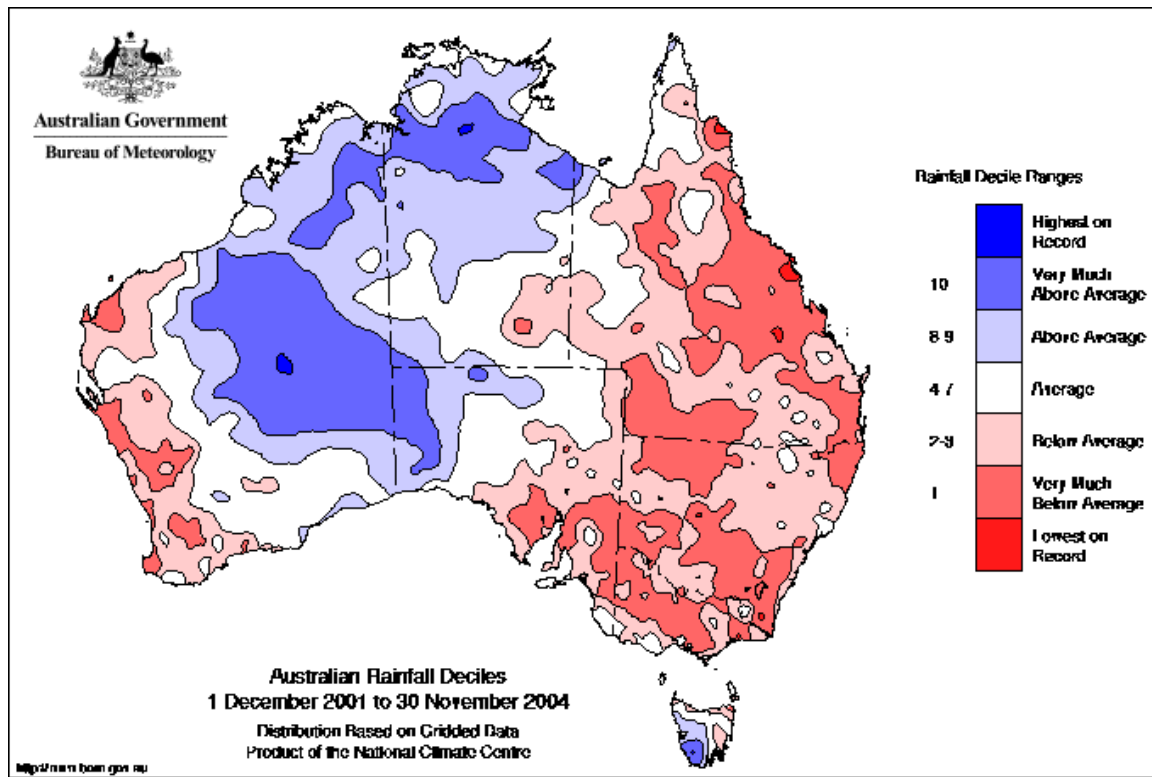


Figure 2: Rainfall deciles for Australia between December 2001 through until November 2004.

▪ **Rainfall Distribution**

The rainfall in the SA rangelands varies from less than 350mm mean annual rainfall in the south of the SA rangelands to less than 250mm in the north of the SA rangelands. The rainfall is more winter dominant in the south (see Hawker example, Figure 3) even distribution in the middle (see Mutooroo example, figure 4) and a little more summer dominant in the north (see Commonwealth Hill example, figure5). The high February average rainfall at Commonwealth Hill is influenced by heavy falls of intense rain over a short period of time in which producers rely on to fill their dams, while the rainfall during winter is usually made up of smaller amounts of rain over a longer period of time.

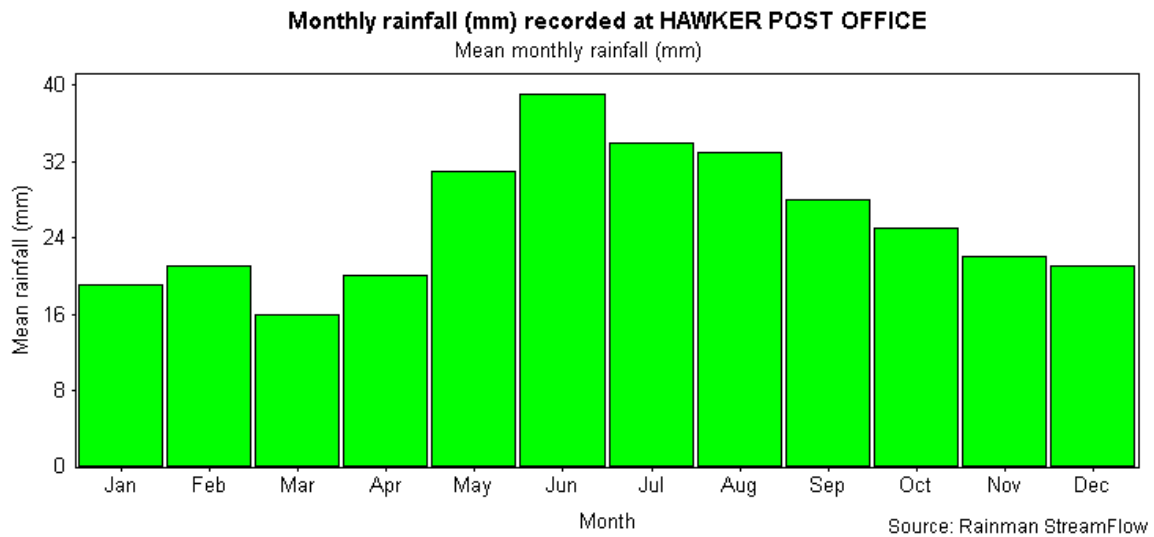


Figure 3 : Rainfall distribution at Hawker in the south of the SA rangelands

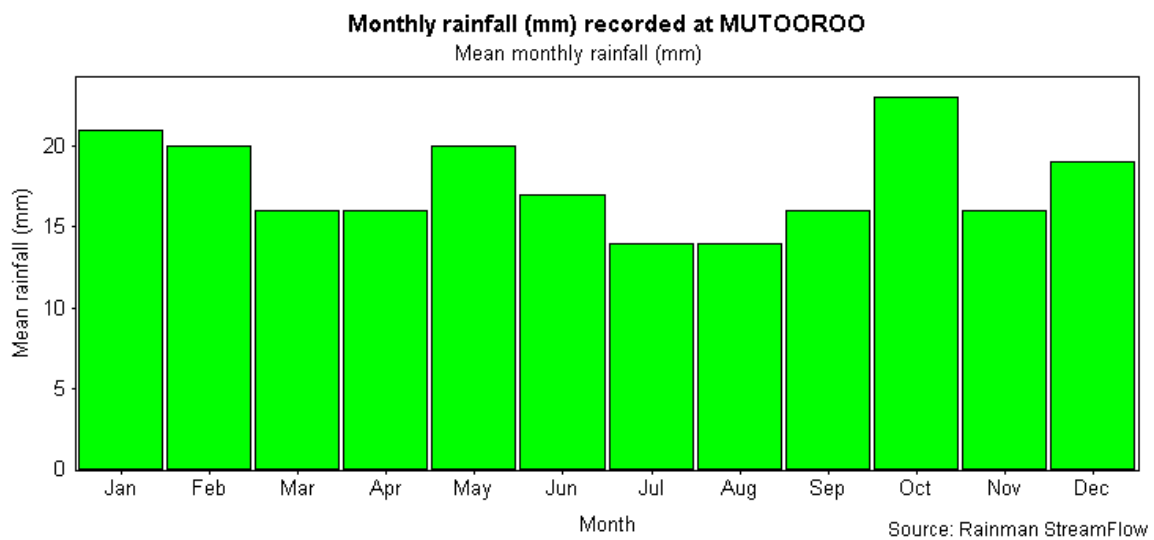


Figure 4 : Rainfall distribution at Mutooroo in the middle of the SA rangelands

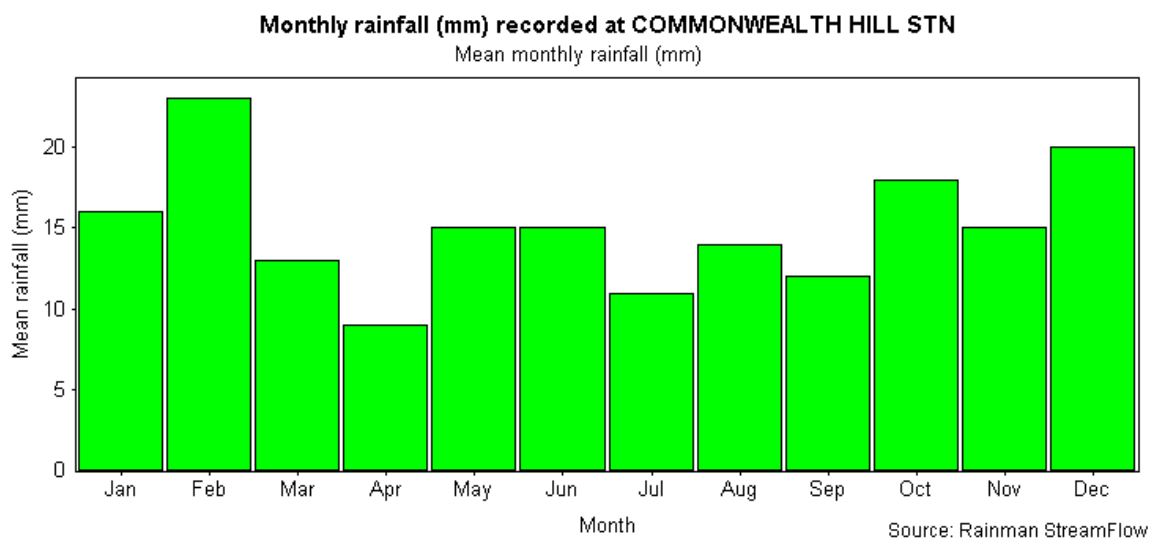


Figure 5: Rainfall distribution at Commonwealth Hill in the north of the SA rangelands

- **The need for improved seasonal climate outlooks**

Within the rangeland wool producing regions, approximately 80% of the profit is made from the best three years in ten, and the worst three years in ten make a loss. Wool producers in the SA rangeland regions have suggested that if seasonal climate outlooks were better able to predict the extreme years, they could maximise their profits in the good years and minimise their losses in the bad years. They would do this by making adjustments to their stocking rates, feed purchases, water cartage, jetting, and general movement of sheep over their properties.

A survey of 58 wool producers completed during milestone 3 of this project showed that wool producers would make little to no management changes if the seasonal climate outlook suggested a 50% chance of exceeding the median rainfall or pasture growth. The survey did show that producers would be willing to make management changes if the seasonal climate outlooks showed that they had either high (above 70%) or low (below 30%) chance of exceeding the median rainfall or pasture growth. We spoke to our case study producers during 2004 and they both agreed that at least these probabilities are needed to make management changes.

- **Forecast Period**

Fifty eight producers in the SA rangeland wool producing regions were asked about the timing of their management decisions. It was found that there was no consistency with the timing of the decisions that producers make in these regions. For example lambing can be in summer, autumn, winter or spring. This is reflected in figure 6 which shows that producers have no obvious preference for the timing of seasonal climate forecasts. However in the southern parts of the SA rangeland regions, the rainfall is winter dominant and tends to be very low in summer. Producers just expect rainfall and pasture growth at these time periods to be low.

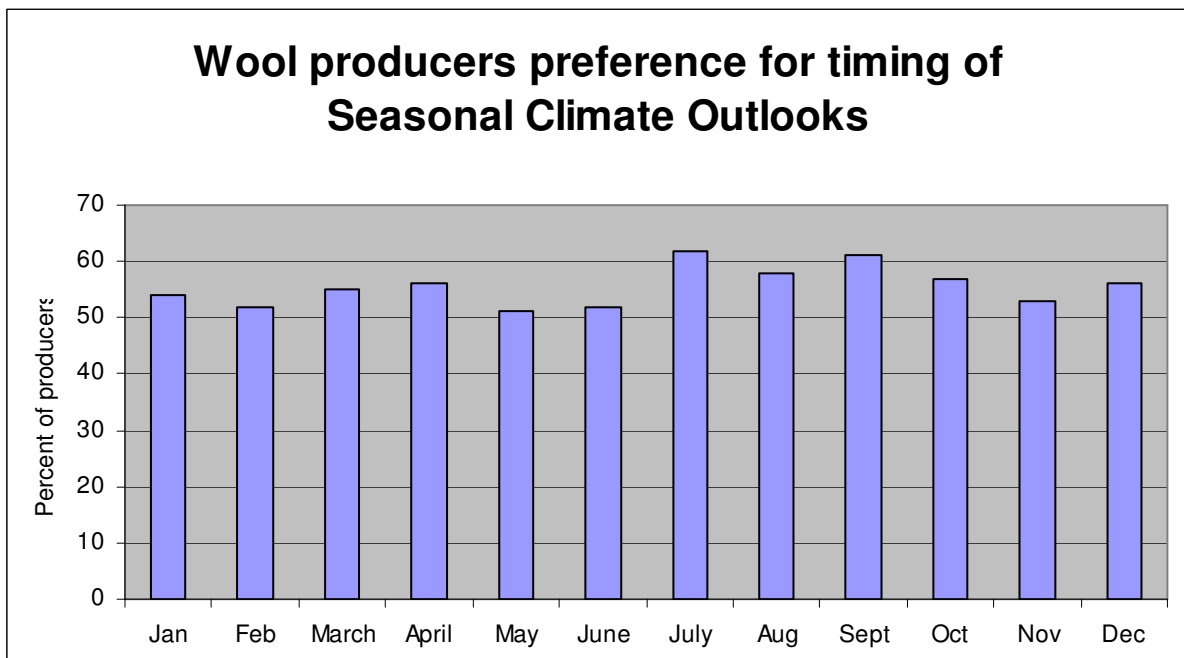


Figure 6: The month of preference for wool producers to receive seasonal climate outlooks.

One of our case study farmers from the Gawler Ranges soil conservation district (GR case study 1) said that a prediction at the start of the growing season is important. On his property

they time lambing in May/June and crutch in August/September. Others shear in Sept and crutch in Feb/March.

As expected wool producers would prefer the seasonal climate outlooks to be of six months duration, however three month running seasonal climate outlooks are also useful to their management decisions.

2. THE PROJECT MILESTONES

2.1 Completion of forecast testing and, recommendations on the forecast system to be utilised in SA. (milestone 4.1 and 4.3)

The Map Arranger facility designed for the LWW Managing Climate Variability program (Henry, 2003) and was used to assess the skill in operational Seasonal Climate Outlooks forecasting rainfall and pasture growth using the SOI 5-phase system (Stone et al, 1996) and the SST 9-phase system (Drosdowsky, 2002). The skill was examined specifically for the SA rangeland wool producing regions. Initially the Chi-square skill test within the Map Arranger facility was used. Further skill tests on rainfall only were applied using the Kruskal-Wallis (KW) test within Australian Rainman. This skill test has since been added to the Map Arranger facility.

The Chi square test showed us that there was no skill using a forecast period of more than 3 months in the SA rangeland wool producing regions. Forecasting with the SST 9-phase system showed that a lead time of one month was more skilful than no lead time, and using the SOI 5-phase system showed that no lead time was more skilful. The Chi Square test showed values of less than 0.01.

The SARDI-CMRU then used Map Arranger to produce 3 month forecasts (beginning at each month of the year) of rainfall and pasture growth, using SOI 5-phase (0 lead time) and SST 9-phase (1 month lead time) also applying the Chi-Square skill test in Map Arranger. We then produced 3 month forecasts of rainfall beginning at each month of the year, using SOI 5-phase (0 lead time) and SST 9-phase (1 month lead time) using the KW skill test in Australian Rainman. The maps produced can be viewed in Appendix 1.

We found (using the Chi-square test or the KW test) that the 3 month forecasts using SOI and SST on rainfall and pasture growth had considerable skill between June and November. If we use the SST with one month lead time we can begin to utilise forecasts in April.

There were differences demonstrated in the use of the two skill tests of Chi-square and KW, particularly when applied to the SST 9-phase system. Mayer (2004) recommended that the KW test is a more suitable skill test for the above application. The KW test has now been added to Map Arranger. The SARDI –CMRU have not yet utilised this to perform tests on pasture growth, although we did perform KW tests on rainfall as discussed above.

2.1.1 Tools/Activities to deliver and test forecasts

The overarching LWW project conducted a national workshop at Indoorpilly 9-10th of June 2004. It was suggested that producers needed a tool to access and understand when seasonal climate outlooks were skilful and useful. As a result of this the SARDI -CRMU produced a draft 'Seasonal Climate Forecast – Pocket Guide – for Wool Producers' as shown in appendix

2. Further tools have also been developed or enhanced as a result of this project and are listed below.

▪ **Pocket Guide**

The aim of the pocket guide was to educate producers of the time period when seasonal climate forecasts are skilful in the SA rangelands (being June to November), the trigger points they should look out for to be more confident of an extremely wet or extremely dry 3 months and when to use these trigger points.

The pocket guide provides the ocean and atmospheric trigger points for wool producers to recognise 70% or more probability of increased rainfall or pasture growth or 70% or more probability of a decreased rainfall or pasture growth using the SOI 5-phase system or the SST 9-phase system. The pocket guide tells producers where to find the latest SOI or SST phases. They then use the key in the pocket guide to look up the latest SOI or SST phase, the key leads them to the appropriate map to find the odds for a wet or dry season. The seasonal climate outlook maps relate to 3 month periods with lead times of 0 to 1 month. The seasonal climate forecasts provide outlooks for both rainfall and pasture growth.

We have put a black line on the maps showing the boundary of the SA rangeland wool producing regions, north of Goyders line and south of the dog fence, and have blacked out the salt lakes in SA. During the a survey conducted as part of milestone 3 report, producers said they were frustrated and confused with the fact that the salt lakes showed up rainfall or growth probabilities.

The pocket guide has a page which tells the wool producers about other trigger points to use in making their management decisions when the SOI or SST is and is not skilful at predicting rainfall or pasture growth (December to May). The other tools include;

- Aussie grass maps forecasting growth
- Other decision support tools such as WinGrasp or Aussie Grass
- Monthly newsletters from SARDI which have outputs of Australian Rainman
- Australian Rainman (in new revised version)
- Use of other seasonal climate forecasts
- Using on farm indicators such as stored soil water and existing pasture growth

▪ **Climate Risk Management Resource Manual**

The climate risk management resource manual was developed primarily through SARDI, however it has been updated during the course of this project. During the workshops, producers receive a climate risk management resource manual. A resource manual sample can be found in Appendix 3. Producers refer to this manual during the workshops and also utilise it after the workshops to revise their understanding.

The resource manual contains an explanation of:

- attitudes to risk and actual climate risk
- understanding weather
- understanding seasonal climate forecasts
- how to access seasonal climate forecasts and information including Aussie Grass
- decision support tools to better manage risk
- price risk management

- **Newsletters**

Newsletters containing a seasonal climate outlook summary, current SOI and SST values, state-wide rainfall and decile maps, the pasture growth outlook from Aussie Grass and total standing dry matter from Aussie Grass were sent to;

- Participants that attended workshops during milestone 3 (45)
- Participants that have attended workshops for milestone 4 (34)
- The remainder of the 153 producers we have in our data base not yet receiving newsletters (78)

Distribution is primarily by e-mail with a small number posted. The file is delivered in PDF format and is normally about 200 to 400 kb in size. We have conducted a survey during milestone 3 on the usefulness of information in the newsletters. We have improved/updated the information supplied in the newsletters. A sample newsletter can be viewed in Appendix 4 (page 4). All wool producers in the SA rangelands are currently receiving our newsletters for free. Generally most are given a free subscription when they attend our workshops, however we are also sending them to other producers on our data base. In the new year the producers will be contacted and asked to pay a renewable annual subscription fee of \$20 e-mailed and \$40 if posted.

- **Stock Journal weather page**

The Stock Journal is a rural newspaper that has 16,000 rural subscribers. Most wool producers in the SA rangelands receive it. Weekly, we write on the weather page which is the back page. On this page we provide a seasonal climate outlook summary, current SOI and SST values and the probability of receiving 'x' amount of rainfall at various locations. Each week we also provide a different graphic. The pasture growth outlook map from Aussie Grass appears once a month, and total standing dry matter may also appear occasionally. We also put in the BOM rainfall outlook and temperature outlook graphics (see example, Appendix 4, page 19)

- **Australian Rainman CD Rom**

Australian Rainman CD Rom was produced by QDPI and its collaborators. We have promoted this during our workshops. It can perform climate analyses and forecasts for individual towns. The CD contains data principally historic monthly and daily rainfall for 3800 Australian locations. Users can;

- analyse records for individual locations for seasonal, monthly and daily patterns,
- forecast seasonal rainfall based on the SOI or SST,
- an updated version of RAINMAN will forecast temperature and pasture growth,
- print results as tables, graphs or maps,
- easily update data from the internet.

To date in the wool producing regions we have had 4 regional advisors purchase a CD and 4 producers to date. We are unsure of how many producers took advantage of the free promotional copy as these were provided direct from QDPI. A picture of the CD can be viewed on Appendix 4 page 16.

- **District Specific forecasts**

Producers have the option of subscribing to district specific forecast information, e-mailed or posted to them, instead of getting information from Australian Rainman and the internet themselves. We have IP arrangements with QDPI for Australian Rainman and the BOM for data used. The district specific forecasts were originally designed for grain growers and we have made the same information available to wool producers for their district. The information sent includes;

- District specific seasonal climate outlooks using SST and SOI to look at the probability of receiving rainfall
- Historical rainfall records and graphs
- Current rainfall decile range compared to historical rainfall for their closest town
- Probabilities of receiving a certain amount of rainfall by a certain date. An example is provided in Appendix 4, page 10.

This information is available to wool producers monthly at a subscription fee of \$100 per season.

▪ **Workshops**

As part of milestone 3, four workshops were provided to wool producers. The workshops helped shape the production of the seasonal climate forecast pocket guide. To test the pocket guide as part of milestone 4, two 6 hour workshops and one 3 hour workshop to a Best Prac group were delivered. The 6 hour workshops were held at two locations in South Australia rangelands (Yunta and Port Augusta). The Yunta workshop attracted 9 producers and one advisor from the north eastern area of SA and the Port Augusta workshop attracted 13. Three of the Port Augusta participants were regional advisors. The two hour workshop with a best prac group (nationally directed by David Heinjus) attracted 12 producers. The workshop program followed was;

Module 1: Understanding climate risk

- Understand the various climate risks affecting wool producers businesses
- Understand the actual risk of a particular climate event occurring
- Understand how farm business decision making is influenced by the actual climate risks occurring and personal attitude to risk

Module 2: Understanding Climate and Weather

- Discover what influences seasonal climate forecasts, for example the ocean and atmosphere
- Discover the measurements of seasonal climate forecasts like the SOI and SST's

Module 3 : Seasonal Climate and forecasting systems

- Understanding the seasonal climate forecast pocket guide for wool producers
- Understanding how to use this seasonal climate forecast pocket guide on a month to month basis by answering a survey.
- How to access other seasonal climate forecast information including the Aussie Grass web site.

Module 4: Making Climate Risk Management Decisions.

- Formulate strategies to reduce the impact key climate risk events have on individual farming businesses

During the 3 hour workshop Module 2 and Module 3 were condensed and delivered only. Follow up will be provided on Module 4 through the Best Prac group meetings. A copy of the workshop materials including a CD Rom of the PowerPoint presentation can be posted upon request.

▪ **Workshop promotion**

Wool producers in the SA rangelands are located across a very broad area. It is common for producers' homesteads to be 100 km apart. Due to this, it is difficult to find central locations to conduct workshops in the rangelands.

A number of methods were used to promote the workshops to the SA rangeland wool producers including;

- Posting workshop flyers to:
 - Agricultural Bureau groups in the rangelands of South Australia (22)
 - The pastoral lessees (owners) within the sheep zone and who run sheep (154)
 - The managers of properties (these may overlap with the above) (103)
 - Stock agents from Elders and Wesfarmers Landmark who operate in the rangelands(18).
 - Primary Industries & Resources South Australia, Rural Solutions SA, Northern Flinders, North East, Gawler Ranges Soil Conservation Boards Animal & Plant Control Commission, Outback Community Development Trust, Northern Region Development Board, Pastoral Board, Natural Resource Management officers and Rangelands Action Project (21).
 - Hotels in the rangeland regions (32).
- Press releases were sent to; The Advertiser, State-wide page, ABC Country Hour (rural reporter North and West), regional newspapers Northern Argus, Transcontinental, Flinders News, Recorder, Whyalla News, West Coast Sentinel, EP Tribune, the Stock Journal. As a result;
 - Editorials occurred in newspapers including; The Stock Journal, and regional newspapers including Northern Argus, Transcontinental, Flinders News.
 - Two radio interviews were played on the ABC country hour and the workshops were advertised each day 2 weeks prior to workshops.
- Producers who had not RSVP'd to the flyers about the workshops were telephoned. The aim of the call was to remind them of the workshop and discover the barriers to their attendance. This enabled us to find answers to our milestones above. (40)
- Reminders were also sent in the monthly newsletters to wool producers (100).

2.2. A fax back/Email system set up for 300 subscribing producers (milestone 3.5)

There are only 155 wool producers in the SA rangeland regions. However there are some wool producers south of this that could also benefit from the climate risk information tools and services that we have listed. Nearly 50% of wool producers in the SA rangelands have attended a climate risk management workshop, and all of them would have received the newsletters. Most wool producers would have also been exposed to the seasonal climate forecast information we provided through media such as the Stock Journal, TV and radio interviews.

As part of this project it was initially proposed that we set up a fax-back/Email system for subscribing producers. We have learned from our experiences with wool producers and grain growers and their suggestions that there is more than one way to deliver information. Every wool producer is different, and for some the web may be a useful way to receive information and for others it may be through fax-back/Email, others media and for some all of the above. For this reason we have developed CRIMFA – Climate Risk Information Management Farmer Association.

CRIMFA provides access to a range of tools and services delivered by a range of methods This includes the tools listed above;

- The Seasonal Climate Pocket Guide for Wool Producers- draft (pocket guide name may change)

- Monthly newsletters posted or e-mailed (not faxed as they are in colour)
- Stock Journal – Weather Page
- Australian Rainman CD Rom
- District Specific Forecasts
- Climate Risk Management Workshops
- Climate Risk Management Resource Manual

During climate risk management workshops the above products are shown and explained to producers. Producers are automatically put on the subscription list to newsletters at no cost for a year. In a years time they are approached to pay for subscription for another year. Details of the tools and services have been explained above and in the attached CRIMFA booklet (Appendix 4). As time goes on new products can be added or upgraded in CRIMFA and producers will be made aware of this through newsletters.

▪ **2.3 Networks for climate workshops established and utilised for ongoing updates and delivery of information.**

We have created a data base of contacts for wool producers in the SA rangelands this includes names, address, phone, details of;

- Collaborating organisations (4)
- Pastoral lessees list for stock returns (217)
- Property managers (107)
- Agricultural bureau groups (13)
- Best Prac groups (6)
- Hotels in the region (31)
- Stock agents(19)
- Govt employees providing services including Department of Water, Land and Biodiversity Conservation, District Councils, PIRSA and Rural Solutions SA(16)
- Productive nutrition group leader (1)
- Developing sustainable rangelands project contacts (2).
- The Northern Regional Development Board contact
- Outback Areas Community Development Trust
- Integrated Natural Resources Management Committee

Networks have been established through SARDI, consultants and producer groups. Producers that have attended a workshop are automatically part of a subscription service and CRIMFA. It is our aim to get the majority of wool producers in the SA rangeland regions to become a part of CRIMFA by subscribing to our newsletters next season and attending a workshop if they have not already. During the workshops the producers will receive a seasonal climate forecast pocket guide and have it explained to them and a climate risk management resource manual for ongoing reference.

2.4 Assessment of resources required to increase regional adoption (milestone 4.2)

▪ Delivery

Two case study farmers were interviewed and 34 producers were surveyed during workshops about what would be needed for ongoing delivery/communication systems. A sample of the survey is provided in Appendix 5. We also telephoned 80 producers who did not reply to attend a workshop. Comments were also invited from the LWW participating organisations, and Barry White gained comments from a LWW Management Meeting in Launceston, Tasmania in October, 2004, Peter Hanrahan, the LWW co-ordinator provided specific comments included in this report. The two case study producers were from the Gawler Ranges (GR case study 1) and the Eastern District (ED Case study 2) soil boards

The majority of workshop participants and telephoned producers surveyed thought workshops were the best way to explain how to access tools and services including the pocket guide and some producers suggested Best Prac groups could be utilised. ED case study 2 suggested we use soil board groups and NRM structures for extra delivery and our case study producer from Gawler Ranges (GR case study 1) suggested preg scanning groups or the productive nutrition workshops could be utilised to get some information across. One producer indicated that running workshops when it rains would be useful as producers would not be worried about stock and have more time as they can not work outside. However rain can quite often make the unsealed roads non-traversable.

When asked if they believed others would use the pocket guide, all farmers replied positively with some producers emphasising the need to have the pocket guide explained to them in a workshop as did Hanrahan.

When asked what time of year workshops would be preferred, times varied quite a bit but the most popular time was around March/April.

Other suggestions for delivery and to increase regional adoption included field days, one on one, email, fax, web, word of mouth, continued advice to graziers, and testimonials. Producers liked the idea of newsletters, press coverage's, radio, internet and e-mail to keep the information up to date.

GR case study 1 said be mindful of the fact that pyramid training is very slow (where you train a trainer and they train a farmer). Information is better coming straight from the horses mouth. ED case study 2 agrees with this and suggests that you need to target the owner of the property if different from the manager. Both say one on one is the most effective way to get information across.

Hanrahan said that we need to make the producers more aware of how tools benefits them and help them make management changes, such as how it would help with stock feed and water. GR case study 1 said they need to know how it ties straight into dollars and profit. GR Case Study 1 said that some wool producers have experienced 15 years of losing money and you then get a victim mentality. We need to be able to explain to them the economy of scale.

GR case study 1 said for tools to be utilised you need to spend the one on one time. Labourers learn more from talking in general than reading so you need to spend the money on extension. GR Case Study 1 said that for every research dollar that is spent, you need to spend four

dollars to get the adoption. He said producers have to get interested in their own business. He said 40 to 50% of grain growers are seekers of information, however he suggested that only 10% of wool producers are seekers of information.

- **Barriers for increased regional adoption**

The most common reason for not attending a workshop was that producers were too busy with things such as lamb marking or selling sheep with one producer saying he would be on holidays, another saying he would be at Coober-Pedy races and another said he was unwell. Twenty percent of producers said that distance was a problem with one producer saying the closest workshop was 5 hours away.

Many producers said that they could no longer afford staff to cover their time as opposed to 10 years ago when they had two or three workers. They said that the only properties that could still afford workers are company properties. Historically information for producers has been free and it is difficult for producers to get their mind around paying.

Five percent of the producers telephoned, were not interested in attending a workshop at all with one comment being “We don’t use percent that much when looking at forecasting” and another being “ I attended a climate workshop before and found it did not apply to my area due to the tropical feeds from the north”.

- **Suggested changes to the pocket guide**

Improvement suggestions from the surveyed producers included making the maps larger, look toward forecasts with longer lead time, having a web-based copy accessible and further reiteration of where the SST and SOI phases can be tracked down.

Hanrahan further suggested we need to be clearer about the use of the calendars within the pocket guide. Also we may need to add some terms to the glossary such as skill. Both Hanrahan and the producers suggested using a more positive photo on the front cover. The current picture shows drought, and they said the good seasons should also be represented.

The general comments from the participating organisations included layout, and flow of information. The participating organisations and Hanrahan suggested that the term pocket guide be changed as the booklet is bigger than this.

Beverly Henry (dept Natural Resources and Mines, QLD) asked the question “Is rainfall odds the best way to express a rainfall probability?”. This ties into the discussion about terminology between the LWW participating organisations in which Henry has coordinated. This will be further discussed before a final version of the Pocket Guide is printed.

2.5 Recommendations on ongoing delivery/communication systems, including timely fax-back or Email, websites, workshops, networks (milestone 4.4)

Most producers said that workshops were the best method for delivery. We therefore recommend that we continue to make workshops available to wool producers on seasonal climate forecasts as we have done. Producers also said email, one on one, fax word of mouth continued advice to graziers, and testimonials could be a way to deliver information. The CRIMFA provides information via all of these methods. We therefore recommend that CRIMFA be the vehicle for delivery of seasonal climate forecast information in the future. The products within CRIMFA will be shown during workshops, however those people who are unable to attend a workshop will be exposed to CRIMFA products through newsletters and media. Only the products relevant to producers in that workshop will be demonstrated.

It is recommended that we advertise workshops through media, field days, fact sheets, newsletters nutrition group meetings, soil board meetings, preg scanning operators and through existing groups such as Best Prac groups.

We will target time periods for workshop delivery that are preferred. Preferred times varied but the most popular time was March/April, so we will begin by targeting this time period.

We need to keep in mind that one on one is important and will be able to speak to producers one on one at field days and in workshops. Through the Stock Journal and Newsletters, producers are always encouraged to telephone with questions.

We may need to run some workshops in more remote locations to get to producers that were unable to attend workshops to date because of distance.

We have also learned from our own experiences that training the trainer with seasonal climate forecast information is not always effective, unless that trainer is prepared to become an expert and have continuous contact with seasonal climate forecast information. As Nicholson suggests, the information is better coming straight from the horses mouth. We can use existing groups and extension people to advertise and spread the word about our project outcomes, however we recommend that someone from SARDI- CRMU delivers them.

Within the CRIMFA booklet, we will add a section on the direct benefit to wool producers and add testimonials. We will be clear on how the information supports their management decisions. Producers may then take the time off from their property if they see more direct benefits of attending climate risk management workshops and then applying the tools.

As the tools are developed we recommend that we spend some time on perfecting them, but most of the time on adoption and extension.

Since producers are not accustomed to paying for information, producers have been provided the newsletters for free. However next season they will be sent a subscription renewal and will be asked to pay \$20 for emailed newsletters and \$40 for posted newsletters annually. We believe that most producers value the information they have received to date and will subscribe. Some people may argue for a valuable management tool this price is cheap.

Our workshops are nationally accredited under Hortus Australia. Because of this our workshops are 75% FarmBis subsidised. To date LWW has subsidised the further 25% of the

fee. However producers will now be asked to pay the 25% to attend the workshop unless LWW continue to subsidise. This equates to around \$60 per farmer. We believe that this helps producers value the information they are being provided. Producers can be assessed by Hortus Australia after attending a workshop and receive points toward a diploma, provided they answer our assess sheets correctly they can get up to 24 points toward a diploma in recognised prior learning . A total diploma is 50 points.

For the 5% of producers that were not interested in attending a workshop, their attitude may change over time through word of mouth.

- **2.6 Submission of a complete set of producer case studies.**

At the beginning of the project (early 2003) two case study wool producers were interviewed as part of milestone 2.4(Truscott and Hubbard, 2003). The case study wool producers have been interviewed again at the end of the project (Sept 2004). During September the case study producers were asked a number of questions about their use of seasonal climate forecasts including their use of the pocket guide and newsletters and this has been compared to their use of seasonal climate forecast information in early 2003.

- **Information used in early 2003**

In early 2003 the case study pastoralists, from Gawler Ranges soil conservation district (GR case study 1, and from Eastern Districts, ED case study 2, were asked what trigger points they use to implement their management strategies in a good and bad season. GR case study 1, indicated that he uses May rain as an indicator for lambing percentages. He also monitors his own rainfall records. GR case study 1 also indicated he uses long range forecasts including rainfall probabilities and the Southern Oscillation Index (SOI). He also uses a United States 10 day forecast (based in Maryland) which he accesses from the Farmshed web site. To access this information, GR case study 1 used a range of web sites and the media.

ED case study 2, indicated that he uses vegetation, land condition, amount of water in dams and grazing history prior to mating, southerly winds and rainfall patterns as trigger points to implement his management strategies. In a bad season, lack of water in dams triggers water carting and sale of stock . ED case study 2, indicated that he uses very little long term forecasts other than following sea surface temperatures with interest. He does not rely on long term forecasts for planning. This pastoralist keeps his own rainfall records and what current decile range he is in (seasonal conditions to date - site specific information) and his experience “gut feel” to make management decisions. Lindner does not have access to the Internet and relied on the media for seasonal forecast information

The case study pastoralists were asked what time period forecasts could help with decision making, and at what time of the year. GR case study 1 identified a three-month outlook in winter as critical for managing pre-lambing. ED case study 2 subconsciously plans 6 to 12 months ahead. He says short term seasonal forecasting information is important for lambing, mating and selling stock. The chill factor information is particularly important.

- **Case studies uptake of new information provided**

During 2003 and 2004, we have delivered seasonal climate forecast information to the two case study pastoralists as listed in this document including the seasonal climate forecast pocket guide. The pocket guide shows the producers seasonal climate forecast trigger points to help them implement their management strategies. We interviewed the case study producers

before we showed 34 more producers the pocket guide during workshops. We gained a good insight into how management decisions may change due to the use of the pocket guide and other seasonal climate forecast information we have provided to them.

GR case study 1 said he would make management changes on a month by month basis, due to the seasonal climate forecast pocket guide trigger points. This is much different than just using May rain. These trigger points indicate a 70% or more probability of a wetter or drier 3 months from June to November with one or two months lead time. His management changes are outlined above (under the benefit seasonal climate outlooks have to wool producers). GR case study 1 indicated that the seasonal climate forecast pocket guide is potentially a very beneficial booklet. It was great for him to understand when seasonal climate forecasts are skilful and he liked the fact that we showed the odds of a wetter or drier season when they do make more management changes as opposed to the in between seasons.

ED case study 2 also liked the pocket guide. He suggested that he would use the SST outlook maps as they do not jump around as much. His problems in the past with forecasts were that they tended to jump around a lot making them confusing. This pocket guide is better at forecasting the extreme bad seasons, so used in conjunction with his trigger points this is going to support his management decisions. He said this information is not long enough for him to make joining decisions. ED case study 2 joins in November to February which is the period when the 3 month outlooks have little skill.

Both case studies read the newsletters and have suggested some small improvements.

- **How to improve delivery of forecasts**

When the case study pastoralists were initially interviewed in 2003, they were asked about how climate forecasting delivery can be improved. GR case study 1 believed that greater access to climate services was important, and these services should be tailored to producer needs, such as the newsletters and the district specific forecast. If this continues producers would be prepared to pay.

ED case study 2 believed that more accurate forecasting was important. He suggested that cycles in the weather patterns occur and if identified would be used by producers.

Delivery of seasonal climate forecasts has certainly improved with the list of information available to producers, including newsletters, books, Rainman CD rom, the Aussie Grass information on the web site, workshops and the Stock Journal weather page. The newsletters are available in colour post format or via the e-mail. Even if producers do not have access to the web, newsletters posted still provide a good insight into the season ahead and provide producers with a good summary of seasonal climate forecast information for their region. Increased understanding of seasonal climate information through books and workshops, allows producers to utilise the tools available such as the pocket guide, Australian Rainman and the Aussie Grass web site. Producers are slowly gaining ownership and initiative to do this themselves through this project.

The case study pastoralists have been good examples to draw upon during the workshops to indicate how the pocket guide could be used on a month to month basis to support management decisions.

2.7. Assessment of benefit to the region

▪ Usefulness of the pocket guide

Producers surveyed said they like the seasonal climate forecast pocket guide for wool producers because it enables them to make early decisions, its easy to decipher maps, they like the analogue years to compare with own farm records, they like the inclusion of only the extreme years, its easy to follow and understand, its concise and “an easy visual and logical way of accessing the information”. Neil Innes of Booleroo wrote “it is a very useful tool if we can accurately have 70% probability of certain weather conditions”.

When asked what the most important part of the pocket guide was, the producers replied with: the trigger point calendars, rainfall maps, information explaining the SST and SOI phases and the websites for further information and current phases. Brenton Blieschke from Melrose wrote “at a quick look I think all is relevant to make it a useful management tool”.

GR case study 1 said that the pocket guide and newsletters are convenient and simple, which is what producers like.

Each participant was asked to provide feedback on the usefulness of the pocket guide as it relates to each month and a good and bad rainfall/growth season. The wool producers participating in the workshops and also the case study pastoralists were asked to identify the decisions they might make if there were high probabilities of a **wet** 3 months (70% chance of exceeding median rainfall or pasture growth) and also if there were high probabilities of a **dry** 3 months (30% chance of exceeding the median rainfall or pasture growth) using the current SST phase or SOI phase as trigger point to implement their decisions.

The trigger points included;

○ *April SST phase for management decisions between June to August.*

Wet: Most of the producers said they would hold or increase stock numbers. Other decisions influenced were to organise fly control, crutch earlier or rest some paddocks. GR case study 1 said he would be in a better state of mind. He also said that he would provide lupins to stock in early June to get udders up in ewes and make lambing earlier in July

Dry: Producers suggested they may sell excess stock, buy feed or organise supplementary feeding.

○ *May SST phase for management decisions July to September*

Wet: the management changes were similar to that for in April, including increasing stock numbers and being aware of fly strike. GR case study 1 said he would purchase less feed.

Dry: Producers suggested they would sell stock sooner, organise supplementary feed, clean dams and monitor dam waters. GR case study 1 said he would carry on supplementary feeding which has an exponential effect on lambing rate. It depends upon the price of lupins and current capital.

○ *June SOI phase for management decisions July to September*

Wet: Producers would make slightly different management changes June (using SOI) as opposed to April (using SST), these decisions included monitoring ewes and lambs, double lambing and using fly risk avoidance techniques. GR case study 1 said if it was

wet and there was extra pasture growth this increases your flystrike risk, therefore you would spray a back liner on at crutching and be careful with its use as flies build up a resistance.

Dry: Producers suggested they would cull or sell surplus stock to relieve feed and water pressure, clean out dry dams, prepare supplementary feeding and shear earlier. GR case study 1 said he uses grey or euro kangaroos condition as a trigger point to decide whether to continue feeding lambs or increase lamb mortality.

- July SOI phase for management decisions August to October

Wet: Producers suggested they would crutch and jet sheep earlier. GR case study 1 said he would also look at his fly prevention strategies.

Dry: Producers said they would escalate de-stocking rates, sell sheep sooner, supplement feed and move lambing ewes into better paddocks. GR case study 1 said he would supplementary feed.

- July SST phase and August SOI phase for management decisions September to November

Wet: Producers suggested they would adjust crutching times sooner, keep sheep on sale longer and increase mating for summer lambs. GR case study 1 said he would jet your sheep using a product called Click. If you have an idea your dams are going to fill it gives you more flexibility.

Dry: Producers suggested this may result in selling sale sheep ASAP, cleaning dams and supplementary feeding. GR case study 1 said he would not jet or crutch his sheep as the risk of fly strike would be minimal and you can save thousands of dollars (in his case with 13 thousand sheep he would save \$13 thousand dollars).

- **The triple bottom line**

As part of the survey producers were asked how they may benefit financially, socially and economically over a 10 year period using the seasonal climate forecast pocket guide.

Comments included;

Financially

- This could be an interesting guide for decision making,
- A very useful tool for management
- Who knows, but potentially very significant
- Only have to make one right decision from using guide for it to have been worth it
- Gives a guide about when to expand and make big purchases (if know good season predicted)
- Great value if we got one or 2 good seasons in 10 and one or 2 bad seasons in 10
- A little in good seasons, fair bit in bad,
- Always be on the side of being conservative
- Management is based on long term strategy of stocking for all dry years.
- If we can predict poor season our input cost would be slashed
- Will help financially as we can plan for it
- Even out income stream
- Might increase overall profit by taking out some of the gambling in it all
- Say 5% over 10 yrs
- Currently sales of excess stock is 15% of my income. If I increase my lambing by 20% excess stock sales become 30% of income
- 30-50% increase in gross income
- Increase lambing percentages by 15%
- Use of property labour (contracts in)

- Increase stocking rate
- Higher wool cuts
- Making final decisions on stock numbers/sales etc
- Less flystrike

Socially

70 % of the comments suggested the pocket guide would reduce the stress levels and further comments included

- Better able to plan for the future
- If it is helpful, prior preparation prevents poor performance
- Planning is too short a period to really influence management in a significant way
- Further interests therefore feel more empowered
- Doubtful if it will affect us
- Be able to plan holidays and so forth, knowing when can go away if not having to check sheep then less stress overall.
- Gives information to work with. Lowers the guess level
- Information to discuss with others
- Knowledge
- Greater control of business – better risk management when coupled to market analysis and better business planning techniques
- If you don't spend in poor years it will make your long term viability
- Never stress over the weather because you can't change it!
- Take control of the situation and you manage the risk not be driven by it.
- It prevents living in hope which is dangerous because if it doesn't deliver then there is more suicide.

Environmentally (increase vegetation, less erosion, greater germination of perennial plants)

- might be able to decrease stocking rates during a poor period so damage is kept to a minimum
- give guide about when to sell sheep to avoid hanging on too long and placing extra stress on the land and vegetation
- yes, obvious benefits if poor seasons can be accurately forecast
- better grazing and stock management
- better control over grazing management by being proactive
- less erosion in bad, although main effect in better yrs if used with confidence
- hopefully current strategy is working
- revegetation projects perhaps
- manage vegetation better
- protection of vulnerable vegetation (native)
- increase the chances of survival of salt bush plantings
- conserve land in dry years
- maintain health of property
- not a major difference
- could help in these areas

3. HOW THIS PROJECT HAS AFFECTED PRODUCERS KNOWLEDGE, ATTITUDES, SKILLS AND ASPIRATIONS.

3.1 Knowledge

At the onset of this project some preliminary investigations were conducted as to the use of seasonal climate forecasts by pastoralists (low rainfall wool producers in South Australia). Our initial research showed that just 18% of producers found seasonal climate outlook information to be useful and just 10% used seasonal climate forecast information in their decision making.

We believe that the reason for lack of uptake of seasonal climate forecast information was due to lack of;

- knowledge of what tools and services are available,
- understanding of when the seasonal climate forecasts are relevant,
- understanding of how to apply seasonal climate forecast information such as SOI and SST.

Through our newsletters, workshops and pocket guides we have been able to address these barriers to the adoption of seasonal climate forecasts. Ninety nine percent of producers said they would like to continue to receive the newsletters that we post out monthly. The majority (34) producers that were shown the pocket guide in workshops said that the workshops were the best way to educate people about the application of seasonal climate forecast information. All of these producers said they would use the pocket guide to influence or change their management decisions in seasons where there was a 70% chance of a wetter or drier 3 months.

Twenty one percent of all producers in the SA rangelands have been shown the pocket guide and their management decisions have been influenced as well as their knowledge of seasonal climate forecasts. Most producers in the rangelands have seen our newsletters and nearly 50% have attended a climate risk management workshop.

3.2 Attitudes

We believe that producers may have been negative toward seasonal climate forecasts because;

- They have been exposed to seasonal climate forecasts at a time of low skill
- The seasonal climate forecasts are showing a 50% chance of exceeding the median rainfall

GR case study 1 said that today many producers do not value their time away from their properties and don't know how to break their routine. He said that where we have spent one on one time with the producers during workshops we have gained their confidence and understanding of the information.

He said people put themselves in a rut. Low wool process creates depression and to avoid this they keep busy. People don't like to be told what they are doing wrong and think they will be told this if they go to a workshop. They may also think that attending a workshop will give them extra work. This is a reaction of 15 years of low wool prices which develops culture and attitude.

However we believe that once producers have attended a workshop they are surprised at what they can learn and the value of the workshops to their business. Thus they recommend these workshops as a method of delivery to other producers.

ED case study 2 said that during the 2004 season he had been reading the seasonal climate forecasts but they did not come into his management decision making due to the forecast being a 50:50 or not significant. ED case study 2 also said that they have not predicted lack of rain which they are experiencing.

The seasonal climate forecast pocket guide for wool producers has helped to overcome these barriers as it shows producers to only take into consideration the forecasts that show a 70% or more chance of exceeding the median rainfall or pasture growth or a 30% chance of not exceeding the median rainfall or pasture growth. At other times it suggests that seasonal indicators such as stored soil moisture, evaporation rate and rainfall to date should be used in conjunction with Aussie Grass indicators.

3.3 Skills

Nearly 50% of the wool producers in the SA rangeland regions have improved skill in making management decisions using seasonal climate forecasts through attending climate risk management workshops. The producers leave the workshops better understanding the indicators affecting our climate and where they can access seasonal climate forecast information (through the workshop and the climate risk management resource manual they are provided). The producers in recent workshops also received a draft seasonal climate forecast pocket guide, which shows them when the seasonal climate forecasts are useful for their region.

Producers are able to further utilise climate risk management tools shown in the workshops like Australian Rainman of which some producers have purchased. Many producers were sent outputs of Rainman for their closest rainfall station during milestone 3 of this project. Producers know they can read the stock journal weather page weekly to gain the latest SOI and SST values and latest seasonal climate outlook. Once a month we put the Aussie Grass – pasture growth forecasts on the weather page. Similar information is provided once a month in the newsletters.

3.4 Aspirations

In most locations, the top producers aspire to better perform, learn and grow with the times. It is these producers who lead the way for the others in their region. GR case study 1 would like to increase his lambing percentages, for better genetic selection and improved wool quality and cuts. He is extremely supportive of climate risk management and the tools and services the SARDI – CRMU has developed. He reads the newsletters and climate risk management resource manual and has grasped how to use the seasonal climate forecast pocket guide. Through this work many other producers have become more interested in seasonal climate forecasts and their benefit to the region. GR case study 1 says that there are still some producers that are not so forthright and they need to get interested in the climate.

4. FUTURE DIRECTIONS

Nearly 50% of producers in the SA rangeland wool producing regions have attended a climate risk management workshop. Nearly 100% of the SA rangeland wool producers have been exposed to climate risk management information through newsletters and the media.

With further funding we would increase the number of producers learning about improved seasonal climate forecasts in the SA rangeland regions and follow up producers that have attended workshops to ensure the seasonal climate forecast information continues to support them to make management decisions.

We would update the Seasonal Climate Forecast Pocket Guide – Draft to incorporate the changes suggested by wool producers, the case study farmers, the LWW participating organisations and coordinator. We would continue to supply monthly seasonal climate forecast newsletters to wool producers and their advisors in the rangeland regions.

We will also utilise the newsletters sent to every wool producer to advertise the pocket guide and the need to attend a workshop to gain access to the pocket guide. We would utilise existing groups and the networks we have developed to deliver the seasonal climate forecast information, tools and services. Best Prac groups will be one of the main targets as they are already established and meet throughout the course of the year.

We would utilise some of the extension processes outlined by the Bennetts Hierachy as suggested by LWW.

The SARDI-CRMU will upgrade their web site and include more LWW project results, and tools and services.

We will use the Map Arranger facility to further explore the skill the SOI 5-phase system and the SST 9-phase system to forecast pasture growth using the KW test.

Appendix 8 - Extract of Milestone report 7

Milestone 7 - Progress Report

Provide to LWA a Progress Report with a brief summary of:

1. Contribution to LWW Review Workshop in Indooroopilly, QLD, April 2005;
2. Progress with new seasonal climate forecast pocket guide for wool producers in SA and enclosing a draft copy of the guide for approval.

Achievement Criteria:

1. Submission of draft of Pocket Guide to Climate Sub-program Co-ordinator, Rohan Nelson and Land, Water and Wool Communications Co-ordinator, Kim Mitchell for approval; and
2. Acceptance of Progress Report by LWA.

Achievement against Milestone Criteria 1

1. Contribution to LWW Review Workshop in Indooroopilly, QLD, April 2005.

Melissa Rebbeck attended the LWW Review Workshop at Indooroopilly, QLD in April 2005. Also present were the other state project representatives and a LWW review committee. The review committee was put together by Dr Barry White in order to review the forecast verification techniques, presentation and interpretation of these by each state project.

At the workshop Melissa presented the attached PowerPoint presentation as shown in Appendix 1. The presentation provided some background to the project and addressed the terms of reference as suggested by the LWW review committee. Melissa discussed the terms of reference with Peter Hayman and other project colleagues before attending the workshop.

Each state representative of the LWW projects also addressed the terms of reference with the review committee. There was much discussion about the terms of reference during the workshop between the review committee and the project representatives. The LWW review committee said that they would get back to the project leaders with some recommendations regarding the approach to use for interpretation and presentation of seasonal climate forecasts.

The LWW review committee sent through recommendations for the state project. Our project commented on the recommendations and then sent back to committee (see appendix 2). The committee then sent back further comments also provided in appendix 2).

Further discussion took place between the state projects and the review committee and then a final set of recommendations were provided in a report. The report is titled "Review of the Land, Water and Wool (LWW) suite of Managing Climate Variability Projects." It is not attached to this report as LWW would have a copy.

The recommendations were utilised to re format the draft pocket guide we had previously developed (not attached, see references, LWW would have a copy).

Achievement against milestone criteria 2.

2. Progress with new seasonal climate forecast pocket guide for wool producers in SA and enclosing a draft copy of the guide for approval.

Pocket guide

An original Seasonal Climate Forecast pocket guide for wool producers was developed (not included in report) provided producers with an a range of SST and SOI Aussie Grass maps for

both rainfall and growth. There was also information on rainfall distribution in the SA rangelands wool producing regions for six locations showing summer and winter dominant rainfall and non dominant rainfall patterns. An explanation of the SOI and SST, a list of locations to find these values was also included in the pocket guide.

Testing original pocket guide

To test the pocket guide two six hour workshops were run and a 3 hour presentation to a Best Prac group. At the workshops producers were asked to evaluate the usefulness of the pocket guide. Workshops were seen as the most effective way of testing the pocket guide. Every effort was made to ensure we had sufficient number of producers at each workshop.

We also sent a five draft copies of the pocket guide to Barry White who distributed them to Peter Hanrahan and other LWW associates. Each project leader in NSW, QLD and WA also received a pocket guide. Barry White, Peter Hanrahan, David Coburn, Beverly Henry, Ian Watson and Ron Hacker provided feedback on the pocket guide. Barry White also showed it to a review team at a meeting in Tasmania.

The LWW review committee also saw the pocket guide and were shown the methods used for forecast verification. The committee suggested that we needed to do further statistical tests on individual phases of the SOI in order to decide what maps we should include in the pocket guide.

Further statistical tests were completed using the Map Arranger product developed by Beverly Henrys team. The tests looked at the significance of the 5 SOI phases (as defined by Stone) to rainfall and pasture growth using LEPS scores and KS tests. Previously the Chi Squared test and KW tests had been applied.

No further statistical tests were performed on Drowsdowsky's SST 9 phase system as the LWW review team suggested that this be omitted from our pocket guide due to phase locking.

The comments of wool producers, the project representatives, and the recommendations of the LWW review committee were used to produce another pocket guide attached in Appendix 3.

The main changes include;

Language including the term seasonal climate risk outlook rather than seasonal climate outlook, larger maps, no negative photo on front cover, no use of the SST 9-phase system, deletion of forecast calendar and added a table, explanation up front of what the pocket guide is about, change in size.

The pocket guide is a draft. There may be some minor errors, however we seek feedback from LWW to make some minor corrections and then print copies to be delivered to wool producers in the SA rangelands.

Delivery aims

The pocket guide will only be delivered to producers in workshops. A copy will not be provided unless producers have received instructions either through a workshop or one on one.

The SARDI climate risk management unit aims to train best prac group leaders as well to deliver the pocket guide to wool producers. In addition producers will be given the option to subscribe to a monthly newsletter (example attached in appendix 4) and district specific

forecast (example attached in appendix 5). Producers will also be provided with a climate risk management resource manual during the workshops (example attached in appendix 6).

Best prac group leaders will be trained in early January 2006 and delivery will continue to aim at having 60% of wool producers exposed to the pocket guide by April 2006.

Variations

There are no variations to financial resources, human resources or future milestones.

Communications

The communications aims are listed above

Summary

Above is a summary of the progress of the project and delivery aims. The SARDI Climate Risk Management Unit has responded to the LWW review committee and updated the seasonal climate forecast pocket guide for wool producers. It has produced a draft and a plan for delivery.

Appendix 9 - Response to Recommendations from SA and review committee further responses.

Peter Hayman and Melissa Rebbeck, SARDI climate risk management unit
24th May 2005

It is recommended that:

1. The projects include hind-cast verifications, using conventional cross-validation.

Agree – however we see this as an issue primarily for the forecast developers. The question of whether it is necessary to re-do the cross validation for pasture production is more difficult.

On pasture: One problem I have is that people “promote” the pasture growth models as “amplifying” the signal from rainfall -- to a user this may sound like better. But do we really have any idea at all if it is better? Is there a paper in a refereed journal that shows that it is “better”? So what approach should be taken – asking for more robust testing of the pasture growth skill and/or usefulness, and if so, how? Or inviting extension people to be more circumspect in use of the outputs of the pasture models? Or what?

2. The project teams apply rigorous and consistent statistical methods in assessing the hind-cast skill when existing and peer reviewed forecast systems are adapted to longer lead times, different forecast periods and finer scales. This is particularly important to underpin plans to issue forecasts at lead times beyond the original design of the systems. Care needs to be taken to avoid false skill, which may be exhibited in the as yet incompletely verified long-lead systems presented. For this reason, extension of these approaches is discouraged prior to further validation.

Agree - In SA we deliberately stuck to using the forecasts with the same lead-time as published – 0 month for SOI phase and 1 month for SST phase. If a peer reviewed forecast is used for a different time than it was peer reviewed for it becomes an experimental forecast.

3. P-values should not be used in isolation as a measure of skill.

Agree – however there is a communication issue here whereby P values are more readily understood by agronomists, livestock officers and the rest of us in the climate applications community than LEPS scores. P values also allow a fairly easy explanation of Type 1 and Type 2 error as is done nicely in the help files in Rainman

I'm not sure what the issue is! Firstly, note that the review didn't demand LEPS scores, rather requested an appropriate skill test. Secondly, if the apps people are familiar with P values, that means they can understand the concept of discrimination – so that's good for their work with the users. Do they need to work with the users in terms of LEPS scores or any skill scores – I would have thought not. Provided someone has done a (hopefully cross-validated) skill test on the forecast system, then the suppliers should have more confidence in the product, and that's the purpose of the testing, not to teach the users about skill testing -- if the users can understand the concept of discrimination and are told the product has been tested for

skill, won't that be OK for them? To me, the skill testing is a duty of care activity for the forecast provider, not a communication issue with the user.

4. The skill of the forecast systems should be assessed prior to operational implementation. Definitions and measurement of skill and value used in the projects should be consistent with internationally accepted standards. In future MCVP projects, greater emphasis on forecast value is recommended.

Agree – In SA our emphasis is on usefulness of forecasts. Skill is necessary but not sufficient for usefulness. This matter is discussed at workshops.

5. Once the projects commence providing routine seasonal forecasts, they should include a forecast verification component, to ensure that public forecasts are assessed in near real-time (the minimum required is periodic assessment every few years).

Agree – this is easier to do for rainfall (I thought that Robert Fawcett NCC did this) than it is for pasture growth, although I imagine NDVI data could be used. This is important to understand adoption, for example the use of SOI phase system in southern Australia in the early 1990s vs Qld. This is important in terms of item 12 where there may be shifts in climate towards warmer and drier conditions.

In NZ, they routinely include a “how did we do” segment in their seasonal outlook service, in which they discuss /present maps on recent forecasts vs what happened. This is not a formal verification. Do you think this is an option that might work for operational services that come out of these projects?

6. The projects should adopt a consistent methodology for accounting for spatial correlation, and determine a level of smoothing which is appropriate for seasonal rainfall outlook information and associated spatial displays. Map displays and other communication of spatial coherence should be guided by work resulting from recommendations about scale issues, to avoid display of noise that could be misinterpreted.

Agree – this is an issue for the Spatial Information System such as Map Arranger – but it is also an issue for end users. In the SA guide we make some reference to this. In passing it is worth noting that similar issues relate to soil maps – which ask end-users to interpret them as landscape units rather than paddock scale maps. The use of points as in the latest version of Rainman has some merit as it lets the user do the smoothing.

7. MCVP/LWW should commission a small working group led by Dr David Jones and Dr Roger Stone (and involving project members as necessary) to meet with the aim of resolving the “phase locking” with the SST phase system and other related issues.

Agree – we wish Drs Jones and Stone all the best. In SA we could remove the SST system from the guide, this would reduce the number of months that a forecast is available. In this study the trend in the SOI should also be considered.

Given the pressures on these two with the drought on, you may wish to press for this to happen sooner rather than later, to get some action going. What specifically do you mean by the second sentence?

8. On the matter of utility and interpretation of ENSO state predictions by numerous GCMs, MCVP/LWW should refer it to the Bureau of Meteorology and QNR&M for investigation with a view to improving the information available on Australian websites.

Agree – one of the issues is multiple definitions of ENSO. In terms of information available on Australian Web sites we recognise the ENSO wrap-up as an excellent source of information. Possibly a little more discussion of how the 11 GCMs that the Bureau compares should be rated as they probably do not all deserve equal rating.

9. All service deliverers should preface forecasts with information about the strength of the signal for a given season and for that pastoral zone, with regard to an appropriate skill measure.

Agree – this is the purpose of the wool growers guide – to indicate the times when the forecasts have skill (or at least useful discriminatory analysis)

10. Forecasts of meteorological variables should be differentiated from the term “climate risk assessment”.

Agree – although should not meteorological variables such as wheat yield that include stored soil water as well as climate be “wheat production risk assessment”?

We considered that wheat yield is not a meteorological variable. We used the following words in the report:

*The review panel considered that a useful distinction is that: “Climate risk assessment in agriculture is based on point estimate of climatic events **and** their impacts on agricultural productivity” (from *The Third International Conference on Geospatial Information in Agriculture and Forestry 2001*). By this distinction, probabilistic forecasts of rainfall distribution are preferably described as “seasonal climate forecasts” or “seasonal climate outlooks”. Probabilistic outputs of pasture growth models fit more comfortably with the definition of climate risk assessments because they provide assessment of biophysical impacts.*

Is this not clear?

Using these words, it seems to me quite compatible to use terminology you suggest: wheat yield that include stored soil water as well as climate be “wheat production risk assessment” We can clarify further if you think it is necessary.

11. In the wider context (relevant beyond the suite of projects under review), there are valid concerns about possible impact of climate change on seasonal forecasting systems. Within the next decade, if climate change continues its current path, the impact on operational systems could become serious. Basic research is therefore needed on better analysis of the potential problems for Australia and on whether operational systems can be optimised to minimise climate change contamination.

We agree with the need for basic research and intend to include a paragraph on this as a caveat in the next version of the SA wool growers’ guide

12. Future projects engage a steering committee to be consulted on technical and methodological matters. This recommendation may benefit the efficiency and outcomes of a wide variety of projects funded through Land and Water Australia, particularly where new

cross-disciplinary research effort is part of the project, such as within the Managing for Climate Variability Program. For example, it may be possible to incorporate new tools or scientific standards into project methodology more quickly.

Yes – agree. However in passing it should be noted that as we understand it the Indooroopilly team did consult a statistician as did the Toowoomba component of the project and the NSW component of the project.

Thanks for this, Peter and Melissa. I'm steering a delicate pathway here, those statisticians on the review team who were most outside of the community we belong to were quite strong in their comments, and I think there should be no direct criticism of what has been done but an attempt to get wider advice in future. The list you supply below shows that people have been and are getting quite serious about improving the standards and that's terrific -- now we have to get those people below to help across the board and the steering committee method is one way. Another way, which I think would be beyond the scope of the review committee to recommend, would be to float the idea of a stats in climate applications conference some time in the near future.

I thought that the WA region had just commissioned a major study on the skill of seasonal forecasts for the Murchison-Gascoyne region. So there has been more consulting of the statistical profession in this project than most other projects. Furthermore as a climate applications group that is willing to learn from the statistical profession but unlikely to make any significant contribution, we note that there is no shortage of groups working on the skill of seasonal climate forecasts. An incomplete list is as follows:

1. *This review*
2. *Holger Meinke and Andries Potgeiter and others at Toowoomba. Andries Potgeiter has published on this and Holger recently published some new thoughts on the matter*
3. *The Rainman team at Toowoomba who have recently developed a nice spatial tool and have long ago provided a method whereby end-users were warned about reading too much into two boxplots that looked different. This was a big improvement on the first version of Rainman.*
4. *We understand from Howard Cox that the Whopper Cropper team is including statistics into the new version of Whopper Cropper*
5. *De Li Liu, Anwar Mohammad and Daniel Rodriguez who have used the input of Scott Power to include skill testing into the CVA climate variability analyser*
6. *Peter McIntosh with SSTman has cross validated skill measures*
7. *David Stephens mentioned that he was looking into innovative ways of measuring skill as well as discussions with 4 and 5 above*
8. *Yvette Everingham has a MCVP proposal that includes skill testing*
9. *BRS is developing innovative ways to measure skill of SCF as part of their MLA project.*
10. *Andrew Watkins BoM is a member of the WMO team on forecast verification and Andrew Watkins and Scott Power had a previous CVAP proposal on forecast verification.*
11. *Yahya Abawi has developed a capacity with his FOWCAST project for statistical measures of different SCF*
12. *Roger Stone, Robert Fawcett, Yvette Everingham et al gave a paper at the Science for Drought forum in Brisbane 2003 suggesting the use of the binomial test Andrew Vizard and Garry Anderson , have used Cost/Loss.*