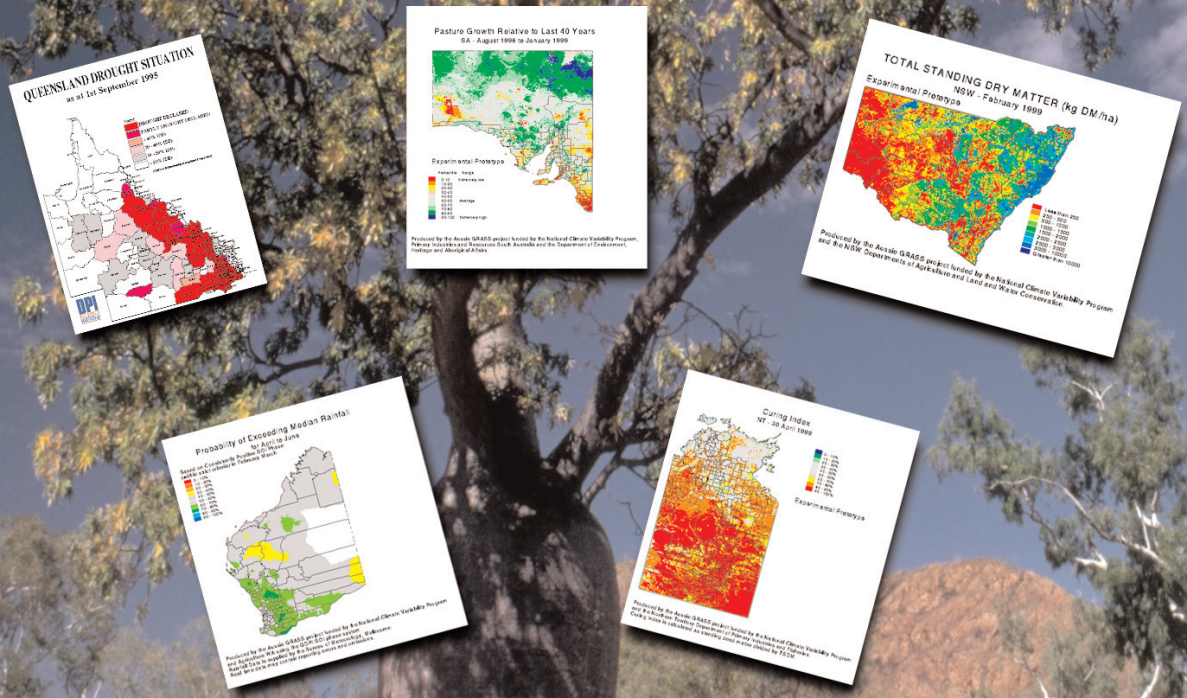
A SURVEY OF THE ASSESSMENT OF SEASONAL CONDITIONS IN PASTORAL AUSTRALIA

Benchmarking in the *Aussie GRASS* Project

PART 5: WESTERN AUSTRALIA



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A SURVEY OF THE ASSESSMENT OF SEASONAL CONDITIONS IN PASTORAL AUSTRALIA

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PART 5: WESTERN AUSTRALIA REPORT

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A product of The Aussie GRASS Project

A collaborative research and extension project carried out by:

Queensland Department of Natural Resources
Queensland Department of Primary Industries
Agriculture Western Australia
Department of Primary Industries and Fisheries, Northern Territory
Primary Industries and Resources South Australia
Department of Environment, Heritage and Aboriginal Affairs, South Australia
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FOREWORD

Australian rangelands have an extremely variable climate which has contributed to land degradation on some pastoral areas over the years. In order for graziers, agribusiness and policy-makers to make timely, profitable and sustainable management decisions, they need to have access to accurate up-to-date information on current and forecast seasonal conditions.

The Aussie GRASS Project.

Pasture research over the last 30 years, combined with modern technologies, is opening up new possibilities for assessing seasonal conditions and improving pasture management decisions. From 1991 to 1996, a spatial modelling framework was developed for Australia to provide up-to-date simulations and forecasts of pasture growth and utilisation, but with an emphasis on Queensland. This work integrated climatic and natural resource data, remote sensing, historical agronomic research and simulation modelling. While seasonal rainfall explained only 40% of the variation in seasonal pasture growth, models of soil water and pasture growth explained approximately 70% of observed variation.

The second stage of the project, called Aussie GRASS, commenced in April 1997. It involves nationwide collaboration of organisations in New South Wales (NSW), Northern Territory (NT), Queensland (Qld), South Australia (SA) and Western Australia(WA), in both research and extension; the aim is to expand the spatial modelling framework and make it operational to enable regular assessment of the condition of Australia's grazing lands. The Queensland Department. of Natural Resources is lead agency in the Project, which is supported by funding from the National Climate Variability Program (administered by the Land and Water Resources Research and Development Corporation).

A range of 32 spatial mapping products has been produced for the States of Queensland, New South Wales, South Australia, Western Australia and the Northern Territory (including some generic Australia-wide maps). These products can be divided into the following groups: recent rainfall, current pasture production/condition, drought situation, seasonal climate outlook indicators, forecast rainfall/pasture condition, and integration of products. Most products are currently available on one or more of the following information systems: Internet World Wide Web - 'The Long Paddock'; SOI Fax Hotlines; Farmfax - Climate section; and SOI Phone Hotline.

These widely available products will enable more timely and improved assessment of seasonal conditions, recognition of climate-related opportunities and threats, and thus influence management decisions such as stocking rate and burning. This will lead to grazing industries and other resource managers being better in tune with changing seasonal conditions and the natural resource base. As a result, proactive management decisions will minimise land degradation during drought events, and government drought policy will be more transparent and nationally consistent.

The Project involves liaison and interaction with a wide range of stakeholders, agencies and related programs and projects, as the products can help with a wide range of decisions.

The Survey

The purpose of the survey was to provide a benchmark profile of Australian graziers for the Aussie GRASS Extension sub -project. The survey was designed to gain information primarily from graziers. However, some feedback was also sought from agribusiness operators in pastoral areas who could contribute up a maximum of 10% of the sample.

The aims of the survey were:

1. To measure the knowledge, attitudes, skills and aspirations of graziers and pastoral agribusiness managers pertaining to the assessment of seasonal conditions, including the use of seasonal climate forecasting;

2. To ascertain how pastoralists currently assess seasonal conditions, the decision-support information/tools they access, and how the information is used in making key property management decisions; and

3. To provide a sound basis for the development of communication and extension strategies in order to achieve effective and efficient transfer of information and technological outputs of the Aussie GRASS research program.

Method

A standard covering letter and questionnaire were used in the survey. The Results section uses the structure and actual questions of the questionnaire in order to systematically report on the responses of participants.
The eight key questions in the survey were:

- KNOWLEDGE about making sound pasture management decisions regarding stocking rates (Question 16);
- ATTITUDES about the usefulness of 'big-picture' information (Questions 19a and 19d);
- SKILLS in accessing relevant information systems (Question 21e); and
- ASPIRATIONS regarding commitment to adoption of sustainable management practices (Questions 17c, 25, 28 and 30)

The aim was to survey a 'representative' sample of at least 50 graziers and pastoral agribusiness managers (up to a maximum of 10% of the total sample) in each of NSW, SA, WA, NT and Qld – that is a total of 250 people. Location, property size, land system, pasture species and enterprise(s) were all considered when developing a 'representative' sample in each State/Territory.

Samples for surveying were obtained in various ways in the collaborating States and the NT. Many of the extension officers in pastoral areas were involved in the distribution of survey forms and collection of completed survey forms.

Most people in the sample were phoned prior to sending out the survey form in order to obtain some commitment to providing feedback. However, time constraints did not always permit this.

Survey forms were mailed in March 1998. The generic covering letter was customised by each State/Territory to indicate local involvement in the Project, as was a follow-up letter to those who had not responded within one month of mailing the survey forms.

As promised, those who provided their names and addresses were sent a coloured poster showing historical Australian rainfall maps and SOI graph, and their names were placed in the draw for 16 book prizes. The book prize winners for the State/Territory were named in the covering letter sent with the posters. Again generic covering letters sent with the posters and the book prizes were customised by each State/Territory prior to sending.

An electronic version of the survey form was produced by the Queensland Centre for Climate Applications, and placed on the SILO World Wide Web site. Each State/Territory then entered their own data that was placed in a relational database. Printed copies of the data entered for respondents were then checked and the errors corrected.

Summaries of the data for each State/Territory were distributed to facilitate production of these detailed reports on the findings for each State/Territory. These reports were then used to compile a national report summarising the overall findings of the Survey.

Feedback in Other States

This report was produced as five separate publications in order to encourage and facilitate the interpretation, distribution and fruitful use of the results on a State/Territory basis:

- Part 1: Queensland Report, Queensland Department of Primary Industries Report Series QO99014, ISSN 0727-6281;

- Part 2: New South Wales Report, Queensland Department of Primary Industries Report Series QO99015, ISSN 0727-6281;
- Part 3: South Australia Report, Queensland Department of Primary Industries Report Series QO99016, ISSN 0727-6281;
- Part 4: Northern Territory Report, Queensland Department of Primary Industries Report Series QO99017, ISSN 0727-6281; and
- Part 5: Western Australia Report, Queensland Department of Primary Industries Report Series QO99018, ISSN 0727-6281.

Each of these reports provides the complete survey results on a regional basis, including all individual responses to open questions, and local interpretation of the responses. In addition, a national summary of the survey results (based on these State/Territory reports) will be published shortly by the Land and Water Research and Development Corporation as an Occasional Publication.

Col Paull
Leader
Aussie GRASS Extension sub-project

INTRODUCTION

The Western Australia survey was conducted as part of the national Aussie GRASS survey. An outline of the Aussie GRASS Project, the aims of the survey, the survey design and methodology used, and publication of the results (in a national summary and for each State/Territory) are covered in the Foreword. The detailed results for Western Australia, on a regional basis, are given below.

SUMMARY

A selected sample of graziers, not strictly random, was surveyed in each of the three Western Australia Regions. A total of 26 completed survey forms was returned. The feedback collected covered four areas: general information about respondent; monitoring seasonal conditions; 'big-picture' information; and scaled attitudinal responses. Detailed responses to all questions are given, including all individual responses received from open questions.

The following conclusions can be made from the survey, as described, and the results obtained:

- The survey results provide reasonable guidance for developing an effective Communication Plan and Extension Program, despite the small sample size.
- As all 26 respondents keep daily rainfall records, and these are all 'complete' or 'fairly complete', the challenge is to help them make better use of these valuable data. A total of 73% of respondents do not currently use long-term climatic records to assist in decision-making. However, all would surely use their perception of 'average' seasons based on their own rainfall records. There is some suggestion, particularly in the winter rainfall dominated Southern Rangelands that managers do not have a clear idea of the rainfall regime of their local area, since about half nominated periods other than winter as the time of most rainfall.
- Fifty-four percent said that judgements of future climatic conditions were 'very important' or 'moderately important' in their planning or decision-making, so they are likely to be receptive to training aimed at a better understanding of seasonal climate forecasting, and the use of such information; Only 27% currently use seasonal climate forecasts in decision-making.
- There is a reasonably good acceptance of probability-based information, as 51% said that probability-based information is 'moderately useful' to 'very useful' in the management of their business. In addition, most respondents agree with releasing seasonal climate forecasts in the form of probabilities. However, it is not clear how well understood the use of probability based information is. There was some indication in the text responses that 'probability' was equated with 'predicted' (i.e. 100% probability).
- While 58% said big-picture information was 'slightly important' to 'moderately important' in their planning, 35% were unaware of the information. In addition 58% of those who have used big-picture information have found it 'moderately useful'. Also, 69% of those who have not used big-picture information thought it could be 'moderately useful' or 'very useful', while 6% of respondents have no idea how useful it might be. Thus respondents should generally be receptive to Aussie GRASS extension activities.
- Users of big-picture products have some problems with accessing information, interpreting and using it; also there are some reservations about product accuracy and forecasting ability. These issues need to be addressed in implementing the Aussie GRASS extension program. It will be important to point out that there is no universal panacea to seasonal forecasting. Best use needs to be made of existing records for seasonal context and good understanding of probabilities is necessary for forecasting purposes.
- The most convenient ways to access seasonal climate outlook information are 'faxed directly', rural newspapers, TV, and radio. As 96% have a facsimile machine, this appears to be the best current method for pastoralists to obtain accurate information. However, 60% have a computer, 12% currently have access to the Internet and most respondents accept that an increasing amount of information will be computerised. Thus their use of software programs and the Internet are likely to increase. Isolation in WA pastoral areas will mean that the use of the Internet will be less than in more populated areas for some time to come.
- There appears to be strong support for the concept of Feed Shortage Alerts, and moderate support for the provision of warnings of possible deterioration of pastures or soil.
- Western Australian pastoralists have not been exposed to the concept of El Nino and the SOI as much as eastern states' producers. Obviously, this is due to the reduced effects of these on the west coast. However,

it does mean that they are less sensitive to big-picture climate information. In the east, El Nino and SOI provide effective vehicles for raising the profile of seasonal intelligence. The same is not true in the west and it will not become so unless a complementary Index is found for the west coast and promoted.

- Seasonally related big-picture information may have to be tailored differently to west coast producers. Rather than focussing on forecasts, it might be better to concentrate on seasonal context information using their own (often very good) long term rainfall records. This would allow them to make better judgements about the 'averageness' of current seasons and set stocking rates accordingly.

METHOD

Rangeland Officers in five regional centres of the rangelands (Carnarvon, Kununurra, Meekatharra, Kalgoorlie) were asked to send out 10 questionnaires each to representative pastoralists. The sampling was not strictly random, but was not intended to capture any particular point of view or interest in climatic variability. Two samples in the Central Agricultural Region (around Northam) were captured opportunistically.

RESULTS – WESTERN AUSTRALIA

The following numbers of completed survey forms were received:

TOTAL	Kimberley	Southern Rangelands	Agricultural Region
26	6	18	2

The following answers and comments were obtained in response to the various questions (the total number of responses in each category is indicated in bold type, followed by the percentage of those who responded to the specific question shown in brackets):

PART A: General Information about Respondent

Q1: What is your nearest town? _____ In what State?_____

A summary of the Western Australia responses is contained in the table above.

Q2: What is the name of your local government area/district? _____

A summary of responses is contained in the table above.

Q3: How big is your property?

There were 26 responses to this question:

> 0 – 100 000 ha	**8**	(31)
>100 000 – 200 000 ha	**6**	(23)
>200 000 – 300 000 ha	**4**	(15)
>300 000 – 400 000 ha	**3**	(12)
>400 000 ha	**5**	(19)

Answers by region

Property size (ha)	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
> 0 - 100 000	**8** (31)	2	4	2
> 100 - 200 000	**6** (23)	0	5	0
> 200 000 – 300 000	**4** (15)	1	4	0
> 300 000 – 400 000	**3** (12)	1	2	0
> 400 000	**5** (5)	2	3	0

Q4: How big is your business (turnover per annum)?

There were 26 responses to this question:

$20 000 - $200 000	**6**	(23)
> $200 000 - $2 000 000	**19**	(73)
> $2 000 000	**1**	(4)

Answers by Region

Turnover per Annum	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
$20 000 - $200 000	**6** (23)	3	3	0
$200 000 - $2 000 000	**19** (73)	2	17	0
> $2 000 000	**1** (4)	1	0	0

Q5: What industries are you in?

There were 39 responses to this question (some of the 26 respondents gave more than one answer):

Beef	**13**	(48)
Sheep	**18**	(67)
Fodder Crops	**1**	(4)
Winter Grain	**2**	(7)
Other Industries (specified below)	**5**	(19)

Other Industries:

- Resource Management…….**1**
- Tourism……**2**
- Wool……**1**
- Yabbies……**1**

Answers by Region

Industry	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Beef	**13** (48)	6	6	1
Sheep	**18** (67)	0	16	2
Fodder Crops	**1** (4)	0	0	1
Winter Grain	**2** (7)	0	0	2
Other Industries	**5** (19)	2	2	1

Q6: For how many years have you been a primary producer?

There were 26 responses to this question:

Up to 10 years	**3**	(12)
>10 – 20 years	**9**	(34)
>20 – 30 years	**8**	(31)
>30 – 40 years	**3**	(12)
>40 – 50 years	**2**	(8)
>50 years	**1**	(4)

Answers by Region

Years spent as primary producer	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Up to 10	**3** (12)	1	2	0
> 10 - 20	**9** (35)	2	7	0
> 20 - 30	**8** (31)	1	5	2
> 30 - 40	**3** (12)	2	1	0
> 40 - 50	**2** (8)	0	2	0
> 50	**1** (4)	0	1	0

Q7a: Do you keep daily rainfall records?

There were 26 responses to this question:

Yes	**26**	(100)
No	**0**	(0)

Answers by region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Yes	**26** (100)	6	18	2
No	**0** (0)	0	0	0

Q7b: How many years have you kept these records?

There were 25 responses to this question:

Up to 10 years	**3**	(12)
>10 – 20 years	**6**	(24)
>20 – 30 years	**4**	(16)
>30 – 40 years	**1**	(4)
>40 – 50 years	**0**	(0)
>50 years	**11**	(44)

Answers by Region

No. of years records have been kept	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Up to 10	**3** (12)	1	2	0
> 10 - 20	**6** (24)	3	2	1
> 20 - 30	**4** (16)	1	2	1
> 30 - 40	**1** (4)	0	1	0
> 40 - 50	**0** (0)	0	0	0
> 50	**11** (44)	1	10	0

Q7c: How complete are these records?

There were 26 responses to this question:

Complete	**20**	(77)
Fairly complete	**6**	(23)
Patchy	**0**	(0)

Answers by Region

Answer	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Complete	**20** (77)	4	14	2
Fairly Complete	**6** (23)	2	4	0

Q8: What is your average annual rainfall?

There were 25 responses to this question:

0 – 200mm	**4**	(16)
> 200 – 400mm	**14**	(56)
> 400 – 600mm	**4**	(16)
> 600 – 800mm	**2**	(8)
> 800mm	**1**	(4)
Don't Know	**0**	(0)

Answers by Region:

Rainfall range	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
0 – 200mm	**4** (16)	0	4	0
> 200 – 400mm	**14** (56)	0	12	2
> 400 – 600mm	**4** (16)	4	0	0
> 600 – 800mm	**2** (8)	2	0	0
> 800mm	**1** (4)	0	1	0

Q8: When do you receive most of your rainfall?

There were 40 responses to this question (some of the 26 respondents gave more than one answer):

Summer	**13**	(33)
Autumn	**6**	(15)
Winter	**16**	(40)
Spring	**3**	(8)
Evenly spread	**2**	(5)

Answers by region:

Season	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Summer	**13** (33)	6	7	0
Autumn	**6** (15)	0	4	2
Winter	**16** (40)	0	14	2
Spring	**3** (8)	0	1	2
Evenly Spread	**2** (5)	0	2	0

PART B: Monitoring Seasonal Conditions. This section is about how you monitor seasonal conditions and respond to a changing situation. The

following questions ask for your opinions and your reasoning. These might be based on information or advice from outside sources and/or your own observations, 'rules of thumb' and so on. There are no 'right' or 'wrong' answers.

Q10: From your experiences and knowledge, do you believe that your climate during the 1980s and 1990s has changed compared with that of the 1960s and 1970s?

Q10a: Rainfall

There were 25 responses to this question:

Don't know	**2**	(8)
No change	**8**	(32)
Drier	**8**	(32)
Wetter	**7**	(28)

Answer by Region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Don't know	**2** (8)	1	1	0
No change	**8** (32)	1	7	0
Drier	**8** (32)	2	4	2
Wetter	**7** (28)	2	5	0

Q10b: Rainfall variability

There were 25 responses to this question:

Don't know	**1**	(4)
No change	**8**	(32)
More variable	**15**	(60)
Less variable	**1**	(4)

Answers by Region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Don't know	**1** (4)	1	0	0
No change	**8** (32)	0	8	0
More variable	**15** (60)	4	9	2
Less variable	**1** (4)	0	1	0

Q10c: Summer daytime temperatures

There were 24 responses to this question:

Don't know	**4**	(17)
No change	**8**	(33)
Hotter	**11**	(46)
Cooler	**1**	(4)

Answer by Region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region

Don't know	**4** (17)	2	1	1
No change	**8** (33)	1	7	0
Hotter	**11** (46)	2	8	1
Cooler	**1** (4)	1	0	0

Q10d: Frost

There were 22 responses to this question:

Don't know	**3**	(14)
No change	**12**	(55)
More frost	**4**	(18)
Less frost	**3**	(14)

Answers by region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Don't know	**3** (14)	1	2	0
No change	**12** (55)	3	8	1
More frost	**4** (18)	1	2	1
Less frost	**3** (14)	1	2	0

Q10e: Humidity

There were 23 responses to this question:

Don't know	**9**	(39)
No change	**10**	(43)
More humid	**3**	(13)
Less humid	**1**	(4)

Answers by region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Don't know	**9** (39)	3	6	0
No change	**10** (43)	1	7	2
More humid	**3** (13)	1	2	0
Less humid	**1** (4)	1	0	0

Q10f: In what year were you born?

There were 24 responses to this question:

1930s	**3**	(13)
1940s	**9**	(38)
1950s	**8**	(33)
1960s	**3**	(13)
1970s	**1**	(4)

Answers by Region:

Decade born	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
1920s	**0** (0)	0	0	0

1930s	**3** (13)	1	2	0
1940s	**9** (38)	2	6	1
1950s	**8** (33)	2	6	0
1960s	**3** (13)	1	1	1
1970s	**1** (4)	0	1	0

Q10g: Any other comments?

Kimberley

- "96-97" have been drier but previous years from 83 to 96 have had heavy rain all at once (16" in 16 days straight) causing floods and no grass worth speaking of ie, a protein drought.
- I have had to watch the destruction of the buffer effect that natural vegetation can have on otherwise erratic weather conditions.
- Large scale fires are having an impact on weather.
- The only unusual occurrences on the Fitzroy River system were the decade of large floods 1983/84 to 1990's

Southern Rangelands

- 1974 station average was 206mm. It is now 220mm. Records started 1964 and we had a 4yr drought 1969/73. Prior to that this land was virgin land.
- In 1963 we had the wettest year on (our) record followed by medium years. Very dry 75-85. Normal dry & average 86-92 Some wet years – all good.
- There seem to be more extremes e.g. records being broken more often.
- We do not appear to be receiving soaking rains either summer (cyclonic) or winter which is having an effect on the carrying capacity of country eg bush always closing down.

Agricultural Region

- The 1980's & 1990's have been normal to drier. The 1960's & 1970's were wetter to normal with 1969 having been a drought year.

Q11: How important are your judgements of future climatic conditions (over the next three to 12 months) in your planning or decision-making.

There were 26 responses to this question:

not at all important	**3** (12)
slightly important	**4** (15)
moderately important	**5** (19)
very important	**14** (54)

Answers by region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Not at all important	**3** (12)	0	3	0
Slightly important	**4** (15)	0	3	1
Moderately important	**5** (19)	1	3	1
Very important	**14** (54)	5	9	0

Q12: Do you currently use long-term (20 years or more) climatic records to assist your decision-making?

There were 26 responses to this question:

Yes	**7**	(27)
No	**19**	(73)

Answers by Region:

Answer	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Yes	**7** (27)	1	6	0
No	**19** (73)	5	12	2

Q13: In your business/industry, what are the <u>three</u> most important annual decisions you make in which the outcomes are affected by future climatic influences?

There were 56 responses to this question (some of the 26 respondents gave more or less than 3 answers):

Selling/agisting of stock	**24**	(92)
Buying stock	**12**	(46)
Forward selling/hedging	**7**	(27)
Sowing crops/pastures	**3**	(11)
Burning pastures	**7**	(27)
Weed/disease/pest control	**3**	(11)

Answers by Region:

Business/ Industry	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Selling/agisting of stock	**24** (92)	5	18	1
Buying stock	**12** (46)	0	12	0
Forward selling/hedging	**7** (27)	1	6	0
Sowing crops/pastures	**3** (11)	1	0	2
Burning pastures	**7** (27)	6	1	0
Weed/disease/pest control	**3** (11)	1	1	1

Other Important Annual Decisions:

Kimberley

- Breeding seasons.
- Decisions on spending for capital improvements.
- Fire control strategies. Stocking rates and calf drops.

Southern Rangelands

- Mating ewes, setting stocking rates
- Ram purchases. Time of shearing. Paddock spelling
- Stocking rates applied to various areas of the station.
- Stocking rates number of ewes to breed from.
- Whether to mate or not, delaying etc. Capital investment.

Agricultural Region

- Size of cropping area. Number of stock on holding.

Q14: How useful is probability-based information in the management of your business?

There were 26 responses to this question:

I don't use it	**10**	(38)
Not at all useful	**0**	(0)
Slightly useful	**3**	(12)
Moderately useful	**10**	(39)
Very useful	**3**	(12)

Answers by region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
I don't use it	**10** (38)	1	9	0
Not at all useful	**0** (0)	0	0	0
Slightly useful	**3** (12)	1	1	1
Moderately useful	**10** (38)	3	6	1
Very useful	**3** (12)	1	2	0

Q15: Do you currently use seasonal climate forecasts, for example information on SOI /El Niño / Indian Ocean temperatures/other indicators to assist with any of your decision-making?

There were 26 responses to this question:

Yes	**7**	(27)
No	**19**	(73)

Answers by Region:

Answer	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Yes	**7** (27)	1	6	0
No	**19** (73)	5	12	2

Q16: If you keep stock, how do you decide what stock numbers to carry through the months of the year when feed shortages are most likely to occur?

There were 33 responses to this question (some of the 24 respondents gave more than one answer):

Observe pasture growth/conditions	**21**	(80)
Use seasonal climate outlook/forecast	**5**	(19)
Measure pasture growth/condition	**7**	(27)
Use AUSTRALIAN RAINMAN	**0**	(0)

Answers by Region:

Decision Aid	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Observe pasture growth/conditions	**21** (80)	5	15	1
Use seasonal climate outlook/forecast	**5** (19)	2	3	0
Measure pasture growth/condition	**7** (27)	2	3	2
Use AUSTRALIAN RAINMAN	**0** (0)	0	0	0

Use of other aids

Kimberley

- Assess stock condition and calving patterns.
- Grazing charts.
- Remove bulls and weaners.
- Run the range land to Agricultural Department carrying capacity recommendations.

Southern Rangelands

- Observe condition of stock.
- Depends on Autumn rains and grass growth as to whether we sell any ewes prior to handling in May/June. Shear in March and sell off sheep.
- Experience.
- Observe stock condition especially in relation to previous experience. A periphery influence would be the behaviour of indigenous animals (nesting birds, births of babies, mating etc).
- Paddock history of previous stock levels. Land system types and ability to curtain sheep over this period.
- Rainfall trends, eg I am bringing stock numbers back after a decade of reasonable seasons. Due for a period of dry seasons.
- Visually appraise amount of feed available and general state of country in relation to winter rainfall which gives us our greatest bulk of feed.
- We know approximately what numbers each paddock will carry through average seasons following a fair – average rainfall year.

Agricultural Region

- Holding enough lupins on farm to cover stock feeding for 12 to 18 months.

Q17a. What signs or indicators do you look for in a paddock to assess the health of your pasture or stock?

Kimberley

- Condition of stock shows heart of country.
- Ground cover, basal plant diameters, distribution of age of species, plant diversity, biodiversity, watercycle (compaction), mineral cycle, energy flow (growth phases of plants, fodder productivity,.
- Pasture indicators, monitoring.
- Perennial species total ground cover.
- What the stock are on and nicer eating.

Southern Rangelands

- Changes in ground cover. Soil loss. Main species.
- Condition of feed both around and away from waters – especially perennials.
- Condition of perennial species the stock eat. Grazing evidence seen of these plants. Amount and quality of annual ground feed.
- Condition of rangeland eg height bush grazed, especially key or preferred bushes. Colour of bush eg vigorous growth currant bush very vivid green as it comes under moisture stress and changes colour to yellow before defoliation.
- Ground cover. Conditions of salt bush pasture.
- Looking for establishment of juvenile desirable plant species.
- Monitoring sites and counts.
- Monitoring what species of shrubs and plants the animals are grazing, and condition of the stock.
- Number of perennial plants, state of condition of perennial plants and edible scrub, and body condition of stock.
- Particular species of plant ie the foliage of plant leaves etc. Grazing of certain species less palatable under normal conditions.
- Pasture deterioration. Pasture productivity indicators.
- Pasture productivity indicators.
- Salt bush (Bladder) losing leaves and nature box horn or water bush are pretty good indicators in the Nullarbor region.
- Stock conditions, wool cut and health pasture conditions using eye and monitoring sites.
- The amount of feed, the quantity, WA Rangeland Monitoring (WARMS).
- What the stock are eating and the condition of the plants and shrubs. Condition of stock – may need to move.

Agricultural Region

- Predominant clover pasture – insect free plant analysis.
- Soil testing, insect damage, growth rate, feed on hand.

Q17b: Do you measure or record information for individual paddocks? (for example pasture species, stock numbers).

There were 26 responses to this question:

Yes	**19**	(73)
No	**7**	(27)

Q17c: What do you measure or record in individual paddocks?

Kimberley

- Animal days based on effective rainfall and pasture management.
- Number on water round half of year. Number of calves – weaners in Sept.
- Stock numbers and classes. Time grazed.
- Stock numbers. We record what each paddock has been assessed to carry. Monitoring sites photographed – sometimes.

Southern Rangelands

- Record numbers in each paddock. Most paddocks have photographic monitoring sites.
- Monitoring site information. Stock numbers in each paddock.
- Number of stock in and out of paddocks.
- Observation of pasture regeneration linking to previous rainfall and stocking rates eg how the country looks.
- Range conditions.
- Rangeland (soil and pasture) types as recorded in the Murchison rangeland survey plus general record of stock carried.
- Shrubs, perennials condition.
- Stock numbers and rainfall for various parts of the property.
- Stock numbers, pasture monitoring sites.
- Stock numbers. Pasture condition.
- Stock numbers. Pasture deterioration.

Agricultural Region

- Numbers of stock – fertiliser records – spray records, clover content percentage.

Q18: Do you regularly compare property management options by actual calculations of the production and financial outcomes of all options?

There were 23 responses to this question:

Yes	**6**	(26)
No	**17**	(74)

Answers by Region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Yes	**6** (26)	3	3	0

No	**17** (74)	3	12	2

PART C: 'Big-picture' information. Several groups have recently developed seasonal climate outlook information, seasonal climate forecasting systems (based on the Southern Oscillation, El Niño, SOI, sea-surface temperature patterns), pasture production computer models and satellite imagery (see 'Definitions' on last page). This work has resulted in a range of 'big-picture' products being made available, usually in the form of a map, covering recent rainfall, recent pasture growth, drought-declared areas, seasonal rainfall outlook and pasture growth prospects. The following questions ask for your thoughts on this 'big-picture' information. There are no 'right' or 'wrong' answers.

Q19a. How important is <u>this</u> big-picture information in your planning, risk management or decision-making?

There were 26 responses to this question:

Unaware of information	**9**	(35)
Not at all important	**2**	(8)
Slightly important	**7**	(27)
Moderately important	**8**	(31)
Very important	**0**	(0)

Answers by Region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Unaware of information	**9** (35)	2	7	0
Not at all important	**2** (8)	1	1	0
Slightly important	**7** (27)	2	4	1
Moderately important	**8** (31)	1	6	1
Very important	**0** (0)	0	0	0

Q19b: Have you used any of the following types of 'big-picture' information?

There were 27 responses to this question (some of the 13 respondents gave more than one answer):

Recent rainfall maps	**11**	(85)
Recent pasture growth maps	**3**	(23)
Drought declared/ exceptional circumstances maps	**1**	(8)
Seasonal rainfall forecasts	**12**	(92)
Seasonal pasture growth forecasts	**0**	(0)

Answers by Region

Type of information	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Recent rainfall maps	**11** (85)	2	8	1
Recent pasture growth maps	**3** (23)	0	3	0
Drought-declared areas/ exceptional circumstances maps	**1** (8)	0	1	0

Seasonal rainfall forecasts	**12** (92)	2	8	2
Seasonal pasture growth forecasts	**0** (0)	0	0	0

Q19c: (If you answered 'yes' to any part of Question 19b). Generally to what extent has the information, which you have used, been useful?

There were 13 responses to this question:

Not useful	**1**	(8)
Slightly useful	**4**	(33)
Moderately useful	**7**	(58)
Very useful	**1**	(8)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Not useful	**1** (8)	0	1	0
Slightly useful	**4** (33)	1	2	1
Moderately useful	**7** (58)	0	6	1
Very useful	**1** (8)	1	0	0

19d. (If you answered 'no' to all parts of Question 19b). To what extent do you think <u>this</u> 'big-picture' information could be useful to you?

There were 16 responses to this question:

Not useful	**0**	(0)
I have no idea	**1**	(6)
Slightly useful	**4**	(25)
Moderately useful	**7**	(44)
Very useful	**4**	(25)

Answers by region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
I have no idea	**1** (6)	0	1	0
Not useful	**0** (0)	0	0	0
Slightly useful	**4** (25)	2	1	1
Moderately useful	**7** (44)	2	4	1
Very useful	**4** (25)	1	3	0

19e: (If applicable). What problems have you had in using <u>this</u> 'big-picture' information?

There were 21 responses to this question (some of the 18 respondents gave more than one answer):

I don't use this information	**4**	(21)
It is difficult to interpret/use	**5**	(26)
No problems	**5**	(26)
Information not detailed enough	**3**	(16)
Access to it is difficult	**4**	(21)
It is too complex	**0**	(0)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
I don't use this information	**4** (21)	0	4	0
It is difficult to interpret/use	**5** (26)	1	4	0
No problems	**5** (26)	1	4	0
Information not detailed enough	**3** (16)	0	1	2
Access to it is difficult	**4** (21)	3	1	0
It is too complex	**0** (0)	0	0	0

Other Problems in Using 'Big-picture Information:

Southern Rangelands

- We know people who have used this information with varied success. It is still too much of a gamble of probabilities, ie, a sudden cyclone, no way of calculating mid-level weather etc.

Agricultural Region

- Still too many variables.

Q20: What 'big-picture' information would help you to make better management decisions, and when or how often is it required?

Kimberley

- Analysis of rainfall effectiveness, graphic display of health and productivity variations of a cross section of local range land.
- Cattle sale options and prices.
- It is always handy to know predicted weather forecasts for the oncoming wet season.

Southern Rangelands

- A system that would accurately forecast seasonal conditions in advance.
- Annual rainfall, Feb-March rainfall.
- Early sell off of sheep to reduce stocking pressure. Also better focus for sale. Sheep selling in better condition.
- End winter, winter break, probability of good winter above average/below average, cyclone activity.
- More information required.
- Rainfall – long term forecasts.
- The big picture which needs painting is setting reliable figures on future commodity prices (ie wool) instead of the bullshit we are fed at the moment.
- The forecasting of known events eg El Nino and how it has affected this area in the past.
- When mid level weather combines with a front we receive good rains which are seldom forecast. We make our own forecasts closely following the cloud and pressure maps on ABC TV.

Agricultural Region

- District outlook for each season.
- Satellite imagery weekly.

Q21a: Do you have a computer?

There were 25 responses to this question:

Yes	**15**	(60)
No	**10**	(40)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Yes	**15** (60)	3	10	2
No	**10** (40)	2	8	0

Q21b: Do you currently have access to the Internet?

There were 26 responses to this question:

Yes	**3**	(12)
No	**23**	(88)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Yes	**3** (12)	1	2	0
No	**23** (88)	5	16	2

Q21c: Do you have a facsimile machine?

There were 26 responses to this question:

Yes	**25**	(96)
No	**1**	(4)

Answers by Region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Yes	**25** (96)	6	17	2
No	**1** (4)	0	1	0

Q21d: What would be the most convenient ways for you to access seasonal climate outlook information?

There were 66 responses to this question (some of the 25 respondents gave more than one answer):

TV	**12**	(48)
Radio	**10**	(40)
Telephone recordings	**2**	(8)
Daily newspapers	**1**	(4)
Rural newspapers	**13**	(52)
Computer packages	**2**	(8)
Internet/E mail	**2**	(8)
Personal conversations/neighbours	**2**	(8)
Faxed directly	**22**	(88)

Answers by Region:

Information source	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
TV	**12** (48)	0	11	1
Radio	**10** (40)	0	9	1
Telephone recordings	**2** (8)	1	1	0

Daily newspapers	**1** (4)	0	1	0
Rural newspapers	**13** (52)	1	10	2
Computer packages	**4** (8)	1	3	0
Internet/E mail	**2** (8)	1	1	0
Personal conversations/ neighbours	**2** (8)	0	2	0
Faxed directly	**22** (88)	5	15	2

Other Convenient Ways to Access Information:

Kimberley

- AGWA newsletters.
- Time delay in receiving daily, local and rural papers.

Q21e: Which of the following sources of seasonal situation/outlook information have you used at least once*?*

There were 26 responses to this question (some of the 21 respondents gave more than one answer):

Queensland Centre for Climate Applications (QCCA)

SOI Fax Hotlines	**2**	(10)
Internet - 'The Long Paddock'	**1**	(5)

Bureau of Meteorology (BoM)

Fax Services	**19**	(90)
Seasonal Climate Outlook subscription	**2**	(10)

Other

Computer Software (for example, AUSTRALIAN RAINMAN, Metaccess)	**1**	(5)
Private Consultant	**1**	(5)

Answers by region

Queensland Centre for Climate Applications (QCCA)

Information source	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
SOI Fax Hotlines	**2** (10)	0	1	1
Internet - 'The Long Paddock'	**1** (10)	1	0	0

Bureau of Meteorology (BoM)

Information source	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Fax Services	**19** (90)	4	13	2
Seasonal Climate Outlook subscription	**2** (10)	0	2	0

Computer Software (for example, AUSTRALIAN RAINMAN, Metaccess)

TOTAL	Kimberley	Southern Rangelands	Agricultural Region
1 (0)	0	1	0

Private Consultant

TOTAL	Kimberley	Southern Rangelands	Agricultural Region
1 (5)	0	1	0

Other Sources of Seasonal Situation/Outlook Information:

Kimberley

- Landline, TV Weekly, National rainfall recordings.

Southern Rangelands

- ABC Country Hour, various rural magazines
- Australian Meteorological personnel.

Agricultural Region

- Weather maps SBS.

Q21f: Considering *all* of the seasonal situation/outlook information sources you know of (including media sources, those above, personal contacts etc.), which source(s) do you think are best and, briefly, why?

Best Sources of Seasonal Situation/Outlook Information – Answers by Region:

Kimberley

- BOM Fax Service, because seeing is believing.
- Electronic/Fax information is easily accessible – printed material can be sent later on request.
- Faxed directly saves time money.
- Relationships between ground cover and river siltation observed from the air, and monitoring of rainfall incidence, vs reliability of watering points.
- Weather bureau, satellite fax, with knowledge from elsewhere I get a good idea of the wet's next move. Agriculture Dept weather forecasts.

Southern Rangelands

- ABC country hour. Rural magazines.
- BOM – the only one I am aware of here in WA.
- Bureau of Meterorology and rural media, including the press. TV and radio. Most accessible and most often listened to.
- I have not trusted any yet.
- Local Meteorology bloke has most accurate info in a readily accessible form.
- More info required as to what is available.
- None because they are all inaccurate.
- None. They are not specific enough, they are too general. Some private forecasters are having success with troughs, and on days it may rain.
- Our own long-term historical records and our own experiences of conditions.
- Satellite photos. You can see the facts.

Agricultural Region

- Bureau of Meteorology maps (weather fax) is most accurate.
- Rural newspapers – SOI – information extended outlook.

PART D: Scaled Attitudinal Responses. How do you respond to the following statements concerning seasonal situation assessment in pastoral

crop areas? Tick the box that indicates your 'position' on the scale, where: 1 = I strongly disagree; 2 = I disagree ; 3 = I neither agree nor disagree; 4 = I agree; 5 = I strongly agree.

Q22: "It is better management practice to simply respond to changing seasonal conditions, rather than try to anticipate and reduce seasonal climatic risks."

There were 24 responses to this question:

Strongly disagree	**3**	(13)
Disagree	**5**	(21)
Neither agree nor disagree	**5**	(21)
Agree	**6**	(25)
Strongly agree	**5**	(21)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**3** (13)	2	1	0
Disagree	**5** (21)	2	3	0
Neither agree nor disagree	**5** (21)	0	5	0
Agree	**6** (25)	2	3	1
Strongly agree	**5** (21)	0	4	1

Q23: "I accept that seasonal climate forecasts are better expressed in terms of probabilities (e.g. '60% chance that the next three months will be drier than average') than like a traditional weather forecast."

There were 24 responses to this question:

Strongly disagree	**2**	(8)
Disagree	**2**	(8)
Neither agree nor disagree	**10**	(42)
Agree	**7**	(29)
Strongly agree	**3**	(13)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**2** (8)	0	1	1
Disagree	**2** (8)	0	2	0
Neither agree nor disagree	**10** (42)	2	8	0
Agree	**7** (29)	2	4	1
Strongly agree	**3** (13)	2	1	0

24. "At present, SOI and probability-based forecasting places undue responsibility on 'users' to interpret the information."

There were 22 responses to this question:

Strongly disagree	**1**	(5)
Disagree	**2**	(9)
Neither agree nor disagree	**8**	(36)

Agree	**2** (9)
Strongly agree	**9** (41)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**1** (5)	1	0	0
Disagree	**2** (9)	0	2	0
Neither agree nor disagree	**8** (36)	2	6	0
Agree	**2** (9)	2	0	0
Strongly agree	**9** (41)	0	7	2

Q25: "Warnings of possible stock feed shortages in 3-6 months time, at a district level, would be valuable in making my management decisions."

There were 23 responses to this question:

Strongly disagree	**2** (9)
Disagree	**1** (4)
Neither agree nor disagree	**4** (17)
Agree	**6** (26)
Strongly agree	**10** (43)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**2** (9)	0	2	0
Disagree	**1** (4)	1	0	0
Neither agree nor disagree	**4** (17)	1	3	0
Agree	**6** (26)	2	3	1
Strongly agree	**10** (43)	3	7	0

Q26: "At present, adequate experience and information are available to enable me to link climate-related information/forecasts to practical property management."

There were 23 responses to this question:

Strongly disagree	**7** (30)
Disagree	**5** (22)
Neither agree nor disagree	**5** (22)
Agree	**4** (17)
Strongly agree	**2** (9)

Answers by Region:

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**7** (30)	0	7	0
Disagree	**5** (22)	1	3	1
Neither agree nor disagree	**5** (22)	2	3	0
Agree	**4** (17)	1	2	1
Strongly agree	**2** (9)	2	0	0

Q27: "I am comfortable with the increasing level of climate-related materials now becoming available via computer programs and computer networks."

There were 22 responses to this question:

Strongly disagree	**2**	(9)
Disagree	**3**	(14)
Neither agree nor disagree	**10**	(45)
Agree	**6**	(27)
Strongly agree	**1**	(5)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**2** (9)	0	2	0
Disagree	**3** (14)	1	1	1
Neither agree nor disagree	**10** (45)	2	7	1
Agree	**6** (27)	2	4	0
Strongly agree	**1** (5)	1	0	0

Q28: "Warnings of the possible pasture deterioration (for example weed invasion, loss of desirable species) at a district level, before the main growing season, would be valuable in making my management decisions."

There were 22 responses to this question:

Strongly disagree	**2**	(9)
Disagree	**2**	(9)
Neither agree nor disagree	**5**	(23)
Agree	**9**	(41)
Strongly agree	**4**	(18)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**2** (9)	1	1	0
Disagree	**2** (9)	1	1	0
Neither agree nor disagree	**5** (23)	2	3	0
Agree	**9** (41)	2	5	2
Strongly agree	**4** (18)	0	4	0

Q29: "Generally, the rural media provide credible and useful sources of seasonal climate forecast information."

There were 24 responses to this question:

Strongly disagree	**3**	(12)
Disagree	**2**	(8)
Neither agree nor disagree	**11**	(46)
Agree	**7**	(29)
Strongly agree	**1**	(4)

Answers by region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**3** (12)	3	0	0

Disagree	**2** (8)	0	2	0
Neither agree nor disagree	**11** (46)	2	9	0
Agree	**7** (29)	1	4	2
Strongly agree	**1** (4)	0	1	0

Q30: "Warnings of possible soil deterioration (for example reduced ground cover, soil loss) on a district basis, before the level of pasture ground cover became critical, would be valuable in making my management decisions."

There were 21 responses to this question:

Strongly disagree	**4** (19)
Disagree	**2** (10)
Neither agree nor disagree	**7** (33)
Agree	**5** (24)
Strongly agree	**3** (14)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**4** (19)	3	1	0
Disagree	**2** (10)	0	2	0
Neither agree nor disagree	**7** (33)	2	5	0
Agree	**5** (24)	1	2	2
Strongly agree	**3** (14)	0	3	0

Q31: "Scientific seasonal climate forecasting is a valuable tool for managing my property in the face of seasonal variability."

There were 25 responses to this question:

Strongly disagree	**0** (0)
Disagree	**3** (12)
Neither agree nor disagree	**9** (36)
Agree	**7** (28)
Strongly agree	**6** (24)

Answers by Region

Response	TOTAL	Kimberley	Southern Rangelands	Agricultural Region
Strongly disagree	**0** (0)	0	0	0
Disagree	**3** (12)	1	2	0
Neither agree nor disagree	**9** (36)	2	6	1
Agree	**7** (28)	2	4	1
Strongly agree	**6** (24)	1	5	0

Q32: Do you have any further comments to make, for example on what we may have missed in this questionnaire?

Further Comments:

Kimberley

- Most information from special interest groups is selected about nature, environment – city telling country what they should do. I distrust some of this information made available to me.
- This questionnaire seems to focus on symptoms rather than causes. I feel that the underlying cause ie man's part in exposing ground surface to the sun and rain by the destruction of vegetation and the momentum that this trend is developing is being happily ignored. Are we trying to place bets on a riderless horse that we are responsible for having a go?

Southern Rangelands

- All we can do is encourage and urge governments forecasts. Unfortunately our Australian records are not sufficiently old. Records on tides, humidity, phases of the moon, seat temperatures, land humidity and wind, mid-level activity etc are incomplete. One begs the question how come emus, kangaroos and migrating birds know when a season is going to be good and our own computer literate academics don't!!!
- Because I have never used any of the products available on computer etc. I am a bit sceptical of them. Rain at the right time and a lot of gut feeling and the adrenalin rush of the gamble keep me going.
- Information is not getting out to the GRASS ROOTS. None of this material is any good if it is sitting in the regional office. The ability to understand and interpret at grass roots levels.
- More accurate area specific forecast could be of great help, as would accurate day to day forecasting which is area specific. The Gascoyne can be a big place when forecasts are predicting rain.
- Take note: most pastoral stations in WA, NT and QLD are on microlink telephone which works at 25 000 alts per second. This is too slow for the Internet, which needs 85 000.

Agricultural Region

- We need accuracy in forecasting when computer models put out 4 different scenarios. Somebody is going to be wrong. Who is going to take responsibility? If I make a business decision based on a forward eg (3 months) ahead weather prediction and it is wrong, who takes responsibility when I'm paying for this information.

DISCUSSION

Part A – General Information about Respondent

The data in Part A emphasise the wide range of property situations that rural producers in Western Australia operate in. For example, property size, annual turnover and annual rainfall all vary across the sample. The sample in the Southern Rangelands appears to have captured the spread of property diversity Most respondents (56%) receive rainfall in the 200 - 400 mm range. However, 16% receive less than 200 mm and 4% receive more than 800 mm (Q8). All properties had a turnover > $20,000 (Q4). Most were in the category $200,000 to $2,000,000. About two-thirds of the respondents ran sheep (Q5), and almost half ran cattle. Nearly 20% were also involved in "Other Industries" , including resource management, tourism, wool and yabbies.

Most of the respondents were experienced, almost 90% had been involved in primary production for more than 10 years (Q6), with most of these having 10 - 30 years' experience. Most respondents were either born in the 1940s (38%) or the 1950s (33%) (Q10f).

All respondents keep daily rainfall records (Q7a) which is generally the case in WA pastoral areas. Almost half the respondents had rainfall records going back more than 50 years (Q7b), again, this is to be expected in WA pastoral areas. Just over one-third had records of less than 20 years. All rainfall records are either 'complete' (77%) or 'fairly complete' (23%) (Q7c).

Part B – Monitoring Seasonal Conditions

About 60% of respondents thought that their climate had altered over the last decade or so (Q10). Of those who thought the climate had altered, opinion was almost equally divided on whether their rainfall had been 'drier' or 'wetter' during this time (Q10a). None of the respondents commented on whether they believed climatic cycles were operating (Q10g), although many split blocks of years into categories such as 'dry' or 'wet'. Rainfall was seen as being the most altered climatic attribute. More than half (60%) believed their rainfall had become more variable (Q10b). Less than half believed summer daytime temperatures were higher, one third believed there was 'no change' (Q10c). More than half believed there was 'no change' in frost, with roughly equal numbers believing there was 'more' or 'less' frost (Q10d). However, frost is uncommon in the Kimberley and in about half the area Southern Rangelands. Almost equal percentages of respondents (~39%) either 'didn't know', or thought there was 'no change' in humidity (Q10e).

Over half (54%) said that judgements of future climatic conditions were 'very important' (Q11), although most (73%) do not use long-term climatic records to assist in decision-making (Q12). Similarly, the majority (73%) do not use seasonal climate forecasts in decision making (Q15).

. All (100%) said that selling/agisting of stock was an important annual decision (Q13). Almost half (50%) included buying stock as part of that decision. Forward selling/hedging was included by 27% or respondents and a similar percentage nominated burning. Decisions about stocking rate were common responses in the Southern Rangelands.

Eighty percent of respondents use observations of pasture growth/condition when deciding on what stock numbers to carry (Q16). The general condition of the vegetation is often used to assess the health of pasture or stock (Q17a). Surprisingly few nominated the condition of stock.

Probability based information was either 'moderately useful' or 'very useful' to 51% of respondents (Q14). A substantial percentage (38%) don't use it.

Many (73%) measure or record information for individual paddocks (Q17b). A range of attributes are recorded on an individual paddock basis. Most of the information relates to stock rather than to vegetation (Q17c). About one-quarter regularly compare property management options quantitatively (Q18).

Part C – 'Big-picture' information

While 58% said big-picture information was 'slightly important' to 'moderately important' in their planning, 35% were unaware of the information (Q19a).

The main types of big-picture information used by respondents are seasonal rainfall forecasts (92%) and recent rainfall maps (85%) (Q19b). There was wide variation in response to the question about difficulties in using big-picture information (Q19e). The response suggested a lack of confidence in the information and too much uncertainty about the effectiveness of the predictions. There was a wide response to the question of what sort of big-picture information is required. Livestock price forecasts and seasonal forecasts were prevalent (Q20).

Ninety one percent of those who have used big-picture information have found it 'slightly useful' to 'moderately useful' (19c). Of those who have not used big-picture information, 69% thought it could be 'slightly useful' to 'moderately useful'.

By far the most convenient way to access seasonal climate outlook information was 'faxed directly' (88%). Rural newspapers (52%), TV (48%), and radio (40%) were also considered convenient (Q21d). The main source of seasonal situation/outlook information used at least once (Q21e) are BoM Fax Services (90%).
Over half (60%) of those surveyed have a computer (Q21a), but only only 12% have access to the Internet (Q21b). All but one respondent have a facsimile machine (Q21c).

Although the responses were varied, many thought that reasonably objective data (e.g. local BoM, satellite photos, weather map) provided the best sources of seasonal information. Many liked to make (and trusted) their own prognosis based on this basic information (Q21f).

Part D – Scaled Attitudinal Responses

Almost half agreed it was better to respond to changing seasonal conditions rather than try to anticipate climatic risks (Q22).

Respondents recognised that seasonal forecasting was difficult and that accurate forecasting for their specific property, given the scale of WA pastoral areas, was even more difficult (Q32). There was some grumpiness that useful information wasn't being delivered where it was needed, that is on the land. There was good indication that the probabilistic nature of seasonal forecasting was not well understood.

Most respondents neither agreed nor disagreed with the assertion that climate forecasts were best expressed as probabilities rather than traditional forecasts (Q23). Only 16% disagreed. Seasonal climate forecasting was seen as a valuable tool by over half the respondents (Q31). None 'strongly disagreed'. Half the respondents agreed that there was too much responsibility placed on the user to interpret SOI and probability-based forecasting (Q24).

Just over half believed that there was not sufficient experience and information available to link forecasts to property management (Q25). Although, most (69%) either 'agreed' or 'strongly agreed' with the value of Feed Shortage Alerts (Q26). Warnings of pasture deterioration were seen by most (59%) as being valuable for management decisions (Q28). Warnings of soil deterioration were seen as valuable by 38% of respondents, while 33% neither agreed nor disagreed (Q30).

Only one third were comfortable with climate related materials being available through computers (Q27). About one third saw climate forecast information through the rural media as being credible and useful (Q29). Almost half were neutral.

CONCLUSIONS

The following conclusions can be made from the survey, as described, and the results obtained:

- The survey results provide reasonable guidance for developing an effective Communication Plan and Extension Program, despite the small sample size.

- As all 26 respondents keep daily rainfall records, and these are all 'complete' or 'fairly complete', the challenge is to help them make better use of these valuable data. A total of 73% of respondents do not currently use long-term climatic records to assist in decision-making. However, all would surely use their perception of 'average' seasons based on their own rainfall records. There is some suggestion, particularly in the winter rainfall dominated Southern Rangelands that managers do not have a clear idea of the rainfall regime of their local area, since about half nominated periods other than winter as the time of most rainfall.

- Fifty-four percent said that judgements of future climatic conditions were 'very important' or 'moderately important' in their planning or decision-making, so they are likely to be receptive to training aimed at a better understanding of seasonal climate forecasting, and the use of such information; Only 27% currently use seasonal climate forecasts in decision-making.

- There is a reasonably good acceptance of probability-based information, as 51% said that probability-based information is 'moderately useful' to 'very useful' in the management of their business. In addition, most respondents agree with releasing seasonal climate forecasts in the form of probabilities. However, it is not clear how well understood the use of probability based information is. There was some indication in the text responses that 'probability' was equated with 'predicted' (that is 100% probability).

- While 58% said big-picture information was 'slightly important' to 'moderately important' in their planning, 35% were unaware of the information. In addition 58% of those who have used big-picture information have found it 'moderately useful'. Also, 69% of those who have not used big-picture information thought it could be 'moderately useful' or 'very useful', while 6% of respondents have no idea how useful it might be. Thus respondents should generally be receptive to Aussie GRASS extension activities.

- Users of big-picture products have some problems with accessing information, interpreting and using it; also there are some reservations about product accuracy and forecasting ability. These issues need to be addressed in implementing the Aussie GRASS extension program. It will be important to point out that there is no universal panacea to seasonal forecasting. Best use needs to be made of existing records for seasonal context and good understanding of probabilities is necessary for forecasting purposes.

- The most convenient ways to access seasonal climate outlook information are 'faxed directly', rural newspapers, TV, and radio. As 96% have a facsimile machine, this appears to be the best current method for pastoralists to obtain accurate information. However, 60% have a computer, 12% currently have access to the Internet and most respondents accept that an increasing amount of information will be computerised. Thus their use of software programs and the Internet are likely to increase. Isolation in WA pastoral areas will mean that the use of the Internet will be less than in more populated areas for some time to come.

- There appears to be strong support for the concept of Feed Shortage Alerts, and moderate support for the provision of warnings of possible deterioration of pastures or soil.

- Western Australian pastoralists have not been exposed to the concept of El Nino and the SOI as much as eastern states' producers. Obviously, this is due to the reduced effects of these on the west coast. However, it does mean that they are less sensitive to big-picture climate information. In the east, El Nino and SOI provide effective vehicles for raising the profile of seasonal intelligence. The same is not true in the west and it will not become so unless a complementary Index is found for the west coast and promoted.

- Seasonally related big-picture information may have to be tailored differently to west coast producers. Rather than focussing on forecasts, it might be better to concentrate on seasonal context information using their own (often very good) long term rainfall records. This would allow them to make better judgements about the 'averageness' of current seasons and set stocking rates accordingly.

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