A SURVEY OF THE ASSESSMENT OF SEASONAL CONDITIONS IN PASTORAL AUSTRALIA

Benchmarking in the *Aussie GRASS* Project

PART 1: QUEENSLAND

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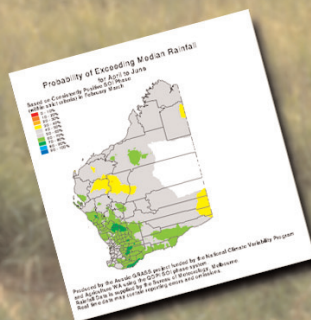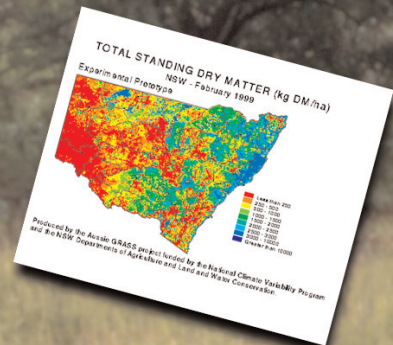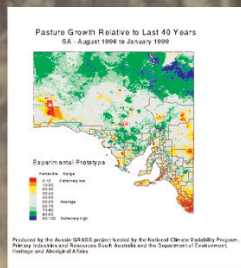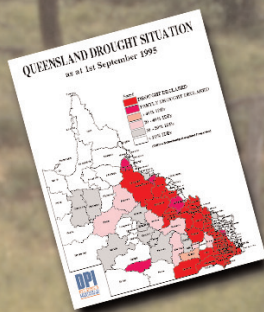
A SURVEY OF THE ASSESSMENT OF SEASONAL CONDITIONS IN PASTORAL AUSTRALIA

Benchmarking in the *Aussie GRASS* Project

PART 1: QUEENSLAND REPORT

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A product of The Aussie GRASS Project

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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 Queensland 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 method used, and publication of the results (in a national summary and for each State/Territory) are covered in the Foreword. The detailed results for Queensland, on a regional basis, are given below.

SUMMARY

A convenience sample of graziers, and a few representatives of agribusiness, were surveyed in each of the five Queensland DPI Regions. A total of 65 completed survey forms were returned. The feedback collected covered four areas: general information about respondent; monitoring seasonal conditions; 'big-picture' information; and scaled attitudinal responses. In central Queensland, eight members of Local Drought Committees, who had been exposed to many of the Aussie GRASS products, were also surveyed. This sample was kept separate from other survey feedback in order to obtain a comparison with the convenience sample for that region. Detailed responses to all questions are given, including all individual responses received from open questions.

Results

The following results were obtained. They are being examined at State and regional levels in order to develop more effective extension strategies and communication plans.

Part A – General Information about Respondent

80% keep daily rainfall records

Of these, 92% have 'complete' or 'fairly complete' records.

PART B – Monitoring Seasonal Conditions

80% believe that their rainfall has become drier.

69% believe that their rainfall has become more variable.

67% believe that summer day-time temperatures have become hotter.

57% believe that there has been 'less frost' during the 1980s and 1990s.

37% feel that the climate has become more humid.

84% said that judgements of future climatic conditions were 'very important' or 'moderately important' in their decision-making.

75% do not use long-term climatic records to assist in decision-making.

48 % said that probability-based information is 'moderately useful' to 'very useful' in the management of their business.

45% currently use seasonal climate forecasts in decision-making.

58% measure or record information for individual paddocks.

38% regularly compare property management options quantitatively.

PART C – 'Big-picture' information (seasonal climate outlook/forecast information, outputs from pasture production computer models, and satellite imagery)

42% (CQ 31%; CQ Progressive 50%) said 'big-picture' information was 'moderately important' to 'very important' in their planning.

72% (CQ 67%; CQ Progressive 80%) had used at least one product.

49% (CQ 43%; CQ Progressive 67%) of those who have used big-picture information have found it 'moderately useful' to 'very useful'.

36% (CQ 29%; CQ Progressive 0%) of those who have not used big-picture information thought it could be 'moderately useful' or 'very useful'.

43% (CQ Progressive 50%) of respondents have no problem using 'big-picture' information. However, some have problems with interpreting and using it (16%), and the information was not detailed enough for others (11%). The comments under 'Other problems' indicate some reservations about product accuracy and forecasting ability.

72% have a facsimile machine.

6% have a computer, 20% currently have access to the Internet and 50% of respondents are comfortable with an increasing amount of information being computerised (see PART D).

The most convenient ways to access seasonal climate outlook information are TV (64%), rural newspapers (61%), radio (50%), and faxed directly (48%). However, the main sources of seasonal situation/outlook information used at least once are BoM Fax Services (69%) and the SOI Fax Hotlines (28%).

PART D – Scaled Attitudinal Responses

'It is better management practice to simply respond to changing seasonal conditions, rather than try to anticipate and reduce seasonal climatic risks' - 42% either 'agree' or 'strongly agree' with this statement.

'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' - 58% 'agree' or 'strongly agree' with this statement.

'At present, SOI and probability-based forecasting places undue responsibility on 'users' to interpret the information' - average response to this statement was neutral.

'Warnings of possible stock feed shortages in 3-6 months time, at a district level, would be valuable in making my management decisions' - 72% (CQ 72%; CQ Progressive 60%) either 'agree' or 'strongly agree' with this statement.

'At present, adequate experience and information are available to enable me to link climate-related information/forecasts to practical property management' - average response to this statement was neutral to 'agree'.

'I am comfortable with the increasing level of climate-related materials now becoming available via computer programs and computer networks' - average response to this statement was neutral to 'agree'.

'Warnings of the possible pasture deterioration (e.g. weed invasion, loss of desirable species) at a district level, before the main growing season, would be valuable in making my management decisions' - 54% (CQ 50%; CQ Progressive 60%) either 'agree' or 'strongly agree' with this statement.

'Generally, the rural media provide credible and useful sources of seasonal climate forecast information' – average response to this statement was neutral to 'agree'.

'Warnings of possible soil deterioration (e.g. reduced ground cover, soil loss – see 'Definitions' on last page) on a district level, before the level of pasture ground cover became critical, would be valuable in making my

management decisions' - average response to this statement was neutral to 'agree', while 48% (CQ 50%; CQ Progressive 60%) answered 'agree' or 'strongly agree'.

'Scientific seasonal climate forecasting is a valuable tool for managing my property in the face of seasonal variability' - average response to this statement was neutral to 'agree', while 61% (CQ 56%; CQ Progressive 80%) answered 'agree' or 'strongly agree'.

Conclusions

The following conclusions can be made from the survey:

- The survey results provide reasonable guidance for developing an effective Communication Plan and extension program.
- The knowledge and attitudes of agribusiness managers are not well represented in the data obtained. Some further information may need to be collected by extension staff through personal contact.
- Our extension program needs to help graziers to make better use of their valuable rainfall records, and other climatic records. A total of 75% of respondents do not currently use long-term climatic records to assist in decision-making.
- Graziers are likely to be receptive to training aimed at a better understanding of seasonal climate forecasting, and the use of such information; 45% currently use seasonal climate forecasts in decision-making.
- There is a reasonably good acceptance of the usefulness of probability-based information (Q15). In addition, most respondents (58%) agree with releasing seasonal climate forecasts in the form of probabilities (Q23). However, in extension activities care needs to be taken to explain the concept simply.
- Answers to questions about the importance and usefulness of 'big-picture' information (Q19) indicate that respondents should generally be receptive to Aussie GRASS extension activities.
- Users of 'big-picture' products have some problems with interpreting and using information (16%), and information is not detailed enough for some. There are also some reservations about product accuracy and forecasting ability. These issues need to be addressed in implementing the Aussie GRASS extension program.
- While the most convenient ways to access seasonal climate outlook information are TV, rural newspapers, radio and faxed directly, the best current method for pastoralists to obtain accurate information appears to be by facsimile machine. However, their use of computers, software programs and the Internet is likely to increase.
- There appears to be strong support for the concept of Feed Shortage Alerts (72%), and moderate support for the provision of warnings of possible deterioration of pastures (54%) or soil (48%). Note that the support for warnings declines as the sustainability threat is perceived as being further in the future, except in the case of the biased central Queensland sample where the change in support is reversed.
- The range of 'big-picture' products needs to be promoted in an integrated fashion, and focused at the property level by linking the information with on-property observations/experiences.
- As participants indicated some concern regarding the accuracy of seasonal climate forecasts, it is important to improve their accuracy for the various pastoral regions of Australia. Only then can we expect graziers to accept the 'look-ahead' products developed under the project.
- In order for the extension of Aussie GRASS products to be effective, the timing of activities and selective use of appropriate decision-support products/tools are essential. It is important that group extension activities be conducted at the most appropriate time in the annual production cycle, when specific products can make a significant difference in the quality of decision-making. Answers to Q 13 help to identify the critical decision-making times for a specific industry in a particular region. Only products/tools relevant to the key property management decision being analysed should be promoted, and this should be done in the context of overall management of the pastoral business.

METHOD

Each of the five Queensland Department of Primary Industries (QDPI) regional climate extension officers involved in the Aussie GRASS Project was requested to obtain at least 10 completed survey forms. The convenience sample for most regions was obtained from QDPI's Animal Health Agricultural Property System

(APS) data base, which was primarily established as a tool for the control of diseases and chemical residues in cattle. In some cases, properties which were less than 100 ha in area were excluded prior to sampling.

In the south-east region of Queensland, a selected sample was obtained using the distribution list for the QDPI's *Beef Newsletter* which is mailed quarterly to every beef producer in the region. This was supplemented by personal contact with graziers who were regarded as representative for the region.

In central Queensland, eight members of Local Drought Committees, who had been exposed to many of the Aussie GRASS products, were also surveyed. This sample was kept separate from other survey feedback in order to obtain a comparison with the convenience sample for that region.

RESULTS - QUEENSLAND

The following numbers of completed survey forms were received:

TOTAL	North Qld	West Qld	Central Qld	South Qld	South-east Qld
65	9	10	18	13	15

The following answers and comments were obtained in response to the various questions ('Q1' is an abbreviation for 'Question 1' and so on; 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?_____

These results are not documented in this report.

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 64 responses to this question:

0 – 1000 ha	**23**	(36)
>1000 – 10 000 ha	**19**	(30)
>10 000 – 30 000 ha	**16**	(25)
>30 000 –100 000 ha	**3**	(5)
>100000 –300 000 ha	**2**	(3)
>300000 ha	**1**	(2)

Property size (ha)	TOTAL	North	West	Central	South	South-east
0 – 1000	**23** (36)	1	0	12	4	6
> 1000 – 10 000	**19** (30)	1	1	4	6	7
> 10 000 – 30 000	**16** (25)	3	7	2	3	1
> 30 000 –100 000	**3** (5)	2	1	0	0	0
> 100 000 –300 000	**2** (3)	2	0	0	0	0
>300000	**1** (2)	0	1	0	0	0

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

There were 64 responses to this question:

Up to $20 000	**7**	(11)
> $20 000 - $200 000	**33**	(52)
> $200 000 - $2 000 000	**23**	(36)
> $2 000 000	**1**	(2)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Up to $20 000	**7** (11)	0	0	6	1	0
> $20 000 - $200 000	**33** (52)	4	5	7	9	8
> $200 000 - $2 000 000	**23** (36)	5	4	5	2	7
> $2 000 000	**1** (2)	0	0	0	1	0

Q5: What industries are you in?

There were 106 responses to this question (some of the 65 respondents gave more than one answer):

Beef	**56**	(86)
Sheep	**11**	(17)
Dairying	**4**	(6)
Winter Grain	**9**	(14)
Summer Grain	**8**	(12)
Fodder Crops	**8**	(12)
Agribusiness	**1**	(2)
Other Industries (specified below)	**10**	(15)

Other Industries:

- Agistment — 1
- Sugar/Cane farming (very little beef) — 3
- Cotton — 1
- Farm stay — 1
- Feedlot — 1
- Flowers — 1
- Fruit growing — 1

Industry	TOTAL	North	West	Central	South	South-east
Beef	**56** (86)	9	10	14	11	12
Sheep	**11** (17)	0	7	0	4	0
Dairying	**4** (6)	0	0	1	0	3
Winter Grain	**9** (14)	0	0	3	6	0
Summer Grain	**8** (12)	0	0	3	4	1
Fodder Crops	**8** (12)	1	0	1	4	2
Agribusiness	**1** (2)	0	0	1	0	0
Other	**10** (15)	2	0	4	4	0

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

There were 60 responses to this question:

Up to 10 years	**5**	(8)
>10 – 20 years	**12**	(20)
>20 – 30 years	**14**	(23)
>30 – 40 years	**11**	(18)
>40 – 50 years	**15**	(25)
>50 years	**3**	(5)

Answers by Region

Years spent as primary producer	TOTAL	North	West	Central	South	South-east
Up to 10	**5** (8)	0	1	2	0	2
>10-20	**12** (20)	0	1	4	5	2
>20-30	**14** (23)	4	4	1	1	4
>30-40	**11** (18)	0	2	4	4	1
>40-50	**15** (25)	3	1	4	2	5
>50	**3** (5)	0	1	1	1	0

Q7a: Do you keep daily rainfall records?

There were 64 responses to this question:

Yes	**51**	(80)
No	**13**	(20)

Answers by Region

Response	TOTAL	North	West	Central	South	South-east
Yes	**51** (80)	7	8	11	11	14
No	**13** (20)	2	2	7	1	1

Q7b: How many years have you kept these records?

There were 51 responses to this question:

Up to 10 years	**7**	(14)
> 10 – 20 years	**17**	(33)
> 20 – 30 years	**13**	(26)
> 30 – 40 years	**7**	(14)

> 40 – 50 years	**3**	(6)
> 50 years	**4**	(8)

Answers by Region

No. of years records have been kept	TOTAL	North	West	Central	South	South-east
Up to 10	**7** (14)	2	1	0	2	2
>10-20	**17** (33)	4	2	5	4	2
>20-30	**13** (26)	0	3	3	3	4
>30-40	**7** (14)	0	1	1	2	3
>40-50	**3** (6)	0	0	0	1	2
>50	**4** (8)	1	1	1	0	1

Q7c: How complete are these records?

There were 52 responses to this question:

Complete	**29**	(56)
Fairly Complete	**19**	(37)
Patchy	**4**	(8)

Answers by Region

Response	TOTAL	North	West	Central	South	South-east
Complete	**29** (56)	3	3	8	6	9
Fairly Complete	**19** (37)	2	4	3	5	5
Patchy	**4** (8)	1	2	0	1	0

Q8: What is your average annual rainfall?

There were 58 responses to this question:

0 – 200mm	**2**	(3)
>200 – 400mm	**6**	(10)
>400 – 600mm	**16**	(28)
>600 – 800mm	**25**	(43)
>800mm	**9**	(16)
Don't know	**1**	(2)

Answers by Region

Rainfall (mm)	TOTAL	North	West	Central	South	South-east
0 – 200	**2** (3)	0	1	1	0	0
> 200 – 400	**6** (10)	1	5	0	0	0
> 400 – 600	**16** (28)	3	3	2	7	1
> 600 – 800	**25** (43)	3	1	8	3	10
> 800	**9** (16)	2	0	4	0	3
Don't know	**1** (2)	0	0	1	0	0

Q9: When do you receive most of your rainfall?

There were 77 responses to this question (some of the 60 respondents gave more than one answer):

Summer	**54**	(90)
Autumn	**7**	(12)
Winter	**1**	(2)
Spring	**5**	(8)
Evenly Spread	**5**	(8)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Summer	**54** (90)	9	8	15	8	14
Autumn	**7** (12)	0	0	4	0	3
Winter	**1** (2)	0	0	0	0	1
Spring	**5** (8)	0	0	2	1	2
Evenly Spread	**5** (8)	0	0	3	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 59 responses to this question:

Don't know	**3**	(5)
No change	**8**	(14)
Drier	**47**	(80)
Wetter	**1**	(2)

Answers by Region

Response	TOTAL	North	West	Central	South	South-east
Don't know	**3** (5)	1	1	0	1	0
No change	**8** (14)	1	2	0	3	2
Drier	**47** (80)	7	6	16	8	10
Wetter	**1** (2)	0	0	0	1	0

Q10b: Rainfall variability

There were 58 responses to this question:

Don't know	**6**	(10)
No change	**6**	(10)
More variable	**40**	(69)
Less variable	**6**	(10)

Answers by Region

Response	TOTAL	North	West	Central	South	South-east
Don't know	**6** (10)	1	1	2	2	0
No change	**6** (10)	0	2	0	3	1

More variable	**40** (69)	6	6	13	7	8
Less variable	**6** (10)	0	1	2	1	2

Q10c: Summer daytime temperatures

There were 58 responses to this question:

Don't know	**10**	(17)
No change	**8**	(14)
Hotter	**39**	(67)
Cooler	**1**	(2)

Answers by Region

Response	TOTAL	North	West	Central	South	South-east
Don't know	**10** (17)	1	1	2	1	5
No change	**8** (14)	1	2	1	2	2
Hotter	**39** (67)	6	5	14	9	5
Cooler	**1** (2)	1	0	0	0	0

Q10d: Frost

There were 56 responses to this question:

Don't know	**10**	(18)
No change	**12**	(21)
More frost	**2**	(4)
Less frost	**32**	(57)

Answers by Region

Response	TOTAL	North	West	Central	South	South-east
Don't know	**10** (18)	1	1	2	1	5
No change	**12** (21)	1	2	2	4	3
More frost	**2** (4)	0	0	0	2	0
Less frost	**32** (57)	6	5	13	4	4

Q10e: Humidity

There were 55 responses to this question:

Don't know	**17**	(27)
No change	**11**	(18)
More humid	**21**	(40)
Less humid	**8**	(15)

Answers by Region

Response	TOTAL	North	West	Central	South	South-east
Don't know	**15** (27)	2	2	4	1	6
No change	**10** (18)	3	0	2	3	2
More humid	**22** (40)	2	3	6	7	4

Less humid	**8** (15)	1	3	4	0	0

Q10f: In what year were you born?

There were 63 responses to this question:

1920s	**3**	(5)
1930s	**20**	(32)
1940s	**14**	(22)
1950s	**19**	(30)
1960s	**5**	(8)
1970s	**2**	(3)

Answers by Region:

Response	TOTAL	North	West	Central	South	South-east
1920s	**3** (5)	1	1	1	0	0
1930s	**20** (32)	0	0	9	6	5
1940s	**14** (22)	3	2	3	1	5
1950s	**19** (30)	3	4	4	5	3
1960s	**5** (8)	0	2	1	1	1
1970s	**2** (3)	1	0	0	0	1

Q10g: Any other comments?

North Queensland

- 'My perspective has changed with time and the responsibility of making the "right" decisions. Above answers are more of a gut reaction than a qualitative assessment.'
- ' '91 to '96 were drier years. The late '60s were also very dry. We are in a very dry area. While we may think it is drier, it may not have been so, but the '90s had the longest succession of dry years.'
- 'My records prior to 1980 have been damaged by cyclonic rain. 1997-98 summer was said to be hottest in Townsville since the Second World War. Although we had droughts prior to 1970 (1969 for example) we mostly received a "wet" of 500 mm or more.'
- 'Because of my age it is quite hard to answer accurately. From information passed on by my father, neighbours etc., I have come across the answers above. The climate does seem to be erratic.'
- 'Winter seems shorter and warmer (milder). Storms seem later with less monsoon activity, this year being the exception with huge rain depressions.'
- 'Regarding Question 8: 950 mm quoted by the Lands Department in those 17 years.'

West Queensland

- 'Question 10a is a bit hard to answer because during the 1980s we had some good winter rain and very little summer rain.'
- 'Regarding question 10a: drier than the 1970s, wetter than the 1960s.'
- 'Winters and summers are getting later.'
- 'Atmosphere must be thinning as "burn" of the sun is increasing.'
- 'The sun burns more.'
- 'The nineteen sixties were very dry. 1970s were very wet. 1980s and 1990s were more stable seasons. It is very difficult to make a comparison of rainfall between 1960s and 1970s and now, as there was such a striking difference between those decades. See attached chart of residual rainfall.'

Central Queensland

- 'I am convinced climate is changing, drier and hotter. Rate of change is accelerating.'
- 'I have only been on this property for 12 years. I only record rain.'

- 'The regular summer rains of the past just don't come any more. Summer flooding every year doesn't happen.'
- 'Late 1980s and 1990s has seen more discernible change.'
- 'My Dad, who lived from 1890-1972 often said we don't get these old-fashioned thunder storms any more. I say the same now. Perhaps weather changes all the time and maybe goes in 100 year or so cycles, or the same weather never occurs again; or maybe things seem different when you're a kid.'
- 'I have lived on this property since 1972, so my experience goes back to then for the sake of this questionnaire.'
- 'The wet seasons do not seem to be as long and the winters are not as cold. Summers are hotter.'
- A response to Question 10d: 'Less frost but more severe.'
- A response to Question 9: 'Evenly spread but patchy.'

South Queensland

- 'Perhaps our weather cycle is bigger than the 200 years the records have been kept.'
- A response to Question 10b: 'Variability could possibly be calculated, an extensive study. Regarding questions 10c, d, e: No actual records.'
- 'It appears rainfall is more extreme (flooding) in recent years -19 inches in Jan-Feb '97, 12 inches in 1998. Then it clears up, going months without a drop.'
- 'Temperature and rainfall is variable, but I don't think it is any hotter or drier than when I was young.'
- A response to Question 9: 'It's supposed to be summer rainfall, but we expect it to come at any time.'
- A response to Question 8: '2283.1 points over 30 years, 1957-1986; 2330 points over 40 years, 1957-1996.'

South-east Queensland

- '1980-98, 8 years over 20 inches, 10 years under 20 inches; 1960-70, 13 years over 20 inches, 6 years under 20 inches.'
- 'Responses to Questions 10a and 10b are substantiated from our records. 10b rainfall is less variable because of absence of "big wets". A couple of "big wets" would restore "normality" to rainfall annual "variability", whatever they are. I have always wished QDPI would core sample and carbon-date the raised mounds/banks left by floods, dropping silt loads on the edges of river channels. Tie that in with tree ring data from the same area.'
- 'Amount of rain is about the same, but falls are usually in smaller amounts - ground dries out quickly and is the {illegible} fall of less use for grass. In 50s, 60s and 70s used to get 5-10 floods per season - now may not get even one.'
- 'We have had a declining rainfall average over the period 1949-1998.'
- 'Rainfall is certainly more variable in 1990s; also there's generally less rain and less incidence of substantial falls (e.g. over 25 mm up to several inches). Longer periods of dry years in succession without break of wet seasons.'
- 'Rainfall is much less reliable since early 1980s, due to grouping of planets in front of sun, as predicted in print by Indigo Jones in the 1940s. Highly intelligent scientists grope around in the dark and will not tie in effect of planets on weather. Until they do we have no hope from forecasts.'
- 'I believe rainfall since the early 80s has come in wet periods, that is, a lot of rain over a 2-6 week period, followed by a period with little or useless rain. These drys have been getting longer through the 90s. In the 60s and 70s you could count on at least one useful fall every month. In '98 we get nothing at all for 3-4 week periods and a lot of heat.'
- A response to Question 9: 'Used to be mainly summer. Has shifted towards autumn. Now has been shifted to drought with very little.'
- A response to Question 7c: '1950-1965, 27 inches; 1965-1980 25 inches; 1980-1998 23 inches. Question 9: Unpredictable.'

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 63 responses to this question:

Not at all	**0**	(0)
Slightly important	**10**	(16)

Moderately important	**18**	(29)
Very important	**35**	(56)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Not at all	**0** (0)	0	0	0	0	0
Slightly important	**10** (16)	3	0	2	2	3
Moderately important	**18** (29)	1	5	6	3	3
Very important	**35** (56)	3	5	10	8	9

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

There were 61 responses to this question:

Yes	**16**	(25)
No	**48**	(75)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Yes	**15** (25)	0	3	1	4	7
No	**46** (75)	9	5	17	9	6

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 167 responses to this question (some of the 63 respondents gave more or less than three answers):

Selling/agisting of stock	**53**	(84)
Buying stock	**28**	(44)
Forward selling/hedging	**11**	(17)
Sowing crops/pastures	**30**	(48)
Burning pastures	**22**	(35)
Weed/disease/pest control	**22**	(35)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Selling/agisting of stock	**53** (84)	9	10	9	12	13
Buying stock	**28** (44)	4	7	6	4	7
Forward selling/hedging	**11** (17)	3	2	1	3	2
Sowing crops/pastures	**30** (48)	2	0	11	8	9
Burning pastures	**22** (35)	4	0	8	2	8
Weed/disease/ pest control	**22** (35)	4	4	7	3	4

Other Important Annual Decisions:

Summary of Answers

The main topics covered, and the number of times each was mentioned, were:

Setting stocking rate/reducing stock before winter……….......….5
Cropping decisions/planting or harvesting………………….....4
Buying feed or supplements/drought feeding…………..……...4
Mating/calving/lambing/likely herd dynamics/weaning…....……..4
Surface water supplies……………………………………..…..2
Budget projection or cashflow/spending decisions…………….2
Timing decisions…………………………………………......1
Woody weed control……………………………………….….1

West Queensland

- 'Setting stocking rate.'
- 'Calving and lambing decisions.'
- 'Only one is important to our operation.'

Central Queensland

- 'Buying feed grain etc. under contract. Forward contract feed.'
- 'When to plant trees (this area has short winters); citrus sales after first frosts, etc.'
- 'Don't ever over stock and then play it as it happens. Stock for average season or under stock.'
- 'Timing decisions.'
- 'Blade ploughing regrowth.'
- 'Harvesting of cane crop.'
- 'Planning new types of crops to grow.'

South Queensland

- 'River flows.'
- 'Weaning of stock. Feeding of stock in drought.'
- 'De-stocking or lightening off before winter.'
- 'Watching the calendar to plant on the right date.'
- 'Water.'
- 'To join ewes and rams, or not to join them.'

South-east Queensland

- 'Why do you not list the most obvious question/decision box?? By far the most important decision is "budget projections", then on cattle breeding properties like mine, "herd reproductive efficiency" (translated, means decisions are made about likely herd dynamics). Next is "spending on repairs, maintenance, burr/timber control, federal income tax and capital items" (in other words, in droughts, herd health, welfare and feeding come first at the expense of repairs etc.) Tell it to animal liberation!!'
- 'Purchase of fodder and supplements, if shortage is anticipated. Maintain stock of hay and molasses.'
- 'All are important.'
- 'Early purchase of feed and feed supplements.'
- 'Lighten off stocking rate; Sell early and buy less if I think it will not rain.'

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

There were 60 responses to this question:

I don't use it	**8**	(13)
Not at all useful	**2**	(3)
Slightly useful	**21**	(35)
Moderately useful	**22**	(37)
Very useful	**7**	(12)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
I don't use it	**8** (13)	2	0	5	1	0
Not at all useful	**2** (3)	1	0	1	0	0
Slightly useful	**21** (35)	3	1	6	5	6
Moderately useful	**22** (37)	2	8	6	2	4
Very useful	**7** (12)	1	1	0	3	2

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 62 responses to this question:

Yes	**28**	(45)
No	**34**	(55)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Yes	**28** (45)	4	3	4	7	10
No	**34** (55)	5	6	14	5	4

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 92 responses to this question (some of the 59 respondents gave more than one answer):

Observe pasture growth/ conditions	**55**	(93)
Use seasonal climate outlook/forecast	**23**	(39)
Measure pasture growth/ conditions	**11**	(19)
Use AUSTRALIAN RAINMAN	**3**	(5)

Answers by Region

Decision Aid	TOTAL	North	West	Central	South	South-east
Observe pasture growth/ conditions	**55** (93)	8	10	14	9	14
Use seasonal climate outlook/forecast	**23** (39)	2	2	3	8	8
Measure pasture growth/ condition	**11** (19)	3	3	2	2	1
Use AUSTRALIAN RAINMAN	**3** (5)	0	1	1	1	0

Use of Other Aids:

Summary of Answers

The main topics covered, and the number of times each was mentioned, were:

Supplements on hand or likely availability/feed to be purchased……………**4**

North Queensland

- 'In most cases, in latter years, supplementation has been used to carry stock through. It is debatable whether this has been advisable.'
- 'The problem, as I see it, is that because of the economic difficulties graziers or agriculture is facing, we are being forced to stress our pastures to keep our heads above water.'
- 'Condition of stock.'

West Queensland

- 'Past rainfall records.'
- 'Grazon.'
- 'Question 15: Some of the time. Question 18. Some of the time.'
- 'Some pasture monitoring of standing yield at fixed monitoring sites.'
- 'I ensure that I have at least 6 months feed for my stock at all times.'

Central Queensland

- 'Buy a bit of feed. If the situation persists, destock.'
- 'People on the land are usually optimists, otherwise they wouldn't stay on the land.'
- 'Hope to hell it rains. If it doesn't, then you sell off.'

South Queensland

- 'Tonnes of grass/ha.'
- 'Specifically, autumn SOI readings are seen as important. A guide to stock numbers (above) will be supplements on hand or likely availability.'
- 'Time of the year helps me decide on numbers; degree of probability, e.g. coming into summer period of expected rain and it hasn't rained for a while; low yearly tally so far set. All taken into account.'
- 'If good summer rain has not arrived by 17/3 I start looking for ways to reduce stock numbers.'
- 'Observe stock condition; amount of grasses in paddock.'

South-east Queensland

- 'Queensland cattle producers are being paid prices on par with 1986 for our stock. Financial imperatives far outweigh what the SOI is up to (it being responsible for 20% of our rain) or a 55% probability that it might, or might not rain. Thus, about 75% of the decision is financial. About 15% is historical (what is known can be carried).'
- 'Subsidise winter deficiencies with crop.'
- 'Have learnt that it is better to have grass to burn at the end of the season than to run out half way through. Moderate stocking.'
- 'With the dairy, we look to see how much feed we need to buy in.'
- 'I grasp at whatever information is available. It is in the lap of the Gods. I scratch my head and do my best.'

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

Summary of Answers

Pasture

Pasture species composition/best species/changes…………………………..**28**
Amount of edible pasture material/growth for time of year and rainfall…....**24**
Changes in ground cover/bare patches/pasture density……………………..**18**
Weeds/density of woody weeds………………………………………………..**13**
Pasture quality/colour…………………………………………………………..**10**
Deterioration of pasture/condition of pasture……………………………..**9**
Amount of rain and when received……………………………….……...…..**6**
Surface water supplies/grazing pressure around water……...………….…..**5**
Soil deterioration/loss/movement…………………………………....……......**3**
Amount of woody plants/unpalatable grass eaten………………………….....**3**
Seeding of pasture………………………………………………………….....**2**
Observation and experience……………………………………………….....**2**
Insect infestation……………………………………………………………...**1**
Comparison with neighbour's paddock……………………………………....**1**

Stock

Condition of stock………………………………………………………….....**13**
Health of stock……………………………………………………………….....**5**
Stock behaviour……………………………………………………………......**3**
Appearance of stock……………………………………………………….....**2**
Reproductive performance………………………………………………….....**2**
Stock numbers……………………………………………………………….....**2**
Comparison with neighbour's stock……………………………………….....**1**

North Queensland

- 'Presence of "3P" grasses; percentage of same; amount of weed invasion; quantity of material - experience as a guide and DPI photo standards are very useful. General condition of cattle; extent of {illegible} areas.'
- 'Deterioration of pasture.'
- 'Stock condition; pasture: density, weeds, pasture species.'
- 'Cattle condition and appearance.'
- 'Encroachment of weeds; dominance of one species of grass indicates to me that the pasture is being overgrazed.'
- 'The amount of feed, quality; time of year; cattle conditions; how many weeds are around; the types of grasses that are prominent at certain times of the year.'
- 'Ground cover; main pasture species. DM quantity and quality/ha; how much growth and time of year or season - whether there is soil moisture or not.'
- 'Observation and experience from both ground and air.'
- 'Main pasture species, ground cover and length, condition of pasture, condition of stock.'
- West Queensland
- 'The amount of main species remaining and the quality of same.'
- 'Look for variety of pastures; remember how rain fell; take into consideration previous seasons.'
- 'How much bulk is left for cattle, and condition of stock.'
- 'Ground cover, main pasture species, and health of stock.'
- 'Pasture species and any change to these; whether we have summer rain or winter storms.'
- 'The amount of rain you receive and when it falls, helps you monitor pastures and stock rates, etc.'
- 'Use Grazon; monitor biomass; stock habits - walking areas.'

- 'Abundance and vigour of Mitchell grass. New growth and leaf content on saltbush. Amount of flood herbage such as clover. Amount of annual grass including content of oat grass in sandhills. Condition of stock; numbers of lactating cows. Distance from water out to main feed. Distribution of water (how many dams are full).'
- 'Edible feed weight estimations. Amount of dry vegetable matter. Amount of mulga eaten. Basal size of grass butts. Dominance of perennial grasses. When pasture last had a chance to seed.'

Central Queensland

- 'Pasture deterioration; insect infestation, e.g., grasshoppers, moths.'
- 'Amount of feed available of the main pasture species.'
- 'Moisture.'
- 'Volume of grass; condition of grass, green or dry.'
- 'Green grasses; stock condition; ticks, buffalo fly, lice.'
- 'Ground cover - amount and type (annual vs perennial); amount of woody weeds; responsiveness to rainfall.'
- 'Visual assessment of quality and quantity of feed. Health and condition of stock easily assessed.'
- 'Moisture in paddock and keep stock numbers down to retain pasture.'
- 'Observe pasture growth in relation to rainfall and competitive regrowth.'
- 'Availability of feed- natural grasses. Animal condition. We have not yet needed to supplement feed. Do not overstock.'
- 'Pasture deterioration.'
- 'Lack of water. Moisture. Stock numbers. Grass cover.'
- 'Changes in ground cover and amount of feed in paddock.'

South Queensland

- 'Changes in ground cover.'
- ' (a.) Pasture: palatable species not hammered too much. (b.) Stock: contentment.'
- 'Mainly stock condition; long term observation of increase in poorer species, i.e. wiregrass and woody weeds.'
- 'Pasture: bulk, degree of {illegible}, healthy plants. Number of bare patches on {illegible} indicates {illegible}. Must have a good bulk of {illegible} healthy pasture in April to carry through winter. Stock are the last to look at - usually too late to act when they are suffering. Take note of walking the fence, hanging at gate, etc.'
- 'Per cent of ground cover. Presence of desirable grass species. Presence of spear grass or galvanized burr.'
- 'Dung of cattle.'
- 'Probability based information.'
- 'Amount of grass available; colour of grasses.'

South-east Queensland

- 'The slow deterioration of the main grass species, combined with the increase of undesirable species.'
- 'Grazing pressure close (200m) to water points. Time of day cattle graze until in morning. Time spent lying down camped. Length of stay at water point. Changes in grass species at the same spot from year to year. Extent that unpalatable grass/shrubs are being eaten. Is stock reaching through fences to eat? Look at your neighbour's paddocks and stock; compare them with yours. Gravel/silt build up in gullies, sand choking rivers, or topsoil. Eutrophication (look that one up) of permanent water-holes. Santa Gertrudis cattle in this area are doing well. Look for sheet erosion/exposed subsoil on the lower third of hillsides. I don't believe city people could ever appreciate just how many things there are to look for, or the bush skills needed, or how long it takes to learn Q.17a "indicators".'
- 'Amount of cover at a particular time of year and access species; for example, annual early grass will die off and disappear if not used. Pioneer Rhodes grass if in volume not useful in dry winter.'
- 'Pasture: species, ground cover, mulch, albedo, weeds, vegetative phase, erosion, windbreaks, unwanted tree seedlings/woody weeds. Stock: appearance - vigour, body condition, pregnancy/lactation status, signs of distress or disease, weight gain, calving rates.'
- 'Pasture deterioration.'
- 'Look how grasses are growing; Check for capping of soil; Check condition score of stock.'
- 'Amount of legumes in the pasture.'

- 'Changes in ground cover; Main pasture species.'
- 'Pasture deterioration; Pasture productivity indicators; Soil deterioration.'
- 'Pasture bulk and quality (subjective); Ground cover.'
- 'Ground cover changes or changes in overall mass (dry matter weight) by feed estimation; Changes in indicator grasses (e.g. looking at increases/decreases in grasses of intermediate value or undesirable species); Changes or incidence in forbs, weeds and timber growth.'
- 'Availability of grass: length and density; colour: green, healthy and growing, or dull and not growing, or brown and getting eaten out.'
- 'Surface water: creeks flowing or stagnant; Body or quantity of feed (ground-cover); Quantity of seed heads visible; Stock damage to eucalyptus regrowth (increases in times of feed-stress).'

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

There were 62 responses to this question:

Yes	**36**	(58)
No	**26**	(42)

Answers by Region:

Answer	TOTAL	North	West	Central	South	South-east
Yes	**36** (58)	7	6	6	6	11
No	**26** (42)	2	4	11	6	3

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

Answers by Region

Summary of Answers

Stock numbers……………………………....…**24**
Pasture dry matter yield/available pasture…………**8**
Pasture condition………………………………......**5**
Pasture monitoring…………………………………**4**
Condition of stock…………………………...………**4**
Amount of water/water quality……………………**3**
Animal production/calving percentage…………….**3**
Class of stock………………………………....……**2**
Long-term carrying capacity………………………**1**
Health of stock………………………………......……...**1**
Rainfall……………………………………….....…**1**

North Queensland

- 'Have worked out exact area of paddocks how many cattle it can safely carry. I am in the process of establishing pasture monitoring sites.'
- 'Condition of pasture.'
- 'Carrying capacity. Main waters are always {kept?} until end of year to have handy water and grass for calving.'
- 'Stock numbers; production in the form of calving percentage in respect of breeders.'
- 'SDH - stock days/ha taken out and remaining or DM yield.'
- 'Stock numbers and pasture monitor sites.'
- West Queensland
- 'Stock numbers' (4 identical responses).

- 'Available pasture in relation to paddock size.'
- 'Stocking rates.'
- 'Class of stock and numbers. Pasture species and abundance at one point in paddock typical of main pasture type within paddock. Only key species listed.'

Central Queensland

- 'Stock numbers.'
- 'Pasture amount.'
- 'We have two grass-check sites; accurate stock numbers and time in each paddock.'
- 'Stock numbers are known and may be sold or shuffled to other paddocks holding up better. A lot depends on time of year and likely response from any rain.'
- 'Stock numbers and their condition.'
- 'Cattle numbers.'

South Queensland

- 'Only cropped paddocks: inputs (fertilizer, chemical, seeding rates etc.): outputs- yield quantity, dollars/ha profit.'
- 'Stock numbers.'
- 'Stock numbers and grazing time. I like to alternate every 10-20 days. Don't measure grass, just observe species etc. (desirable ones, they must survive).'
- 'Only stock numbers.'
- 'Number of stock in each paddock and amount of grass and water.'

South-east Queensland

- 'SDHs = stock days/ha.'
- 'Quality assurance requirements mean (probably) better stock inventory control. Stock records go back to about 1948 regarding numbers in each paddock. The above question 17c is very badly put- it is a motherhood type question- nonspecific and confusing. The ultimate "measure/ record" is of course the time control cell grazing system, which QDPI still calls "experimental".'
- 'Pasture growth and more importantly species.'
- 'I record quality and quantity of pasture feed and water, by paddock. I record sex, age, breed, condition, health and quantity of stock by paddock.'
- 'Assess pasture and condition of stock. Rainfall.'
- 'Planting different pastures per season; which crops grow better in each paddock; which crops the dairy cows milk better on.'
- 'Stock numbers.'
- 'Individual stock numbers monitored in each paddock.'
- 'I keep stock numbers in individual paddocks.'
- 'Cattle numbers and weights. Also gain/acre and capacity (stocking weight/acre) to be computed.

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

There were 58 responses to this question:

Yes	**23**	(40)
No	**35**	(60)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Yes	**23** (40)	2	4	5	4	8
No	**35** (60)	6	3	12	8	6

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 this big-picture information in your planning, risk management or decision-making?

There were 60 responses to this question:

Unaware of information	**4**	(7)
Not at all important	**5**	(8)
Slightly important	**26**	(43)
Moderately important	**16**	(27)
Very important	**9**	(15)

Answers by Region

Answer	TOTAL		North	West	Central	South	South-east
Unaware of information	**4**	(7)	1	0	1	0	2
Not at all important	**5**	(8)	1	1	1	2	0
Slightly important	**26**	(43)	2	3	9	6	6
Moderately important	**16**	(27)	3	3	4	3	3
Very important	**9**	(15)	2	3	1	0	3

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

There were 125 responses to this question (some of the 53 respondents gave more than one answer):

Recent rainfall maps	**39**	(74)
Recent pasture growth maps	**8**	(15)
Drought declared/ exceptional circumstances maps	**24**	(45)
Seasonal rainfall forecasts	**45**	(85)
Seasonal pasture growth forecasts	**8**	(15)

Answers by Region

Answer	TOTAL		North	West	Central	South	South-east
Recent rainfall maps	**39**	(74)	5	8	9	10	7
Recent pasture growth maps	**8**	(15)	0	1	1	2	4
Drought declared/ exceptional circumstances maps	**24**	(45)	3	4	4	5	8
Seasonal rainfall forecasts	**45**	(85)	5	9	11	8	12

Seasonal pasture growth forecasts	**8** (15)	0	2	2	3	1

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 53 responses to this question:

Not useful	**2**	(4)
Slightly useful	**25**	(47)
Moderately useful	**22**	(42)
Very useful	**4**	(8)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Not useful	**2** (4)	0	0	1	0	1
Slightly useful	**25** (47)	3	2	7	4	9
Moderately useful	**22** (42)	3	6	5	5	3
Very useful	**4** (8)	0	1	1	1	1

Q19d: (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 22 responses to this question:

I have no idea	**5**	(23)
Not useful	**1**	(5)
Slightly useful	**8**	(36)
Moderately useful	**4**	(18)
Very useful	**4**	(18)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
I have no idea	**5** (23)	0	1	3	0	1
Not useful	**1** (4)	0	0	0	1	0
Slightly useful	**8** (36)	1	0	2	3	2
Moderately useful	**4** (18)	2	0	1	1	0
Very useful	**4** (18)	1	0	1	1	1

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

There were 73 responses to this question (some of the 44 respondents gave more than one answer):

I don't use this information	**11**	(25)
It is difficult to interpret/use	**7**	(16)
No problems	**19**	(43)
Information not detailed enough	**5**	(11)
Access to it is difficult	**4**	(9)
It is too complex	**3**	(7)

Answers by Region

Answer	TOTAL		North	West	Central	South	South-east
I don't use this information	**11**	(25)	3	1	3	2	2
It is difficult to interpret/use	**7**	(16)	1	2	0	1	3
No problems	**19**	(43)	2	0	6	6	5
Information not detailed enough	**5**	(11)	0	1	1	0	3
Access to it is difficult	**4**	(9)	1	2	0	0	1
It is too complex	**3**	(7)	1	1	0	0	1

Other Problems in Using 'Big-picture Information:

Summary of Other Problems

Accuracy of forecasts / forecasts do not fully account for variations due to storms…………**9**
Use information as a guide only / only use it in a limited way……………………….…..**5**
Lack of faith in 'big-picture information/forecasts………………………….…..……....**4**
Wants to make better use of the information………………………....……………….**3**
Information mostly irrelevant / information not required…………………………….**2**
Interpretation of NOAA imagery……………………………………………….……..**1**
Rainfall maps too small…………………………………………………………….**1**

North Queensland

- 'Option ticked in 19e is probably not a true answer. It is hard to forecast pasture growth in any one season as there can be a heavy wet but all in a few weeks.'
- 'Although it tells you what has happened concerning rainfall etc., if you were not fortunate enough to be in the rainy area, it can't tell you when you will be lucky, only MAYBE.'
- 'What worries me about SOI forecasts is the amount of publicity it receives. If you constantly hear that it will be a bad year, next year you will be cautious as to how many cattle you buy etc. This is the best year we've had in the 1990s.'
- 'These guides, at this point, can only be used to help influence a decision.'

West Queensland

- 'I haven't got a lot of faith in some of these systems.'
- 'Many of the NOAA responses vary more with the land type, and the "greenness" product must be interpreted for mulga, gibber, sandhill, etc. as well as for rainfall. Greener does not mean higher rainfall.'

Central Queensland

- 'Realise that general probability and El Niño/SOI based forecasts do not largely account for the storm falls in our area, i.e. storms still occur, although scattered.'
- 'The forecasts were wrong (rainfall).'
- 'We are just starting in citrus, and it is trial and error. Advice is usually sought from nurseries.'
- 'I also read comics and treat these somewhat in the same light at present.'
- 'I use the information as a guide only!'
- 'I receive the above information as the Q.G.G.A. (graingrowers) representative for the Shire, on the Drought Committee. In recent years rainfall has been very patchy within single colour-coded areas.'
- 'Only use it in a limited way.'
- 'I have found it not to be accurate.'

South Queensland

- 'It is trying to define the indefinable.'
- 'Recent results have proven this information irrelevant, mostly.'
- 'The money could be better spent.'

South-east Queensland

- 'Problem: Megabucks of QDPI resources are wasted on last year's rain maps, forums on whether climate is changing (who cares? -just accept it probably is) and lots of historical charts etc. that are wonderful things to hang on walls and decorate stands at field days. QDPI focus is wrong. Too much history and not enough prophesy! Can QDPI not grasp the fact that it is a clearer view of what the future holds, that is what producers need, and that mirror portraits of our past (climate) should be incorporated on disk, and masters archived. Give me tomorrow today.'
- '1. Rainfall maps too small and you already have yours recorded. 2. Pasture growth at home only really important. 3. You will know if you are in drought. 4. Useful. 5. You can make your own using your rainfall knowledge and using your power to observe.'
- 'We look at all this "Big Picture" like a road sign which warns of danger, but doesn't have every bump marked. We then try to pick our way through the rocks and bumps as we see them on our property.'
- 'This is why we participated in the "managing the climate workshop" to know how to use this information better.'
- 'Still relying on probabilities, so not 100% accurate and doesn't always take into account local variations, storm fronts etc.'
- 'I know you cannot make it rain. I do believe SOI info is valuable. You must be honest and not apply it to spring/early summer when {storm?} rain occurs and does not affect. You lose credibility.'
- 'Question 19d: Big picture information should be very useful. Relative to state rainfall and pasture to my rainfall and pasture. Both these will affect cattle for market and prices received.'
- 'Question 19: I get this information monthly. I am still trying to work out what to do with it to get much out of it.'

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

Summary of 'Big-picture' Information Requirements

More reliable and more timely seasonal forecasts / sea-surface temperatures (weekly to half-yearly)…**11**
Weather forecasting (fresh data)……………………………………………………………………...…….**4**
Pasture growth forecasts (at least at the end of April and mid-October) / pasture condition / % of
 country that is dry, droughted or bountiful…………………………………………………………….**4**
Need a better understanding of the information………………………………………………………..**4**
Past rainfall history………………………………………………………………………………….......**1**
Information not relevant…………………………………………………………………………….......**1**
Information with greater accuracy………………………………………………………….…………...**1**
Market intelligence……………………………………………………………………………….....…**1**

Times when various types of information are required varies: daily, monthly, six-monthly or yearly.

North Queensland

- 'Earlier interpretation of El Niño and how it will impact on my locality. Interpretation of Indian Ocean temperatures and local impact of them.'
- 'Sea-surface temperature at least half-yearly.'
- 'The biggest dilemma I have is WHEN it is going to rain. If that was known it would be a simple decision to know whether stock should be fed or sold. I have yet to see a system in which the forecast is 50 percent right.'
- 'It can only be a guide. Until they can guarantee that SOI information is based on fact then I will only use it as a guide. Plenty of people in our area have said if this is El Niño we would like more of it.'
- 'To try and anticipate market trends by percentage of cattle country that is dry, droughted or bountiful.'

West Queensland

- 'Past history; a sure way of predicting likelihood of rain.'
- 'The information is not certain enough to be relevant. A constant surveillance of weather map is more useful.'

- 'Seasonal pasture growth forecasts (corrected for main land types) would be required at end of April and mid October as a minimum. This allows for stock adjustments during first and second round of mustering.'
- 'I would like to see this "big picture" information provided by government for publication in *The Land* rural press.'

Central Queensland

- 'More reliable seasonal forecasts.'
- 'Should be available electronically at all times. Updated regularly. Pasture condition compared to previous years or rainfalls. Timing of the regular waves {?} across the continent.'
- 'I see on TV recently that a computer program has been able to correctly predict the weather 6 months ahead. Let's get this going if its predictions are mostly correct.'
- 'Information with a greater amount of accuracy would gradually encourage people who are failing when using their own judgment.'

South Queensland

- 'Future long term seasonal outlook, quarterly.'
- 'More accurate weather forecasting; market intelligence; better terms of trade.'
- 'All appropriate at this time.'
- 'SOI rainfall probability.'

South-east Queensland

- 'I dial 019725352 and receive data that is fresh. The "hotlines" give outdated info. I don't use it. Big picture info? Models of cold front trajectories. Indian Ocean temperature data. Short advice on all SOI El Niño models, weekly.'
- 'Interested, but not sure.'
- 'I don't know how well I use the info available. Have no way to evaluate my skill.'
- 'Seems to be improving all the time. There's no such thing as certainty with weather. Monthly updates at least.'
- 'General long-term, once or twice a year. Immediate day to day for hay making.'
- 'Future weather conditions and pasture growth forecasts.'
- 'The most beneficial would be fairly accurate and reliable predictions of rainfall expectations. Less than this is still just guessing and leaves you as in Question 11.'
- 'Cloud maps, pressure system maps of all the Pacific Ocean. Monthly or more frequently.'

Q21a: Do you have a computer?

There were 64 responses to this question:

Yes	**39**	(61)
No	**25**	(39)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Yes	**39** (61)	7	7	10	6	9
No	**25** (39)	2	3	8	6	6

Q21b: Do you currently have access to the Internet?

There were 64 responses to this question:

Yes	**13**	(20)
No	**51**	(80)

Answer	TOTAL	North	West	Central	South	South-east
Yes	**13** (20)	2	3	3	1	4
No	**51** (80)	6	7	15	12	11

Q21c: Do you have a facsimile machine?

There were 65 responses to this question:

Yes	**47**	(72)
No	**18**	(28)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Yes	**47** (72)	9	9	8	11	10
No	**18** (28)	0	1	10	2	5

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

There were 187 responses to this question (some of the 64 respondents gave more than one answer):

TV	**41**	(64)
Radio	**32**	(50)
Telephone Recordings	**2**	(3)
Daily newspapers	**8**	(13)
Local newspapers	**6**	(9)
Rural newspapers	**39**	(61)
Computer packages	**6**	(9)
Internet/E mail	**10**	(16)
Personal conversations/ neighbours	**12**	(19)
Faxed directly	**31**	(48)

Answers by Region

Information source	TOTAL	North	West	Central	South	South-east
TV	**41** (64)	4	5	13	11	8
Radio	**32** (50)	4	6	8	8	6
Telephone Recordings	**2** (3)	0	0	2	0	0
Daily newspapers	**8** (13)	0	0	7	1	0
Local newspapers	**6** (9)	0	1	5	0	0
Rural newspapers	**39** (61)	6	4	11	6	12
Computer packages	**6** (9)	0	1	1	2	2
Internet/E mail	**10** (16)	1	4	2	1	2
Personal conversations/ neighbours	**12** (19)	4	1	5	0	2
Faxed directly	**31** (48)	6	7	5	5	8

Other Convenient Ways to Access Information:

Summary

Six comments were received; publications by industry associations, and DPI farm technical updates were mentioned.

West Queensland

- ' Would like to be able to download to a package that could superimpose a paddock plan.'

Central Queensland

- 'Mail.'

South Queensland

- 'Radio is useful for work staff while driving machinery.'
- South-east Queensland
- 'Bureau of Meteorology Climate Centre, Melbourne, by phone direct to meteorologists; "Seasonal climate outlook" by NCC.'
- 'Industry Association publications.'
- 'DPI Farm Tech Updates.'

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

There were 74 responses to this question (some of the 39 respondents gave more than one answer):
Queensland Centre for Climate Applications (QCCA)

SOI Phone Hotline	**7**	(18)
SOI Fax Hotline		(33)
13		
Internet - 'The Long Paddock'	**8**	(21)
Bureau of Meteorology (BoM)		
Fax Services	**31**	(79)
Internet site	**4**	(10)
Seasonal Climate Outlook subscription	**4**	(10)
Other		
Computer Software (for example, AUSTRALIAN RAINMAN, Metaccess)	**4**	(10)
SILO (QCCA/BoM) - Australian meteorological and agricultural information on Internet	**3**	(8)
Private Consultant	**0**	(0)

Answers by Region

Queensland Centre for Climate Applications (QCCA)

Information source	TOTAL		North	West	Central	South	South-east
SOI Phone Hotline	**7**	(18)	2	0	0	3	2
SOI Fax Hotline	**13**	(33)	3	1	1`	3	5
Internet – 'The Long Paddock'	**8**	(21)	1	2	1	2	2

Bureau of Meteorology (BoM)

Information source	TOTAL		North	West	Central	South	South-east
Fax Services	**31**	(79)	5	7	6	6	7
Internet Site	**4**	(10)	0	2	2	0	0
Seasonal Climate Outlook subscription	**4**	(10)	0	0	1	0	3

Computer Software (For example, AUSTRALIAN RAINMAN, Metaccess)

TOTAL	North	West	Central	South	South-east
4 (10)	0	2	0	2	0

SILO (QCCA/BoM) - Australian meteorological and agricultural information on Internet

TOTAL	North	West	Central	South	South-east
3 (8)	0	1	1	0	1

Other Sources of Seasonal Situation/Outlook Information

Summary

The following sources were mentioned by the number of respondents indicated:

> Television…………………………...**4**
> Rural newspapers/papers…………....**4**
> Radio……………………………...**2**
> QCCA………………………….…**1**
> Bureau of Meteorology……………...**1**
> Computer software……………….…**1**

North Queensland

- 'SBS cloud photo test pattern.'
- West Queensland
- 'I used none.'

Central Queensland

- 'Radio/TV.'
- 'Rural newspapers.'
- 'TV; rural papers.'

South Queensland

- 'TV forecasting and papers.'
- 'QCCA, computer software.'

South-east Queensland

- 'Brisbane Bureau of Meteorology.'
- 'TV, radio, rural newspaper. Further than these, I don't believe it is worth spending the money.'

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?

Summary of Best Sources of Seasonal Situation/Outlook Information

> Rural newspapers / papers…………………………………....**16**
> Television……………………………………………….…**14**
> Radio…………………………………………………….....**9**

Best Sources of Seasonal Situation/Outlook Information - Answers by Region

North Queensland

- 'SBS cloud pattern because you can see the big systems. ABC radio and TV: good information.'
- 'Media sources.'
- 'TV pictures, weather maps in and around Australia. The radio offers more local information. Personal: gives information as to how people react to situations which can differ from place to place and still be right.'
- 'Perhaps personal contacts.'
- 'QCCA/BOM should have an Ag {illegible}'
- 'Short term - Met service. Long term…?'
- 'Weather maps together with local knowledge of area.'
- 'Look at pasture and soil moisture. The future is too unpredictable weatherwise.'

West Queensland

- 'None. No one seems to be able to pick droughts, floods, etc.'
- 'Media sources, weather maps, Internet, because they are constantly upgraded.'
- 'SOI on Net - can peruse past years.'
- 'SBS weather map. It is in colour, available twice daily, and free. Coloured state rainfall summary in Rural Newspaper. NOAA "greenness" image supplied monthly for SA by DEHAA. Both Rural Newspaper and DEHAA provide a good overview on likely cattle supply. QDPI "Longpaddock" pasture growth map as percentage of maximum growth. This places history in context with the present.'
- 'Rural newspapers – ease of access, cost, layout.'

Central Queensland

- 'TV, radio, papers. These sources suit me personally.'
- 'TV and rural papers because of easy access.'
- 'Rural News, because I read it every week.'
- 'Media - easy access.'
- 'BoM and SILO - Long Paddock; overall maps and forecast probabilities.'
- 'TV forecast from 1 day to 7 days; rural newspapers up to 6 months. Personal conversations with neighbours: we forecast weather in our own areas in short term and most times in the long term.'
- 'Widely read papers. You have time to digest it and can check later how wrong it is. Australia and even Queensland covers a very large area and a general forecast can be right in one area and very wrong in others. The severe flooding in parts of the north, for example.'
- 'All sources are good. Always pick up and find out news.'
- 'TV and newspaper publications of probability forecasts, working on the assumption that one won't get rain. It's better than betting you will!'
- 'TV/Radio- easy access.'
- 'Information on TV, radio, guest speakers etc. Also many farmers have not got the newer equipment mentioned.'
- 'We only listen to forecasts on TV and plan our own planting or cattle work around that.'
- 'Rural papers.'
- 'I have not found any to be very accurate.'

South Queensland

- 'Fax, computer.'
- 'Morning (6:15 to 7am) ABC Radio; Fax services (providing one knows which numbers to call).'
- 'Fax, because it is picked off the machine and read (a bit like a phone is always answered).'
- 'Bureau of meteorology - farm weather, cotton fields etc. I give it 80% accuracy.'
- 'QCCA - DPI/DNR, because they seem to be well researched and unbiased assessments.'
- 'Rural press because time to study details.'
- 'TV, Fax, papers, radio etc. and personal subscriptions to seasonal outlook.'
- 'Local radio because it is available in home, vehicle, tractor.'
- 'TV or maps in Country Life or daily paper.'
- 'Long Range Forecast (rural newspaper).'

South-east Queensland

- 'A summary of seasonal conditions in Qld, produced by Dept. of Natural Resources.'
- 'Melbourne Bureau of Meteorology is best because: 1. their fax 019725352 sea temp. data; 2. their meteorologists are in the nerve centre, climate-wise, and if they don't know, no one does; 3. I suspect that QDPI's weather, like everything else in QDPI, is highly political at the top level. I wonder do political games muddy the science of QDPI's weather? Should the ALP gain government, my prediction is for winds of change across the QDPI weather service. If this happens, it will prove my point. When it comes down to meteorologist's nuances, I'll back Melbourne.'
- 'Radio on ABC explained by department personnel. Neighbours with 84 years of family experience.'
- 'I look at the maps, the markets, my own paddocks, my neighbour's paddocks, the district in general, and act conservatively.'
- 'The QDPI day that was conducted recently in Monto with Dr. Roger Stone proved to be most informative and I would recommend it.'
- 'Fax and Internet, because they have the latest information I can get when I need it.'
- 'The fax services as they seem to give better detail and information.'
- 'Articles in rural press, SOI, QDPI Bulletin and Internet site.'
- 'Rural newspaper articles and faxed information would be most user-friendly for seasonal climate outlooks.'
- 'If reliability and credibility were markedly improved, I would reconsider others.'
- 'Unfortunately, I cannot comment as I have not been aware of most of the above services. Most seasonal info has come from ABC weather, SBS cloud charts and "Qld Country Life" weather.

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 to simply respond to changing seasonal conditions, rather than try to anticipate and reduce seasonal climatic risks."

There were 60 responses to this question:

Strongly disagree	**11**	(18)
Disagree	**6**	(10)
Neither agree nor disagree	**17**	(28)
Agree	**13**	(22)
Strongly agree	**13**	(22)

Answer	TOTAL	North	West	Central	South	South-east
Strongly disagree	**11** (18)	1	2	1	3	4
Disagree	**6** (10)	0	2	2	1	1
Neither agree nor disagree	**17** (28)	1	3	6	3	4
Agree	**13** (22)	2	2	3	4	2
Strongly agree	**13** (22)	4	1	5	1	2

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 60 responses to this question:

Strongly disagree	**0**	(0)
Disagree	**3**	(5)
Neither agree nor disagree	**9**	(15)
Agree	**28**	(47)
Strongly agree	**20**	(11)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Strongly disagree	**0** (0)	0	0	0	0	0
Disagree	**3** (5)	0	1	1	1	0
Neither agree nor disagree	**9** (15)	1	2	3	2	1
Agree	**28** (47)	5	4	8	6	5
Strongly agree	**20** (11)	3	3	3	3	8

Q24: "At present, SOI and probability-based forecasting places undue responsibility on 'users' to interpret the information."

There were 60 responses to this question:

Strongly disagree	**6**	(10)
Disagree	**14**	(23)
Neither agree nor disagree	**17**	(28)
Agree	**14**	(23)
Strongly agree	**9**	(15)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Strongly disagree	**6** (10)	0	1	1	2	2
Disagree	**14** (23)	1	3	2	4	4
Neither agree nor disagree	**17** (28)	3	3	5	3	3
Agree	**14** (23)	2	3	7	0	2
Strongly agree	**9** (15)	2	0	2	3	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 61 responses to this question:

Strongly disagree	**4**	(7)
Disagree	**4**	(7)
Neither agree nor disagree	**9**	(15)
Agree	**15**	(25)
Strongly agree	**29**	(48)

Answers by Region

Answer	TOTAL		North	West	Central	South	South-east
Strongly disagree	**4**	(7)	0	0	2	1	1
Disagree	**4**	(7)	2	0	0	1	1
Neither agree nor disagree	**9**	(15)	2	1	1	2	3
Agree	**15**	(25)	2	2	4	4	3
Strongly agree	**29**	(48)	3	7	10	3	6

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

There were 62 responses to this question:

Strongly disagree	**6**	(10)
Disagree	**10**	(16)
Neither agree nor disagree	**19**	(31)
Agree	**23**	(37)
Strongly agree	**4**	(6)

Answers by Region

Answer	TOTAL		North	West	Central	South	South-east
Strongly disagree	**6**	(10)	1	2	3	0	0
Disagree	**10**	(16)	0	3	1	3	3
Neither agree nor disagree	**19**	(31)	4	1	6	3	5
Agree	**23**	(37)	3	3	6	5	6
Strongly agree	**4**	(6)	1	0	2	1	0

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

There were 48 responses to this question:

Strongly disagree	**6**	(13)
Disagree	**2**	(4)
Neither agree nor disagree	**16**	(33)
Agree	**18**	(38)

| Strongly agree | **6** (13) | | | | | |

Answer	TOTAL	North	West	Central	South	South-east
Strongly disagree	**6** (13)	0	0	2	1	3
Disagree	**2** (4)	0	1	0	1	0
Neither agree nor disagree	**16** (33)	6	3	5	2	0
Agree	**18** (38)	1	4	4	5	4
Strongly agree	**6** (12)	0	1	1	0	4

Q28: "Warnings of the possible pasture deterioration (e.g. 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 61 responses to this question:

Strongly disagree	**4**	(7)
Disagree	**13**	(21)
Neither agree nor disagree	**11**	(18)
Agree	**17**	(28)
Strongly agree	**16**	(26)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Strongly disagree	**4** (7)	1	0	1	0	2
Disagree	**13** (21)	1	1	5	4	2
Neither agree nor disagree	**11** (18)	0	3	3	1	4
Agree	**17** (28)	3	3	2	6	3
Strongly agree	**16** (26)	3	3	7	1	2

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

There were 63 responses to this question:

Strongly disagree	**2**	(3)
Disagree	**10**	(16)
Neither agree nor disagree	**15**	(24)
Agree	**27**	(43)
Strongly agree	**9**	(14)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Strongly disagree	**2** (3)	0	0	1	0	1
Disagree	**10** (16)	1	3	1	0	5
Neither agree nor disagree	**15** (24)	3	4	3	2	3
Agree	**27** (43)	3	2	12	7	3
Strongly agree	**9** (14)	2	1	1	3	2

Q30: "Warnings of possible soil deterioration (e.g. reduced ground cover, soil loss – see 'Definitions' on last page) on a district level, before the level of pasture ground cover became critical, would be valuable in making my management decisions."

There were 58 responses to this question:

Strongly disagree	**5**	(9)
Disagree	**6**	(10)
Neither agree nor disagree	**19**	(33)
Agree	**17**	(29)
Strongly agree	**11**	(19)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Strongly disagree	**5** (9)	2	0	1	1	1
Disagree	**6** (10)	0	0	3	3	0
Neither agree nor disagree	**19** (33)	2	1	4	4	8
Agree	**17** (29)	1	5	5	3	3
Strongly agree	**11** (19)	2	4	3	1	1

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

There were 61 responses to this question:

Strongly disagree	**1**	(2)
Disagree	**9**	(15)
Neither agree nor disagree	**14**	(23)
Agree	**23**	(38)
Strongly agree	**14**	(23)

Answers by Region

Answer	TOTAL	North	West	Central	South	South-east
Strongly disagree	**1** (2)	0	0	1	0	0
Disagree	**9** (15)	4	1	2	1	1
Neither agree nor disagree	**14** (23)	0	4	5	3	2
Agree	**23** (38)	2	3	8	6	4
Strongly agree	**14** (23)	3	2	2	2	5

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

Summary of Further Comments

The following selections of ideas/quotes were made from the plethora of additional comments (where more than one comment was received, the total number of participants giving similar comments is shown):

> Seasonal climate forecasting would be a very valuable tool if it was accurate…....…**3**
> Accuracy of seasonal forecasts/weather forecasts…………………………………..**2**
> Overstocking/we have degraded pasture areas…………………………………...**2**
> 'Good seasons sometimes do not make for good pastures'
> 'Financial pressures force us into carrying more cattle than we think the country can maintain long term'
> Pasture yield forecasting is required at the paddock level.
> Measurement of 'useful daily rainfall' is required.

Comments by Region

North Queensland

- 'SBS and ABC could use the test pattern slot to exhibit various satellite images with a detailed written interpretation of events with more of a global approach, so progress of major systems could be followed; for example, in terms of hay-making the 40 day event is very important. I will soon be purchasing computer software to help me make more informed decisions.'
- 'We feel that seasonal climate forecasting would be a very valuable management tool if it could be more accurately refined.'
- 'If the long term forecast is accurate it would be very useful as a management tool. At present, our management is dictated by (1) the season, and (2) our financial position.'
- Regarding Question 11: 'This is a silly question: we plan on present climatic conditions.' A response to Question 15. 'The worst SOI index in 20 years has resulted in the best season in 20 years.'
- 'Forecasting is like picking winners. Good seasons sometimes do not make for good pastures, ie, heavy falls can be spasmodic and of little use, while more moderate and regular falls can really set up pasture.'
- 'I find the hardest decision on this property to make is if stock should be fed or sold in a dry time. Sometimes you make the right decision and sometimes not. I consider the seasonal forecasts but do not always act on their advice. I would say sometimes I get it wrong but I believe I am in front of the advice from the forecasts.'
- 'By predicting what lies ahead with the weather, graziers have to make decisions themselves. It is our livelihood we are controlling. An outside influence such as SOI can have negative and positive effects on business decisions. I would like to see research continue in the area of weather forecasting. I also think financial pressures force us into carrying more cattle than we think the country can sustain long term.'
- 'To me it is all about having your pasture-soil in a condition where it can make use of every available drop of rain.

West Queensland

- 'Scientific information is very good, providing it is good enough to rely on; and only time will tell if it is good enough to base management decisions on it.'
- 'Yes. When will the next drought be?'
- 'Layout editing.' {of questionnaire}
- 'The ideal situation would be when the pasture yield forecasting had accurate enough land type and growth model information to be accurate at the paddock (100 sq km) scale, and that this could be available (downloaded) into a basic GIS on a farm computer so decisions on feed patchiness, etc. could be made on a paddock basis.'

Central Queensland

- 'My thoughts, though not relevant to this questionnaire: Global warming is a fact. We have over-cleared, overstocked, over-polluted, wasted resources through lack of conservation policies in the past; and at present, the nature of man is to stuff things if he's not restrained. I feel for future generations.'
- 'Seasonal forecasts would be very valuable if they were much more accurate. I reduced my stock considerably last year because of forecasts of a very dry summer. But this has been the best summer for years.'
- 'I filled in this questionnaire keeping in mind my area and not the whole district, because the area varies a lot due to distance; and I am also looking at it from a cane farming point of view, rather than a pastoral one.'
- Regarding Question 19a: 'But as yet unable to use the system.'

South Queensland

- Regarding Question 31: 'Wheat planting in '97 was deliberately delayed because of risk of late frost in low SOI year.'
- 'The SOI info is interesting at all times and of growing importance. Currently, only the autumn scores influence me.'
- 'Weather forecasting, in my experience, is still unreliable.'
- A response to Question 22: 'I attempt to keep numbers low so that I don't have to "react" when it is dry.'

South-east Queensland

- 'Summary: 1. update everything weekly, esp. on fax. 2. More hard data (oceanography, carbon dating, tree rings) and less fast chatter (spindoctors and "experts") 3. Less history (last month's rain), more prophesy (next month's rain) 4. Same as '3.' above, it's not a bloody joke, it is a serious request from a survey respondent, who usually fills out, then tears up QDPI surveys from utter frustration! 5. Stop asking "why?" Who are we to inquire? "why?" is not ours to ask! "Why climate change?" "Why droughts?" Stop asking "why?" and say "why not?" 6.QDPI should say "Why not roll with the climate king hits and change our programs to encompass apparent change". Drop "swamp". More on control cell grazing. More on WASCA land rehabilitation. What's 'WASCA'? coming soon to ABC TV 'Landline'. 7. QDPI cannot avoid political interference. So how can its weather? Discuss it, before the *Courier Mail* gets onto it (or would that be a good idea?). P.S.! ! Re "swamp" - at least stop the burning - it accentuates nutrient flux, and it's well known to restore speargrass; spell the paddock.'
- Regarding Question 28: 'Rhodes grass in droughts does disappear under heavy grazing. Native blue grass comes back very well and colonises the Rhodes grass areas. Gatton Panic, Purple pigeon grass and B{illegible} Panic appear to be able to come back.'
- '1. We take note of the big picture climate forecasting for other parts of the world, insofar as it alerts us to changes in our competitors' positions in markets, as well as changes in consumption due to local economic disasters related to climate. It appears to have relevance on a macro basis. 2.When 'Rainman' was developed, I attempted to use it. I was told 'Sorry, we don't have any data for your area'. Later, a second attempt, I learned it was only for IBM compatible equipment, so I thought I would have to bring my data to DPI. Decided it wasn't worth the effort.'
- 'Keep trying. While we may never be able to confidently predict our weather, I feel big steps forward have been made. The more informed we are the better chance we have of surviving in Primary Industry.'
- 'I believe property owners have to be made more aware of ground baring's effect on the number of weeds. Also, some fail to see overstocking as a problem. They continue to blame the weather. How do your pasture availability charts take these into account?'
- 'Do not ask for basically yes/no answers: draw participants out and get their views and opinions. Many scientists jump on band wagons hoping to access funds and keep themselves in a job. This applies to some degree with SOI/El Niño. Virtually all predictions are based on it. Please look further afield to planets, sea surface temperatures, upper air {temperature?}, volcanic activity, cyclones sucking moisture from other areas etc.'
- 'One thing that has been overlooked in analysing rainfall records is the measure of useful daily rain as opposed to useless daily rain, and periods or aggregations of rain, that is, rain influence over 2 days or even 2 weeks. Looking at monthly rainfall does not yield this information, and it is critical information in this present local drought. An example is 1977 with 93.7% useful rain (total 936mm), and 1997 with less than 50% (total 548mm).'

- 'I will not be planting a winter spring pasture this year, because of the information I have received from DNR. I believe the risk of failure is too great.'
- Regarding Question 18. 'No' was also marked. 'I lighten off stocking rate - hard to compare with control of not lightening off.'

DISCUSSION

Comparison with Biased Sample

The discussion below contains some reference to data collected from a biased sample of graziers in central Queensland (CQ). In such cases, the Queensland result is quoted first followed by the central Queensland results (in brackets), together with responses from the biased sample of 10 graziers in central Queensland (CQ Biased) who had experienced significant exposure to the Aussie GRASS products (expressed as a percentage of those who responded to the specific question).

Part A – General Information about Respondent

The data in Part A emphasises the wide range of *property situations* that pastoralists operate in throughout Queensland. For example, property size, annual turnover, annual rainfall and the season when most rainfall is received all vary greatly. This needs to be kept in mind when interpreting the survey data, particularly when interpreting the answers to open questions. In many cases the results may be more valuable by referring to the data and information for a particular region, and also by comparing regions. However, care needs to be taken in interpolating regional data as the sample size is relatively small.

The categories for *'$ turnover per annum'* (Q4) were probably not the most appropriate for the Queensland situation. While the lower category of '<20 000' indicates that 7% were in the 'hobby-farm' size, only 1% of the sample was in the highest category of '>2 000 000'.

A total of 86% of respondents are involved in the beef industry, while 17% run sheep (Q5). Many of the respondents are involved in a range of other industries, but only 2% of the sample represented are in agribusiness. At least 14% are involved in farming operations.

Eighty-seven percent of respondents had been involved in primary production for 10 to 50 years (Q6), and surprisingly there was a reasonably even spread over this range.

A total of 80% of respondents keep daily *rainfall records* (Q 7a), and 73% of those who keep daily rainfall records have kept them for less than 30 years (Q 7b). Out of those who keep daily rainfall records, 92% have 'complete' or 'fairly complete' records (Q 7c). However, the challenge is to make better use of the valuable records being produced.

Eighty-four percent of survey properties have an *average annual rainfall* of 400mm or more (Q 8).

Part B – Monitoring Seasonal Conditions

Question 10 examined respondents' *perceptions of climate change*. Eighty percent of them believe that their rainfall has become drier (Q10a), while 69% believe that their rainfall has become more variable (Q10b). Both these beliefs are consistent across all regions.

A total of 67% of respondents believe that summer day-time temperatures have become hotter. This trend is present in all regions except South-east Queensland (Q10c). Twenty-one percent believe that there has been no change in frost frequency, while 57% believe that there has been 'less frost' during the 1980s and 1990s (Q10d).

Ninteen percent believe that there has been no change in humidity while 37% feel that the climate has become more humid (Q10e).

Questions 11 and 12 were concerned with the *use of climatic information*. Eighty-four percent of respondents said that judgements of future climatic conditions were 'very important' or 'moderately important' in their planning or decision-making (Q11). However, 75% do not use long-term climatic records to assist in decision-making (Q12). It is therefore concluded that they are likely to be receptive to training aimed at a better understanding of seasonal climate forecasting and the use of such information.

Respondents were asked to list their most *important annual decisions* in Question 13. Selling/agisting stock (83%) and buying stock (44%), were highlighted. Surprisingly, under 'Others' only one respondent mentioned financial budgeting; however, many decisions listed were pertaining to stock production performance.

A total of 48 % of respondents said that *probability-based information* is 'moderately useful' to 'very useful' in the management of their business (Q 14), and 45% currently use seasonal climate forecasts in decision-making (Q 15).

Ninty percent *observe pasture growth/conditions* when deciding on what stock numbers to carry through the months of the year when feed shortages are most likely to occur (Q 16). Fifty-eight percent measure or record information for individual paddocks (Q 17b).

The main *indicators* used to assess the health of pasture (Q 17a) were pasture species composition, amount of edible biomass for that time of year and the rainfall received, changes in ground cover, weeds present, pasture quality. Alternatively, the main indicators used by respondents to assess the health of stock (Q 17a) were the condition of stock, and their appearance or behaviour. However, there is considerable experience and skill involved in weighing up all such factors and then making the best possible management decisions. Any decision-support aids which help to ensure that such decisions are of a high standard, and the result of a systematic, quantitative analysis of the situation, will be a step in the right direction (for example, quantitative pasture measurements and expert systems).

The main paddock records kept by participants (Q 17c) covered stock numbers (mentioned 24 times), and pasture condition and trend (mentioned 17 times). Perhaps there is a need for including more emphasis on paddock records covering reproductive efficiency and production performance.

Thirty-eight percent of respondents regularly compare property management options quantitatively (Q 18).

Part C – 'Big-picture' Information

The most convenient ways to access seasonal climate outlook information are TV (64%), rural newspapers (61%), radio (50%), and faxed directly (48%). However, the main sources of seasonal situation/outlook information used at least once are BoM Fax Services (69%) and the SOI Fax Hotlines (28%).

While 42% (CQ 31%; CQ Biased 50%) said 'big-picture' information was 'moderately important' to 'very important' in their planning (Q 19a), 7% (CQ 6%; CQ Biased 0%) were unaware of the information (Q 19a). A total of 72% (CQ 67%; CQ Biased 80%) of respondents had used at least one product. The main types of big-picture information used by respondents are seasonal rainfall forecasts (83%) and recent rainfall maps (74%) (Q 19b). Thus respondents should generally be receptive to Aussie GRASS extension activities.

Forty-nine percent (CQ 43%; CQ Biased 67%) of those who have used big-picture information have found it 'moderately useful' to 'very useful' (Q 19c). Thirty-six percent (CQ 29%; CQ Biased 0%) of those who have not used big-picture information thought it could be 'moderately useful' or 'very useful', while 23% of respondents have no idea how useful it might be (Q 19d). Thus respondents should generally be receptive to Aussie GRASS extension activities.

Forty-three percent (CQ Biased 50%) of respondents have no problems using 'big-picture' information (Q 19e). However, some have problems with interpreting and using it (16%), and the information was not detailed enough for others (11%). The comments under 'Other problems' indicate some reservations about product

accuracy and forecasting ability. These issues need to be addressed in implementing the Aussie GRASS extension program.

Some of the feedback on how frequently 'big-picture information was required (Q 20), indicated a lack of understanding of how some information products could be used.

A total of 72% of respondents have a facsimile machine (Q21c), and the main sources of seasonal situation/outlook information used at least once are BoM Fax Services (69%) and the SOI Fax Hotlines (28%) (Q21e). This appears to be the best current method for pastoralists to obtain accurate information. However, 61% have a computer (Q21a), 20% currently have access to the internet (Q21b) and 50% of respondents are comfortable with an increasing amount of information being computerised (see PART D). Thus their use of software programs and the internet is likely to increase.

The most convenient ways to access seasonal climate outlook information are TV (64%), rural newspapers (61%), radio (50%), and faxed directly (48%) (Q21d). However, the accuracy and depth of the distributed information are likely to be reduced when using mass-media delivery vehicles.

Participants indicated that their best sources of seasonal situation/outlook information (Q21f) were newspapers (mentioned 16 times) and television (14) while radio (9), internet (8), facsimile (7), and Bureau of Meteorology (7) were mentioned less frequently.

Twelve training workshops were conducted around Australia from 1997 to 1999 to familiarise extension staff and influential producers with the products, to obtain feedback on the products and to discuss their use in making property management decisions. Feedback from most participants in the workshops was very positive, and many of the products were regarded as valuable for helping with management decisions in pastoral areas. However, there were some reservations regarding the accuracy of some products, and the applicability of seasonal climate forecasting in some regions of Australia

Part D – Scaled Attitudinal Responses

'It is better management practice to simply respond to changing seasonal conditions, rather than try to anticipate and reduce seasonal climatic risks' (Q22) - 42% either 'agree' or 'strongly agree' with this statement.

'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' (Q23) - 58% 'agree' or 'strongly agree' with this statement.

'At present, SOI and probability-based forecasting places undue responsibility on 'users' to interpret the information' (Q24) - average response to this statement was neutral.

'Warnings of possible stock feed shortages in 3-6 months time, at a district level, would be valuable in making my management decisions' (Q25) - 72% (CQ 72%; CQ Biased 60%) either 'agree' or 'strongly agree' with this statement.

'At present, adequate experience and information are available to enable me to link climate-related information/forecasts to practical property management' (Q26) - average response to this statement was neutral to 'agree'.

I am comfortable with the increasing level of climate-related materials now becoming available via computer programs and computer networks' (Q27) - average response to this statement was neutral to 'agree'.

'Warnings of the possible pasture deterioration (e.g. weed invasion, loss of desirable species) at a district level, before the main growing season, would be valuable in making my management decisions'(Q28) - 54% (CQ 50%; CQ Biased 60%) either 'agree' or 'strongly agree' with this statement.

'Generally, the rural media provide credible and useful sources of seasonal climate forecast information' (Q29) – average response to this statement was neutral to 'agree'.

'Warnings of possible soil deterioration (e.g. reduced ground cover, soil loss – see 'Definitions' on last page) on a district level, before the level of pasture ground cover became critical, would be valuable in making my management decisions' (Q30) - average response to this statement was neutral to 'agree', while 48% (CQ 50%; CQ Biased 60%) answered 'agree' or 'strongly agree'.

'Scientific seasonal climate forecasting is a valuable tool for managing my property in the face of seasonal variability' (Q31) - average response to this statement was neutral to 'agree', while 61% (CQ 56%; CQ Biased 80%) answered 'agree' or 'strongly agree'.

In the additional comments (Q32), there was some focus on:

- The accuracy of forecasts, and the conviction that seasonal climate forecasting would be a very valuable tool if they were accurate; and
- That we have degraded pastures - but no solutions were offered.

CONCLUSIONS

The following conclusions can be made from the survey:

- The survey results provide reasonable guidance for developing an effective Communication Plan and extension program.

- The knowledge and attitudes of agribusiness managers are not well represented in the data obtained. Some further information may need to be collected by extension staff through personal contact.

- Our extension program needs to help graziers to make better use of their valuable rainfall records, and other climatic records. A total of 75% of respondents do not currently use long-term climatic records to assist in decision-making.

- Graziers are likely to be receptive to training aimed at a better understanding of seasonal climate forecasting, and the use of such information; 45% currently use seasonal climate forecasts in decision-making.

- There is a reasonably good acceptance of the usefulness of probability-based information (Q15). In addition, most respondents (58%) agree with releasing seasonal climate forecasts in the form of probabilities (Q23). However, in extension activities care needs to be taken to explain the concept simply.

- Answers to questions about the importance and usefulness of 'big-picture' information (Q19) indicate that respondents should generally be receptive to Aussie GRASS extension activities.

- Users of 'big-picture' products have some problems with interpreting and using information (16%), and information is not detailed enough for some. There are also some reservations about product accuracy and forecasting ability. These issues need to be addressed in implementing the Aussie GRASS extension program.

- While the most convenient ways to access seasonal climate outlook information are TV, rural newspapers, radio and faxed directly, the best current method for pastoralists to obtain accurate information appears to be by facsimile machine. However, their use of computers and the internet is likely to increase.

- There appears to be strong support for the concept of Feed Shortage Alerts (72%), and moderate support for the provision of warnings of possible deterioration of pastures (54%) or soil (48%). Note that the support for warnings declines as the sustainability threat is perceived as being further in the future, except in the case of the biased central Queensland sample where the change in support is reversed.

- The range of 'big-picture' products needs to be promoted in an integrated fashion, and focused at the property level by linking the information with on-property observations/experiences.

- As participants indicated some concern regarding the accuracy of seasonal climate forecasts, it is important to improve their accuracy for the various pastoral regions of Australia. Only then can we expect graziers to accept the 'look-ahead' products developed under the project.

- In order for the extension of Aussie GRASS products to be effective, the timing of activities and selective use of appropriate decision-support products/tools are essential. It is important that group extension activities be conducted at the most appropriate time in the annual production cycle, when specific products can make a significant difference in the quality of decision-making. Answers to Q 13 help to identify the critical decision-making times for a specific industry in a particular region. Only products/tools relevant to the key property management decision being analysed should be promoted, and this should be done in the context of overall management of the pastoral business.

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