econnect
communication

Seasonal climate forecast tools and information on the internet

User needs analysis

Final report

Managing Climate Variability

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Contents

1. Executive summary

This report summarises Econnect Communication's user needs analysis of seasonal forecast tools and information on the internet conducted for Managing Climate Variability, in close liaison with the Bureau of Meteorology. We (Econnect Communication) started by interviewing 12 industry visionaries from across Australia, representing agriculture and natural resource management. We then surveyed farmers, advisors, and regional natural resource management bodies.

1.1 Who uses seasonal forecasting and why?

1.1.1 Farmers and advisors

In our survey of 499 farmers and advisors, we found that 83% of respondents access seasonal forecast information on the internet, via broadband or satellite, and use it to help them make decisions about:

- the timing and area of seeding/planting
- the timing and amount of fertiliser to apply
- the timing of stocking or de-stocking cattle or sheep
- the choice of crop or cultivar to plant
- the timing of pest/weed/disease management

Farmers and advisors who did not use seasonal forecasting information for decision making believe that seasonal forecasts are unreliable and lack local relevance.

1.1.2 Regional natural resource management bodies

In our survey of 116 regional natural resource management (NRM) body representatives, we found that 67% of respondents access seasonal forecast information on the internet, via broadband, and use it to help them make decisions about:

- what advice to give to landholders/farmers about their practices
- the timing of tree planting
- strategic planning for the catchment
- recommended land practices to change in the catchment
- the timing of pest management

Those regional NRM body representatives who did not use seasonal forecast information appeared to have low awareness of the potential benefits and applicability of seasonal forecast information to their business.

1.2 What seasonal forecast information and tools do users want?

The majority of seasonal forecast users—farmers, advisors and regional NRM body representatives—want information on the following weather elements, in order of importance:

1. rainfall amount
2. rainfall intensity
3. air temperature

4. frost occurrence
5. wind

Users want to be able to tailor seasonal forecast products to their needs at a particular time. They want to be able to choose the scale, ranging from local to national. And they want to be able to choose deciles/percentiles, rainfall amounts, and base temperatures from any seasonal forecasting product.

They want to see seasonal forecast information as maps, graphs and diagrams, which are accompanied by explanatory text that is layered in increasing detail and complexity. They want to be able to read information easily online rather than printing it out. And they want additional explanatory information on climate drivers and phenomena such as Indian Ocean dipole and the Southern Oscillation Index.

Users want the Bureau of Meteorology to develop its proposed seasonal forecasting products, with the following order of importance:

1. El Niño/La Niña alert system
2. seasonal rainfall forecast map – fixed probability percentage
3. seasonal rainfall forecast map – fixed amount of rainfall
4. seasonal rainfall forecast – tabular format, by rainfall station
5. rainfall scenario graph (plume)
6. cumulative degree day graph

1.3 Where do they want to get it from?

Users largely access seasonal forecast information from the Bureau's website, other websites, and, to a lesser extent, radio and TV. The tools they particularly like to use are the Bureau's seasonal outlook, the Southern Oscillation Index, the Madden-Julian Oscillation and the Indian Ocean dipole.

All users are very supportive of the concept of a 'one-stop-shop' climate risk management website that links to credible websites for seasonal forecast tools and information.

1.4 When do they want to get it?

Most farmers/advisors access online seasonal forecast information either daily or weekly, while regional NRM body representatives access it weekly or fortnightly. Most users want to get seasonal forecast information a month in advance.

All users want flexibility in choosing the forecast start date and time period in seasonal forecast products.

1.5 How can we meet these needs?

We recommend that the Bureau and Managing Climate Variability (MCV) take the following actions within the scientific, role and resource constraints they operate under:

1. Continue to raise awareness of Bureau and MCV websites, especially with regional NRM bodies and natural resource managers.
2. Recognise the needs of users as summarised above, especially the need for users to be able to tailor products to their needs at different times
3. Continue research to make seasonal forecasts more reliable, more accurate, and more applicable at local and regional scales.

4. Expand the MCV website to become the ‘one-stop-shop’ for climate risk management by providing links to relevant and credible seasonal forecasting websites, including the Bureau’s website.
5. Develop the Bureau’s proposed products (tools and information), taking into account the specific needs of users, and testing prototypes or early versions with users.
6. Further interrogate the survey data to better determine specific seasonal forecasting needs of different sectors of the target groups.
7. Support further research of farmers, advisors and natural resource managers who are currently not accessing seasonal forecasting information or tools on the internet.
8. Work closely with users to develop seasonal forecast tools and explanatory information.

2. Introduction

2.1 Context

This user needs analysis looks at the needs of Australian farmers and their advisors, regional natural resource management (NRM) bodies, and other natural resource managers for seasonal forecast tools and information on the internet.

The user needs analysis was a recommendation of a business case produced by Econnect Communication under contract to Managing Climate Variability (MCV) and in close liaison with the Bureau of Meteorology. The business case supported the development of products and narrative for inclusion on the Bureau's Water and the Land (WATL) website. It also supported the development of the MCV website as a portal to both Bureau and non-Bureau climate risk management tools and information. WATL would also link to the MCV website, with both sites working together to provide a 'one-stop shop' for quality climate risk management information and tools.

The business case was stimulated by the perception that there is currently no credible organisation in Australia providing primary producers and their advisors (agribusiness, consultants and government agencies) with a single, easily accessible website for climate risk management tools and information.

There are also known limitations to the seasonal forecast product set (both tools and narrative) that the Bureau already publishes on its website. And while the Bureau's recently developed WATL website goes some way towards addressing the needs of a rural audience, primary producers require further interpretation of the data, in particular for their region and commodity, written in plain English.

While the business case focussed on primary producers and their advisors as being the main users of seasonal forecasting tools on the internet, it also recognised other target audiences, especially natural resources managers, including Australia's 56 regional NRM bodies.

MCV agreed to support the business case and fund the Bureau in developing seasonal forecast tools and information. MCV agreed that, prior to any developing any products, a user needs analysis was important for providing more information about the perceptions, concerns and needs of the target users—farmers, advisors and natural resource managers.

2.2 Aim of user needs analysis

With this user needs analysis, we wanted to find out more about the perceptions, concerns and needs of target groups for seasonal forecasting tools and information on the internet. This information would inform development by the Bureau and MCV of web-based seasonal forecasting tools and information.

The target groups for the needs analysis were:

- primary producers and their advisors
- natural resource managers in rural and urban water authorities
- Australia's 56 regional NRM bodies

The set of tools and information proposed by the Bureau were selected by the Bureau based on its existing knowledge about producers and advisors, as shown in Table 1 below (data is taken from the business case). With this user needs analysis we wanted to provide more specific information to the Bureau on the proposed

products and to expand our knowledge about the needs of natural resource managers.

Table 1: Producer/advisor needs and proposed Bureau products

Producer/advisor need	Proposed Bureau product (tool/information)	Proposed development
Be able to understand probability easily.	Prediction products	Translate probability information into the likelihood of receiving specific rainfall amounts for specific periods.
Know what the current rainfall situation is and what it is likely to be in the future.	Rainfall plumes	Show cumulative rainfall to date, what are the likely projections based on historical data
A more formal system of assessing the status of El Niño events.	El Niño alert system	Develop an alert system that provides an El Niño 'watch', including warning and event alerts.
Clear explanations of climate scale phenomena.	Climate education products	Develop maps, risk management descriptions and case studies to help explain climate scale phenomena; review and recommend changes to existing education products, as appropriate.
Know when a crop will likely reach maturity, based on the number of days the temperature has been above a certain level.	Heat summation degree/day service	Further develop prototype products.
Know how to use climate information in a risk management framework.	Audio / video briefings	Conduct a pilot study to investigate the costs and benefits of providing climate information through audio and video presentations; provide risk management education products
Be able to easily find and select reputable products (tools and information) according to regions and / or commodities.	MCV website (linked to and from Bureau's WATL website)	In a user-friendly framework, offer links to products (tools and information) developed through MCV-funded research and other products that MCV chooses to support.

2.3 Methods of analysis

We began the needs analysis by interviewing 12 industry 'visionaries' with an excellent knowledge of their industry. This included representatives of primary industries, representatives of urban and rural water authorities, and a representative from a regional NRM body. See Appendix 1 for a detailed report of these interviews.

We used the findings from the visionary interviews to design two web-based surveys—one for farmers and one for regional NRM bodies—which we conducted in October 2007. We promoted the farmer survey publicly through rural media and relevant email lists. We promoted the NRM survey to regional NRM bodies through

personalised emails. See Attachments 2 and 3 of Appendix 2 for the list of survey questions.

We analysed the survey results both quantitatively and qualitatively, and a full report of the results can be found in Appendix 2. We conducted descriptive statistical analysis only. Resources were not available to comprehensively analyse the data according to industry, role, location, sex or age. For some survey questions, at the request of the Bureau, we compared the responses of farmers with those of advisors and summarised the responses by industry.

We reviewed the literature about the benefits and challenges of seasonal forecasting and the problems of communicating risk in seasonal forecasts. Our intern at Econnect Communication, Adriana Velez, did the review as part of her Master's thesis at The University of Queensland. See Appendix 3 for the relevant chapters of her thesis.

This report summarises the major findings of both the visionary interviews and the surveys, and includes relevant information from the literature review.

2.4 Survey respondents

2.4.1 Farmers and advisors

As with all online surveys, the respondents were self selecting. Therefore, our survey respondents represent farmers with regular and easy internet access rather than the Australian farming population as a whole.

A total of 499 people started the farmer/advisor survey, with almost 70% (334) completing it. Almost 85% of respondents were farmers with the remaining 15% being advisors. Figure 1 shows the respondents by industry.

Three quarters of the respondents were primarily involved in crops, grains or grazing, or a combination of crops/grazing. Compared to the 2005 Australian Bureau of Agricultural Resource Economics figures, there appears to be over-representation of mixed farmers, and slight over-representation of grain growers and cotton growers. There appears to be under-representation of graziers and dairy farmers.

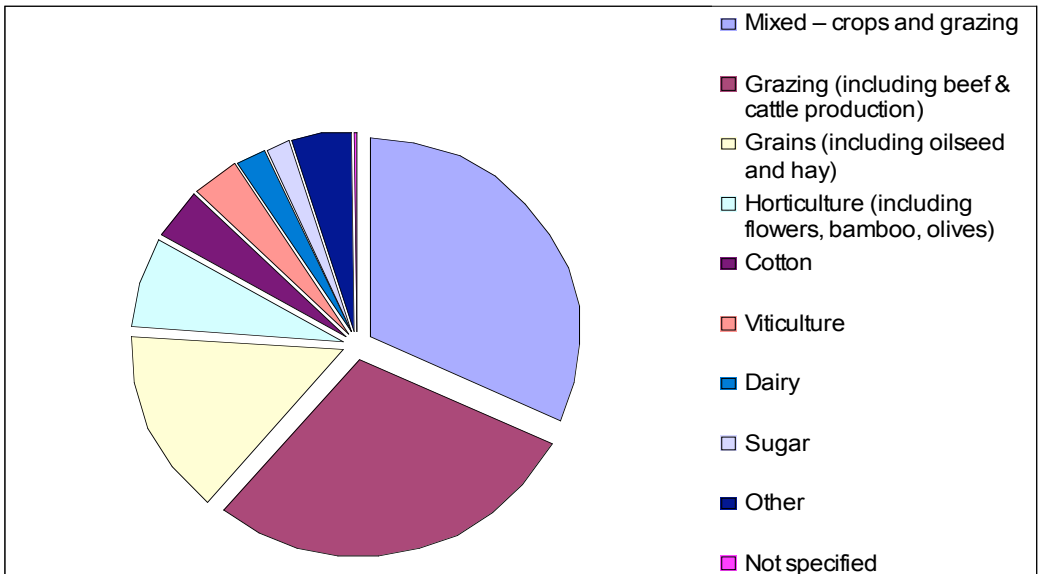

Figure 1: Farmer/advisor respondents by industry

A slight majority (62%) of respondents did not irrigate their crops. Almost half (45%) were from New South Wales, followed by Victoria (20%) and Queensland (13%). Most were males (85%) and aged 40 years or older (72%), with the largest number of respondents (43%) being in the age group of 40–54 years.

2.4.2 Regional NRM bodies

Of the 116 regional NRM body representatives who responded to the survey, about a third (35%) were from Queensland, followed by Victoria (19%) and New South Wales (17%). Ten regional NRM bodies did not respond to the survey.

The respondents' roles varied widely, but tended to be in the areas of water/river management, general management, facilitation, project officer, coordination, and monitoring and evaluation. The majority of respondents were male (58%) and were younger than 40 (51%), with most being in the age group of 26–39 years (39%).

3. Literature review

The literature helped us to find out more about our target groups for seasonal forecasting and about risk communication issues. We found that while there was some information to support the fact that farmers were using the internet for climate forecasting information, there was little information about what they were using and how they were using it. The following is a summary of the literature that is central to this user needs analysis. See Appendix 3 for details, including references.

Australian farmers have to manage their businesses in one of the most variable climates in the world (Deuter, 2006). Climate variability and its unpredictability are just two of several factors that they have to take into account.

The literature clearly suggests that developing skilful and opportune seasonal climate forecasts to help farmers cope with climate variability is critical to their survival. For example, several authors indicate that seasonal climate forecasts have the potential to improve farm profitability, minimise land degradation, assist with drought preparation and reduce vulnerability to future climate change (Hansen et al., 2005).

Seasonal forecasts are free, or relatively low cost, and the information they provide can be used across different enterprises. For instance, dryland croppers could make use of opportunistic crops in especially bad years (Hammer et al., 1996); irrigators could better manage planting dates (Dudley and Hearn, 1993); and graziers could manage herd size by predicting reproduction and mortality rates, and applying buying or selling strategies (Paull 2002).

Although Paull (2002) believes that primary producers are starting to use seasonal forecast information to guide their on-farm decisions, many still need more reassurance about the accuracy of the information.

Despite the perceived benefits, the literature also shows that seasonal forecast information still has significant applicability challenges that need to be addressed.

Firstly, the chaotic nature of climate limits the accuracy of the predictions. In other words, seasonal forecasts will always have a degree of uncertainty which can never be fully eliminated, and high levels of uncertainty require harder decisions.

Secondly, seasonal climate forecasts are probabilistic predictions and as such, they can neither be wrong nor right. So the challenge is to show farmers how to work with skilful yet uncertain information.

Finally, the probabilistic nature of the predictions means that the benefits from using the information are not immediate. The challenge is to help largely profit-motivated farmers understand the long-term benefits of using seasonal climate forecasts.

According to Hammer et al. (2001), probabilistic forecasts, unlike categorical predictions, are the best way to convey climate information because they are honest about the uncertainty of the information. However, there are some concerns that farmers might not be adopting forecast information because they simply do not understand the way it is presented.

For Nicholls (1999), the problem with probabilistic information is that people tend to use “cognitive illusions” or “rules of thumb” to simplify the decision making process. Cognitive illusions mean that people are more likely to adopt or accept new technology if it agrees on their initial views about them.

4. Use of seasonal forecast information

4.1 Levels of use

Most of the people we interviewed and surveyed are using seasonal climate forecast information in their management decisions. This includes 83% of farmers/advisors and 67% of regional NRM body survey respondents.

Most farmers/advisors reported accessing seasonal climate forecast information online either daily (44%) or weekly (35%), whereas NRM body representatives appeared to access it within a longer timeframe of weekly (23%) or monthly (26%). This was reflected in a comment from one of our NRM body respondents that their business is about long-term planning. Only six farmers/advisors respondents and 11 regional NRM body respondents said they never used the internet to access seasonal forecast information.

Farmer/advisor respondents were likely to access the internet using broadband (53%) or satellite connections (33%), with 14% still using dialup. Regional NRM body respondents (90%) were much more likely to have broadband access.

Although there is some overlap, the decisions for which seasonal forecast information is being used differ for farmers/advisors and regional NRM body representatives.

The most popular decisions for farmers/advisors include:

1. timing of seeding/planting (60%)
2. area of seeding/planting (56%)
3. timing of fertiliser (55%)
4. amount of fertiliser (50%)
5. stocking and de-stocking (49%)
6. crop/cultivar choice (49%)
7. timing of pest/weed/disease management (46%)

For regional NRM body representatives, the most popular decisions using seasonal forecast information were:

1. providing advice to landholders/farmers about their practices (48%)
2. timing of tree planting (46%)
3. strategic planning for the catchment (46%)
4. recommending land practices that need to be changed in the catchment (44%)
5. timing of pest management (44%)

Most farmers/advisors indicated that would like seasonal forecasts in March (64%), April (65%) and September (64%). However, there was no time during the year that at least 33% of farmers/advisors would not find a seasonal forecast useful. For regional NRM body respondents, September was the most popular month for seasonal forecasts (58%). However, more than 40% of them found all other months to be useful too.

The industry visionaries correctly predicted that the majority of farmers, advisors and water authorities are using seasonal forecast information in their management decisions. Only a small percentage (17%) of the farmers and advisors who we surveyed indicated that they did not. Farmers and advisors who reported not using

seasonal forecast information said that it was not reliable enough (65%), or not specific enough for their region (41%). Only 3% listed complexity as a deterrent; see Figure 2 below. The people who nominated 'other' cited being a first time user or new to seasonal forecasting. Others said they found seasonal forecasting to be inaccurate, which backs up the 'unreliable' quantitative result listed above.

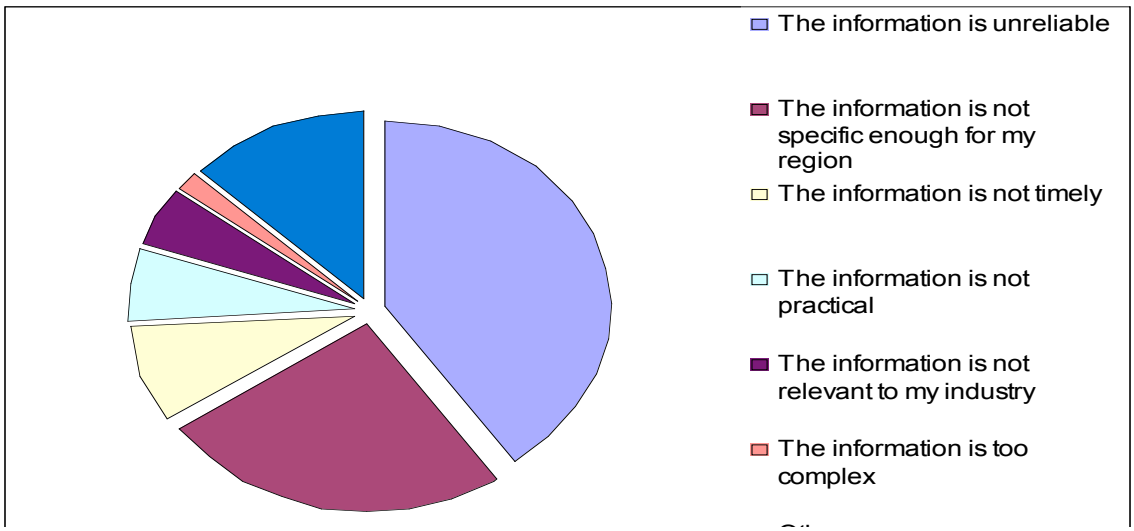

Figure 2: Reasons why farmers/advisors do not use seasonal forecast information

Our horticulture visionary indicated that the information was generally not relevant enough for his industry, and that the nature of horticulture meant that farmers were too 'time poor' to make use of the current tools.

About a quarter (28%) of NRM body respondents reported that their organisation did not use seasonal forecast information for a variety of reasons. Some said that the information was not required because they did not plan at that level of detail, or because they did limited on-ground work. For others, the forecast period was seen to be too short for long-term planning in their business. Floods, for example, can not be predicted months ahead. Others said that the information is hard to access due to its low availability and their lack of time and resources to pursue it. Some respondents also noted that their organisations had not recognised the importance of seasonal forecasting information until recently.

For some natural resource managers (both visionaries and survey respondents), seasonal climate forecast information was used more informally at the project scale in liaison with other natural resource managers or landholders, or on an interest basis. However, many of them saw potential in applications such as aquifer modelling, wet season monitoring, and tree planting. One respondent said that they did not use the information but believed that many landholders did.

Throughout the surveys, respondents were concerned about the accuracy and reliability of seasonal forecasting. While these are improving, it may indicate that there is a lack of understanding of forecast information.

4.2 Important weather elements

Most of the farmers/advisors surveyed (96%) said that seasonal forecasts of the amount of rainfall were important or very important. Other important elements were rainfall intensity (59%), frost occurrence (58%), air temperature (56%) and wind (55%). For these users, sea surface temperature was the least important weather element to be forecast. See Figure 3 for details.

The majority (95%) of NRM body respondents also saw rainfall amount as being important or very important, followed by rainfall intensity (78%), air temperature (65%), frost (50%) and wind (55%). NRM body respondents were more likely to see sea surface temperature and evapotranspiration as moderately important. This might suggest that they have a greater understanding of the importance of sea surface temperatures for seasonal forecasts and evapotranspiration for water balance.

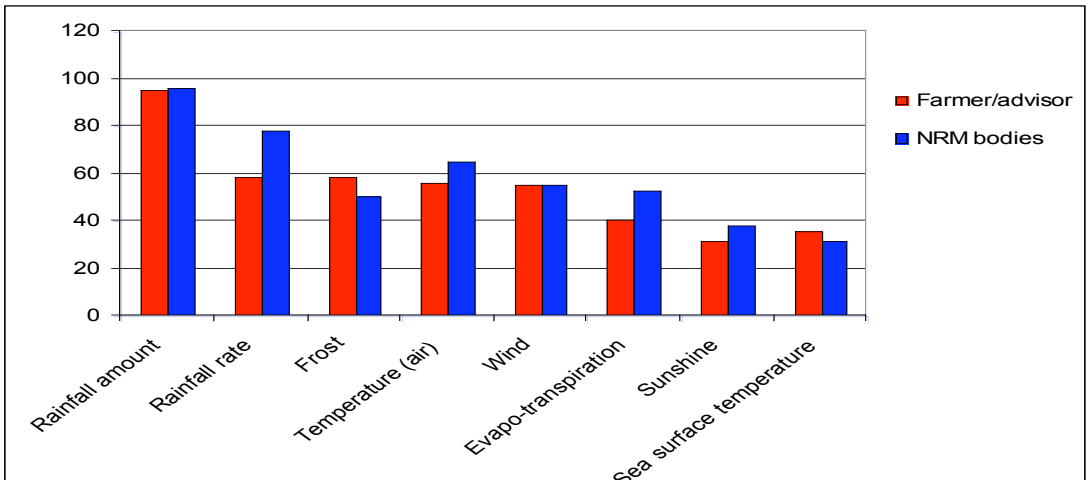

Figure 3: Weather elements seen as important or very important

4.3 Sources of seasonal forecast tools and information

4.3.1 Sources of seasonal forecast information

The vast majority of the farmer/advisor respondents (92%) and regional NRM body respondents (96%) rated the Bureau as an important or very important source of seasonal forecast information. See Figure 4 for details.

However, 74% of farmers/advisors and 65% of regional NRM body respondents said that other websites, such as Elders, were also important or very important to them as sources of seasonal forecast information. This indicates that people do not distinguish between weather and climate; the Elders site does not provide seasonal forecasts but provides daily forecasts over a 4-week period.

The Bureau website was ranked well above agribusiness advice as a source of information, which was rated moderately important by most regional NRM body respondents, with about a third (32%) of farmers/advisors rating it as not important.

Half of the surveyed farmers/advisors and half of the visionaries said they are regular visitors to the Bureau's WATL site, compared to only 21% of NRM body respondents. It is important to note that the survey was promoted on the WATL site. However, about a third (30%) of all survey respondents had never heard of WATL. Our visionaries suggested that the degree to which WATL is accessed is dependent on circumstances such as drought or warm weather. In general, they thought that WATL was not well known and needed to be promoted more.

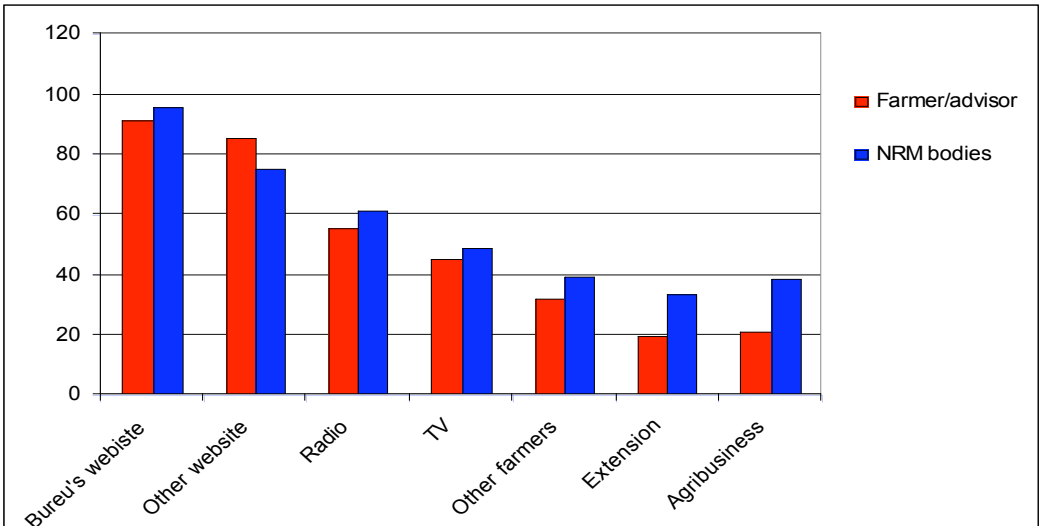

Figure 4: Sources of seasonal forecast information rated as important or very important

4.3.2 Seasonal forecast tools

Of the seasonal forecast tools presented in the survey for comment, both farmers/advisors (74%) and regional NRM body representatives (65%) rated the Bureau's seasonal outlook, including the ENSO wrap-up, as the most important to them. Farmers/advisors (65%) and regional NRM body representatives (52%) also rated the Southern Oscillation Index as important or very important. Other tools (Madden-Julian Oscillation, Indian Ocean Dipole, and RainMan) were generally rated as moderately important by all survey respondents. See Figure 5 for details.

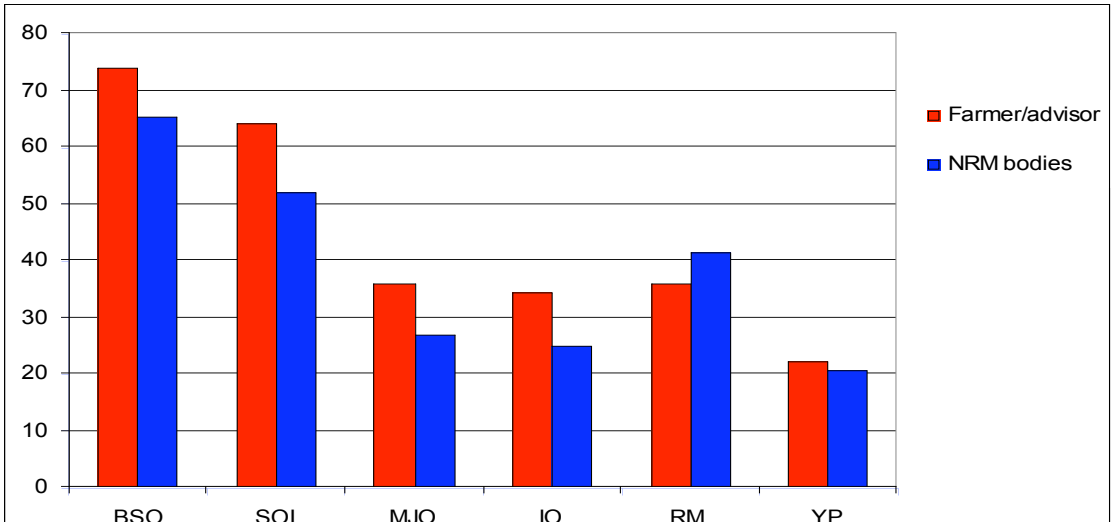

Figure 5: Seasonal forecast tools rated as important or very important

BSO: Bureau's seasonal outlook
SOI: Southern Oscillation Index
MJO: Madden-Julian Oscillation
IO: Indian Ocean dipole
RM: RainMan
YP: Yield Prophet

4.4 Internet needs

Maps and images, supported by text, are preferred by the vast majority (90%) of our survey respondents. This may reflect that most respondents have broadband access in some form and, therefore, would not have difficulty downloading images. However, since our survey was administered online and involved maps, images and text, our results may be skewed toward those with higher internet speeds.

A slight majority of farmers/advisors preferred to read information in detail online (55%), whereas NRM body representatives were twice as likely to prefer to scan (60%) than to read in detail online (31%). Few respondents of either survey preferred to download to print or read offline.

5. Proposed Bureau products

We asked the industry visionaries and survey respondents to answer a series of questions about the proposed Bureau products. The questions were accompanied by maps, graphs and tables (see Appendix 1, section 7, for the complete list of visionary interview questions; see Appendix 2 for the complete list of survey questions).

The visionaries and survey respondents were generally supportive of all the proposed products, with less than 5% considering them not relevant to their business.

A common theme from all our feedback on the proposed products was that visionaries and survey respondents wanted the ability to tailor the information presented in the maps, graphs and tables. For example, they wanted to have the option of selecting timeframes, geographical scales, probabilities, rainfall amounts, percentiles and base temperatures. They wanted information to be more specific, detailed and localised.

The accuracy of the information was also a recurrent issue in the feedback on the proposed products.

5.1 Seasonal forecast products for rainfall

5.1.1 Usefulness

We asked industry visionaries and survey respondents to rate the usefulness of two proposed seasonal forecast maps for rainfall and a tabular version at Bureau rainfall station scale. The first map showed how much rainfall was forecast across Australia for a fixed percentage probability (75% in the example). The second map showed the percentage probabilities of receiving at least a fixed amount of rainfall (150 mm in the example) across Australia. The tabular version listed the percentage chances of getting a fixed amount of rainfall at the Bureau's rainfall stations.

The industry visionaries were generally positive about the proposed products. They saw them as better than the current probability of exceeding the median map, which they perceived as conducive to errors by users in interpreting probabilities. Survey respondents were also positive about the products, with the 'fixed probability' map seen as being the most useful. See Table 2 for a summary of survey responses.

Table 2: Usefulness of proposed rainfall products

Product	Farmer/advisor rating		Regional NRM body rating	
	Useful or very useful	Not useful or not very useful	Useful or very useful	Not useful or not very useful
Map showing 75% chance of getting an amount of rainfall	80%	5%	65%	3%
Map showing the different chances of getting 150mm of rainfall	77%	13%	60%	9%
Table showing rainfall probabilities X amount X rainfall station location	75%	14%	66%	11%

5.1.2 Usefulness of historical data

Survey respondents were asked whether the two rainfall maps discussed above would be more useful if they were accompanied by the historical average or deciles. In both cases, as illustrated in Table 3, survey respondents supported this idea.

Table 3: Usefulness of historical average or deciles

Product	Farmers		Advisors		Regional NRM bodies	
	Useful	Not useful	Useful	Not useful	Useful	Not useful
Map showing 75% chance of getting an amount of rainfall	83%	17%	94%	6%	80%	20%
Map showing the different chances of getting 150mm of rainfall	80%	20%	87%	13%	77%	23%

As can be seen in Table 3, advisors who responded were particularly interested in getting this extra detail. We also looked at how useful the different primary industries found historical averages or deciles. The majority of respondents in all industries (>60%) rated the historical average or deciles as useful additions to both maps. For most industries, except horticulture and viticulture, more than 80% of survey respondents saw historical averages and deciles as being useful in both maps. This was particularly true for the map showing 75% chance of getting an amount of rainfall.

5.1.3 Preferred rainfall percentages and amounts

We asked survey respondents about their preferred percentage for the map showing rainfall amounts for a fixed probability (75% in the example). Both farmer/advisor (33%) and regional NRM body (30%) respondents chose 75%, as presented in the map. The next preferred percentage was 80%, which was preferred by 24% of farmers/advisors and 19% of regional NRM body respondents. In response to an open question, most survey respondents stressed their need for more emphatic forecasts (75% or higher) for the forecast to be useful to them in making decisions.

With the second map, which showed rainfall probabilities for a fixed amount (150 mm in the example), we asked survey respondents what rainfall amounts they would prefer to see. The most preferred amount by 48% of farmers/advisors and 28% of regional NRM body respondents was 50 mm. The next preference was for 120 mm by 18% of farmers/advisors and 23% of regional NRM body respondents.

In other comments, survey respondents and visionaries made it clear that the preferred deciles and amount of rainfall would depend on location and time of year.

5.1.4 Scale of maps

We asked survey respondents if they preferred the rainfall maps to be national, by state, or at some other scale. With the second map (probabilities for a fixed amount of rainfall), we also asked about a regional scale. All respondents showed a slight preference for state and regional scale maps, but a number of respondents and industry visionaries said they would prefer to select different scales according to their needs at the time. Generally, people want as much detail as they can get.

5.1.5 Forecast periods

The examples of the two proposed rainfall maps that we showed to industry visionaries and survey respondents were for a three-month forecast period. We asked them for their preferred forecast period. Farmers/advisors and regional NRM body respondents all preferred forecast periods of one or three months (see Table 4). Other options such as one week, two months, six months and 12 months scored less than 16%. However, again, respondents and visionaries wanted the flexibility of being able to choose a forecast period according to their needs and the season.

Table 4: Preferred forecast periods for rainfall maps

Product	Farmers/advisors preference		Regional NRM bodies preference	
	One month	Three months	One month	Three months
Map showing 75% chance of getting an amount of rainfall	28%	28%	32%	27%
Map showing the different chances of getting 150mm of rainfall	32%	28%	27%	41%

5.1.6 Forecast lead times

We asked survey respondents their preferred lead time for the two rainfall forecast maps. Most respondents preferred a one-month lead time for both maps. Lead times of six months or longer were selected by very few respondents (less than 8% for both surveyed groups). See Table 5 for a summary of survey responses.

Table 5: Preferred forecast lead times for rainfall maps

Product	Farmers/advisors preference			Regional NRM bodies preference		
	One month	Two months	Three months	One month	Two months	Three months
Map showing 75% chance of getting an amount of rainfall	48%	19%	21%	48%	21%	24%
Map showing the different chances of getting 150mm of rainfall	53%	20%	18%	48%	21%	24%

5.1.7 Tabular by rainfall station

We asked survey respondents to provide any additional comments about the usefulness of the tabular version of the seasonal rainfall forecast. Some respondents preferred the table to the maps because the information was more localised and specific, but others said it was harder to visualise. A few others suggested having both the maps and the table for a more complete picture. The industry visionaries suggested that the maps and the tabular version are particularly complementary as a set.

5.2 Rainfall scenarios (the 'plume')

We asked the industry visionaries and survey respondents for feedback on a rainfall scenario graph, or 'plume'. The graph showed rainfall to date at a specific location, from a given start date, and the projected rainfall for the rest of the year based on historical record. The forecast rainfall was shown at different percentiles of probability.

Although some of the visionaries and the majority of survey respondents (63% of farmers/advisors and 55% of NRM body respondents chose 'useful' or 'very useful') were very supportive of this product, there were concerns that its complexity would limit its usability. The majority of farmers/advisors (65%) and regional NRM body respondents (58%) said the graph was understandable. However, a significant number (32% of farmers/advisors and 42% of regional NRM body respondents) found it a 'bit hard to understand'. This was backed up by the open comments on the graph which suggested that it be accompanied by explanatory text.

There was not a clear preference for any of the suggested time periods for the proposed graph product, but the most popular alternatives were three, six and 12 months. However, as shown in Table 6, regional NRM body respondents favoured the longer time period of 12 months, while there was a slight preference by farmers/advisors for three months. The 6-month forecast period was preferred by half of the visionaries. Survey respondents could select as many time periods as they liked, and the results indicate that they would like to be able to choose different time periods depending on their needs and the time of year.

Table 6: Preferred time period for plume forecast

Time period	Farmers/advisors	Regional NRM bodies
1 month	34%	38%
2 month	15%	8%
3 months	46%	48%
6 months	44%	51%
12 months	40%	54%

Survey respondents were also asked about their preferred forecast percentiles to be displayed on the graph (the example showed projections based on the 10^{th}, 50^{th} and 90^{th} percentiles). The most popular options for both survey respondents and visionaries were the 10^{th}, 50^{th} and 90^{th} percentiles. It is important to highlight that 17% of farmers/advisors and 10% of NRM body respondents said that they did not understand the percentile question. This could reflect the complexity of the graph or limited understanding of statistical terms such as 'percentile' and 'mean'.

5.3 Cumulative degree days

We asked visionaries and survey respondents for feedback on a graph that showed the accumulation of temperature above a set threshold over time. This product is applicable to those concerned with plant growth. In particular, industry visionaries from horticulture, irrigated cropping and viticulture expressed interest in this product.

More farmers/advisors (66%) than regional NRM body (54%) survey respondents were interested in a seasonal forecast for growing degree days. More farmers/advisors (64%) than regional NRM body (44%) respondents also found the

cumulative degree day graph useful or very useful. This could reflect the fact that half of the regional NRM body respondents found the graph a bit hard to understand, compared to 28% of farmers and 12% of advisors who responded. We also compared the understanding of respondents by primary industry. Those involved in grazing only (37%) and mixed crop and grazing (29%) were the industries most likely to state they found the graph 'a bit hard to understand'. All of the 10 cotton growers responding to the survey said they understood the graph.

Approximately one third of farmers/advisors and regional NRM body respondents chose 10 °C as their preferred base temperature for the growing degree days graph. There were no differences between farmers and advisors, yet there were discrepancies between the different industries represented in the survey. For instance, cotton growers suggested 12 °C as an option. As our visionaries pointed out, the base temperature chosen depends on the crop being grown and there needs to be flexibility in choosing the base temperature.

Our urban water authority visionary said that the number of days over 35°C would also be useful.

In general, 50% was chosen by farmers, advisors and regional NRM respondents as the best percentile for comparing temperature accumulation on the graph. However, other percentiles (see Table 7) also received support from all groups. Again, respondents want the ability to choose their own percentiles.

Table 7: Preferred percentiles for comparing temperature accumulation

Percentile	Farmers	Advisors	Regional NRM bodies
10	40%	29%	50%
25	28%	50%	41%
50	63%	75%	65%
75	28%	42%	41%
90	34%	29%	44%

September was the preferred start date for temperature accumulation for both farmers/advisors (39%) and regional NRM body respondents (38%). However, NRM body respondents were just as likely to choose July (38%).

Our horticulture visionary reported that they would benefit from a start date on every day of the year, whereas our urban water authority visionary indicated that the summer months were the most important for their decision making; as temperature accumulates over summer, so does water consumption.

We asked whether a similar product for cooling degree days (temperature below a certain threshold) would be useful and 40% of farmer/advisors and 36% of regional NRM body respondents said they would find this useful. However, 28% of farmers/advisors and 40% of regional NRM body respondents said they did not know if it would be useful. For those who did think it would be useful, 33% of farmers/advisors and 23% of regional NRM body respondents selected 2 °C as the preferred base temperature. Our viticulture and horticulture visionaries said it would be useful for their industries, with some fruit needing a winter chill and others needing to avoid frosts.

5.4 El Niño/La Niña alert system

We asked the industry visionaries and survey respondents about their interest in an El Niño/La Niña alert system. Most of the visionaries and the majority of the farmers/advisors (80%) and regional NRM body respondents (69%) said they were interested. Likewise, 82% of farmers/advisors and 83% of regional NRM body respondents said that they would find it useful or very useful.

However, the survey respondents and visionaries were concerned that the proposed alert system would not include climate drivers such as the Indian Ocean, which is more relevant in some parts of the country than other drivers.

Some people (including our cropping visionary from WA) were also concerned with the timing of the alerts and perceived that they often received such information too late for it to be useful.

Most survey respondents preferred a greater level of detail with the alerts, with two thirds of all respondents wanting some commentary that synthesises the detail, and about a third of all respondents wanting to see the list of atmospheric and oceanic criteria that have been met in reaching the alert level given.

Most of the farmers/advisors (66%) and regional NRM respondents (54%) preferred to receive the alert information by looking on the Bureau's website. Email was the second favoured method of notification for farmers/advisors (26%) and regional NRM body respondents (35%), with some people requesting a combination of both methods. None of our survey respondents were interested in receiving alerts via SMS.

5.5 Education and information products

5.5.1 Overall interest

The proposal of producing climate education products was received positively by most of farmers/advisors (76%) and NRM body (82%) survey respondents. They found most of the suggested topics of at least moderate use. Information on seasonal forecast maps and graphs, the driving forces behind Australia's regional climate, how the Indian Ocean affects our climate, and managing climate risk were found to be the most useful topics. See Table 8 for a summary of the survey responses.

Table 8: Usefulness of climate education topics

Topic	**Farmers/advisors rating**		**Regional NRM bodies rating**	
	Useful or very useful	Not useful or not very useful	Useful or very useful	Not useful or not very useful
Seasonal forecast graphs and maps	87%	3%	88%	0%
How the Indian Ocean affects our climate	86%	4%	72%	6%
The driving forces behind Australia's regional climate	85%	1%	88%	4%
ENSO/Southern Oscillation Index	76%	7%	74%	2%
Managing climate risk	77%	6%	82%	4%

Topic	Farmers/advisors rating		Regional NRM bodies rating	
	Useful or very useful	Not useful or not very useful	Useful or very useful	Not useful or not very useful
Madden-Julian Oscillation	70%	12%	60%	12%
Using probabilities	59%	14%	50%	14%
Stories about farmers managing risk	57%	17%	73%	7%
Terminology – median, deciles, percentages etc	52%	16%	46%	14%

Some of the industry visionaries were sceptical about farmers' abilities to currently understand the information. However, the people we consulted generally agreed that climate education products could be potentially useful if presented and explained plainly and clearly.

5.5.2 Audio and video briefings

We asked about interest in audio/video briefings about seasonal forecasting being available for download from the internet. Less than half of our farmers/advisors (44%) and just over half of our regional NRM body respondents (53%) expressed interest. However, time permitting most farmers/advisors (67%) and regional NRM body respondents (68%) said they were willing to watch a video briefing on the internet. Farmers and advisors (56%) and regional NRM body respondents (41%) would also listen to an audio briefing on the internet, but only about a quarter of farmers/advisors and about a third of regional NRM body respondents would download a video or audio briefing to watch or listen to later.

Some of our industry visionaries thought audio/video briefings on the internet would be useful if they were well produced, had quality presenters, and offered optional layers of complexity.

6. Climate risk management website

In our survey, both farmers/advisors (94%) and NRM bodies (91%) expressed strong support for a 'one-stop shop' climate risk management website with links to reputable sources of tools and information. Aside from the crucial importance of the information for managing their enterprises, they also believed it would save them valuable time. To this effect, they requested that the website be kept as concise as possible to maximise its efficient use and make it accessible to everyone.

They stressed that the information presented needed to be simple, clear and credible. Some people admitted that they were ill-equipped for using currently available sources of information, and would be interested in having the website offer more detailed education and training that included information on interpreting probabilities and climate risk.

Again, accuracy and reliability of the information was of primary concern to the people we consulted.

There were some regional concerns about information being valid for only some parts of Australia. For example, one survey respondent pointed out that managing climate risk in northern Australia was very different than in the southern part of the country.

Some of our visionaries said that using the MCV website as the 'one-stop shop' might depend on the industry. For example, cotton growers, who already have a website specific to their industry, might not be interested in looking elsewhere. Many of our visionaries reported having their own preferred links for forecast information, but were also supportive of the MCV website having links as long as the information was relevant (sorted by industry), reliable, and validated.

7. Discussion and recommendations

There is no doubt that this user needs analysis has confirmed the importance of seasonal forecasting tools and information on the internet for farmers, advisors, natural resource managers and regional NRM bodies. These groups are supportive of each of the Bureau's proposed seasonal forecast products and of the concept of linking the Bureau's WATL website with a new website dedicated to climate risk management. In fact, the most positive response (>90%) by all survey respondents was for a 'one-stop-shop' website with links to reputable sources of climate risk management tools and information.

This user needs analysis has identified:

- the levels of use of internet-based seasonal forecasting information
- people's preferred seasonal forecast tools and information, and their sources
- people's internet needs and preferences
- what people need from seasonal forecasting on the internet
- what people think about the Bureau's proposed seasonal forecasting products, and what changes they would like to see
- what people education information people need about seasonal forecasting

We also recommend further research analysis of the data collected to explore the needs of specific groups of users, such as female farmers.

7.1 Levels of use

Farmers and advisors are using seasonal forecast information at a higher level than those involved in natural resource management. This suggests that the information is more important to the day-to-day operations of farmers than natural resources managers. However, it also suggests that there is a lower awareness by natural resources managers about the potential benefits of seasonal forecasting information to their business. This conclusion is backed up by the low number of regional NRM bodies that are aware of the Bureau's WATL website.

We recommend that the Bureau and MCV continue to raise awareness of their websites with farmers, but that they also extend this to natural resources managers.

People that use seasonal forecasting information on the internet tend to do so because they want to make decisions about on-ground activities. These decisions are generally about timing; for example, the timing of seeding/planting, fertiliser application, stocking or de-stocking, tree planting and pest/weed control.

We recommend that in developing seasonal forecast tools and information, MCV and the Bureau continue to recognise the importance of timing for target groups.

People who do not use seasonal forecasting information largely explain this as being because the information is unreliable or not specific enough to their region.

We recommend that MCV and the Bureau continue to invest in research to make seasonal forecasts more reliable and accurate, and continue to expand the applicability of seasonal forecasting tools on an industry, regional and local basis.

7.2 Preferred seasonal forecasting information, sources and tools

The people we consulted want seasonal forecast information about the following weather elements, in order of importance:

1. rainfall amount
2. rainfall intensity
3. frost
4. air temperature
5. wind

We recommend that the Bureau and MCV prioritises further development of seasonal forecasting tools accordingly. However, we recognise that the Bureau's role is focused on developing tools based on seasonal forecasting information and that they do not have a role to link seasonal forecast information with specific crop and soil information. Such work is carried out by other agencies including those involved in MCV research.

The Bureau's website is the preferred source of seasonal forecast information for the people we consulted. This backs up the findings of the business case which drove this user needs analysis. However, other target users are also accessing other websites for seasonal forecast information, especially those websites targeted to their specific needs. As mentioned above, all users were very supportive of having a 'one-stop-shop' website that linked to credible sources of seasonal forecast information.

We recommend that MCV develop their website as a 'one-stop-shop' portal or entry point to seasonal forecast tools and information, including the WATL site. The MCV site would continue to host the most up-to-date information on MCV research, but would also link to other relevant sites with seasonal forecast tools and information. We recommend that MCV identify other reputable seasonal forecast websites for linking to from the MCV website.

The people we consulted are accessing all of the major seasonal forecast tools currently available, especially the Bureau's seasonal outlook and the Southern Oscillation Index.

7.3 Internet needs and preferences

The majority of users indicated they had high speed internet access and that, for seasonal forecast content on the internet, they preferred:

- to see content as maps and images, supported by text
- to have the option to read more detail and explanation
- to view content online (rather than print off)

We recommend that the Bureau and MCV provide simple and clear seasonal forecast diagrams, maps and pictures with clear explanatory text, explicitly written for the web, and information in layers so that people can access as much or as little detail as they need.

Information recorded in video and audio will be accessed directly online by some users. However, given there was not strong support for these products, we recommend that only short segments on high priority topics be produced and with well respected speakers.

7.4 What people need from seasonal forecast products

We identified that people have common needs from seasonal forecasting tools and information on the internet. They wanted more accurate information, and information that was more specific to their specific location. They also wanted more flexibility in choosing:

- the scale, from local to national
- the forecast period
- the lead time
- the starting time
- the probabilities they want to see rainfall amounts for
- the rainfall amounts they want to see probabilities for
- the base temperature to use for calculating growing degree days

We recommend that the Bureau and MCV make their seasonal forecasting tools as flexible as possible to allow users to choose the variables that best suit them at the time.

7.5 Feedback on the Bureau's proposed products

We identified specific needs for each of the proposed new forecast maps, table and graphs as proposed for WATL. We recommend that the Bureau refer to these needs before developing these products further. It is also important that the products are flexible so that people can choose the variables that best suit them at the time.

The Bureau should consider prioritising development according to the usefulness ranking in Table 9.

Table 9: Usefulness of Bureau's proposed products

Product	**Farmers/advisors rating**	**Regional NRM bodies rating**
	Useful or very useful	Useful or very useful
El Nino alert system	82%	83%
Map showing 75% chance of getting an amount of rainfall	80%	65%
Map showing the different chances of getting 150mm of rainfall	77%	60%
Table showing rainfall probabilities X amount X rainfall station location	75%	66%
Rainfall scenarios graph	63%	55%
Cumulative degree days	66%	44%

7.6 Preferred seasonal forecasting education products

We identified that all groups would find additional seasonal forecast explanations useful, especially explanations of seasonal forecast graphs and maps, how the Indian Ocean affects our climate, and the driving forces behind Australia's regional climate.

Some of the survey respondents had difficulty interpreting the rainfall scenario graph (plume) and the cumulative degree day graph, and had difficulty with terms such as percentile and median. We recommend that the Bureau address these problems by developing and testing graphs and accompanying them with easy to understand narrative.

We believe this provides further support for our previous recommendation to provide layered information on the internet that allows users to access more detail and complexity as required.

7.7 Further analysis of the data and research

We have only analysed the survey data in a descriptive manner. We recommend that the comprehensive data we have collected be further analysed to see if there are any significant differences between different demographic groups (e.g. age, sex), between different industry groups (for farmers/advisors), between different geographic groups and between the different roles of the regional NRM body respondents. This would assist with further targeting communication. For example, MCV's new northern Australian team could investigate the responses from people living above the Tropic of Capricorn.

The respondents to the survey were self selecting, and given that it was an online survey with graphics, it is likely that only those with broadband access completed the survey. We recommend further research to identify the barriers and opportunities for target users who do not have fast internet access to accessing seasonal forecast information.

7.8 Bureau–MCV communication

We recommend that the following communication activities be included in any communication plans and strategies being developed by the Bureau and MCV:

- pre-test any further development of the proposed products with a sample of target users
- increase the awareness of target users, especially regional NRM bodies and natural resource managers, of the benefits of using seasonal forecast tools and information
- work with target users, in a participatory style of science communication, to write clear explanations of climate terms (percentile, median, etc) and climate risk that can be included in seasonal forecast information on the internet
- create seasonal forecast content specifically for the web, including as a series of layered chunks of narrative from brief and simple explanations that can be scanned quickly, to more detailed explanations