CLIMAG

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Masters of the Climate discovered

A national competition, Masters of the Climate, recently investigated how Australian landholders use climatic information to make better land management decisions.

Leading rural affairs commentator and Chairman of the Masters of the Climate Steering Committee, Mr Neil Inall, said the competition was a great way of finding little known or clever innovations being pioneered by farmers or land managers to better manage seasonal climate variability.

"Seasonal variability is an absolute given here in Australia, so it was impressive to see how land managers are making the most of climate data to reduce the impact of adverse seasons," Mr Inall said.

A steering committee consisting of seven climate experts from across Australia selected the winning entries from each state. The winners were:

Jeff Hoffman from Lockhart, New South Wales, who commenced serious climate analysis in 1986 and incorporated a combination of 112 years of rainfall records and thirty years of farming experience to submit a winning entry.

Ian McEwan utilises international expertise from the University of Maryland, US, and satelite images from Japan to make land-management decisions on his 1,050 hectare property in Donald, Victoria.

Dick Shaw's unique enterprise of passionfruit, tamarillo and avocado growing in Devonport, Tasmania, became a state winner for the combined use of regional, Australian, New Zealand, African and U.K. temperature data.

At the top of Lake Eyre, South Australia, **Tony Boyd** uses the sea surface temperatures of the Indian and Pacific Oceans to manage his 650,000ha more effectively.

Western Australian winner, **Erland Happ**, from Dunsborough has managed to differentiate grape flavours on his 37 hectare property by incorporating a 'heat load' technique into land management decisions.

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CVAP Climate Variability in Agriculture R&D Program

The Climate Variability in Agriculture R&D Program is administered by LWRRDC and jointly supported by the following organisations

Agriculture Fisheries Forestry Australia

RIRDC Rural Industries Research & Development Corporation

GRDC Grains Research & Development Corporation

National Farmers' Federation Australia

Dairy Research and Development Corporation

Sugar Research and Development Corporation

Land & Water Resources Research & Development Corporation

CVAP News

Toowoomba meeting

The recent CVAP Committee meeting in Toowoomba was an important opportunity to hear about the wide range of research projects underway (see photo right). CVAP is funding several national projects which build on the pioneering role Toowoomba researchers have in applications of climate forecasting.

In addition to projects involving the Queensland Centre for Climate Applications, there were also presentations from other researchers as featured in this edition.

Other outcomes of the meeting included plans for a meeting later in the year in Western Australia, as well as a mid-term review of the current phase of CVAP.

The meeting also marked the end of Alan Wilson's involvement in CVAP through WOOLMARK. The Committee recognised the contributions he has made to the program over many years.

CVAP Committee members George Wilson (Rural Industries R&D Corporation), Rob Troedson (Sugar R&D Corporation) and Robert Douglas (National Farmers' Federation) at the Toowoomba meeeting.

About CLIMAG

Climag, as the newsletter of the Climate Variability in Agriculture R&D Program (CVAP), has an important role in promoting the overall goal of the program:

"To work with the Australian agricultural sector to develop and implement profitable and sustainable management strategies which prepare it to respond to the major opportunities and risks arising from climate variability."

CVAP is a national R&D program administered and supported by the Land and Water Resources R&D Corporation (LWRRDC). The major stakeholder in CVAP is Agriculture, Fisheries and Forestry - Australia (AFFA).

Four other R&D Corporations (see page 1) also currently support CVAP through funding for generic projects and for partnership funding of projects of value to their specific industry or charter.

CLIMAG Reader Feedback

The first edition of *Climag* included a questionnaire to survey readers' responses to the newsletter. These survey results have been analysed by Capital Public Affairs Consultants (CPAC).

For the close to 300 respondents who completed the questionnaire with their registration form, 80% of responses to the five statements were positive.

The statements included relevance, layout, readibility, level of technical detail, as well plans to follow-up on information included in the newsletter.

The level of technical detail was clearly one aspect where it is difficult to get it right for everybody.

This is primarily because the audience for *Climag* is wide and varied — including climate and agricultural researchers as well as those interested in applications across a range of industries. The best compromise is to provide further contacts for readers wanting to follow up on more detail.

There was an encouraging, even overwhelming response on interesting topics readers would like covered. The 130 suggestions could be grouped under some more general themes, particularly:

- More case studies on what farmers are doing now;
- Regular updates on current CVAP projects; and
- More regional information including potential application of forecasts.

This issue picks up on these themes, for example the Masters of the Climate cover story, reports on several of the new projects (pages 6-9) and rules of thumb for southern Australia on the back page.

CVAP WebSite

A comprehensive site for readers wanting to access more detail on projects, reports, and general information on CVAP is now available. Have a look at <www.cvap.gov.au>.

CVAP Factsheets

A set of two-page factsheets will soon be available on the current and recent projects funded by CVAP. These factsheets will be available in both printed form as well as on the CVAP WebSite. For enquiries contact LWRRDC (see back page).

Predicting wheat crops using climate forecasts - what have we learnt?

Guest Spot

By Graeme Hammer and Roger Stone *

The 1997 and 1998 wheat seasons contrasted beautifully — emerging El Niño leading into 1997 and the breaking of the El Niño leading into 1998.

Despite disparities among climate models early in the year (as discussed by Neville Nicholls in the last issue of *Climag*), by the end of May the tried and true statistical systems and many of the models were giving clear signals. Although more lead time would have been useful, this was still enough to act on. So how do we get from climate forecast to wheat?

The statistical systems based on the SOI give us historical analogue years that can be used with our crop models. The analogues are just those years in the historical record that have SOI patterns up to May similar to the current year. The seasonal weather projections from those years are used to drive the wheat crop simulation.

There may be 15-20 analogue years, so we end up with a range of possibilities, not a single forecast. The direction of shift in likely wheat yield reflects the direction of shift in likely rainfall, but that is about the extent of the similarity. Yield is affected greatly by timing of rainfall, soil conditions at sowing, and many other factors.

We know that below average rain can sometimes give above average yield and vice-versa. So what happened leading into 1997 and 1998?

In May of 1997 and 1998, after doing the simulation analyses for representative locations in the wheat belt, we issued media releases and other advisories indicating that chances of exceeding long term median yield were reduced in 1997 (25 - 40% depending on location) and increased in 1998 (58 - 74%). If there was no forecast skill this would be 50%.

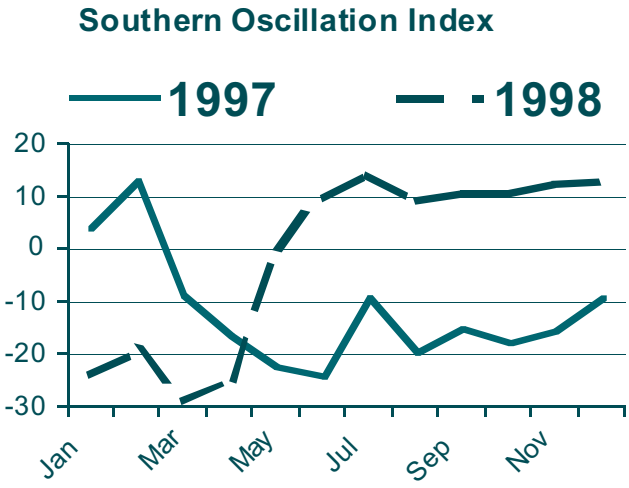
Note that this was not a forecast of low yield in 1997 and high yield in 1998. It was a forecast of a shift in likely yield distribution either down (1997) or up (1998). The medians of these distributions were 25% below (1997) and 22% above (1998) long-term expectations.

We had also worked closely with local farmers and advisors in analysing risks associated with various crop management decision options that might be appropriate in responding to this increased awareness of the season ahead.

So what eventuated in 1997 and 1998? In 1997 there was a lot of science and media-driven hype about the El Niño. The implication was that this would lead to a huge drought in Australia. We know that this is not always the case.

What eventuated (in general) was a below average rainfall season, but with timely rain in September giving a reasonable national wheat crop about 10% below the long-term median.

This was above our forecast median (the forecast median was a 25% reduction) but well within the distribution of outcomes associated with the



analogue years. There was considerable reaction about 'getting it wrong' that had been fuelled by the incorrect implication that El Niño always equals drought.

In 1998, the opposite occurred. There was an extremely wet cropping season to the extent that waterlogging and disease became major constraints to cropping.

These factors were not included in our pre-season analysis because our ability to estimate their effects is poor, they are highly variable, and often associated with specific local conditions.

The national outcome of about 4% above the long-term median production was below our forecast median (22% increase), but again well within expectations when the distribution is considered.

Our approach in 1997 and 1998 was valued by those who looked closely and it helped us greatly in post-mortems to reinforce the inappropriateness of the 'right and wrong' language and mentality.

The lessons from this are clear. We must communicate what we know, not what we

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Wine for Climag winners

Carmel at home in her native garden.

The first 100 readers to respond to the *Climag* reader survey from Issue 1 went into a draw to win a dozen bottles of wine. The two lucky winners were Carmel Staniland from Perth, Western Australia and Leanne Coleman from Lake Cargelligo in New South Wales.

Carmel came across *Climag* through her research at the University of Western Australia in the Faculty of Agriculture. She is currently working with an inter-agency committee, examining off-site impacts of rural draining in south-western Australia.

"I welcome this new newsletter. *Climag* is timely, informative and engaging. I particularly look forward to reading about landholders who use climate information to better manage their farms," Carmel said.

Leanne Coleman - finds *Climag* useful for her job as information facilitator.

On the other side of Australia, Leanne Coleman from New South Wales also finds *Climag* useful with her work as Information Facilitator for the Rural Communities Program, which is funded through Agriculture, Fisheries and Forestry - Australia.

"This newsletter is a great resource for me, and to then pass on to the rural community. It is becoming increasingly important to keep up-to-date with R&D in order to participate in opportunities that will increase productivity. Newsletters such as *Climag* are an essential source of information," Leanne said.

Although no questionnaire is included in this issue, comments regarding *Climag* are still most welcome. Please contact the editor for content matters, and for distribution enquiries please contact Capital Public Affairs Consultants (see contacts box page 16).

BC Revisted

The BC cartoon in the last issue of *Climag* (page 3) featured a weather forcaster claiming 50% accuracy. The forecaster claimed this was not the same as guessing, stated to be at 54%. The question posed for readers was 'What can be said about the chance of the event occurring?'

One answer is about one in three, which also happens to be about a typical chance of a rain day nearer the coast. Over 100 days, a no-skill forecaster would get about 11 of the 33 rain days right by chance and about 44 of the 67 no-rain days. Overall accuracy (no skill) is thus 55% for this one in three event.

Predicting wheat crops using climate forecasts

(continued from page 3)

think people want to hear or what we think they can understand. If we find that the message is not well understood then we must find ways to communicate it more effectively, not simplify the message to the point of making it misleading. We know there are uncertainties in rainfall/crop forecasts, but we can quantify (some of) the risks. There will sometimes be risks that no-one foresaw.

We have an obligation to communicate the entire distribution of outcomes. In decision-making, the information on risk is as important as (sometimes more important than) the median estimate.

This information must be used in a risk management context. It is not about getting it right or wrong — we know we cannot forecast a specific outcome. Our experience is that credibility is built by shooting straight about what we do and don't know.

The bottom line is that we know each year is a sample of one but we can only forecast the distribution. We can often forecast a distribution shifted significantly from the all years (no skill) case.

The task we are working at is making best use of this in a risk management context — and we have done enough to know that it adds value.

** The authors are among the leading pioneers in climate applications research and are in Toowoomba with researchers from the Queensland Centre for Climate Applications and CSIRO.*

Revaluing seasonal forecasts in southern Australia

Just what is the potential value of seasonal climate forecasts for farmers in southern Australia?

This was an important issue considered by the CVAP Committee at their recent meeting in Toowoomba.

Then then CVAP Chair, John Taylor, said that results from recent research on grower attitudes to managing climate risk warranted a fresh approach to climate applications research in southern Australia.

Some of the possibilities included better ways to get across the shift in the odds reflected in the climate forecasts and more detailed research on the value of forecasts in changing decisions.

There was also scope to better apply the new seasonal forecasts from the Bureau of Meteorology based on Pacific and Indian Ocean temperature data. These promise improved skill, particularly in southern Australia.

John Cameron (ICAN Pty Ltd) has reported on grower responses to climate forecasts as part of a national project led by Peter Wylie (see page 9).

He said southern Australia growers, in particular, had mixed reactions to seasonal forecasts, some accepting and some sceptical.

Growers' responses to a hypothetical forecast in May of an above average season ranged from 'hit the ground running on the first opportunity' to 'not change much at all except perhaps manage for a longer season'.

The value of seasonal forecasts in changing cropping decisions has been a major focus of the research of the APSRU (CSIRO/Queensland Department of Primary Industries/Queensland Department of Natural Resources) group in Toowoomba.

Holger Meinke from APSRU recently gave seminars at Horsham and Geelong on his research program. In his view what is missing in southern Australia is better information on the greater impact predictors like SOI or ocean temperatures have on crop yield rather than on seasonal rainfall. This is because crops integrate not only the amount but also the effectiveness of in-season rainfall. For example, his preliminary research using a wheat crop model at Wentworth and other locations in the Mallee shows that the SOI phase in April/May can substantially change the chances of above or below average crops.

The change in median yields can be up to 30% depending on SOI phase. (These are estimates of potential yields, assuming optimal crop management.) These yield changes are substantially higher than changes in median rainfall, however, there is usually less difference in seasonal rainfall totals.

Holger stated, "This amplification (see diagram right) is probably the missing link in southern Australia. Amplification arises because the SOI changes not only the amount of rainfall but also the temporal distribution during the cropping season, and crops integrate these effects over the growing season."

Commenting on the performance of forecasts over recent years, Holger's comment was "If you are looking to the next season, then is it better to use the last one hundred years as a guide rather than the last one or two?"

"To conduct such analyses, it is essential to have well-tested and reliable crop simulation models because a model can easily check both the long and the short-term consequences of rainfall variability and management responses."

Horsham farmer and consultant Max Hedt was at the seminar. He said if seasonal climate forecasts improve as much in the next decade as in the last, they will be more important to farmer's income and decisions than weather forecasts.

In Max's view, crop models had great potential in crop management decisions if they prove themselves in southern Australia where the soil

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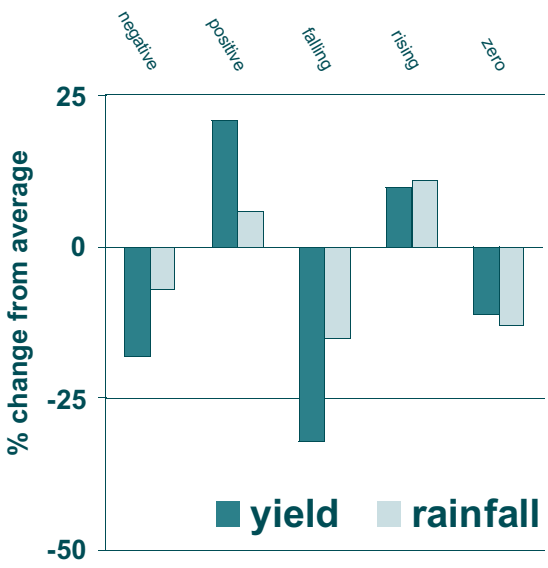
The amplified effect of SOI phase on crop yield compared to growing season rainfall

(Wentworth example)



Climate impacts within the agricultural value chain

Peter Carberry, leader of the CVAP agribusiness project, with Larissa Taylor and Michael O'Keeffe of Rabobank Australia.

At a recent workshop held in Toowoomba, Larissa Taylor and Michael O'Keeffe from Rabobank Australia assisted members of the Agricultural Production Systems Research Unit (APSRU) to explore potential applications for climate forecasts and crop yield simulations at different points across the agricultural value chain.

Outcomes of this meeting included both the development of a scoping document that reviewed potential applications for climate forecasts and crop yield simulations within the agribusiness service sector, and the initiation of at least six case studies.

Project leader Peter Carberry from CSIRO said that the development and implementation of case studies in collaboration with agribusiness is a key research strategy of the CVAP project 'Better management of climate variability within the agribusiness service sector'.

Climate variability significantly impacts on the business operations of the agricultural service sector, affecting the operations and policies of agribusiness suppliers, banking and insurance companies.

Bank lending policy and agribusiness advice were definitely affected by recent El Niño events.

The question this CVAP project addresses is whether these business operations and policies could benefit from access to better processes for dealing with climate variability.

Peter emphasised the project's action research approach — APSRU researchers work alongside agribusiness staff in order to test the feasibility of an agribusiness firm, if it did have the in-house capability, utilising climate forecasts and crop simulations in designing and implementing improved marketing, finance and insurance packages.

A key agribusiness collaborator in this project is IAMA Limited, who will explore the use of APSRU tools within their business operations.

Other companies who have already agreed to be involved in designing and implementing case studies include Rabobank and National Australia Bank (NAB).

For further information contact Peter Carberry, APSRU, on phone (07) 4688 1377 or email <peter.carberry@tag.csiro.au>.

Masters of the Climate discovered

(continued from page 1)

Colin Lane of Nhulunbuy, Northern Territory, uses indigenous information and local records to improve tree planting dates.

Mervyn Mayes from Wandoan, Queensland, has managed to stabilise variables in income by analysing information provided by the Queensland Centre for Climate Applications, weather fax, and the internet.

Each state winner received Australian RAINMAN climate forecasting software and a 12-month subscription to Austar, the home of Weather 21 – Australia's only 24-hour weather channel.

A result of the competition will be the publication of a case study manual funded by CVAP.

For more information please contact Gavin Atkins, Cox Inall Communications, on phone (02) 9956 7755.

(continued from page 5)

moisture story was inverted. He thought this was a factor in the slower acceptance of seasonal climate forecasts and crop models as you move south and winter rainfall dominates.

Dr Bob Belford, Director of the Victorian Institute of Dryland Agriculture, said the review by Holger Meinke was a very effective demonstration of how crop modelling capability could address what growers see as important decisions.

"There have been some erratic breaks to the season in the last few years and local farmers are now very aware of how important decisions around this time can be," Bob said. He added that "Existing models can be adapted to be useful in this area. A three year field program can't provide sufficient information on which to base decision making at sowing time."

For further information contact Holger Meinke at APSRU, Toowoomba, phone (07) 4688 1378 or email <meinkeh@dpi.qld.gov.au>.

(Note: the amplification diagram on page 5 was developed by the editor from data provided by Holger Meinke from a wheat crop simulation at Wentworth from 1890 to 1998.)

Sugar first with across industry approach

Strategies to use seasonal forecasts in marketing, transport, milling and on-farm are being researched as part of a new CVAP project with the Sugar R&D Corporation.

Project leader Dr Russell Muchow (CSIRO) said the aim is to increase industry competitiveness by providing improved risk management and decision making capability.

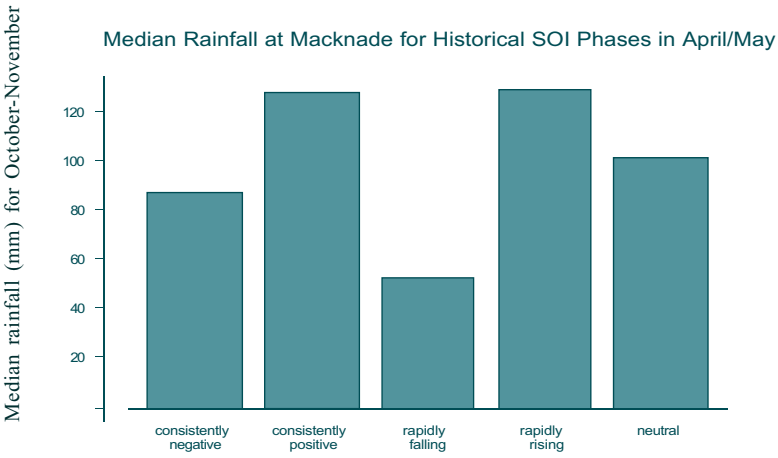
The first step has been to develop partnerships with various industry sectors to identify key industry decisions influenced by climate, examine the feasibility of different mechanisms for delivery of information stemming from the project, and most importantly assess the benefits and costs of tactical decision-making based on climate forecasts.

A case study is underway with marketers from the Queensland Sugar Corporation (QSC), and another with growers and millers around Ingham in North Queensland.

It was not unusual to find that some decisions across the value chain relate to rainfall occurring in similar periods.

The amount of rainfall which occurs at the beginning (June) and towards the end (October-November) of the harvest season is vitally important to the marketing of raw sugar, but also for farm productivity and mill planning and profitability.

In 1998, cane was left unharvested in the field and the sugar content dropped to low and often unprofitable levels due to excess rainfall.



Bar graph displaying how the median rainfall in October-November at Macknade varies with SOI phases in April/May.

Macknade, near Ingham, had almost 300mm of rain during October-November — more than triple the median for this period.

Historical records show this has happened about one year in ten.

This demonstrates that whilst the rainfall event in 1998 was unusual, it was not a rarity and the advantages associated with being able to forecast the increased chance of such events may be extremely high.

One existing seasonal climate forecast model is based on phases of the Southern Oscillation Index (SOI).

The figure displays how the median rainfall for October-November at Macknade changes depending on the SOI phase in April/May.

The medians are higher for consistently positive and rapidly rising phases.

In 1998, the SOI phase in April/May was 'rapidly rising' — thereby giving some indication of higher rainfall for the October-November period, with sufficient time to change harvesting decisions.

Dr Muchow said that as the research continues, improvements to existing climate forecast schemes will be investigated, as well as the development of new climate forecast models to assist in risk management issues for the sugar industry.

This project 'Seasonal Climate Forecasting to Improve Sugar Industry Competitiveness' is a four-year project to December 2002.

The principal research scientist working on the project is Dr Yvette Mallet (CSIRO), under the leadership of cropping systems scientist, Dr Russell Muchow (CSIRO) and climatologist Dr Roger Stone (QDPI/APSRU/QCCA).

For further information contact Russell Muchow on phone (07) 3214 2253 or email <russell.muchow@tag.csiro.au>.

"It's the season not the soil that yields."

Herodotus

Does the SOI affect pasture and animal production in SE Australia?

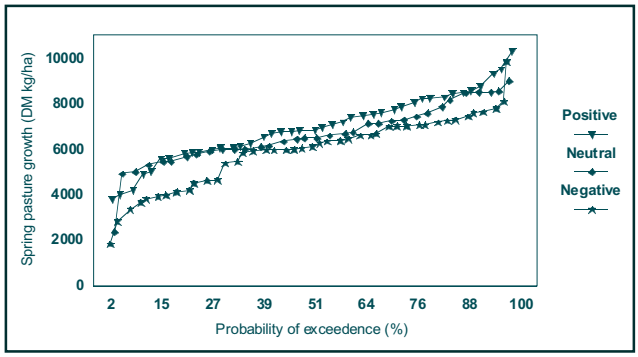


Figure 1. Spring pasture growth related to winter SOI, Hamilton 1881-1998

By Elizabeth Austen and Stephen Clark

Pastoral and Veterinary Institute, Hamilton, Victoria

The Southern Oscillation Index (SOI) is being routinely published in newspapers, and discussed on radio and television.

We are used to thinking El Niño - drought, La Niña - high rainfall. There is no doubt that there is a strong relationship between SOI phase and our climate. It is unclear, however, just how strong the relationship is in south-eastern Australia.

A new CVAP project, based in Hamilton, south-western Victoria, is examining the climatic variability of south-eastern Australia and its effects on pasture and animal production.

The GrassGro decision support tool is being used to model pasture and animal growth using long-term historical climatic data for key locations in the region.

Initial analysis for a Hamilton simulation indicates that a negative SOI in winter often points to below average spring pasture growth (Figure 1 - above left).

The relationship is not strong, however, but becomes useful when combined with other predictors such as winter soil moisture content (Figure 2 - below).

If SOI is negative and soil moisture levels are low in winter there is a strong likelihood of poor spring pasture growth.

One consequence of this would be the increased demand for supplementary feeding in the summer-autumn period (Figure 3 - below left).

Note that when soil moisture is high there are many years when supplementary feeding is not required at all compared to years when soil moisture is low.

For further information contact Stephen Clark on phone (03) 5573 0900.

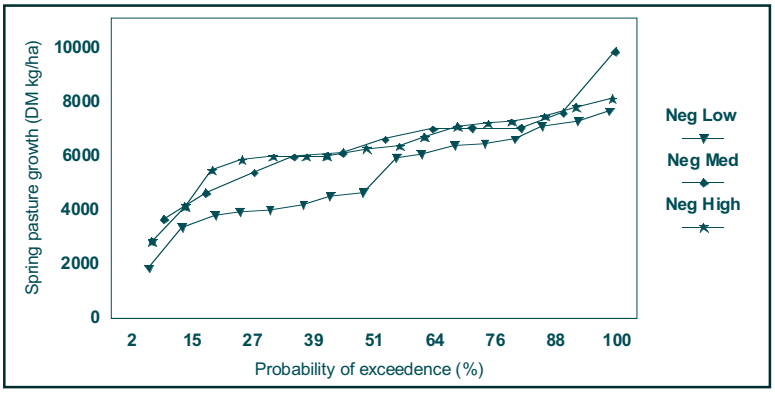


Figure 2. Spring pasture growth related to negative winter SOI values and soil moisture classed as Low, Medium or High, Hamilton 1881-1998.

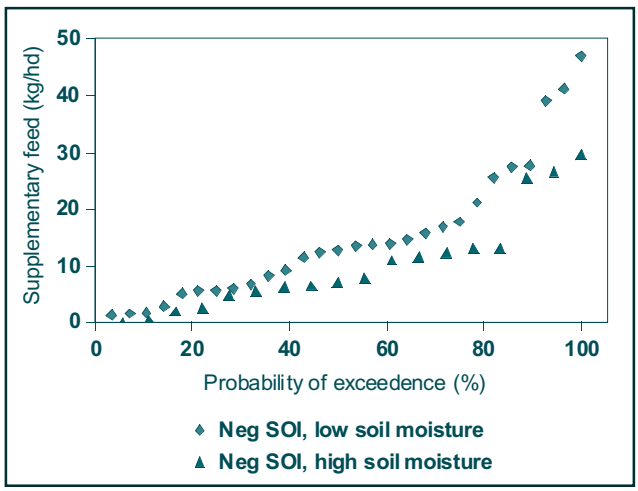


Figure 3. Supplementary feed requirement when winter SOI is strongly negative and soil moisture level is either low or high, Hamilton 1881-1998.

LWRRDC's R&D newsletters

LWRRDC publishes a number of newsletters which help land, water and vegetation resource managers and researchers share R&D program specific information. These include:

- ***Intersect*** - LWRRDC general newsletter;
- ***FOCUS*** - Dryland salinity newsletter;
- ***RIPRAP*** - Riparian and river restoration and management newsletter;
- ***WaterWheel*** - Irrigation newsletter; and
- ***Rivers for the Future*** newsletter.

Steamline is the natural resources database supported by LWRRDC. To subscribe to, or to receive a brochure about Streamline, phone Pam Handyside on (02) 6236 6267 or email <infoscan@acslink.net.au>.

To be placed on the mailing list for any of these free newsletters, contact LWRRDC on phone (02) 6257 3379, fax (02) 6257 3420 or email <public@lwrrdc.gov.au> for a Communications Request Form.

Managing climate makes money

Research on climate risks is showing up the importance of managing climate risk for making a profit and whether farmers remain in business. These are some of the issues emerging from a CVAP project led by farm management consultant, Peter Wylie.

This new CVAP project 'Improved management of climate variability on Australian grain farms' has already begun to pull together a wide range of strategies used by farmers to manage climate-related risks. Highlights of the findings to date follow.

Water balance vs Bank balance : *rain is a credit, irrigation a debit.*

Peter said that in his experience, business failure often results from a succession of poor crops, due to such problems as drought, waterlogging or frost.

Farmers will mostly say there is nothing they can do to manage these risks, but good managers are more diversified, have more robust farming systems and adjust their management according to the season, rather than doing the same thing each year.

Although seasonal forecasts provide new ways to manage climate risks, there are many things which can be done on farms, without using forecasts, to reduce crop loss from drought, wet seasons, frost and disease.

Diversification

Good farm programs will usually involve compromise and a good element of diversification. For example, growing more sorghum is one of the best ways to manage climate risk in western wheat areas of Queensland and northern NSW. During El Niño years, winter rainfall at Roma is low, but summer rainfall is less affected.

Spreading risk

While farmers will mostly agree that a spread of flowering time is good for risk management, they often will do the opposite. A spread of flowering to manage frost and rain damage may require planting some early maturing wheat before late maturing varieties.

Harvest management

Farmers right across Australia should be considering strategies to manage the risk of loss from harvest rain. These include spreading maturity, starting harvest early and using aeration and or drying, bringing in extra headers and a sense of urgency combined with good harvest management.

Too much water

In some parts of Australia, August rainfall is more damaging than useful, because it will encourage waterlogging. There are several strategies to manage this problem, including planting early and drying the profile out using short rotations with lucerne.

Rotations

Managing climate is particularly important for crops such as chickpea which experience waterlogging and disease. Lucerne could be used more in short-term rotations, right around Australia, to help tackle land degradation and improve climate risk management.

For further information contact Peter Wylie, Horizon Rural Management, Dalby, on phone (07) 4662 4899 or email <horizon@esprov.com.au>.

Canberra - against the odds

Canberra forecasts of daily rainfall on a probability basis have been shown to have a high level of skill. According to Ian Mason, formerly Canberra Regional Director of the Bureau of Meteorology, "The time may be ripe to consider extending the forecasts to other regions."

Canberra is currently the only Australian region where daily rainfall is routinely forecast and made available on a probabilistic basis, although this is a standard in many countries. A trial was introduced in Canberra in 1986. A paper on 'Verification of some rainfall probabilities for Canberra' was presented by Ian at a recent conference of the Australian Meteorological and Oceanographic Society. The Canberra forecasts are of the % chance of rain, for example 30% chance of rain over a specific period, and validated at the Canberra airport gauge. As an example of skill at one extreme, 1,211 forecasts of zero probability of rain were 98% correct.

According to Ian, Canberra media and the public generally now have a good understanding of the probability basis, any confusion usually related to the definition of the event being forecast. (Around Australia, media handling of unfamiliar probability forecasts for seasonal climate and El Niño forecasts has been subject to much criticism, although this might also reflect a reader bias for certainty).

"It is a valid comment that extending daily rain forecasts to a probability basis, Australia wide, should as a bonus result in better communication of El Niño-type climate forecasts," Ian said.

However, he stressed that any extension of probabilities for daily rain forecasts would need to be accompanied by an education campaign. This should be justified because a number of studies have shown the increased commercial value of probabilistic forecasts.

For information contact Ian Mason on <ibmason@ozemail.com.au>.

Communicating probabilities with a chocolate wheel

By Peter Hayman*

The Drought Policy Review Task Force (1992) stated that *"management decisions should take into account the law of probabilities..."* This is easier said than done.

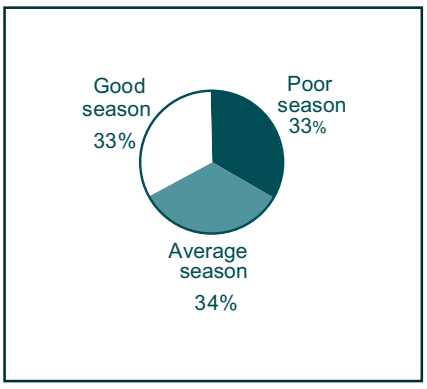
In their report to LWRRDC, the agricultural consultants Peter Wylie and Peter Ridge said "*Farmers have said they want to know whether it is likely to be dry, wet or average, not whether there is a 60% chance of getting 40% of the average rainfall.*"

Their concerns are supported by many psychological studies showing humans to be poor intuitive statisticians.

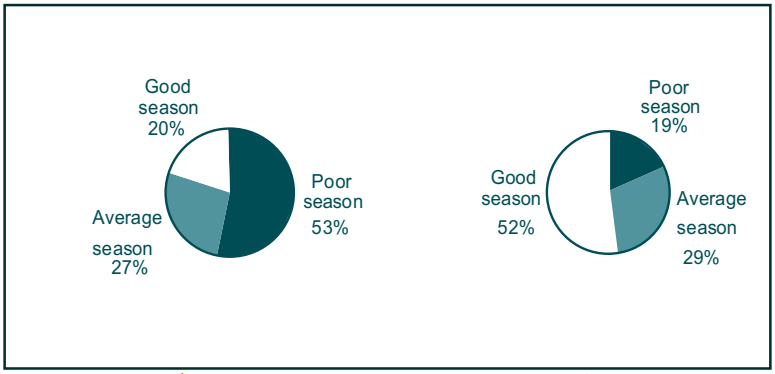
In discussing seasonal forecasts with farmers in northern NSW we found a chocolate wheel has been effective in communicating probabilities.

We presented growers with a pie chart (below) divided into thirds based on the long-term record. Growers are involved in a discussion to reinforce the equal chance of what for Tamworth is a poor (<220mm), average (220 to 300 mm) or good (>300mm) season from June to November.

The wheel is spun with the 100 nails to emphasise the notion that (a) there is an equal chance of landing in one of the three seasons and (b) there is only one spin of the wheel per year.



We then introduced the notion of seasonal climate forecasting as a change to the pattern on the wheel, not a prediction of which of the 100 nails the pointer will end up on. The example above compares the pattern on the chocolate wheel when the SOI phase for April/May is negative or rapidly rising.



April May SOI is negative | **April May SOI is rapidly rising**

In discussing probabilities with growers (and agricultural scientists) it has been interesting to observe that although we work in a risky business and are familiar with odds, few farmers or advisers are comfortable with probabilistic advice. As Bertrand Russell observed, what mankind wants is not knowledge but certainty.

Further information is available from Peter Hayman on phone (02) 6763 1256 or email <peter. hayman@agric.nsw.gov.au>.

**Peter has been appointed as Coordinator, and Mr Paul Carberry as Advisory Officer, at the newly established Climatology Advisory Unit at NSW Agriculture's Tamworth Centre for Crop Improvement.*

Is the south-west of Western Australia drying out ?

Concern that there may be a declining trend in rainfall and potential water shortages in the south-west of Western Australia lead to the formation of the Indian Ocean Climate Initiative (IOCI).

As a collaborator in this project, the Bureau of Meteorology has a particular interest in understanding the climate of this region with the aim of producing improved seasonal forecasts.

The south-west of WA has a 'Mediterranean' climate, dominated by winter rainfall. The wet season is generally considered to be from May to October (referred to as winter, below) during which much of the annual rainfall total falls.

Lynda Chambers of BMRC has been researching how surprising the rainfall decrease has been and if the decline started in a particular year/ decade.

Using a modified version of time series modelling, she compared statistically simulated and observed rainfall records. When enough simulations are made it is possible to obtain an

(continued on page 11)

Climate tools now on CD

Australian RAINMAN

The Windows-based Version 3 of Australian RAINMAN is now available on CD.

The version includes up to 3,700 rainfall stations, tutorials and a CD version of the popular Internet site The Long Paddock.

Rural Industries R&D Corporation and CVAP have provided funding towards the new version.

The graph for Wagga Wagga (right) is an example of one new feature, Seasonal Forecast Skill.

For three months seasons, the SOI negative phase has greatest impact on rainfall from July to September.

Thus if the SOI phase in May-June is negative, there is only a 13% chance of exceeding the all-years median for July to September.

In other words, if the SOI is in negative phase, there is about one chance in eight of rainfall being above the long term median of 150 mm.

By definition, the all-seasons median has been exceeded four years in eight.

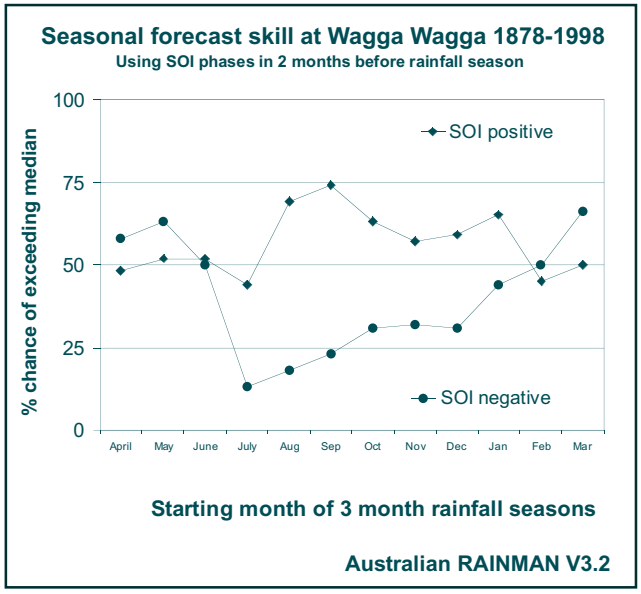
For more information on Australian RAINMAN contact the Queensland Centre for Climate Applications on phone (07) 4688 1200 or email <qcca@dpi.qld.gov.au>.

DroughtPlan

A comprehensive range of tools to help graziers manage for climate variability has been assembled in the DroughtPlan CD-ROM.

DroughtPlan was a major nation-wide project funded in an earlier CVAP program.

Funding was also provided by Meat and Livestock Australia and Woolmark.



Mark Stafford Smith at CSIRO, Alice Springs was project leader.

The nine products include general purpose approaches to livestock management, as well as tools more applicable to regions, primarily extensive grazing in northern Australia.

The products are based on consultation with producers to help with a wide range of decisions including stocking rates and financial management.

Workshop modules are included together with the full project report also published as LWRRDC Occasional Paper CVO1/97 which sells for $20.00 from the AFFA Shopfront on freecall 1-800-020 157.

For more information contact David Cobon on phone (07) 4688 1151 or email <cobond@dpi.qld.gov.au>.

(continued from page 10)

indication of how unusual a particular observed rainfall trend is. It turned out that a number of rainfall stations in the south-west of WA had higher numbers of below-average winter rainfall seasons than expected.

An example is Manjimup (Wilgarrup) which had below-average winter rainfall from 1974 to 1987. This length of consistently below (or even above) average rainfall is only expected to happen about once in every 3,500 years, making it an extremely 'rare' event.

One method of looking for particular years in which the rainfall may have changed is to look for sudden changes in the mean (average) rainfall. An interesting result is the general decrease in rainfall in the south-western corner, an increase in rainfall to the north-east and no real change in the region between.

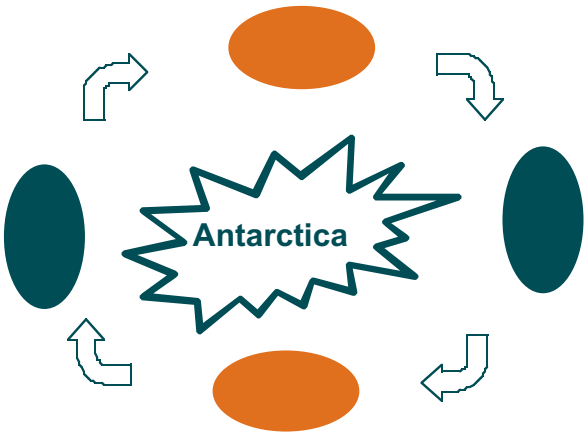
There is considerable variation in the years in which large changes in the mean winter rainfall occurred. Work on detecting when the winter rainfall changed is continuing.

For further information contact Lynda Chambers, Bureau of Meteorology Research Centre, Melbourne on phone (03) 9669 4784 or email <L.Chambers@bom.gov.au>.

Three theories on why Australians like to gamble a bit: (1) because they understand probabilities, (2) because they don't, or (3) probably just the vestiges of an old survival skill.

Riding the new wave: the Antarctic Circumpolar

'El Antartico ?'



The Antarctic Circumpolar Wave with alternating masses of relatively warmer and cooler water circling the Antarctic. (Ed)

Peter Baines is one of a group of scientists at CSIRO Atmospheric Research eagerly examining southern Australia's rainfall records to determine how the recently discovered Antarctic Circumpolar Wave (ACW) affects our climate.

Recent research suggests that predicting the ACW may be more important for predicting New Zealand rainfall and temperature than for predicting El Niño developments.

Neil Cherry from Lincoln University was co-author of the research with Warren White from the Scripps Institution of Oceanography in California.

"My strong impression is that scientists appear to be totally unaware of the importance of the ACW for New Zealand. I was the only one who forecast a drier than average summer and autumn, based on La Niña and colder than average water to the south of us with the current phase of the ACW," Neil commented from Christchurch on the last summer.

Following on from the New Zealand research, Warren White expanded it to include Australian rainfall, finding it influenced significantly by changing sea surface temperature patterns in the Indian and Southern oceans.

His summary follows: The eastward propagation of anomalies by the ACW in the Southern Ocean south of Australia allowed year-to-year changes in precipitation over Australia to be predicted over the 40 years from 1960 to 1999.

This statistical climate prediction system is based upon the slow eastward propagation of the ACW, yielding significant skill for predicting interannual precipitation anomalies over most of Australia at lead times of six and 18 months, and explaining 50% of the total interannual variance over Western Australia, Victoria and New South Wales for 40 years from 1958 to 1997.

This level of predictability extended over most of Australia south of 20°S — north of there in the tropics year-to-year changes in precipitation is presumably influenced more by El Niño activity in the tropical ocean north of Australia.

Peter Baines agrees that it now seems likely the ACW will be more important for rainfall in the southern states of Australia than El Niño. The ACW is a child of the Southern Ocean.

Within this Ocean, a massive current (the Antarctic Circumpolar) transports water, taking eight or nine years for a complete, clockwise rotation of Antarctica.

Embedded in this current (and carried along with it) are two large regions of relatively warm water — thousands of kilometres across — alternating with two equally large regions of relatively cold water.

When a warm region is present and when the southern Australian States experience winds off the Southern Ocean, the winds contain slightly more moisture than usual.

Preliminary CSIRO research suggests we are in the last stages of a cold region, and may expect a warm region to arrive next year. Warm regions may increase the chance of winters, for example, being warmer and wetter than average.

Three oceanic drivers - Variations in Australian climate stem from changes to the Pacific, Indian and Southern Oceans. The effects of each of these wax and wane, adding to and subtracting from each other, making each year different from the last.

Looking ahead - Peter Baines and colleagues are currently using CSIRO's climate models to explore the mechanisms of operation of El Niño, the ACW and the Indian Ocean, as well as their interactions.

For more information contact Peter Baines on phone (03) 9239 4651, email <peter.baines@dar.csiro.au>, Neil Cherry on email <cherry@lincoln.ac.nz> and Warren B White on email <wbwhite@ucsd.edu>.

UNESCO's International Oceanographic Commission (IOC) has begun operation of a Perth Regional Programme Office. Contact email <brian.sadler@bigpond.com>.

NEWS AND REVIEWS

Seasonal Climate Information

In response to *Climag* reader requests for information on current seasonal climate forecasts, details of some of the most widely used services follow:

Bureau of Meteorology

- Australian Seasonal Outlook Summary. Telephone 1900 155 348.
- Seasonal Climate Outlook subscriptions. Telephone (03) 9669 4655.
- The CVAP SILO project at <www.bom.gov.au/silo/>.

Queensland Department of Primary Industries/ Queensland Department of Natural Resources

- SOI message. Telephone (07) 3896 9602.
- Index to Services. Fax 1902 935 300.
- Long Paddock at <www.dnr.qld.gov.au/longpdk>.

El Niño Specials

El Niño : History and Crises (Ed. Richard H. Grove, Australian National University) 250pp. The White Horse Press. This important new book brings together the latest historical and scientific studies of El Niño and its dramatic effects on past and present civilisations.

National Geographic (March 1999) — El Niño/La Niña cover story, p72-95.

The El Niño CD. A comprehensive overview and introduction suitable for secondary students and others, despite a mainly USA perspective on impacts. Enquiries to New Horizons on telephone 1800 023 069.

La Niña Forecast Good for BHP

Last year's La Niña forecast of above-average rain encouraged BHP to quickly grow their coal stockpile at their Central Queensland Open Cut Mine and avoid wet weather delays.

As the Queensland Minister for Primary Industries, Henry Palaszczuk stated 'BHP benefited by millions of dollars, and it was quite clear that the sophisticated climate control package (RAINMAN) developed for primary producers now has a wide range of potential applications throughout Australia and around the world.' (Queensland Department of Primary Industries News Release 20/3/99).

Climate Conferences

Australian Meteorological and Oceanographic Society — Annual Conference. Melbourne, 7-9 Feb 2000. Convenors: Ian Smith (telephone (03) 9239 4539) and Scott Power (telephone (03) 9239 4444). <www.dar.csiro.au/res/amos2000>.

Australia New Zealand Climate Forum. 10-12 April 2000. Theme is 'Climate science: Farming land and water'. Convenor: Stuart Godfrey (telephone (03) 6232 5210).<www.marine.csiro.au> (and click ANZ Forum)

Climate of Twentieth Century (CVAP funded). Probably November 2000. Convenor: Scott Power (telephone (03) 9239 4444).

Decision-making with climate forecasts. Combined CVAP/ACIAR workshop hosted by QCCA, Toowoomba. 17-19 April 2000. Enquiries to Rod Saal (telephone (07) 4688 1457).

Review – 'How to Manage Climate Risk' Holmes, Sackett and Associates

This publication is part of the AgInsights Series (No 14.0) and is aimed at improved decision-making in Australian regions with 'uniform to winter-dominant rainfall'. There are three main sections on tools such as the Southern Oscillation Index (SOI), Crop Management (mainly on a water use efficiency basis) and livestock management. Only the SOI part is commented on below. Following some simple correlation analyses for four locations for January and July, it concludes that the SOI 'should be of curiosity value only!'

The SOI valuation is based on a wrong deduction — a correlation of 0.2 at Bendigo (accounting for 20% of the variation) was assumed to result in correct decisions only 20% of the time. (The implication is the contrary decision would be good value at 80% correct!). Even a simple analysis with Australian RAINMAN would have shown an overall accuracy of about 70% in using winter SOI to predict spring rainfall at Bendigo. For example, for all years, about three years in 10 get less than 100 mm spring rain. For those years when the SOI in June-July is <-10, about eight years in 10 get less than 100 mm. The difference the SOI can make in midwinter in southern Australia could be beyond curiosity value for many decision makers. Accordingly the publication would not be of value to anyone interested in exploring the potential of the SOI in decision making. (Ed)

Authors response to the review above

There is more to managing climate risk than knowing the accuracy of the SOI in predicting spring rainfall. Regardless of the outcome of analysis of historical rainfall and SOI readings, it does not tell you what is going to happen in the future. It will only provide you with probabilities of what might happen. If you are really interested in minimising your businesses exposure to climatic risk, then there are management strategies that can be implemented to reduce this exposure. This is the focus of this AgInsight.

The publication provides the reader with proven methods of reducing the exposure of a typical mixed farming business to climatic risk. The methods described will enable readers to improve their understanding of how climate will influence their farms level of production and profitability and begin to have some control over something that is largely unpredictable.

For enquiries about the publication contact the publisher at Wagga Wagga on (02) 6931 7110.

Aussie GRASS — starting to grow...

The vastness of Australian grazing lands coupled with the variability in pasture growth are two factors posing major problems for researching and developing more sustainable management systems.

Wayne Hall, Aussie GRASS Coordinator, said the impetus for the project arose from a national recognition that managers of grazing lands require accurate near-real time data. This is essential to make timely management decisions in the face of an extremely variable climate. Aussie GRASS aims to provide the necessary information on a continental basis, and facilitate action before land degradation events occur.

Aussie GRASS is a CVAP funded project that uses simulation modelling and collaboration between State and Territory agencies to address the problem of quantitative assessment of the condition of Australia's grasslands and rangelands.

Agencies involved are the Queensland Department of Natural Resources, Queensland Department of Primary Industries, Agriculture Western Australia, Primary Industries and Resources South Australia, Department of Environment, Heritage and Aboriginal Affairs (South Australia), NSW Agriculture, Department of Land and Water Conservation (New South Wales) and the Northern Territory Department of Primary Industries and Fisheries.

Left to right: Barry White (CVAP), Wayne Hall (Aussie GRASS coordinator) and John Stewart putting the grazing industry perspective at the recent Steering Committee meeeting.

The Aussie GRASS simulation approach involves running a pasture growth model on a spatial basis (5 km grid) over the Australian continent. The model currently generates prototype products on a monthly basis for each collaborating State and Territory. The products — which include maps of rainfall, pasture growth and total standing dry matter — are automatically downloaded to the Aussie GRASS web site.

The site is currently password protected. The Aussie GRASS project includes a number of sub-projects: Southern Pastures; Northern Territory and Kimberleys; High Rainfall Temperate Zone; and Extension.

Each of the 'regional' sub-projects has a heavy emphasis on ensuring the pasture model is suitable for use within that region, and that it is adequately parameterised using all available field data — much of which is being collected by the collaborators.

For example, in the High Rainfall Temperate Zone sub-project, the GRASSGRO model developed by CSIRO Plant Industry — and intended for use in temperate southern Australia — is being used to assess seasonal conditions in the appropriate regions of New South Wales.

Due to the language in which GRASSGRO is written, it is unable to be fully incorporated within the spatial modelling framework — instead it is being run for selected points representing divisions within Rural Lands Protection Boards.

The project team has elected to use the metabolisable

(continued on page 15)

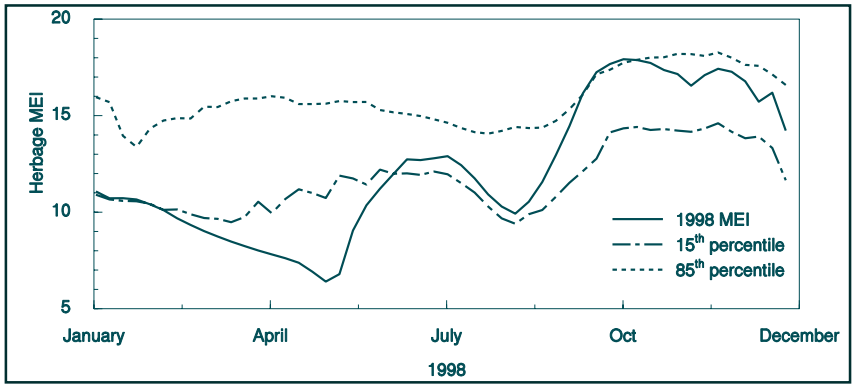


Figure 1: Simulated metabolisable energy intake (MEI) per DSE for 1998 relative to the 15th and 85th percentiles derived from long term simulations at Bombala, NSW.

Climate change and variability in Australia's Rangelands

The importance of looking at climate change, as well as climate variability, in any analysis of the impact of climate on agriculture, is illustrated in two landmark papers by Greg McKeon and Wayne Hall and their colleagues from the Queensland Department of Natural Resources.

McKeon's paper on climate change in Queensland demonstrates that climate change is upon us now. He convincingly shows that minimum temperatures have increased by up to 3°C in May since 1957. But what is the impact? The accompanying paper by Hall on the impact of climate change on animal production from native pastures shows that the associated rise in CO2 levels may compensate for the higher temperature and changes in rainfall by increasing the growth rate of pastures.

If climate change is occuring that quickly, it suggests that there should be more integration between the climate variability and change research programs. Our present statistical approaches to the analysis of climate variability based on historical data do not allow for trends in the background climate.

These papers may be found in the special issue of The Rangeland Journal on *'Water in Rangelands'* (Vol 20 No 2). Other papers in this issue cover a range of topics on surface runoff, stream management and ground water supplies in Australia's inland. These papers show that what we do with the rainfall we receive, and the water resources it generates, have a bigger effect on agricultural and environmental outcomes than its variability.

In matters of water it seems that eveything is linked. A holistic approach to climate research and agriculture is essential.

Allan Wilson, Deniliquin (formerly CVAP Committee)

(continued from page 14)

energy intake (MEI) from pastures as the integrator of resource and climatic variability.

For example, Figure 1 shows how GRASSGRO simulated 1998 MEI ranks relative to the 15th and 85th percentile for Bombala, New South Wales.

By May 1998, conditions were well below average for that time of year (the May 1998 intake is well below the 15th percentile, 15% of years have intake less than this).

By October, the situation had improved to well above average. It is also intended to use the output from the GRASSGRO runs to develop appropriate parameter sets for use in the spatial model.

For further information contact Wayne Hall (National Technical Coordinator) on phone (07) 3896 9612, fax (07) 3896 9843 or email <wayne.hall@dnr.qld.gov.au>.

Climate Change vs Climate Variability

Several readers suggested topics for *Climag* on climate change, rather than climate variability. As Allan Wilson's review (left) shows there are clearly some strong inter-connections between climate change and climate variability. Many of the researchers in CVAP are also at the forefront of climate change research and often use the same tools to investigate impacts and responses to climate change. For more on climate change see the Climate Change Newsletter on <www.brs.gov.au.ccs/ccn/ccn.html> or write to Climate Change Newsletter, Bureau of Rural Science, PO Box E11, Kingston ACT 2604.

Odds and Sods

Evidence-based Astrology? Sherlock Holmes and Dr Watson were camping. As they tucked in for the night, Holmes queried Watson, "Let's look up at the stars. What do they tell you?" Watson deduced "Meteorologically, I expect a high probability of a fine day tomorrow, Sir. What do they tell you?", and Sherlock replied, "My dear Watson, some cad has stolen our tent."

Gambling in the long run "We try to keep problem gamblers out — they are not our long-term customers, after all." (PR operative at Star City Casino, Saturday Australian, 8-9/5/99).

Economics in the long run "In the long run we are all dead. Economists set themselves too easy, too useless a task if, in tempestuous seasons, they can only tell us when the storm is long past, the ocean will be flat again". J.M.Keynes.

Forecasting short-run shareprices "I have never met a rich chartist." Rene Rivkin.

Arguing the toss (heads you win, tails I lose) The Laws of Cricket now require captains to call either heads or tails. Match referees have been supervising tosses since a complaint by former New Zealand captain, Ken Rutherford, that Pakistan's Salim Malik mumbled Urdu words at the toss then said 'good we'll bat' no matter how the coin landed. (Courier Mail 31/5/99).

John Cleese's other idea - "An idea is not responsible for the people that hold it".

El Niño and Everything

Reproduced with permission from Gary Clarke, Swamp Productions

El Niño is becoming a scapegoat (scapegrace?) of convenience for many weather woes around the world. The ultimate addition to the 'Blame it on the El Niño' list would have to be the more rapid emergence of civilisation some 5,000 to 6,000 years ago.

Recent articles in *Science* have begun to speculate on some emerging threads, particularly around the Pacific (Sandweiss et al, *Science* 1999 283:499-500). *New Scientist* (22 May 1999, *Born in a Storm)* states "A climate upheaval some six thousand years ago may have forced people all over the world to adapt simply to survive".

Some evidence from lake sediments and coral records suggest a much-diminished El Niño between 5,000 and 12,000 years ago. More complex cultures and urbanised societies developed rapidly from 3,000 BC, for example Egypt, the classic cradle of civilisation associated with the unification of the middle and lower catchments of the Nile.

So what would have been some of the responses if the current El Niño patterns and increased climate variability had been emerging or re-emerging 5,000 years ago?

El Niño's would have made it easier to sail from Asia into the Pacific to undertake the relatively recent settlement of much of the Pacific. In other regions more variable crop yields in a post-Eden climate would have stimulated trade.

El Niño Southern Oscillation (ENSO) correlations appear to be such that in a time of famine in one part of the Mediterranean, there are increased chances of above average rain in some other parts.

Increased variability would have seriously undermined the predictions of the prophets of the day — a case for new temples and 'new gods for new odds'.

The good omen in all this emerging speculation could be that the more rapid emergence of civilisation was, in some small way, a response to increased challenges. (Ed.)

Southern Aussie Rules

1. **When there is an El Niño-type situation in mid to late winter, the odds of above-average spring rain change from evens to about 3 to 1.**
2. **When there is an La Nina-type situation in mid to late winter, the odds of below-average spring rain change from evens to about 3 to 1.**

The above rules of thumb are a simplified interpretation for south-eastern Australia, condensing and averaging the fluctuating experience of the last century. For more detailed information for a particular month and for your location, check Australian RAINMAN and see the Wagga Wagga example, (page 11).

These rules apply best in inland south-eastern Australia. They are generally less applicable at near-coastal locations, and at times of the year other than mid to late winter. The rules may under or over-estimate the change in the odds at some locations. They are presented as a starting point for discussion, and are a response to requests from *Climag* readers.

Rules of thumb are best used as a prompt for more serious analysis for your situation using more specific forecasts, based on Sea Surface Temperatures or SOI phases. Research has shown that the impact of a forecast can be amplified, and its value clarified, when crop yields, pasture growth or stream-flow for example, are forecast rather than rainfall. (Ed.)

Melbourne Cup Odds

What odds of rain at Flemington over October-November? If the SOI is consistently positive in July/August (a La Niña indicator), the odds of below average October/November rain blow out from evens to 3 to 1.

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