KONDINDIN GROUP RESEARCH REPORT

Climate risk for graziers

Natural Heritage Trust
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KONDININ GROUP

Australian Government
Department of Agriculture, Fisheries and Forestry
Land & Water Australia

Simple tools to weather the good and bad

Graziers have many tools for assessing climate risk at their fingertips, including local rainfall records, seasonal climate forecasts and pasture growth monitoring. This report, funded by Land & Water Australia's Climate Variability in Agriculture Research and Development Programme, looks at the tools and management strategies for an effective climate risk management plan for graziers in non-arid southern temperate areas.

At a glance

- Local rainfall records, seasonal climate forecasts and pasture monitoring are some of the best tools available to enable graziers to manage climate risk.
- Poor pasture availability during early- to mid-spring can indicate the need for higher supplementary feeding in the following autumn.
- In grazing enterprises use seasonal forecasts for decisions that only impact for short periods (three months) such as selling stock early, applying fertiliser or early weaning.
- The seasonal climate outlooks are not of sufficient accuracy on which to base strategic decisions such as major changes to breeding herd structure.
- Long range forecasts are best used to alert producers to the possibility of a change in seasonal conditions so tactical responses can be implemented sooner.
- Develop long-term grazing management plans, which incorporate feed budgets and decision trigger points to allow management to adapt rapidly to seasonal changes.
- Fodder and financial reserves offer the best protection against adverse seasonal conditions.
- Choose stocking rates that maximise profitability by matching livestock numbers to pasture supply but be prepared to increase pasture productivity, drought reserves and be more responsive to the forecasting or advent of adverse conditions.
- Select breeding times that match livestock feeding requirements to pasture availability.

Ben White

Setting up climate risk management plans will help graziers make the most of the good seasons and be prepared for poorer seasons. Pasture monitoring and using local rainfall records are key tools to predicting future climate conditions and benchmarking events that trigger changes in livestock management.

Monitoring pastures and reflecting on historical rainfall records in conjunction with seasonal climate forecasts are among the best tools available to help graziers develop effective climate risk management plans.

A knowledge of local conditions enables producers to assess the impact of seasonal variability on pasture production and set triggers to indicate when management needs to respond to changing conditions.

Seasonal forecasts such as the Southern Oscillation Index (SOI) and climate computer programmes are also used regularly by graziers to better identify climate risk situations and simulate 'what if' scenarios.

Climate risk management plans are a vital part of farm management and need to include strategies to cope with good and bad seasons such as setting up on-farm feedlots or selling unproductive livestock during a bad season or conserving fodder, agisting or buying trade stock during good seasons.

Present and future impacts

There are two common types of livestock systems: long-term breeding enterprises and shorter term, more opportunistic trading enterprises.

Because livestock breeding is a continuous cycle, many of the strategic responses to seasonal conditions available to graziers often impact well beyond the forecast period.

In contrast, croppers experience a discrete event with each season's crop, so have more opportunity to react to a forecast without long-term consequences.

For example, if a cattle producer decides not to join the breeding herd during a drought, the impact will be felt in following years through reduced turn-off and cash flow rather than immediately.

Role of forecasts

If a grazier runs a conservative system or is in a reliable rainfall area, they are relatively insulated from risk and might not have as much need for active climate risk management. But if they run a high performing system or are in a more variable low-rainfall environment, the grazier needs to use and understand all the climate risk management tools available.

Current seasonal forecasts are not accurate enough to be the sole basis for making major strategic decisions in grazing enterprises. But they can be used to make short-term tactical management decisions.

For example, graziers running short-term, variable enterprises such as opportunity livestock trading can use forecasting tools to

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modify the number of livestock bought or the amount of fodder conserved.

Knowing local conditions

Local historical climate records, especially rainfall, are the best base for the long-term climatic conditions of an area. In certain phases, the Southern Oscillation Index (SOI) will shift the rainfall probabilities. The impact will vary according to particular areas across Australia.

Surprisingly, more than 40 per cent of farmers did not use long-term local rainfall records, according to Kondinin Group's 2003 National Agricultural Survey (NAS).

Studying climate records gives graziers a 'feel' for the climate that otherwise could take decades to develop.

By comparing the present conditions with historical rainfall and pasture production, graziers can identify good, average and poor seasons quickly and react appropriately.

Local climate records are available from the Commonwealth Bureau of Meteorology web site at www.bom.gov.au. Software packages such as Rainman Streamflow Version 4 and MetAccess also include rainfall data for a large number of sites across Australia, which enable users to sort and evaluate data and make management decisions.

Rainman Streamflow also allows producers to enter and further analyse their own rainfall records. The higher the number of rainfall records, the more accurate the analysis.

Assumptions and limitations

Table 1 shows the probability of receiving or exceeding rainfall. For example, at Wagga Wagga, New South Wales, in 80% of years at least 11 millimetres of rainfall will occur during January but in 20% of years at least 66mm could occur.

If climatology records like Table 1 are the only tool used the probability of exceeding the median always will be 50%.

Table 2 shows how rainfall has behaved in the past in various phases of the SOI. In the case of Canberra, Australian Capital Territory,

TABLE 1 Rainfall probability (Wagga Wagga, New South Wales)

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Year
80% of years	11	5	8	13	19	28	26	28	26	28	12	10	432
Median, 50% of years	29	26	27	34	39	52	49	51	46	52	38	32	548
20% of years	66	67	64	71	70	85	76	76	66	86	66	66	683
Mean	39	39	42	43	48	57	51	51	48	57	41	40	558

The probability of receiving or exceeding each month the given amounts of rainfall in millimetres.

Source: Commonwealth Bureau of Meteorology.

TABLE 2 Impact of SOI phases on rainfall probability

Location	SOI falling	SOI negative	SOI neutral	SOI rising	SOI positive	All years
Mt Barker, WA	38	52	61	45	46	50
Canberra, ACT	19	29	48	55	81	49

This table shows the impact of SOI phases on the probability of rainfall for the September to November period in different locations in Australia. The basis of comparison is the percentage of years where rainfall is more than the median — 50% of years where rainfall is higher and 50% of years when rainfall is lower. There is a significant impact of the SOI in Canberra whereas it has no impact in Mt Barker.

Source: David Buckley, Charles Sturt University, using Rainman Streamflow Version 4.

only in the falling, negative and positive SOI phases are these shifts significant. In other words, graziers can be confident the shifts are not due to natural variations associated with random chance. Because the SOI does not have a statistically significant effect at Mt Barker, Western Australia, then rainfall probability charts like Table 1 are as good a guide as the SOI phases.

The impact of the SOI needs to be established for each location and an ideal way is to use Rainman Streamflow.

Predicting pasture growth

Ultimately, graziers use climate forecasts not to predict rainfall but pasture availability and subsequent animal production.

Generally, poor winter and spring pasture growth is an early warning of an increased risk for the grazier in the following summer and autumn.

Conversely, if there is excellent grass growth, good soil moisture and livestock are in good condition, adverse seasonal conditions are unlikely to occur in the short to medium term and the opportunity to purchase more livestock or conserve more feed is increased.

Pasture availability

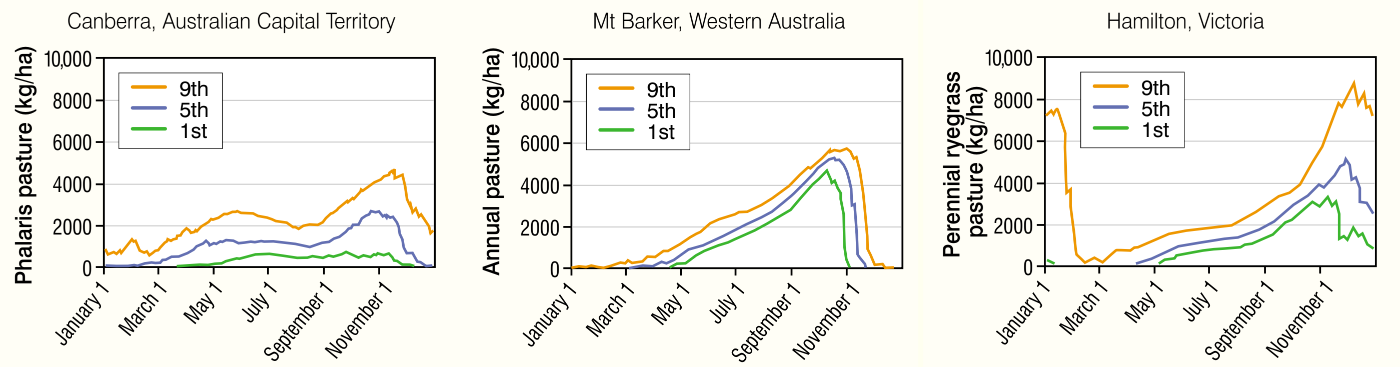
Understanding the variability of pasture growth a particular location provides an insight into the impact of seasonal conditions.

A knowledge of pasture growth during the year on a property in average, above average and below average years, enables graziers to better estimate potential pasture availability during the growing season.

CSIRO's GrassGro program can help graziers establish a pasture budget for their property for various stocking rates, pasture species and grazing methods.

For example, Figure 1 shows pasture availability for Canberra, Mt Barker and Hamilton, Victoria, with each showing average available pasture for each day of the year in a median or average year (shown as the 5th decile line), a very dry year which

FIGURE 1 Live total pasture production per hectare at typical stocking rates for three locations in southern Australia



Live total pasture production in the wettest 10% of years (9th decile), average year (5th decile) and driest 10% of years (1st decile).

Source: David Buckley, Charles Sturt University.

occurs one in 10 years (1st decile line) and a very wet year, which occurs one in 10 years (9th decile line).

Although the average peak spring growth is similar for Hamilton and Mt Barker at about 5000 kilograms of dry matter per hectare, pasture growth is more reliable at Mt Barker as there is less variation between the deciles and hence less risk.

Pasture availability in Canberra is more variable than at Hamilton and Mt Barker, and only during very wet years does spring growth peak at almost 5000kg DM/ha.

Predicting the year ahead

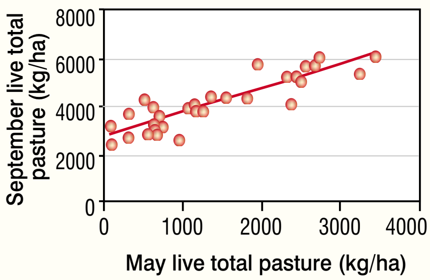
An analysis of pasture growth by Charles Sturt University using computer models showed that in some locations pasture quantity during May correlated strongly with pasture quantity during September.

This relationship explained 79% of the variability at Hamilton, 59% of the variability at Mt Barker and 20% of the variability at Canberra (see Figure 2).

At Canberra, there is a relationship between spring rainfall and the mid-winter SOI.

Since 1887, of the 20 years in the SOI negative phase (an indicator of an El Niño in the Pacific) at the end of July, only five have been above median spring rainfall (August–October).

FIGURE 2 Pasture growth*



* The relationship between May and September pasture growth in Hamilton, Victoria.

Source: David Buckley, Charles Sturt University.

As a result, seasonal climate forecasts are likely to have more of a role at Canberra than at Hamilton or Mt Barker but pasture monitoring can be an excellent seasonal forecasting tool at these latter locations.

For example, for the relationship between pasture availability during May and pasture levels during September at Hamilton use the following calculation:

September pasture (kg/ha) = May pasture (kg/ha) + 2740kg

If a producer has 1800kg/ha of pasture during May, he or she could expect 4540kg/ha during September.

Because the average September pasture for Hamilton is 4200kg/ha, a September pasture level of 4540kg/ha would place it close to the top 10% of years.

If the stocking rate was based on an average year, there would be a 340kg/ha pasture surplus during September, which could be used to make silage or run extra livestock such as trade lambs.

Mid-spring pasture

Experience in southern Australia shows the amount of grass present during early- to mid-spring gives a strong indication of an impending drought.

If pasture is not present by this time, temperate grasses and clovers are unlikely to grow due to increasing temperatures and changes in plant metabolism.

This simple piece of science offers graziers a powerful on-farm forecasting tool.

While most graziers can measure the feed on offer, they need base levels for comparison to assess the range and variability in pasture growth between seasons and years to plan for changes in seasonal conditions.

Weather know-how assists cattle buying decisions

Farm information

Farmers

Adam, Karen, Troy, Sally and Merv Mayes

Location

Wandoan, Queensland

Property size

Chilgerrie Hill: 1202ha
Dundas 3: 874ha

Enterprises

Cattle breeding and fattening (including stores), Santa Gertrudis stud, opportunity pasture seed and grain production

Annual rainfall

650mm

Soil type

Heavy creek flat clays, Brigalow grey clays, vine scrub soils

Soil pH

Neutral

Queensland climate enthusiast Merv Mayes, Wandoan, is proof that a little weather know-how can assist cattle buying and feed budgeting decisions.

The family's decision to buy store cattle hinges on wise use of favourable seasonal outlooks and a rapidly rising Southern Oscillation Index (SOI).

For example, during July 2003, the three-month seasonal outlook for southern Queensland indicated a 'below to well below' average spring season.

Despite this, local predictions suggested a 50–60 per cent chance of above average spring rainfall, so the Mayes bought store condition cows for quick turn-off during October-November 2003.

At the time, store cattle prices were low due to reduced demand from local traders.

In response, the family bought light-score cattle from Mt Isa and Cloncurry at average weights of 380 kilograms for $0.60–$1.09/kg.

By early October, average cattle weights had increased to 530kg, right on target for an end of month turn-off to a processor at 560–600kg. Merv said the punt paid off as July–October rainfall was 125 millimetres, considerably more than the long-term average.

The Mayes became interested in climate risk tools during the dry early 1990s. At that time, local records were the only climate risk tool available to them but the internet had expanded the information on offer.

Merv said time and telephone line speeds were now the only limiting factor to taking advantage of seasonal forecasts.

Range of tools

The Mayes primarily rely on the climate risk tool Rainman Streamflow, produced by Department of Primary Industries, Queensland (DPIQ). Merv also accesses DPIQ's web site for climate notes, rainfall probabilities, the SOI and the sea surface temperatures of the Indian and Pacific oceans.

In addition he consults trade wind patterns the intra-seasonal oscillation (30–50 day wave) and the Long Paddock web site.

Cross checking data

Merv uses the internet to check Australian data with predictions from the United States Climate Prediction Centre. For example, during September 2003, Merv saw the sea surface temperature on South America's

Decision support tools such as GrassGro allow farmers or their consultants to model this pasture production data for a range of sites, stocking rates and management methods.

Rainfall equals profit

A main aim of dryland cropping or livestock enterprises is to maximise the efficiency with which often limited rainfall is used. Performance is increasingly being measured using benchmarks based on growing season rainfall.

In many cases, profit is directly related to rainfall, so, as spring rainfall increases so too do average gross margins.

For example, the simulations in Figures 3 and 4 show spring rainfall against the average annual gross margin (in dollars per hectare) at a constant stocking rate for a wool enterprise near Canberra. Not only does the average gross margin increase as rainfall increases but its volatility falls.

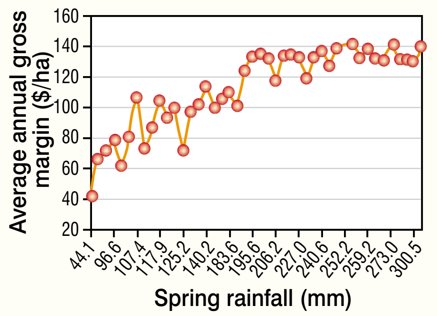
In this example, each extra 25 millimetres of rainfall increases the average gross margin by $8.40/ha.

After spring rainfall is more than 200mm further increases in gross margins are limited at a fixed stocking rate.

The challenge with managing climate variability is not only managing the risk of a poor season but also capturing the additional benefits of a good season.

The correlation between mid-winter SOI and spring rainfall in Canberra can provide an early indication of spring rainfall.

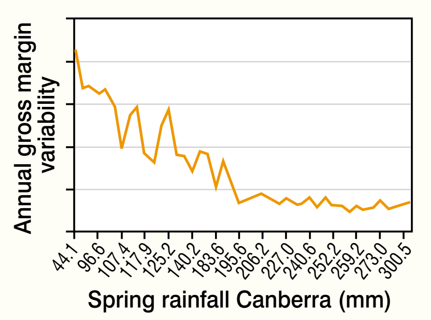
FIGURE 3 Gross margins



* For Canberra, ACT.

Source: David Buckley, CSU, using GrassGro.

FIGURE 4 Gross margin variability*



* For Canberra, ACT.

Source: David Buckley, CSU, using GrassGro.

Grazing management

Little is known about the ability of tactical grazing responses to reduce the impact of drought but about 15% of the 2003 NAS respondents wanted to improve their pasture management as a result of the 2002 drought.

One option is to increase the level of perennial grasses in pastures as these source water more effectively and respond to rainfall more rapidly than annual species.

So, increasing the proportion of palatable perennial plants could improve a pasture's ability to access soil water during dry periods and improve profitability.

Rotational grazing methods that increase the portion of desirable perennials could reduce the impact of dry periods on pasture availability.

west coast was still about one degree above normal.

From this Merv concluded the El Niño effect had not quite finished and believed the phenomenon was in a neutral pattern.

He reinforced his conclusion by looking at Atmospheric Circulation Patterns. These patterns suggested the continental highs persistently located from central Australia to tropical latitudes would remain.

At the time, a high-pressure band extended from Madagascar to well east of Australia. Until this band starts its seasonal retreat to the south, the chances of large volumes of tropical air feeding in to trough systems and generating good general rain bands in inland Queensland are reduced.

Prediction and reinforcement

Merv said climate risk tools were used mainly to reinforce management decisions based on physical and financial predictors.

He estimated climate risk data had a reliability of 60–65% and would not make a major decision on seasonal forecasts alone.

The Mayes monitor pasture and prepare feed budgets to address planned stocking rates and cash flow needs. Stud stock numbers remain relatively fixed but store cattle are bought if the seasonal outlook is positive and feed supplies are adequate.

Merv Mayes and sons Adam and Troy, Wandoan, Queensland, believe climate forecasts are a valuable tool to assist cattle buying and feed budgeting decisions.

Early reaction to drought

During 2002, the Mayes evaluated a series of stock management 'each-way bets' using different scenarios and climate tools.

At the time, the family believed the drought would continue into 2003.

As a result, breeding stock numbers were reduced and the focus shifted to stock trading. More fodder and grain was bought and a small amount of on-farm feedlotting was carried out to lift cattle turn-off weights and maximise cash flow. The Mayes also secured long-term agistment for cows and calves at favourable rates, before demand peaked.

This was a decision that paid dividends and Merv is now convinced climate risk tools can significantly assist graziers who want to 'work smarter not harder' in the new millennium.

Forecasts provide clues but not the full picture

Seasonal rainfall forecasts can draw attention to an increased probability of a below or above average season and be used to back up strategic management decisions and tactical responses to observed conditions.

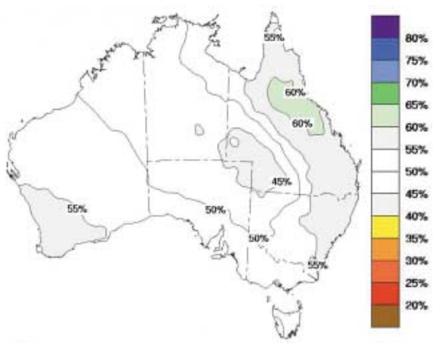
Kondinin Group's 2003 National Agricultural Survey (NAS) showed only 36 per cent of members used long-range weather forecasts.

Of those surveyed, most farmed in New South Wales and Australian Capital Territory (47%), Western Australia (42%), Queensland (34%), Victoria and Tasmania (28%) and South Australia (24%).

The most popular source was the Commonwealth Bureau of Meteorology, followed by the internet (with web sites such as the United States' Medium Range Forecasts of Vertical Velocity and Precipitation, Farmshed and Weatherzone), national and local media and State agricultural departments.

Some Kondinin Group members also used private forecasters.

FIGURE 5 Seasonal Outlook



Seasonal Outlook showing the chance of exceeding the median rainfall for December 2003 to February 2004. Above average rainfalls are generally a 50:50 prospect across parts of the country, except for north-east Queensland where higher rainfall is favoured.

Source: Commonwealth Bureau of Meteorology.

Of those surveyed, 5% used computer software programs as climate risk management tools — the most popular being Rainman Streamflow but GrassGro and Takeaway (now replaced by Ready Rations Pro) were also used and some respondents had developed their own spreadsheet to analyse local records.

Forecasts on the internet

In Australia, the most widely used forecasts are the Seasonal Climate Outlooks (SCOs) of the Commonwealth Bureau of Meteorology (see Figures 5 and 6) and the Southern Oscillation Index (SOI) phase system from the Department of Primary Industries, Queensland (DPIQ).

The Bureau of Meteorology's main published forecast is based on ocean temperatures — one predictor centred in the Indian Ocean and one based on a pattern in the Pacific, which is closely related to the SOI.

The role of the SOI

The SOI phase system sorts historical data and examines how rainfall behaved at a particular location when the SOI was in a particular phase.

In locations where it has a significant impact on the probability of rainfall (as

Trading relies on accurate climate trends

With an average annual rainfall of just 350 millimetres, Tom and Marg Porter, Hay, New South Wales, rely heavily on accurate climate forecasting tools to run their lamb breeding, cattle and irrigated cropping enterprises.

Tom uses climate forecasting tools such as the Southern Oscillation Index (SOI), historical rainfall records, satellite maps and the Commonwealth Bureau of Meteorology long-range forecasts to help make decisions more quickly about when to buy and sell stock and when to take a risk.

Taking advantage

Tom has used climatic information to buy cheap cattle during drought, knowing the area was likely to receive significant autumn rainfall — although cattle needed to be very cheap to warrant taking such a risk.

Climate data is less applicable for his lamb breeding enterprise because he aims to maintain a core breeding nucleus at all times.

But he believes climate information does have its place, particularly if there is a need to sell surplus stock earlier to reduce pressure on the land during dry periods.

Farm information

Farmers
Tom and Marg Porter

Location
Hay, New South Wales

Property size
5300ha

Enterprises
Wool, fat lambs, cattle and cropping

Annual rainfall
350mm

Soil type
Unknown

Soil pH
Not recorded

Advanced warning

During the 1990s, there were several occasions when Tom decided to buy cattle in autumn based on climatic information.

For example, Tom was aware of a falling SOI during 1999, so was cautious about buying cattle as this often meant the chances of an unusually dry period were higher.

Under these conditions Tom would not buy trade cattle during autumn and would consider actual weather conditions from September to January before deciding what action to take with his existing stock.

Using the same information, Tom decided not to buy cattle during autumn 2002 as he was not confident of a beneficial autumn rainfall.

But Tom said it was more difficult to predict the extreme winds between September 2002 and January 2003, which affected pasture just as severely as the lack of rainfall.

Good indicators

Tom has found the SOI during April, May and June was accurate for the lower western area of NSW, so always considers these values when deciding to buy or sell stock.

From observations, Tom believed the SOI ran in 12–18-month cycles in his area.

outlined for Canberra on page 3) it alerts graziers to changes in their risk profile.

Generally, graziers expect to bias their management toward dry conditions when the SOI is in a 'negative' or in a 'falling' phase and toward wet weather when the SOI is in a 'rising' or in a 'positive' phase.

Phases of the SOI

But this is not true in every area, as the phases can vary between sites, so the software program Rainman Streamflow is useful for examining the influence of the SOI on actual rainfall at particular locations (see Table 2, page 3).

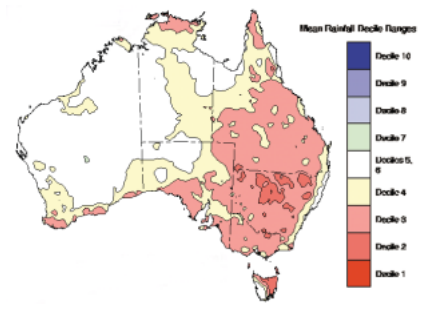
These data show the change in the probability at Canberra associated with different SOI phases.

In a positive SOI phase there is an 81 per cent chance that September to November rainfall will exceed the median.

In this case, graziers are more likely to consider buying more livestock or conserving excess feed.

But in this case, there remains a 19% chance (one year in five) that rainfall will not exceed the median and graziers need to keep this in mind when making management decisions.

FIGURE 6 Winter–spring El Niño



Australian winter–spring mean rainfall deciles for 12 El Niño events.

The map shows the average impact for the six-month total rainfall is below average (in deciles 2 or 3 and shown in red) across most of eastern Australia. Areas specifically affected include the north-eastern half of Tasmania, almost all of Victoria, almost all of New South Wales (excluding coastal areas), eastern and coastal parts of South Australia and the southern half of Queensland. Relatively small coastal areas of southern Western Australia, the Northern Territory and northern Queensland are also affected.

Source: Commonwealth Bureau of Meteorology.

Tom Porter, Hay, New South Wales, uses forecasting tools for making livestock buying and selling decisions to gain optimum benefits.

For example, if there was rainfall before January, there probably would not be any significant autumn rainfall.

In contrast, if conditions were dry throughout summer, good autumn rainfall could be expected the following year.

Tom also said if there was no significant rainfall from autumn to spring, the area was likely to receive good autumn rain in the following year.

Drought conditions were unlikely to continue for more than one year, although the most recent drought could be an exception to the trend.

Internet resources

The other main climate forecasting tool Tom uses is the 10-day precipitation forecast from the United States.

Tom accesses this information on the internet regularly and finds it useful for short-term predictions and more accurate than Australian weather forecasting tools.

He has also developed his own web site at www.bushlink.com.au to enable easy access to relevant agricultural information including weather forecasts and climatic information.

Plan to respond quickly to seasonal changes

Climate risk management plans based on an analysis of present on-farm and atmospheric conditions allow farmers to prepare early for possible changes in seasonal conditions.

Early warning can increase a grazier's ability to implement strategies to maximise production or minimise the impact of poor conditions.

Assessing present conditions such as cumulative rainfall and pasture growth provides the foundation for climate risk management plans. This will enable producers to better understand the local conditions in a 'normal' and 'abnormal' year and how they influence pasture growth.

After likely pasture growth is understood, feed budgets can be developed to estimate the feed requirements of various classes of livestock. These then can be compared with likely pasture growth, as determined by soil moisture, temperature and the seasonal climate forecast, to identify any surpluses or shortfalls.

In areas where winter pasture growth is limited by temperature rather than rainfall, the Commonwealth Bureau Of Meteorology seasonal temperature forecast also could be a useful tool during early spring to predict when pasture growth will start. In addition, it is vital to review management records such as drought 'post-mortems' to learn from past experiences.

Kondinin Group's 2003 National Agricultural Survey (NAS) showed 89 per cent of respondents had improved their knowledge and preparedness for drought during the past 10 years.

Tools for assessing pasture

Future pasture availability can be determined from current available pasture and the likely pasture growth rate.

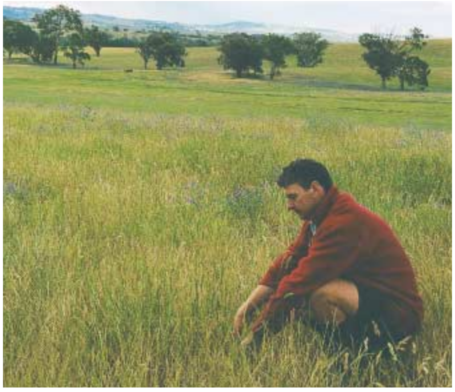
To estimate the amount of pasture available, measure average pasture height and assess pasture density visually.

Compare these figures with standard measurements (see Table 3) to estimate available pasture in kilograms of green dry matter per hectare.

Expected pasture growth rate depends on soil moisture, soil fertility, climatic conditions in that location, species and grazing management. Contact local agronomists and consultants for guideline figures.

Satellite imagery can help assess pasture growth rates on an ongoing basis.

CSIRO, in conjunction with the Department of Agriculture, Western Australia and the WA Department of Land Management has developed pasture growth rate maps for individual shires in southern Australia.



Pamela Horsley

By looking at the pasture currently available and cumulative rainfall, graziers can develop feed budgets. The CSIRO computer program GrassGro is an excellent way of assessing likely future pasture productivity for varying soil profiles, pasture species, climatic conditions and management regimes.

The maps indicate which areas of a paddock are more or less productive, allowing specific areas to be isolated and managed differently. Visit the web site at www.pgr.csiro.au.

Preparing a feed budget

Feed budgets help predict any likely feed gaps or surpluses by comparing livestock feed requirements with predicted pasture growth.

The actual feed requirements of livestock will depend on climate, the livestock class and whether the animals are dry, pregnant or lactating.

CSIRO Plant Industry has developed the computer program GrassGro, which allows graziers to simulate a range of management decisions.

TABLE 3 Pasture height

Height (mm)	Green dry matter (kg DM/ha)* Open pasture	Moderate density pasture	Dense pasture
10	250	400	500
20	500	700	800
30	600	1000	1100
40	800	1200	1400
50	1000	1400	1700
60	1150	1600	2000
70	1300	1750	2250
80	1450	1900	2500
90	1600	2000	2750
100	1700	2100	3000

* Some adjustments could be required to calibrate the pasture height relationship for different pasture types.

Source: Triple P Programme.

The program can help determine a property's sustainable carrying capacity using daily weather records and information about the soil profile, pasture species, livestock and management to assess likely on-farm productivity.

The program is excellent for determining which pasture species perform best in dry, average and wet seasons and when pasture surpluses and deficits could occur.

GrassGro also determines the average length of the growing season for a given pasture mix and how pasture availability varies in any given month in a good, average or bad season.

The program is also useful for examining the impact of past El Niño occurrences on subsequent pasture growth.

Trigger points

By predicting pasture levels under various climatic conditions, decision trigger points can be put in place to help alert farmers when pasture production variations would require management changes.

For example, a grazier in an area with a long growing season could recognise that May's pasture growth was below average.

Taking into account the probability that pasture growth could continue to be below average for the rest of the growing season, the grazier could plan to reduce livestock or buy fodder.

Similarly, if the pasture growth trend was above average, the grazier could conserve fodder at the peak of the growing season, take on agistment or buy more livestock to increase the stocking rate.

In some areas, the lead-time and length of growing season is not sufficient to make decisions from predicted pasture growth trends.

But these areas could be like Mt Barker, WA, (see Figure 1, page 3) and have little differentiation in pasture production between good, average and bad seasons, which will lower their climate risk.

Accumulating reserves

Knowing the potential pasture production under various conditions allows producers to decide what levels of reserves are needed to survive periods of low pasture production and profitability.

Highly profitable enterprises with cash surpluses can better accumulate reserves, either as fodder or cash.

NAS 2003 showed 20% of respondents planned to increase fodder reserves in response to the latest drought and a further 20% would increase their financial reserves.

Do not be too conservative

Coping with climate variability requires an underlying profitable enterprise and flexible, adaptive management to take advantage of good years and minimise the impact of bad years.

Graziers are used to irregular income and relying on a small number of excellent years to provide a disproportionately large portion of total income.

Adopting an excessively conservative management approach to avoid risk could compromise enterprise survival if it removes the ability to take advantage of good years.

In the longer term, the gains sacrificed due to conservative management during good seasons often outweigh the reduction in losses during poor seasons and could limit a business's ability to cope with the very risk it intended to reduce.

Droughts and floods are more readily remembered than production gains achieved during non-drought years, which could explain farmers' bias toward conservative management.

While current climate forecasts are not accurate enough to be the basis for major strategic management decisions, graziers can still use these along with long-term climate averages for decision making.

Short-term tactical responses then can be made to conditions as they arise providing farmers with the ability to take advantage of good seasons.

Stocking rates

Benchmarking studies by various agricultural consultancies show profitable producers have a low cost of production due to having high production per unit area.

The high production was achieved by increasing stocking rates through improved pasture productivity and use.

Using computer models, the late Fred Morley from CSIRO simulated the minimum bank balance of a wool growing enterprise at a range of stocking rates over several years.

CSIRO defined the stocking rate that minimised risk as the one that resulted in the smallest negative bank balance in any year.

The stocking rate with the highest average bank balance was defined as the most profitable.

In any given year, the stocking rate that minimised risk was only 15% less than the most profitable stocking rate.

The computer modelling shows the perception that conservative management, particularly in stocking rates, reduces risk might not be entirely correct.

Effect on drought frequency

One issue to consider when managing climate risk is whether increasing the

Saving paddocks by rotating grazing reaps rewards

Farm information

Farmers
James and Libby Gardiner

Location
Cobar, New South Wales

Property size
20,000ha

Enterprises
Sheep for meat and wool, meat goats

Annual rainfall
300mm

Soil type
Red clay loam to sand, interspersed with gravel ridges

Soil pH
5.2

The Gardiners, Cobar, New South Wales, monitor pasture availability and graze paddocks according to how quickly plants are growing. This method has increased dry matter production by about 400 per cent (left of fenceline).

Rather than rely on technological tools to predict future conditions, James and Libby Gardiner, Cobar, New South Wales, work with the resources they have such as maximising soil moisture to manage climate risk.

The couple has set up their rangeland grazing property to make the most of rainfall through carefully monitored rotational grazing and to protect resources in the long term.

A changing climate

After moving from Victoria during the mid-1970s the Gardiners found that according to CSIRO's long-range forecasts the rainfall frequency in their area was predicted to halve within 30 years, despite average annual rainfall remaining unchanged.

By 1996, maintaining perennial pastures had become difficult as the Gardiners had to contend with only receiving one significant rainfall event every three months rather than every six weeks.

New management methods

Longer dry periods meant major changes to grazing management were required, so the Gardiners adopted the Savory Centre's (United States) Holistic Management.

Instead of set stocking rates, holistic management aims to graze animals in large mobs and rotate them through paddocks relatively quickly, depending on how fast the pasture is growing. This ensures the growing plant is not damaged, as the time spent grazing a paddock is adjusted according to plant growth rates.

The Gardiners graze animals with the aim of eating one-third of the plant, trampling one-third and leaving one-third to regenerate. The couple monitors the pasture species to be kept and moves livestock to new paddocks after these plants have been grazed to a specific height.

Biodiversity improves production

Since adopting the holistic approach biodiversity has increased, both in native wildlife and beneficial rangeland grasses.

The sheep no longer need mineral supplements to maintain health and James estimates dry matter production has increased by at least 400 per cent to 2.5 tonnes per hectare. This has allowed the Gardiners to improve lambing percentages and wool production and retain water in the soil longer to increase pasture growth.

The Gardiners believe soil is the base resource. Grazing sheep in large mobs speeds decomposition, increasing the humus layer in the soil and improves water penetration and pasture growth.

Plans aid decisions

During September 2002, the Gardiners assessed their future grazing needs and decided the drought would irreparably damage pastures unless animals were moved off-farm. The couple agisted 1300 ewes and 500 lambs while the animals were still in good condition. At this time, pastures were still reasonably healthy and could recover easily after rainfall.

Final dividends

Because the sheep were in good condition, the annual wool clip and sale of wether lambs helped meet agistment costs. The remaining sheep returned to the property during August 2003 and the ewes have since lambed at 100%.

While sheep were agisted, the Gardiners bought another 550 ewes and, given a reasonable season and pasture, they hope to rebuild sheep numbers during 2004.

The Gardiners believe that by planning grazing, monitoring animal impact and resting plants, they have managed to survive possibly the worst drought in 100 years.

Pamela Horsley

Farm profit can be improved by increasing stocking rates and pasture productivity. Higher stocking rates will increase the severity of the impact of drought, not drought frequency, so graziers need higher levels of drought reserves and management plans to counteract this.

stocking rate to improve production will increase the exposure to climate risk.

Where increased stocking rates are associated with increased pasture production through better grazing management and higher inputs, the frequency of drought is unlikely to change.

Where the risk is likely to increase is in the severity of the impact of a particular drought event.

Graziers with higher stocking rates will have a larger feed deficit in years of low rainfall and therefore must react quickly and have additional supplementary feed available.

Selecting a stocking rate

An optimal stocking rate maximises long-term profitability, usually determined by benchmarking, computer simulations or experience.

In the short term, the optimal stocking rate will vary between years and between seasons.

Producers can expect periods of insufficient pasture and periods of surplus pasture but the more time spent closer to the optimal stocking rate the better the outcome.

For most producers, this will mean being flexible and adjusting stocking rates to match seasonal conditions.

While producers need to run stocking rates that maximise profitability they also need to increase pasture productivity, drought reserves and to be more responsive to adverse conditions.

Paddock size, season and soil

A common guide to setting stocking rates is one dry sheep equivalent (DSE) per hectare for every 25 millimetres of rainfall above 250mm.

But research by Department of Natural Resources Victoria has produced a better model to help graziers select the best stocking rate for pastures under various conditions (see Table 4).

The model combines paddock size, growing season and soil fertility to determine the DSE/ha carrying capacity, based on pastures grown under the Triple P programme.

For example, in an area with an eight-month average growing season, in an 18ha paddock with an Olsen P reading of 10mg/kg, the optimal stocking rate is about 23 DSE/ha.

Breeding time

Selecting the optimal breeding time can reduce the frequency of seasonal feed shortages dramatically while maintaining or increasing stocking rates.

Nutritional demands of livestock and the pasture supply are not constant throughout the year, with demand highest during late pregnancy and early lactation.

Matching livestock nutritional demands to pasture supply maximises pasture use and reduces the need for supplementary feeding. In most cases, this will require a winter or early spring lambing or calving.

Moving the calving or lambing time closer to the spring flush, rather than the traditional time of autumn, allows more livestock to be carried with similar or lower hand feeding levels.

Autumn feed gap

Lambing or calving earlier than winter or spring could lead to late autumn feed deficiencies and require hand feeding and hay making or reduced stocking rates.

Feed deficiencies, especially in cattle herds, can increase breeding intervals if a lack of nutrition reduces a cow's ability to conceive quickly after calving. All of these changes can impact on profits.

TABLE 4 Stocking rates (dry sheep equivalents per hectare)*

Number of months of growing season	5	6	7	8	9	10	11	12
Less than 20ha paddock								
Olsen P of 10mg/kg	11	14	17	23	24	28	31	34
Olsen P of 20mg/kg	12	16	19	23	26	29	33	36
More than 20ha paddock								
Olsen P of 10mg/kg	8	11	15	18	21	25	28	32
Olsen P of 20mg/kg	10	13	16	20	23	27	30	33

* Determined by carrying capacity, paddock size and average growing season.

Source: Department of Natural Resources and Environment, Victoria.

Stored feed and pastures combine to reduce risk

Farm information

Farmers

Jeff and Larraine Hoffmann

Location

Lockhart, New South Wales

Property size

1100ha

Enterprises

Wheat, canola, wool, prime lambs, steer fattening

Annual rainfall

475mm

Soil type

Undulating red loam

Soil pH

5.5

Sheds full of hay, silos full of grain, lucerne pastures and dams positioned to collect road water run-off are some of the climate risk management tools Jeff Hoffmann, Lockhart, New South Wales, uses to mitigate climate risk.

These tools were a practical way to reduce risk in grazing enterprises following an analysis of the local climate.

Like many farmers, Jeff acknowledged that climate is the only part of the farm business that cannot be modified. The only real tool farmers have to manage the climate is to understand it.

He believed producers could maximise enterprise efficiency by analysing the local climate, especially its variability and relationship with wider climate predictors such as the Southern Oscillation Index (SOI). This enables him to understand what could occur and when.

Analysing long-term records

Jeff started analysing local rainfall records during the 1980s to help understand his local climate and the risks and opportunities it posed.

His historical records date from 1884, consisting of a combination of dates for a site 10 kilometres away and later records kept by his family.

Jeff plotted monthly and annual rainfall probability charts, which he used to assess the likelihood of achieving any given monthly rainfall total.

An interesting find was the timing of the autumn break, which he defined as being when there was enough rainfall to germinate winter pasture and allow it to survive.

According to his charts, Jeff found the break usually occurred late April or early May, except for one in 10 years when it would occur during June. There also were periods of 10–20 years when rainfall patterns varied significantly from the overall trend.

Help from computer software

Jeff has used several software programs to help analyse climate risk, including Rainman Streamflow, which assesses the probability of future rainfall on the basis of the SOI and sea surface temperatures.

His increased understanding of how the SOI affected the local area allowed him to assess the relationship between the SOI during July and subsequent spring rainfalls.

On average, if the July SOI was less than 10 and falling, average spring rainfall was 112 millimetres. If the SOI was more than 10 and rising, average spring rainfall was 226mm.

Jeff applied this information to nitrogen fertiliser applications, when to sell livestock and whether to buy steers to fatten.

The CSIRO-developed GrassGro and Grazfeed programs were used to monitor the likely available pasture and the feed ration calculator, Ready Rations Pro (formerly Takeaway), estimated the cheapest feeds.

Jeff uses the Commonwealth Bureau of Meteorology web site for short-term climate assessment and also plans to use the climate data program, MetAccess.

Using tools with a grain of salt

Jeff claimed forecast tools were useful for assessing future climate risk but not at predicting actual events.

He said these were limited by probability, only telling the user the probability of an event occurring given a set of climate indicators and past records.

For example, there have been high-rainfall years when the SOI was low and falling. A producer faced with a low and falling SOI could be conservative and sell all their livestock and not apply fertiliser. But if a good year eventuated, that decision could cost the producer more money than an actual drought.

So if, for example, best indications show a 66.66 per cent chance of an event occurring, Jeff will plan operations accordingly while remembering that conditions could change as forecasts are only reliable within the probability stated.

Using the information

On a practical level, there are limited opportunities for Jeff to make significant changes to the livestock enterprises even using the knowledge gained from climate risk tools.

Although some livestock would be sold earlier than usual if a poor season was likely, the core spring lambing ewe flock was maintained.

Jeff Hoffman, Lockhart, New South Wales, uses pastures and stored hay and grain in his climate risk programme.

Indicators for spring rainfall are the strongest during July, which is the same time ewes are lambing, so severely restricts the opportunity to reduce flock numbers.

Instead, Jeff uses climate risk information to make feeding decisions that will best use stored feed and ensure lucerne survival.

Another decision based on rainfall probability is whether to finish lambs to the top weight or sell them at the earliest opportunity. This decision depends on stored feed on-hand and the probability of sufficient rainfall to ensure lucerne production.

Jeff uses similar information for his cropping enterprises, which form a large part of the farm business.

He said late-winter fertiliser decisions were influenced by predicted spring rainfall and soil water reserves but he placed more importance on actual soil water levels and crop growth when determining application rates.

Recent drought

During the 2002 drought, Jeff decided during late winter that spring rainfall was likely to fail and that crops would be either very low yielding or grazed. He also assumed livestock would need to be fed until at least autumn and probably through winter.

Jeff's predictions proved correct but while he found the stored feed supplies were sufficient, water supplies were difficult to maintain.

Fortunately, Jeff was able to wean the lambs and shear the ewes before selling livestock. The sale was profitable due to well-conditioned livestock and excellent prices.

But cash flow and soil erosion were still major concerns during the drought.

Jeff said producers needed to become used to the possibility of drought and remember its impact was influenced by the way producers chose to use the land, matching farming practices to local land and climate conditions.

Flexibility is the key to toughing out drought

Supplementary feeding, selling cast-for-age wethers early, grazing fodder paddocks and destocking surplus livestock were the most common drought strategies Australian farmers used, according to La Trobe University.

Researchers identified 33 tactical responses farmers used to adapt to changes in seasonal conditions, the key being flexibility in management strategies.

Supplementary feeding

The most widely used tactical response to offset poor pasture is supplementary feeding.

Because supplementary feeding is expensive, strategies to reduce its cost would improve profits. For example, graziers can feed a maintenance, survival or production ration, depending on their circumstances and the relative price of feed to livestock.

Maintenance rations will maintain an animal's bodyweight while drought or survival feeding controls weight loss until it reaches the minimum level needed for survival.

Animals in this situation become increasingly efficient as their metabolism adapts to the tough conditions. Production levels are feeding above maintenance levels to promote growth or increase production.

Production feeding during drought is not cost-effective as livestock prices seldom justify inflated feed prices.

John Ive

Supplementary feeding and using on-farm feedlots help tough out droughts but it is vital graziers use maintenance level rations to reduce feed costs.

Estimating beef breakeven levels

Beef production is basically turning cereal grains, hay, silage and pasture into beef.

The efficiency with which an animal produces a kilogram of beef is known as feed conversion efficiency (FCE), usually expressed as a ratio. This ratio is the amount of feed consumed by an animal (kg/head/day) for every kilogram of liveweight gained (see Table 5).

Cattle and sheep usually achieve FCE ratios of 5.5:1 for animals in highly efficient feedlots to 25:1 for those being fed low-quality silage. Most on-farm production feeding averages about 8:1–10:1.

The FCE needs to be estimated before the likely outcome of feeding can be calculated.

As the quantity of feed required to produce a kilogram of beef increases (FCE increases) so does the price that must be received for finishing an animal to breakeven level.

For example, Table 6 shows a sale price of $1.72/kg is required to make production feeding profitable. If the price for finished C4 steers of 330–400kg is $1.42/kg, finishing the livestock is not economical.

Improving feed use efficiency (which lowers the FCE ratio) will make production feeding more profitable but producers are unlikely to achieve a FCE ratio higher than 5.5:1 on-farm without a well-run dedicated feedlot.

Reducing feed costs will also help increase profits from production feeding but often this is not possible during poor seasons.

Calculate breakeven costs

Before production feeding starts, feed prices and the livestock's current value, weight and target weight can be used to calculate the price the finished livestock need to achieve to breakeven.

Include an acceptable profit margin before investing time and labour into finishing the livestock.

The breakeven price is calculated as:

[Sale weight (kg) – current weight (kg)]
x [Feed conversion efficiency x ration cost ($/kg)]
+ [Current weight (kg) x current price ($)]
÷ Sale weight (kg)

Compare the breakeven price with the current market price for finished livestock to decide if feeding is worthwhile.

In most cases, the margin for finished livestock during poor seasons is not sufficient to produce positive returns.

Grain cost alone a poor guide

The profitability of feeding livestock does not depend solely on the price of feed or livestock but is dictated by the FCE and the difference in the two prices:

FCE breakeven =
Net beef price ($/kg liveweight)/ration cost ($/kg)

If the breakeven FCE is lower than that likely to be achieved on-farm with the fodder and resources available, further calculations are not necessary.

Do not over-estimate hay needs

Because of its high FCE, hay is rarely the cheapest fodder for providing the key nutrients and energy required for drought survival.

Cereal and pasture hays in particular can be of insufficient digestibility and quality to provide even maintenance energy requirements. The role of hay is to maintain rumen health.

Tactical responses to drought

Selling stock during drought

In temperate, non-arid areas of southern Australia, where droughts seldom last for more than 12 months, feeding livestock throughout drought has been cheaper than the trading losses made from buying livestock after drought or the lost production while numbers were restored.

Post-drought herd rebuilding

Rebuilding livestock numbers post-drought by breeding is kind on cash flow but the loss of income due to low production levels for several years is substantial. To avoid a loss, restore properties to full production quickly.

Feeding throughout a drought

Properties with low reserves, low profitability or where owners are close to retirement will have difficulty replenishing reserves after a drought. Plan drought strategies toward selling livestock and minimising the use of reserves.

Feedlotting

Use feedlots and sacrifice paddocks earlier in drought to reduce devegetation, soil and nutrient loss and to reduce the feed and labour costs of hand feeding.

Drought reserves

Financial reserves are less risky than physical reserves as they do not decay, burn or deteriorate.

Kondinin Group research has shown that physical reserves of up to 30 per cent of that required for the most severe drought could be a cost-effective level of physical reserves in most years.

In good years, maximise the conservation of surplus pasture growth.

Drought avoidance

Establish off-farm investments unrelated to agriculture to mitigate the reduced cash flow during droughts.

TABLE 5 Feed conversion rates*

Feed type	FCE rating
High-quality silage	9:1–10:1
Low-quality silage	25:1
High-quality lucerne hay	8:1
Low-quality lucerne hay	20:1
Grain	6:1
Full feedlotting	7:1
Silage and processed grain	5.5–7:1
Hay and processed grain	6–7.5:1

* Feed conversion efficiency rates. Assumes a balanced diet and the animal is fed to appetite.

Source: Kondinin Group.

Cereal grains have a high FCE and are often a cheaper source of energy. Many producers tend to feed rations that include too much hay (20–25 per cent), which can inflate the energy cost of the ration. By reducing the proportion of hay in feed rations, producers could lower feed costs dramatically.

Actual requirements

Adult dry sheep can survive on grain-only diets for long periods. Even if only a small amount of pasture is present, they will have enough roughage to maintain rumen health. In feedlots, rations need to include at least 10% roughage to increase survival rates.

Cattle have a higher roughage requirement. Like sheep, small amounts of pasture can eliminate the need for hay in a grain-only diet but in feedlots they need about 10–15% roughage in a maintenance ration.

Producers supplying lower roughage rates will need to be vigilant in monitoring the condition of livestock. These lower levels also could be insufficient for young or lactating animals, which need about 20% roughage to maintain rumen health.

Feedlotting livestock

On-farm feedlots and sacrifice paddocks are a valuable method of reducing the energy lost through grazing, the labour costs of feeding and the impact on the environment.

Transferring livestock to feedlots during drought can prevent the total removal of paddock ground cover and reduce erosion.

If possible, remove livestock from paddocks when ground cover falls to 70% to ensure soils and pastures do not deteriorate to

TABLE 6 Breakeven example

	Breakeven price
Steer starting weight	200kg
Starting price	$1.22
Target weight	320kg
Ration price	$0.32/kg ($320/t)

Source: Kondinin Group.

Making the best of the good seasons pays off

Farm information

Farmers
Ray and Wendy Brown

Location
Morven, Queensland

Property size
5463ha

Enterprise
Beef cattle (10,000 head)

Annual rainfall
525mm

Soil type
Bottle tree scrub to brigalow

Soil pH
Not recorded

Ray and Wendy Brown, Morven, Queensland, continually assess markets, available feed and seasonal conditions to ensure their cattle breeding and feedlot enterprises are run at optimum production.

The Browns have 2000–4500 head custom fed in a feedlot each year and usually have another 2000–4000 head being grass fattened on their own, leased and agisted land.

The couple's management strategy is to alter the balance between numbers in the feedlot and paddock system, according to changes in cattle markets, available land and feed and climate forecasts.

Switch to trade heifers

For the past four years, Morven has had limited pasture feed available, resulting in Ray reducing livestock numbers in the paddock system to about 2100 head, the lowest levels ever. These numbers consisted of about 300 breeders (usually 600–700) and the rest were young trade stock.

Ray recently bought trade heifers rather than steers, believing there would be a shortage of breeding stock in the next few years. The well-bred heifers can be kept for the breeding herd or fattened in the feedlot for sale.

Ray buys trade cattle for his own operation and for a major feedlot in the State, accessing quality cattle from northern Queensland.

All breeding stock are run in Queensland where their performance is strictly monitored. Each cow will either have a small calf at foot or a larger calf at foot and be pregnant. If a breeding animal is not performing it becomes sale beef and is grass-fattened in

Ray Brown, Morven, Queensland, runs beef cattle throughout Queensland and New South Wales. Depending on seasonal conditions, the cattle are either fattened in a pasture system on-farm, on leased and agisted land or in a feedlot.

New South Wales where the cost of production is lower.

During the past 10 years, the Browns have found that by spreading their cattle enterprise throughout Queensland and NSW, they can spread their risk of a poor season and buffer against climate risk.

Not enough accuracy

Although the Browns monitor climatic conditions via internet weather sites, the Austar weather channel and historical records, they realise some tools are not always reliable. This was especially true during the recent drought where weather prediction tools severely understated its duration and severity.

From February 2002 to February 2003, their property only received 35 millimetres of rainfall compared with the 525mm average.

Evolving methods

How the Browns predict long-range weather conditions evolved as more advanced technology became available.

The couple initially used simple tools such as the long-range forecasts in newspapers and local rainfall records dating back to 1887. But internet and satellite television access has meant they can now use Commonwealth Bureau of Meteorology forecasts, the FarmShed weather site and Austar's weather channel.

Monitoring feed

The availability of feed is vital. Ray has set up the business to be flexible enough so that if paddock feed becomes a problem, cattle can be transferred to the feedlot.

A nutritionist assesses feed availability of their pastures and develops liquid feed supplements which the Browns can use while livestock are still grazing paddocks.

During 2002, Ray fed about 1200 head on grain, which helped ensure the breeding cows cycled and were joined successfully for calving during 2003.

TABLE 7 Ways to improve drought feeding management	
Eliminate excess roughage	Reduce hand-feeding costs by lowering hay levels in feed rations. While hay commands substantial price premiums during drought, it is seldom the most cost-effective fodder. The main value of hay is as roughage and only 5–15% is needed to maintain rumen. Hay is not needed if livestock can access roughage from the paddock.
Survival feeding	Control weight loss to survival levels and maintain this level while pasture remains inadequate. Feeding at above survival levels or to enhance lactation or fertility is rarely cost-effective during drought.
Reduce protein	High levels of protein are needed for growth and fattening but are seldom required for survival feeding. Cereal grain provides enough protein for most livestock and expensive protein supplements are not required.
Use cereal grains in rations	Cereal grains usually are the cheapest feed during drought, especially when the infrastructure, transport and feedlot costs of alternative sources are considered. Cereal grains are high in energy and have enough protein for survival.
Match stock and rations	Weigh and draft livestock into mobs according to their feed requirements to better match feed to stock requirements. Controlled weight loss to survival levels will also help reduce the level of feeding required.

Source: David Buckley, Charles Sturt University.

an unrecoverable level. Satellite vegetation maps will help gauge ground cover levels, which will trigger destocking decisions.

Matching feed to need

Feed requirements can be reduced substantially by matching feed rations to livestock requirements and implementing a controlled weight-loss programme to lower body fat levels to the minimum needed for survival. Weigh and draft livestock into groups of similar requirements.

Table 7 has ways to improve drought feeding management and reduce feeding costs.

Selling stock

One of the most widely used strategies is to sell more livestock as the drought progresses. This provides a cash flow to counteract the ongoing expense of feeding.

In areas where drought rarely lasts longer than 12 months, the most economical option has been to feed all livestock, except those sold as part of the annual production cycle.

TABLE 8 Expected net income from drought management strategies (1988)

	Next 12 months	Following year	Total two years
Retain all sheep and feed	$35,730	$57,720	$93,450
Sell oldest, feed young sheep, breed up	$38,730	$43,720	$82,450
Sell wethers, feed ewes and weaners, buy in after drought	$40,500	$720	$41,220
Agist wethers, feed ewes and weaners	$21,080	$57,720	$78,800

Source: Agriculture Victoria.

The costs of selling livestock during drought are not always obvious, so are often underestimated, especially trading losses associated with selling livestock during drought and buying replacements in the competitive post-drought restocking market.

To avoid trading losses, many producers prefer to restock by breeding gradually.

But the profit foregone due to a property being understocked for several years is an enormous hidden cost. This lost income or opportunity cost is often the largest cost of a drought. Returning a property to full production quickly will reduce this cost.

For producers who have sold livestock, increasing cropping area or livestock agistment could reduce the impact of destocking. Unfortunately, agistment is often not required after drought due to low livestock numbers, while more cropping would increase costs.

Making a choice

During 1988, Agriculture Victoria analysed how four different drought management strategies impact farm income and found retaining and feeding livestock was the best option for returns (see Table 8), provided the business could source and afford adequate feed.

Producers who retain livestock will need to carefully estimate the drought's duration as there is a risk the drought could last longer than a property's feed or cash reserves.

The most uneconomic outcome would be to feed livestock for an extended period but eventually still have to sell before the drought has broken.

Contacts

Program	Contact	Phone	Web site
Climate risk management software programs			
Rainman Streamflow	Kondinin Group	1800 677 761	www.kondinin.com.au
GrassGro	Horizon Agriculture	(02) 9440 8088	www.hzn.com.au/grassgro.htm
Ready Ration Pro		1800 652 483	www.pir.sa.gov.au
Pasture Growth Rate	CSIRO	(08) 9333 6000	www.pgr.csiro.au
Useful web sites			
United States medium range forecasts of vertical velocity and precipitation for Australia			http://grads.iges.org/pix/aus.vv.html
Farmshed:			www.thefarmshed.com.au
CSIRO pasture growth rate satellite tool			www.pgr.csiro.au
Weatherzone			www.weatherzone.com.au
Commonwealth Bureau of Meteorology			www.bom.gov.au/
The Long Paddock (Department of Natural Resources and Mines, Queensland)			www.longpaddock.qld.gov.au
ENSO predictions			www.dar.csiro.au/res/cm/coca.htm
Climate variability in agriculture research and development programme			www.cvap.gov.au
NSW Agriculture			www.agric.nsw.gov.au

Further reading

Rainman Streamflow review, see *Farming Ahead* No. 103, pages 20–21.

CSIRO satellite pasture assessment, see *Farming Ahead* No. 129, pages 4–49.

Feed budgeting, see *Farming Ahead* No. 126, pages 53–57.

Drought reserves, see *Farming Ahead* No. 137, pages 62–67.

Farm climate analysis aids management plans

Keeping detailed rainfall, pasture growth and enterprise performance records has enabled John and Robyn Ive, Yass, New South Wales, to weather seasonal conditions.

Watching their grazing enterprises suffer during the 1982–1983 drought was the catalyst to becoming better informed about seasonal conditions and prospects.

John wanted to become more proactive and adaptive in his responses to forecast conditions and uses a range of climate risk tools to set strategies in place.

Records and sources

Past, current and predicted seasonal conditions are an important part of John's records. He looks for patterns by analysing past rainfall.

Rather than aiming for a definitive weather prediction John prefers to use a range of information sources as a basis for viewing conditions and prospects from an informed perspective. These include tools such as the Rainman Streamflow computer software program, the Commonwealth Bureau of Meteorology web site and agricultural media.

Measuring performance

Maximising productivity from the limited amount of rainfall received is the key to the Ives' management strategy.

Each year the Ives analyse their grazing enterprise's performance relative to the climatic conditions during the year.

John calculated that in his cattle enterprise, individual weaning weights increased by more than two kilograms for each additional 10 millimetres of rainfall in the 12 months before weaning.

Similarly, in the superfine wool enterprise, the average wool cut per head (15.2 microns) increased by about 0.5 per cent for each additional 10mm of rainfall in the 12 months before shearing.

By comparing production in similar rainfall years, the Ives can know how efficiently the rainfall is used in each enterprise.

When production is lower than previous years, John investigates areas which can be improved such as stocking rates and flock age structure.

The Ives also monitor long-term productivity gains, separated from gains relating to variation in annual rainfall.

Since the 1982–1983 drought they have made significant gains for both enterprises, including an overall 50kg/head increase in cattle weaning weights.

Management changes

Because staple strength is an important characteristic in superfine wool and is largely influenced by seasonal conditions, John has developed profiles of staple fibre diameter against seasonal conditions.

The profiles show the seasonal conditions under which fibre diameter is likely to change most rapidly.

As a result, John alters feed availability during these periods to keep the fibre diameter as even as possible.

The Ives also measured the June–September wind patterns on their property for two years before choosing the least windy locations to build shelters for freshly shorn sheep. The sheep seek the protection offered by these structures automatically when weather conditions deteriorate.

Using the information

Climate data is also used in other ways to manage grazing enterprises. For example, when there is a poor seasonal forecast, John will decide the timing and number of livestock to turn-off to ensure they are in good condition to attract a price premium.

Similarly, because John does not produce on-farm stock feed, he will source fodder and grain during the better seasons while prices are low and store it on-farm.

Pasture improvement programmes are carried out when above average rainfall is expected. This minimises the pressure of livestock on the remaining pasture when land is temporarily removed from grazing and allows for improved pasture.

If poor seasonal conditions are forecast, John stops rotating stock around paddocks and transfers them to sacrifice paddocks where they are supplementary fed.

Leaving paddocks free from grazing enables a quick recovery when climate conditions improve.

Past experiences

John believes he relied too heavily on his experience of the 1982–1983 drought when he predicted the most recent drought would break during February or March 2003. On this basis, he had on-farm fodder reserves to carry all his stock until about June 2003.

Although there was encouraging rainfall during February, pasture growth was low, requiring hand-feeding of livestock until early September 2003.

While the Ives had enough stored grain to continue feeding sheep until September they had to buy hay during July for the cattle due for calving.

The hay was expensive at $460 per tonne but on average lucerne hay fed out from August 2002 to September 2003 (with a six-week break during September and October 2002) only cost $200/t because John had bought most of his fodder reserves earlier when prices were low. FA

Farm information

Farmers
John and Robyn Ive

Location
Yass, New South Wales

Property size
250ha

Enterprises
Self-replacing superfine Merino sheep, Angus cattle and farm forestry

Annual rainfall
730mm

Soil types
Heavy clays, sandy loams and skeletal soils

Soil pH
3.6–5.0

About the authors

Pamela Horsley (pictured) is a research officer with Kondinin Group and David Buckley (pictured) is an agribusiness lecturer at Charles Sturt University.

Email at pamelah@kondinin.com.au or dbuckly@csu.edu.au

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