Managing Risk in an Uncertain Climate

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Abstract
Managers of agricultural enterprises face a range of risks which impact on the outputs from their businesses. The result is variability in both physical production and financial performance. One of the primary drivers of this variability is climate. This paper focuses on the management of climate related risks, both historically and current, on a specific farm in a traditionally lower rainfall cropping region.

Historical Perspective

Farmers, particularly those in lower rainfall districts, have become very adept at managing the range of possibilities associated with farming in an uncertain climate. History has been a great teacher for those dynasties that have survived and a harsh master for those that have exposed themselves to unmanageable risks. Often, decision making has come down to intuition or "gut-feel" after suitable reference is made to the range of trigger points, indicators and information that experienced operators use. Wisdom developed from many years of hard knocks has often provided the important edge.

The result for many climatically challenged farmers has been survival and growth when fundamental economics would suggest otherwise. Farmers have developed systems which minimise downside risk in lean times (poor seasons) but leave the upside open when the (relatively) few good profit opportunities present themselves. The challenge for climate risk management is to find ways to build on these skills particularly when faced with a range of new issues to address. There have been significant changes in input and output pricing over the past two years. Fertiliser prices have risen from $535/tonne in 2007 to $1200/tonne in 2008 with projections of $1500/tonne in 2009. These changes along with poor seasonal conditions and the strong likelihood of enhanced greenhouse gas induced climate change are driving the need for improved strategies into the future.

Our property at Port Germein is located on the lower rainfall edge of the South Australian cropping zone with annual mean rainfall of about 310mm (Figure 1 shows average monthly rainfall and mean temperatures for a nearby recording station). Variability in rainfall is high as shown in the time series for rainfall for the same station in Figure 2.

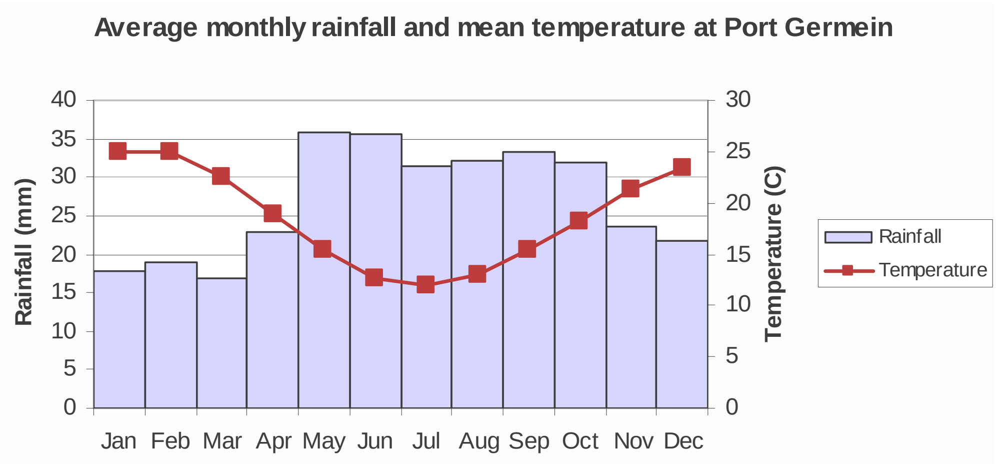

Figure 1. Average monthly rainfall (mm) and mean temperature (^{o}C) at Port Germein, SA, 1900-2007.

Global Issues Paddock Action. Proceedings of the 14th Australian Agronomy Conference. September 2008, Adelaide South Australia.

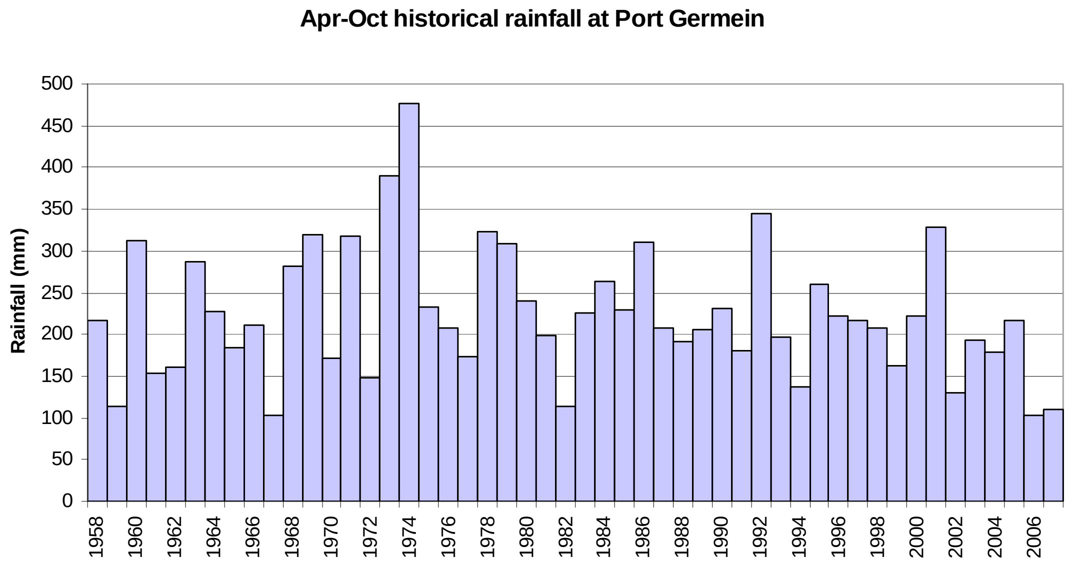

Figure 2. April-Oct historical rainfall over the past 50 years at Port Germein.

I have been involved in our farm business for 30 years and can identify about 5 years in that time that have been very profitable for our business. As an example, Figure 3 shows the variation in operating profit over the past 12 years. The profitable years have primarily resulted from good seasonal rains and timing, but luck with output pricing has also played its part. The remaining years have generally seen seasonal conditions which have resulted in moisture stress to a greater or lesser extent. In these years, the management focus has been heavily biased towards limiting too much downside exposure rather than maximising returns.

Interestingly, traditional viability assessments of such systems have tended to focus on a mythical Decile 5 season with costs and returns being calculated on this median event. This has tended to understate the profitability actually achieved under a managed risk approach.

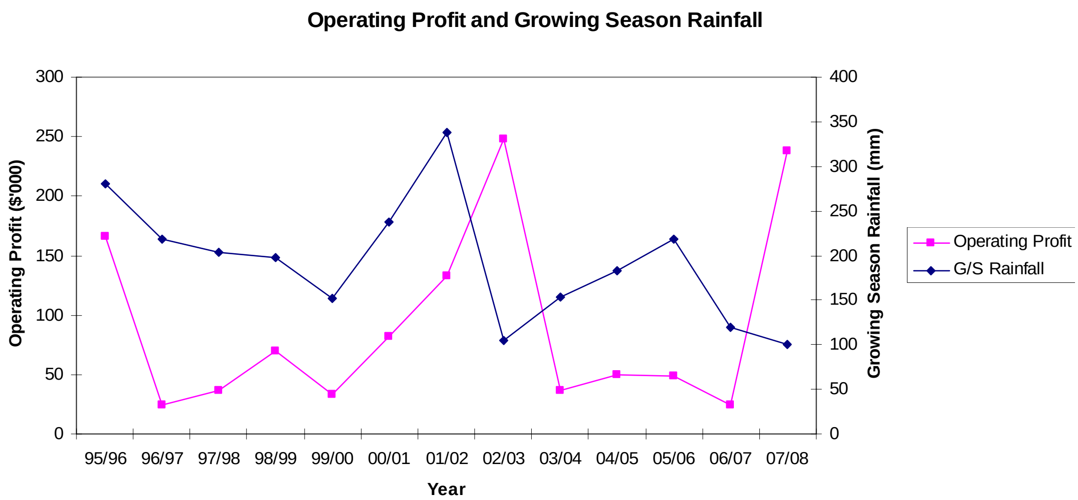

Figure 3. Operating Profit and Growing Season Rainfall over time. Note that some of the receipt of profits from cropping in 2001 were delayed until 2002/03 through grain pooling.

Current Approaches to Managing Climate Variability

Several years ago, improved methods of managing risk (or variability) was identified by our business as a primary focus area to lift longer term viability. The processes by which this has been done historically and currently can broadly be segregated into short term and longer term responses. Bill Long, a respected Yorke Peninsula farm consultant and thinker, described these responses as strategic (long term) and tactical (short term).

Strategic Response
The strategic response to managing climate variability is the building of robust and resilient businesses which are able to handle and respond to the variability. In this regard, the variability is seen as a detriment to the business and is countered by employing systems which attempt to reduce the downside risks (often at the expense of reduced upside opportunity).

The most common strategic response to managing climate variability in lower rainfall cropping areas is to maintain a healthy emphasis on livestock enterprises. More intensive cropping regimes are seen as high risk even though a run of better seasons would likely see a more profitable outcome from more intensive cropping. A relatively recent development of an old technique involves using cereal crops as a grazing resource either at an early stage of the season or throughout the year. Multipurpose crop outcomes (grain, graze, hay) allow the manager to obtain returns when single crop outcomes would fail.

On our own property, insufficient scale was identified as an important driver of business risk. There was a need to expand the size of the business to allow both better opportunities to capitalise on upside opportunities as well as allowing more scope to ride out the poorer seasons. Our goal was to double the 2001/02 crop area of 550 Ha over the next 5 years. The response was to purchase farming land in a more reliable area and expand sharefarming and leased areas. The trade off for a more resilient business was a drop in business equity, but not to a dangerous level. Table 1 includes cropped area to cereals over the past 10 years and shows that the goal was achieved, albeit slightly slower than anticipated.

The attempt to quarantine risk was a part of this strategic response. This involved establishing a portion of the business which was largely insulated from seasonal risk. We were fortunate to have a modest area of irrigation available on which we established a lucerne hay enterprise with sales made to the local horse trade. The irrigation also guaranteed winter fodder production effectively insulating the livestock enterprises from poor seasons. Our aim was to have at least 50% of our total annual costs covered from non-seasonally dependant sources. The balance of the business which was exposed to seasonal risk could be forgiven for not performing in the poorer years but would show spectacular returns during favourable times. Unfortunately, the extended run of dry years has seen irrigation water decline to the stage where this strategy is no longer valid.

Other examples of strategic responses (not necessarily on our own property) include diversification, off-farm income and general high levels of financial and agronomic management.

Tactical Response
The short term or tactical response to climate variability on our property has been to attempt to develop techniques to better capture upside opportunities and limit downside exposure. Unlike longer term responses, tactical response accepts that variability is our friend and can be used to maximise profits over time. In our case, variability provides us with effectively the opportunity to farm in a much higher rainfall zone, albeit only once or twice a decade.

The success of such an approach relies on our ability to pick where a season is headed in the short term and adjust management accordingly. We have very large production variability, particularly on our more marginal northern country and this production variability is largely moisture driven (rather than frost or other uncertainty). So the focus has been on assessing the yield drivers and assigning values to them to attempt to arrive at best bet yield outlooks early enough to include them in management. This needs to be at seeding when larger scale decisions are required regarding crop areas and type and input levels.

Our assessment of yield drivers on our farm is as follows:

- Plant Available Water (PAW) at seeding
- Seeding Date as compared to optimum
- Amount of seeding rain (related to PAW but also to crop establishment issues)
- Agronomic constraints-Weeds, nutrition, diseases
- Sub-soil constraints- but effectively allowed for in PAW
- Growing season rainfall (post seeding)

With the exception of the post sowing growing season rainfall, all of the other drivers are known at seeding. As a proxy for the growing season rainfall we use a seasonal outlook forecast which while being far from accurate, has shown itself to be right more often than wrong over a long time period.

We have developed simple tools to incorporate the yield drivers into forms which can give indications of final yield response. These include a seeding index and a yield prediction model. An important further development of this was the establishment of a soil characterisation site on our property in 2007. This has allowed us to use the yield probability curve generated by the APSIM model to establish probabilities of various yield outcomes.

The tactical response system we are using on our property is a derivative of what farmers have been using in lower rainfall areas for many years. We have merely changed the emphasis slightly towards active management and objective assessment, which hopefully allows improved long term impact on profitability.

Results

It is difficult to assess the success or otherwise of the active focus we have placed on improving our management of seasonal risk.

The strategic response changes address wider risk areas and I am confident they have allowed the business to become more resilient.

The shorter term tactical responses are aimed at better outcomes for the business over a reasonably long timeframe (perhaps 5-10 years). Success is determined by whether the profitability drivers (primarily crop yield) can be predicted well enough to enable the management changes to have effect. There is a very strong emphasis on maximising of opportunities. Unfortunately, these opportunities have been few in recent years due to the extended poor run of seasons.

Table 1 Predicted versus actual yields and cropped area.

YIELDS	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
"Sandalwood"										
-Predicted	1.7	1.0	2.5	2.7	0.7	1.8	0.2	1.0	0.5	2.9
-Actual	2.2	0.4	1.8	3.0	0.0	0.4	0.7	1.2	0.6	0.9
"The Oaks"										
-Predicted	2.2	1.5	3.4	3.6	1.7	2.5	1.1	1.7	1.3	3.7
-Actual	2.0	0.8	2.4	4.5	1.2	1.8	0.9	1.6	0.9	1.5
Normal Cereal Area	550	550	550	550	550	550	740	740	1080	910
Actual Cereal Area	662	532	642	550	437	855	640	702	709	1348

Table 1 sets out predicted yields and actual yields over two of our properties over the past 10 years. This method of predicting yields was commenced in 2003 with historical data used for earlier years. The table also shows the actual area cropped to cereals each year compared to that which would occur under a "normal" rotation.

Since 2003 we have become more confident in our ability to predict the seasonal outcome. We have made substantial changes to crop area and type and fertiliser input levels in certain years depending on projections. The extent of the changes has depended on the strength of the signal. A number of years (perhaps 40-50% over a long period) will have mixed signals and it is not possible to get a clear direction on where the season is heading. However, there are other years which provide strong signals in either direction. On our property, signals in 2006 were strongly negative (subsequently proved correct) while in 2007 they were strongly positive. It is these "clear signal" years which provide us with opportunities to make substantial changes which will hopefully result in better outcomes.

As it turned out, 2007 was an interesting test case. The predicted yield and profit projections were very high with strong positive signals (based on good planting conditions, high PAW and above average seasonal outlook forecasts). The farm program was expanded substantially with crop area increased to the maximum into a rotation phase that had been working towards this opportunity for the preceding two years.

As we now know, 2007 did not provide us with the above average growing season rainfall we were anticipating. The growing season rainfall post-seeding was in the lower regions of Decile 1 (rather than the predicted Decile 7). Normally, this would mean very poor yields. However, due to the good PAW at seeding, yields ended up being just slightly below average. With the better price structure in 2007, the overall result has been financially reasonable. The fact that we “went for it” but did not get the season we were anticipating has not had a detrimental effect on our business.

Conclusions

Farmers are facing a new level of challenges in adjusting to higher input and output prices and the associated changes in risk profiles. As the effects of climate change become more apparent, management techniques will need to be sharpened as part of the adaptive process.

The lower rainfall portions of the cropping belt are not automatically destined for large scale system decimation under climate change scenarios. These regions have shown remarkable resilience over more than a century of change. The improved management of climatic risk as part of a systems approach to business risk management has the potential to improve outcomes for primary producers in these areas. The development and enhancement of tools which support the strategic and tactical responses is seen as an important part of the process.