So, what happens when the drought breaks?

By David Dowling

To borrow a term from a famous middle east dictator, the past 12 to 18 months has seen the 'mother of all droughts' in Australia. Until February at least, a big proportion of the country was in drought — much of it the worst on record.

Isolated areas, especially on the east coast, are probably already out of drought. And things are also starting to look up in our major broadacre cropping areas after some good but patchy falls in February and March.

The El Niño 'event' of the past year hasn't been a strong one in historical terms. Sea surface tempreatures in the equatorial Pacific have been consistently high over the period, although not to the same extent as previous El Niños.

But the effect on the ground has been out of all proportion to the 'strength' of the El Niño. And the geographical spread of this big dry is just about unheard of.

The good news is that these dark clouds are starting to show a silver lining, if you'll pardon the pun. Both the Bureau of Meteorology's National Climate Centre and the Queensland Centre for Climate Applications (QCCA) are saying that the odds are good for a cooling of the equatorial Pacific and a sustained rise in the Southern Oscillation Index (SOI) in the important autumn–early winter period this year.

In other words, it looks like the drought is going to break — the same conclusion drawn by many people just looking at the change in weather patterns over the past couple of months. This view is supported by the majority of the large scale global climate models used around the world. Most of these models predict more favourable sea surface temperatures in coming months which should move the SOI to neutral or La Niña territory.

So what would the breaking of the drought signify for the prospects of a cotton crop next season? Droughts can either break with a bang or with a whimper. In the former case, we will probably be complaining about floods sooner rather than later. But if it breaks with a whimper, water supplies are going to remain critical going into next season.

Cotton (or any?) farming is a game of reducing risk and taking advantage of opportunities. So let's assume that all the models are right and this El Niño breaks down soon.

How much water can we expect in the major irrigation storages by the start of next season?

And what sort of soil moisture levels can we expect to kick off next year's crop — both irrigated and dryland.

To get some rough answers, we ran some scenarios through the *Streamflow* program — a recent add-on to the new version of the very popular *Rainman* program developed by the QCCA.

Most growers would be well aware of *Rainman*. Put simply, it uses historical rainfall records in individual areas to predict the likely seasonal rainfall based on the recent or expected pattern of behaviour of the SOI. If the SOI is positive or rising, there is usually an increased chance of more rain.

Streamflow works in a similar way, except that it predicts likely river flows based on historical stream guage information.

There are a couple of limitations to this approach. Firstly, the historical records of many stream flows have been changed significantly by the construction of irrigation storages. And water authorities north of the border are reluctant to provide good access to inflow records in Queensland storages until the current review of water resources is completed.

On the other hand, there are good records (over 100 years) for stream flows into all the major storages in NSW and some elsewhere.

The scenarious

We used *Streamflow* to estimate the likely median and average stream flows into these storages between April and November, and the resulting percentage of full capacity these flow would produce.

Of course, they don't tell the full story, because some of the water in each storage is not 'effective' and there would be evaporation losses over that period. Growers would have to make their own estimates of likely evaporation losses and possible allocations given these levels in the storages.

According to QCCA's Nick Clarkson, the median value for storage inflow is probably the best indicator. The median is the value that is exceeded in half of the years.

"The average flow tends to overestimate what is likely to happen because it includes some major flood years which skew the results," he says.

The three scenarios we used for the SOI were:

• It stays below minus five this year, which is fairly unlikely according to the experts;

• It swings to being strongly positive for the rest of the year — quite possible, but no sure thing; and,

• It breaks out of the negative pattern but doesn't necessarily become strongly positive. In this case we used the long term median and average flow for all years.

So, if the El Niño breaks down this autumn as expected, median stream flows will range between the median for all years and the median for La Niña years.

The value of the SOI has a significant impact on stream flows.

RESULTS

For every storage, there were statistically significant differences between the three scenarios (see Table 1). The only areas where the SOI had no significant effect on the stream flow were in central Queensland.

Border rivers

If the El Niño continues, Glenlyon dam will have a median inflow of about 14,000 ML by November, leaving it with only 17 per cent. But if the El Niño breaks down, the median inflow is over 23,000 ML, taking it to 20 per cent. And if the SOI becomes strongly positive, the median flow would be 44,000 ML, taking Glenlyon to 28 per cent.

For Pindari, the median inflows would range from 65,000 to 101,000 ML if the El Niño breaks down as expected, producing 46–57 per cent of full capacity.

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TABLE 1: Likely inflows into major storages before next season

Dam	Full volume (ML)	Current volume (ML at March 17)	Catchment area (sq km)	SOI level (April to Nov)	Median inflow (ML, April to Nov)	% full	Average inflow (ML, April to Nov)	% full
Glenlyon	254,310	28435	1320	<–5	13972	17	16817	18
				>+5	43692	**28**	66898	37
				All years	23414	**20**	40603	27
Pindari	312000	76930	2110	<–5	22925	32	35010	36
				>+5	101238	**57**	161528	76
				All years	65551	**46**	98915	56
Copeton	1361720	161197	5240	<–5	98296	19	116824	20
				>+5	331853	**36**	567323	53
				All years	206169	**27**	331167	36
Split Rock	397000	50725	1650	<–5	18170	17	29915	20
				>+5	92690	**36**	127155	45
				All years	35720	**22**	69676	30
Keepit	425,500	59989	5700	<–5	64740	29	81002	33
				>+5	244645	**72**	313147	88
				All years	132145	**45**	197421	60
Burrendong	1188000	139136	13880	<–5	228915	31	316149	38
				>+5	980880	**94**	1377084	128
				All years	594958	**62**	830323	82
Windamere	368120	186703	1030	<–5	12881	54	20064	56
				>+5	38589	**61**	75785	71
				All years	30074	**59**	42963	62
Wyangala	1220000	144087	8290	<–5	211765	29	338694	40
				>+5	762578	**74**	1051162	98
				All years	483406	**51**	687357	68

Gwydir valley

The analysis shows the median level of inflow into Copeton dam to range from 206,000 to 332,000 ML if the El Niño breaks down, taking it to 27–36 per cent of full capacity.

Namoi valley

The smaller capacity and relatively large catchment of Keepit dam would ensure it goes to 45–72 per cent of full capacity from median flows if the El Niño breaks down. Split Rock dam would go to 22–36 per cent.

Macquarie valley

The situation in the Macquarie looks quite promising (touch wood). An El Niño breakdown would produce median flows to take Burrendong to 62–94 per cent capacity by November plus 59–61 per cent in Windamere.

Even if the SOI stays negative, median flows would take Burrendong to 31 per cent and Windamere to 54 per cent.

Lachlan valley

In the Lachlan, Wyangala dam would go to 51–74 per cent of capacity.

QUEENSLAND RESULTS

Apart from Emerald, the Queensland irrigation storages are generally not as big as in NSW and there is not the same data on storage inflow. But there are some interesting comparisons of stream flow variability (Table 2).

Balonne

The SOI effect on the Balonne at St George was very striking. If the SOI remains negative, the median flow would be about 27,000 ML at St George. The 'all years' median flow would be about 147,000 ML, with over 587,000 ML in a La Niña year. Irrigators in south west Queensland would be well advised to keep an eye on the SOI over the next few months.

Condamine

The flow in the Condamine at Chinchilla also shows a very strong response to the SOI — ranging from 16,000 ML in a negative year to 145,000 in a positive year, with a median of 80,000 ML across all years.

Emerald

The impact of the SOI on median stream flow in the Nogoa river at Craigmore, upstream of Fairbairn dam, was not significant. Using the same scenario as before, median stream flow at this location only ranged from 20,000 ML for a strongly negative SOI to 42,000 ML for a strongly positive SOI. No estimates can be made of the flows into the storage.

TABLE 2: Likely flows in selected Queensland streams

River	Stream gauge	SOI level (April to Nov)	Median inflow (ML, April to Nov)	Average inflow (ML, April to Nov)
Nogoa*	Craigmore	<–5	19858	62167
		>+5	41963	90327
		All years	26064	150538
Dawson*	Utopia Downs	<–5	6583	9615
		>+5	19567	50674
		All years	7772	52040
Balonne	St George	<–5	26753	101280
		>+5	587468	1162492
		All years	147336	574949
Condamine	Chinchilla	<–5	15912	54620
		>+5	145435	462914
		All years	80009	235064

* Not significant

TABLE 3: Likely rainfall at selected locations

Town	SOI level (April to Nov)	Median rainfall (mm, April to Nov)	Average rainfall (mm, April to Nov)
Dalby	<–5	243	256
	>+5	429	436
	All years	353	353
Emerald	<–5	190	209
	>+5	341	369
	All years	264	276
Narrabri	<–5	294	299
	>+5	477	475
	All years	358	376
Bourke	<–5	142	143
	>+5	260	284
	All years	191	207

Dawson river

The only stream guage available for the Dawson river was at Utopia Downs. Again, the impact of the SOI on stream flow was not significant, although the flow was three times as great for a strongly positive SOI as for a strongly negative value. Again, no estimates should be drawn of total flows.

RAINFALL EFFECTS

Of course, stream flows and storage inflows don't give the full story of the water resources available to plant and grow a cotton crop.

Higher stream flows are likely to mean an increase in high flow and water harvesting events, which means on-farm storages are likely to be holding more water next spring if the El Niño breaks down soon.

And above average winter and spring rainfall will add to soil moisture reserves for both irrigated and dryland crops. We all know that the soil is the best place to store moisture, so it is worthwhile looking at some expected rainfall effects of our breakdown in the El Niño (Table 3).

While the differences are significant for the four towns shown, the effect is not as great as for stream flow. Nevertheless, an extra 100 to 200 mm of rain in each area will go a long way to topping up soil moisture reserves — taking the strain off early irrigation supplies and maybe allowing some dryland cotton plantings.

CRYSTAL BALL TIME

It will be interesting to see how these estimates pan out. But assuming the El Niño breaks down soon, the median stream flow figures point to irrigation storages between 30 and 80 per cent of capacity for next season. Given that on-farm storages and soil moisture levels should also be healthier, a cotton crop planting of over 70 per cent of the full area is not out of the question.

Let's say 420,000 hectares. Has anyone got a better guess?

For more information on the Streamflow and Rainman programs, contact Nick Clarkson at QCCA on 07 4688 1248.