

# Farm-planning

## for all seasons

Graeme O'Neill



THE **INDUSTRY** sector in Australia feels the impact of drought earlier or more severely than agriculture. Climate variability – teamed with the vagaries of economic cycles and international commodity prices – adds risk to a risky business.

The impact of the extended El Niño sequence of 1991/95 on Australia's rural sector has been devastating. In a paper presented at a Sydney drought conference on April 6 this year, a senior economist with the Australian Bureau of Agriculture and Resource Economics, Vivek Tulpule, said that during this period average production by drought-hit rural industries fell by about 10%, while agricultural exports fell by 12%.

The direct costs to agriculture totalled some \$2.4 billion, but because of a 2:1 multiplier effect on industries that orbit agriculture, the eventual cost to the Australian economy could be close to \$5 billion.

CSIRO's climate variability program aims, in the long term, to give rural communities reliable predictions of climate as far as three seasons ahead, and to develop tools to simplify decision-making. Farmers will use more reliable predictions of seasonal conditions to enhance their agronomic and economic decisions.

The immediate effects of lost production can be devastating for farmers, and for the economy. It is the underlying consequences of drought, however, that

threaten the sustainability of Australia's agriculture in the long term. One of the most significant of these effects is the loss of topsoil which is eroded by wind and rain.

'After drought and wind erosion, the exposed surface soil is fragile,' Dr Colin Chartres from CSIRO's Division of Soils at Canberra, says. 'In semi-arid environments, drought exposes the soil surface to the elements, and in high winds, paddocks lose topsoil.'

'Most mineralised nutrients and organic matter are contained in the top few centimetres of soil, especially phosphate and nitrogen. Much of the fine topsoil is lost from the continent into the surrounding oceans.'

Dr John Williams, also from the Soils Division, says graziers need tools that enable them to match their stocking rates to climate variability. For example, in the Upper Burdekin region of Queensland's semi-arid tropics, the actual stocking rate after the 1960s did not match the safe stocking rate, which was following the seasonal variability (see graph on page 24).

Williams says the gap between safe stocking rate and actual rate during the late 1970s and 1980s caused severe erosion and degradation. Following overgrazing, pasture grasses must be re-established. In the meantime, pastures are vulnerable to invasion by weeds, particularly woody weeds. Several decision support systems that help guide graziers to optimum management strategies for livestock production for pasture have been developed at the Division of Plant Industry (see story below).

## Decision-making in the field

REDUCING stocking rates in response to drought is often seen as an obvious management option to avoid further damage to the environment. But such a decision must be made carefully as a reduction in livestock will reduce income in the years following drought.

CSIRO's Division of Plant Industry has developed several computer-based decision-support systems that help graziers select optimum management strategies for livestock production from pasture. Using these systems, the cost of maintaining protective ground cover through agistment, sale or supplementary feeding, coupled with the management of reproductive animals, can be estimated and optimal policy developed.

Two decision-support systems in widespread use are GrazFeed (grazing-animal nutrition and production) and MetAccess (a daily weather database), both available from Horizon Technology Pty Ltd. A third system, GrassGro, which links GrazFeed to pasture growth and gross margins, will be released shortly.

This project was developed by Dr John Donnelly and his colleagues Dr Mike Freer and Dr Andrew Moore. Donnelly says MetAccess draws on historic

climate data for a particular region to estimate, for example, the frequency of useful falls of rain at different times of year.

'This information will, on average, give the best estimate of success or failure for a decision,' Donnelly says. 'These assessments may be improved, however, as meteorologists learn more about the weather systems affecting Australia's climate.'

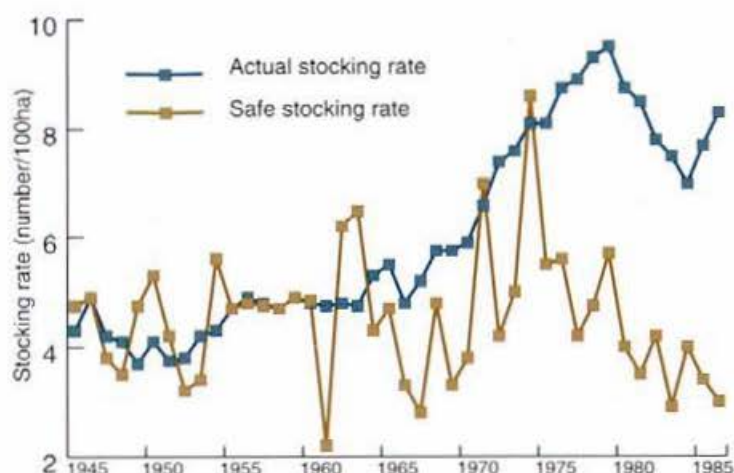
Another decision-support system, RANGEPAK Herd-Econ, has been developed at the Division of Wildlife and Ecology for graziers in pastoral regions. The program enables pastoralists to compare the profitability of different management options during drought, such as which age and class of stock to retain, or the potential benefits of stock agistment.

### More about the programs

Donnelly J (1995) Weather records and decisions. *Mackinnon Project Newsletter* Jan, pp2-3.

Taylor R (1995) Planning for drought. *Rural Research* 166:21-22.





In the Upper Burdekin region of Queensland's semi-arid tropics, the actual stocking rate after the 1960s did not match the safe stocking rate. During the late 1970s and 1980s, this caused severe erosion and degradation. (Source: Tony Pressland and Greg McKeon, QDPI)

### When the drought breaks

Drought is not the only face of climate to have damaging effects on primary production. The occurrence and impacts of high-rainfall events are also of concern to scientists involved in the Climate Variability Program.

Chartres says that heavy, drought-breaking rains can cause large amounts of soil to run-off and be deposited as sediment that can trigger algal blooms and silt up dams and roadway culverts.

Run-off is accentuated by land clearance, a factor that Chartres says almost certainly worsened the flooding that occurred in northern Queensland and northern New South Wales in the early 1990s. Natural vegetation, by slowing run-off and promoting infiltration, tends to retain rain where it falls.

A combination of land clearance and high recharge rates during extreme rainfall can have serious long-term consequences by causing the water table to rise, bringing salt stored deep in the soil profile to the surface.

Chartres says the Liverpool Plains Catchment in north-western NSW is an area where the climate variability program is focusing some of its efforts.

'The Liverpool Plains is one of the most productive agricultural areas in the country because there is both winter and summer cropping,' Chartres says. 'Water tables under the region are rising at 10/30 cm a year, threatening to render a sixth of the region's 1.2 million hectares of agricultural soil useless within 10 years.'

'The area has been approaching a threshold where a few wetter-than-average years, or a big flood, may have an overwhelming impact on agricultural sustainability because of rising water tables and associated salts reaching rooting depth over wide areas.'

Waterlogging and salinisation occur together in most cases. The salts are carried in by groundwater.

Chartres says large areas of Western Australia's Kent catchment have been affected by this process, and parts of the Upper Burdekin region are also at risk.

Present and future land clearing in the Burdekin area may have the consequence in some terrain of increasing dryland salinisation, he says. The fact that there has been a period of drought in recent years may have slowed the onset of waterlogging and salinisation.

The role of the program will be to use models to predict the likely occurrence of abnormal sequences of wet weather and then to link this information to the catchment's response in terms of waterlogging and salinisation. These outcomes will then be used as

feedback to help farmers change management practices in an economically viable manner in order to minimise water recharge to the groundwater table.

Chartres says CSIRO and other state and federal agencies collaborating in the Liverpool Plains study are developing a model of the catchment that will enable a range of scenarios to be simulated.

'We will be able to ask questions such as, if we get five wet years in a row, how much land goes out of production?' he says. 'If we can use the model to determine the maximum allowable rate of recharge, we can hope to change cropping systems to minimise overall recharge.'

'We can also help farmers to make decisions on opportunistic cropping to take advantage of stored soil water. Often farmers will leave a field fallow for 12 months between their winter and summer crops. If conditions are right, they could grow an extra crop instead of leaving the soil fallow.'

Better climate modelling could improve the timing of management decisions, or aid assessment of the likely impact of extreme events on underlying problems, Chartres says. Extra notice of good seasons, for example, would help wheat farmers in humid areas to increase fertiliser rates, raising the yield and protein content in their grain.

### More about farming

Clewett J Owens DT, Clarkson NM and Partridge IJ (1993) RAINMAN: Using El Niño and Australia's rainfall history for better management today. *Proc. Tasmanian Zone of the Australian Institute of Agricultural Science National Conference*, pp16-19.

Muchow RC and Bellamy JA eds (1991) *Climatic risk in crop production: models and management for the semi-arid tropics and subtropics*. CAB International, London.

## Climate ex

IN AUSTRALIA'S arid zone, the environmental impact of pastoralism depends on how well climate variability is managed by graziers.

Dr Mark Stafford Smith from CSIRO's Centre for Arid Zone Research at Alice Springs is studying the influence of climatic variability on the productivity of Australia's arid rangelands. He says the way graziers in the arid zone manage climate variability can magnify or minimise the impact of grazing on the landscape.

'If graziers stock their land lightly, it may take a disastrous drought before they have to de-stock,' he says. 'But if they stock heavily they can find themselves in trouble in an average year. The key is to optimise one's management against the pattern of dry, good and average years.'

What makes management challenging is the diversity of climatic regimes in the rangelands, Stafford Smith says. There can be no such thing as a 'homogenised approach'. For example, graziers in the Top End are guaranteed some rain every year, but they don't know when or how much. By March, if there has been no useful rain, they must make a decision on their stocking rate.

In the southern half of the rangelands the climate is dominated by winter rainfall, so graziers can make decisions at the end of winter. But there is a band south of Alice Springs where rain can occur at any time. In these areas,

# Extremes a challenge for pastoralists

climate prediction can be very important, Stafford Smith says.

He says better insights are needed into how climate influences wildlife diversity, and the population density of feral animals that prey upon or compete with native species.

'Drought is an opportune time to control larger feral animals because they have to come to water,' he says. 'But it's also a hard time to motivate graziers to take control measures, and the money may not be available. The ability to forecast drought would enable government agencies to set aside funds for control programs.

'For instance, if there were \$300 000 available over three years, it might be best to spend most of it during a drought year when feral animals are vulnerable. We need to develop our ability to budget more effectively, not just in monetary terms, but in the way we use water and fire in management.'

In the arid zone it's not just year-to-year variability, but decadal variability that is important, Stafford Smith says.

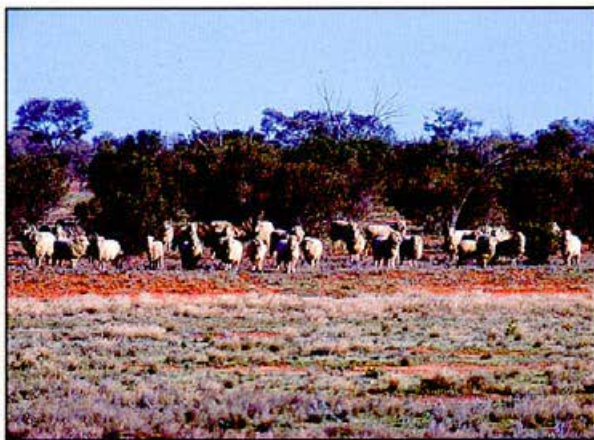
'If you look back at rainfall records for Alice Springs, the mean annual rainfall between 1968/78 was two-and-a-half times that of the preceding decade, the driest on record. Events on that timescale are important because it was during this wet period that we had the huge germination of woody weeds across the eastern half of the continent. Today, the opportunity to control the weeds has passed. We should take our chances when the climate presents them.'

## More about arid lands

Stafford Smith DM (1992) Stocking rate strategies across Australia: or, how do you cope with drought? *Range Management Newsletter* 92(1):1-3.

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