This week Drought

Australia is in the grip of an epic drought. It now faces some tough decisions about how its people are going to live on a land with ever-diminishing water supplies. Rachel Nowak reports

THE CONTINENT THAT RAN DRY
IN THE beginning the Australian drought was fun. A talking point over the barbecue, an excuse to shower with a lover or spend more cloud-free days with friends at the beach. Tales of thirst-crazed camels rampaging through country towns merely added to the excitement.

Sometime last year, the mood changed – perhaps with the first inkling that water restrictions had all but destroyed urban gardens and that agricultural production across the country had fallen by a fifth. Last month, when water storage fell so low that energy supplies were threatened, the sense of panic became palpable. Australia is facing a national crisis, one that promises to transform the country, inexorably changing where people live, what they eat, what they do in their spare time, and – most threatening of all – their future economic well-being.

Whether Australia can adapt remains to be seen, and water experts around the world will be following closely as regions as far afield as the south-east and south-west US, and south-west China grapple with their own droughts. “Water will still come out of the tap, but at what cost?” asks Chris Mitchell of CSIRO Marine and Atmospheric Research (CMAR) in Melbourne. “Will we adapt and ameliorate the problem or adapt and exacerbate it.”

Across the continent, average rainfall has actually increased marginally over the past century. But there has been a shift in where rain falls. Since the 1970s the unpopulated regions of the north have got wetter, but the southern and eastern regions, where most people live, are drier.

To make matters worse, Australia’s average temperatures have been increasing at an accelerating rate in the past 20 years. Seven of the past 10 years have been hotter than average, and four states have just clocked up their warmest autumn on record. Higher temperatures increase evaporation, making a bad drought even worse.

Today large swathes of six of Australia’s seven states and territories, and all of Australia’s major cities, are officially “in drought” and have been
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for years. That’s in spite of the rain that has fallen over the past few weeks, and the once-in-30-years storms and floods that hit Hunter valley, north of Sydney, last weekend. Because the land is bone dry, it has simply sucked up the rain. That has helped some farmers but water run-off is still well below average and the level of reservoirs remains perilously low (see Diagram, p 11).

Melbourne’s water storage stands at 28 per cent of its capacity. Sydney’s is at 37 per cent. Perth, where rainfall has fallen 15 per cent in the past half-century, and inflows into the dams by more than 40 per cent, now accepts drought as the norm, and has dropped its expected annual catchment from 340 to 180 gigalitres. Last year, just 120 gigalitres flowed into its dams.

“People have been taken by surprise at the speed this has happened,” says John Langford, director of UniWater, a research initiative shared by Monash and Melbourne Universities. What makes the Big Dry more shocking is that just 10 years ago, Australia was considered drought-proof. Precisely because the country is so susceptible to huge variations in rainfall, the nation-builders of the 1950s and 1960s equipped city and country with massive multi-year reservoirs, providing the highest water storage capacity per capita in the world, and plumb in hundreds of kilometres of irrigation channels. What they hadn’t bargained for was the thirst of the country’s growing population, or just how brutal a drought could be.

Australia sits at the centre of three oceans, the Indian, the Pacific and the Southern. Its reputation as the driest inhabited continent on Earth, and the one with the most variable rainfall (in the 1970s, large parts of Australia were beset with floods), depends on a complex interplay between these oceans and the atmosphere.

The best understood system is the El Niño-Southern Oscillation. During El Niño events, which usually peak in the Australian summer, warm water develops in the eastern and southeastern tropical Pacific, triggering differences in air pressure that drive rain that should fall onto eastern Australia out over the ocean. Australia has had two such El Niños in quick succession, one in 2002 and 2003, and one in 2006 and 2007, with no intervening wet periods.

Since 1997, the Indian Ocean Dipole – a cooling of the tropical eastern Indian Ocean, and a warming of the west – has also been more active, reducing spring rains in south-east Australia. Finally, winter rains have dropped off due to changes in the Southern Annular Mode, a climate pattern that prevents rain-bearing low-pressure systems reaching southern Australia.

A large portion of the drought-inducing changes is undoubtedly due to natural variation. But there is the possibility that climate change, especially rising temperatures, has turned a severe drought into a historic one. In Australia’s worst-hit region, Perth and the south-west, increases in greenhouse gases account for about half of the reduction in rainfall, according to an analysis of 70 experiments using 21 climate models by Wenju Cai of CMAR and CSIRO colleague Tim Cowan (Geophysical Research Letters, vol 33, p L247098).

For many water experts the spectre of climate change makes arguments over the cause of the current drought almost irrelevant: the most recent assessment by the Intergovernmental Panel on Climate Change was confident that climate change would make the southern regions of Australia where most people live warmer and drier, and more susceptible to extreme variations in weather. In other words, Australia may survive this drought, but there will be more to come.

“For our major cities, supply will fail to meet demand by 40 per cent by

MURRAY RIVER SYSTEM DRIES UP

Talk about drought in Australia, and conversation quickly turns to the Murray-Darling Basin (MDB). This monster river system symbolises the difficulties of divvying up an ephemeral resource like water.

The rivers of the MDB cross four states and one territory, each of which hands over some of its water management responsibilities to a mishmash of often overlapping local authorities. Add in a shrinking water supply, a growing population, and the competing needs of irrigation, industry, the environment and water for drinking, and it is easy to see why no one’s happy.

Long before the current drought, water extraction had pushed the MDB to breaking point, slowing its rivers, increasing their salinity and nutrient concentrations, and altering their temperatures. With the drought, farmers, who rely on the MDB to produce 60 per cent of the nation’s food and fibre, are suffering too – their pain became international news in April when Prime Minister John Howard announced that they won’t see a drop of irrigation water until significant rains fall.

Nor are city dwellers happy. The Murray was once the most reliable source of water for Adelaide, a city of 1.1 million. Now the river threatens to fall below the level of the pumps.

The latest attempt to rectify the situation is Howard’s “National Plan for Water Security”, revolving around revamping irrigation in the MDB. Its aims, to give farmers less water and to better police and measure water in the basin, have won support from water experts. Others fear that plans to plug leaks in the hundreds of kilometres of decr...
KEEPING COOL OVER ENERGY

“You can’t put a tight little boundary around the water issue,” says Barney Foran, a policy analyst at The Australian National University in Canberra. As well as being a trade, environment and population issue, it is an energy issue, he says.

In the last few months dwindling water supplies have forced Victoria’s major power stations to buy in water for cooling to supplement local sources. Queensland has turned off two of its generators, reducing its total capacity by 700 megawatts. Meanwhile, dams holding water to power hydroelectric turbines in the snowy mountains of New South Wales are at their lowest levels, containing just 8 per cent of the water once available for power generation. That has forced the government to temporarily waive environmental restrictions to allow fuller use of gas-fired power plants.

Water scarcity has also helped double the wholesale price of electricity from A$30 ($25) to A$60 per megawatt-hour. According to a recent report from the National Electricity Market Management Company, which manages most of Australia’s electricity supply, the lack of water could cut the total energy available by up to 10 per cent by late 2008. Such a shortfall would drive up electricity prices, and lead to rationing and rolling blackouts during the summer, when air conditioners send electricity consumption soaring.

2025, we will need another 800 to 1000 gigalitres per year,” says Tom Hatton, director of CSIRO’s Water for a Healthy Country Flagship. In comparison, Perth, Australia’s fourth largest city, uses 300 gigalitres a year. “That’s based on projected population growth, and in hindsight, on rather optimistic estimates of the improved efficiency with which we can use water, and rather conservative estimates for declines in rainfall.”

Can technology keep the water flowing? All but the greenest policymakers now see desalination plants as essential, at the very least as back-ups to see Australia through this and future droughts. But you need huge amounts of energy to pump seawater through membrane filters, and the waste brine created by desalination is bad news for the environment.

Perth completed its first desalination plant last year, with a new wind farm being built to supply the electricity and offset the 24 megawatts required to run the plant. Desalination now supplies 17 per cent of the city’s drinking water and a second plant has been commissioned. Sydney is building one, and Melbourne is expected to follow suit. Industrial plants which depend on a secure water supply, such as BHP Billiton’s copper and uranium mine in South Australia, are considering building their own large desalination plants.

Recycling waste water could be a more sustainable option because it uses roughly a third of the energy required to desalinate seawater. But last year Toowoomba, Queensland’s largest inland city, overwhelmingly voted to reject adding recycled effluent to the water supply, making politicians elsewhere nervous about introducing similar measures. Nonetheless, Queensland’s government hopes to start recycling sewage before Brisbane’s main water supply runs dry early in 2009. Most experts agree that recycled water will be supplementing Australian drinking supplies within the decade.

Even the politically unpopular and costly option of piping water from one catchment area to another – robbing Peter to pay Paul – will become more common. “Desalination, recycling and piping all cost more energy per unit volume of water than traditional reservoirs,” says Hatton. That worries climate experts, because more energy tends to mean more greenhouse gases, which in turn will exacerbate climate change and future droughts.

Hatton believes we can still save the day by reducing demand for water, for example by increasing its price, and by making the same water stretch further. The Water for a Healthy Country Flagship is developing new techniques to bring down the economic and environmental costs of desalination and recycling, and to improve how water use is measured, which in turn will make water use more efficient. It is also working on new storage techniques, including “managed aquifer recharge”, in which partly recycled water is pumped into underground aquifers. Not only does that reduce evaporation, which can be significant from a dam surface, but water quality also improves with time as pathogens die off.

Not everyone is convinced this will be enough. “You can fiddle around with technology, but there is a limit to the amount of water available. Population needs to be part of the discussion,” says Graeme Pearman, director of the Monash Sustainability Institute at Monash University in Melbourne. He and others say people are failing to address the impact of Australia’s burgeoning population, expected to grow from 21 million to between 25 and 33 million by 2051, for fear of appearing racist or anti-development.

That attitude may be starting to change. In March, delegates at a high-profile conference in Canberra on population and water use discussed the need both for a national population policy that took into account the scarcity of resources such as water, and for more strategic regional planning that ensures new settlements follow the water rather than vice versa.

Barney Foran, a policy analyst at The Australian National University in Canberra, says Australians must also address their per capita water use. When you factor in the water used to make products such as food, drink, clothing and newspapers, the average Australian consumes roughly six to eight times more water than what their domestic water meter records, with more affluent Australians consuming twice as much as less affluent ones.

Meanwhile, illogical as it seems, the biggest obstacle to dealing with an ever drier Australia could be rain itself. “We have a window of opportunity,” says Quentin Grafton of The Australian National University. “My concern is that if the drought breaks then people’s attention will move on to something else. Five years down the track when we have another drought – which will happen – we won’t be ready.”