

WATER RESOURCE ISSUES IN DROUGHT-STRICKEN AUSTRALIA

AUSTRALIA is currently in the grip of a major water crisis, brought about by a long drought that has spanned a decade. Drought, according to the Australian Bureau of Meteorology is 'a prolonged, abnormally dry period when there is not enough water for users' normal needs'. The country is currently experiencing one of the worst droughts on record, said to be a 1 in 1,000 year event. The drought has meant the country has had to evaluate carefully its use of dwindling water resources, and in many states there has been drastic action to conserve the **finite** (limited) water supplies and ensure that there will be adequate provision for the future.

The problem

Australia is a very dry country – in fact it is the driest inhabited continent in the world. Average annual rainfall is 455 mm (Figure 1) and a large area of the country is **semi-arid** (with low annual rainfall) or desert. Unreliable rainfall in recent years has resulted in rivers drying up, whilst high temperatures mean that evaporation rates from reservoirs are high, compounding the issue of a lack of water.

The drought is associated with climate change and global warming. Statistics have been released by The Commonwealth Scientific and Industrial Research Organisation (a leading scientific body within Australia) which predicts a 7°C temperature rise by 2070, and a 40% drop in rainfall in eastern Australia. These statistics are disturbing as it means

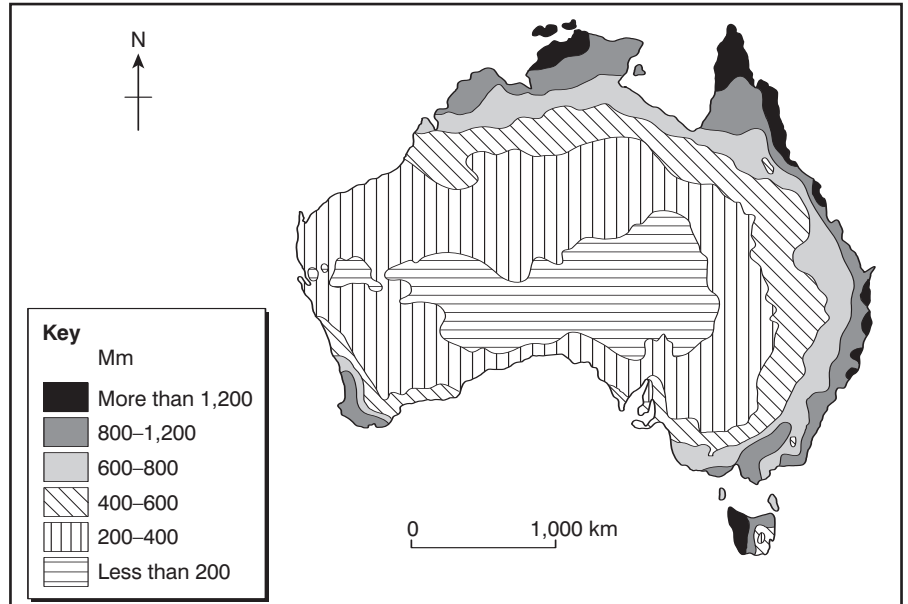


Figure 1: Australia's annual median rainfall

Source: Australian Bureau of Meteorology

that Australia's problems are only set to worsen.

The consequences

The consequences of the drought and lack of rainfall are far-reaching. River systems are drying up, resulting in the loss of wetland habitats, algal blooms, decline in native fish stocks, and increased salinity. The impact of the drought has been especially evident in the declining levels of the Murray and Darling Rivers in south-east Australia. The Murray-Darling basin covers 14% of Australia and provides three-quarters of the water consumed nationally. Figure 2 shows its vast geographical area: 1,061,469 km² covering four states. The basin is often referred to as Australia's food basket, as agriculture here is a key economic activity and the area contains half of Australia's arable land and 70% of its population.

The drought is also leading to severe land degradation and has increased the risk of bush fires and dust storms. Dust-bowl conditions have advanced into key agricultural regions, where the impact of the drought is being felt the hardest. Reservoirs are depleted and so irrigation has been restricted, crop yields are low and stock has been lost. Restrictions on agricultural irrigation are thought to have knocked 1% off the \$940 billion (Australian dollars) economy in 2006–07.

Suicide rates among farmers have soared; according to 'Body Blue', Australia's national mental health body, one farmer commits suicide every four days. This is a startling statistic and highlights the severity of the problem. The Australian government has recognised that the long-term drought could result in economic ruin for many

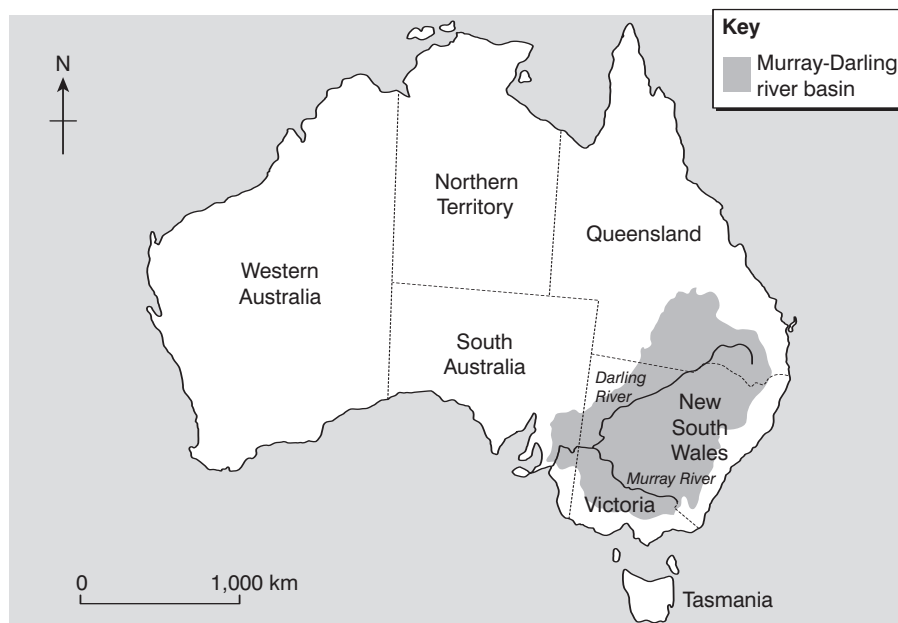


Figure 2: The Murray-Darling river basin

- washing vehicles
- refilling swimming pools.

The restrictions have proved effective. In the city of Melbourne in Victoria the local government has stated that the city's water consumption was 16% lower in 2007 than in 2006. To put this into perspective, this was a reduction of 69 billion litres – enough to fill 27,600 Olympic swimming pools!

Other responses to the water crisis include recycling water. Currently under discussion is the idea of using 'grey water'. This idea is already in operation across the world, including parts of Europe, the United States, Israel and Singapore. **Grey water** is waste water that is the product of domestic processes such as from washing machines, bathing and washing.

Grey water can be used for irrigation purposes, but there are also proposals to use recycled water for drinking. This has not had widespread support and several states have rejected this idea. However, a trial of the idea is likely to commence in 2009 in Perth, Western Australia.

Other strategies to conserve water include tapping into underground water and developing systems of desalination. Desalination is the process whereby salt and minerals are removed from water to make it **potable** (drinkable). In November 2006 a seawater desalination plant was completed in Perth, Western Australia. It is estimated that this plant alone can supply the city with approximately 17% of its water needs, and plans are now in place to develop more plants around the country.

In Sydney, New South Wales, desalinated water could help to secure the city's water supply in the future as its population continues to grow. The city proposes to build a \$1.3 billion

Stage 1	Stage 2	Stage 3	Stage 4
• Manual watering of lawns 6–8 pm and 8–10 pm on alternate days only	• Lawns cannot be watered • Garden watering as stage 1	• No watering of lawns • Washing vehicles only at commercial car wash • Bucket can be used to clean windows, mirrors and lights • New swimming pools and spas cannot be filled • Existing pools and spas topped up only by using a bucket	• Outdoor sprinklers and hoses banned; no watering of any lawns or gardens • No vehicle washing; only for health and safety reasons (windows, mirrors, lights)

Figure 3: Water restrictions in the state of Victoria

industries and businesses, particularly farming. In response it has introduced 'exit grants'. These are payments that farmers receive if they sell their farm and leave the profession because farming is no longer viable.

Action

The government has responded to the water crisis by imposing water restrictions across Australia to try and conserve supplies and encourage responsible, **sustainable** (meeting the present needs of the

population without compromising the needs of future generations) use of water. Australia's water restrictions follow a series of stages (Figure 3) which varies slightly between individual states. Under these restrictions water pressure may be reduced and the following activities may be restricted or prohibited completely:

- watering lawns
- watering sports fields
- using sprinkler systems

desalination plant which will distribute water to 1.5 million people. Further south, in Victoria, a larger project estimated at \$3.1 billion is due to begin in 2009 to deliver an additional 150 billion litres of water to Melbourne and Geelong.

A North–South pipeline costing \$750 million is also under construction in Victoria. The 70 km pipe will take water from Yea in northern Victoria down to Sugarloaf Reservoir to provide water for Melbourne and Geelong. The pipeline will be finished in 2010 but has been much criticised by its opponents who claim that it takes water from one of the driest catchments and gives it to one of the wettest (Melbourne).

The future

The water shortages in Australia have brought to the forefront the necessity to plan for water provision, and the importance of educating the Australian population about water conservation. Despite the problems there was some light relief in June and July 2007 when rainfall helped to refill dwindling reservoirs and alleviate water shortages. However, a great deal more is needed to replenish both underground and surface water stores.

The crisis has sparked much political debate over Australia's environmental responsibilities and its refusal to sign the Kyoto Protocol. The Australian government claims that the international agreement is flawed because the biggest contributors to greenhouse gas emissions (India, China and the USA) are not included. However, with Australia feeling the effects of climate change, and being one of the highest emitters of greenhouse gases per capita, its government must surely soon realise that in order to slow the rate of global warming, action needs to be taken

by everyone in the international community to work towards a more sustainable future for our planet.

The weather outlook

At the time of going to print, Australia's Bureau of Meteorology announced that May 2008 had been the driest May on record. Climate change is evident; in 2007 south-east Australia, South Australia, New South Wales, the ACT and the Murray-Darling Basin all experienced high temperatures that set new records. This increased Australia's mean temperature by 0.7 degrees above average, making it the nation's sixth-warmest year.

Newspapers reporting on the drought have suggested that rather than stating that the country is being gripped by drought, it is perhaps time to accept the dry climate as a *permanent* change to the country's climate. The Bureau of Meteorology's head of climate analysis, David Jones, has called it Australia's 'new climate' and stated that 'there is absolutely no debate that Australia is warming'. While the link between short-term changes in weather and long-term climate change is not definite, it is thought that the lack of rainfall is a problem that will continue with increased frequency into the future.

Activities

1 Define the terms finite and sustainable.

2 Use the rainfall statistics in Figure 4 to draw a bar graph showing Australia's annual rainfall. Describe the trend that your graph shows.

Year	Mean rainfall (mm)
1993	499
1994	340
1995	522
1996	469
1997	527
1998	565
1999	584
2000	727
2001	558
2002	338

Figure 4: Australian average rainfall
Source: Australian Bureau of Meteorology

3 Study Figure 1 which shows Australia's average annual rainfall, and Figure 5 which shows the country's population distribution. Describe and explain the relationship between rainfall and population distribution.

4 Produce a spider diagram to show the effects of the prolonged drought on Australia's agriculture.

5 Study Figure 6, which shows the amount of water that is required to produce 1 kg of particular agricultural products. Produce a graph to represent the data. Describe what it shows and how this information might be important for the future.

6 (a) What does the term potable mean?
(b) What is grey water and why do you think many Australians have objected to it as a solution to the water crisis?

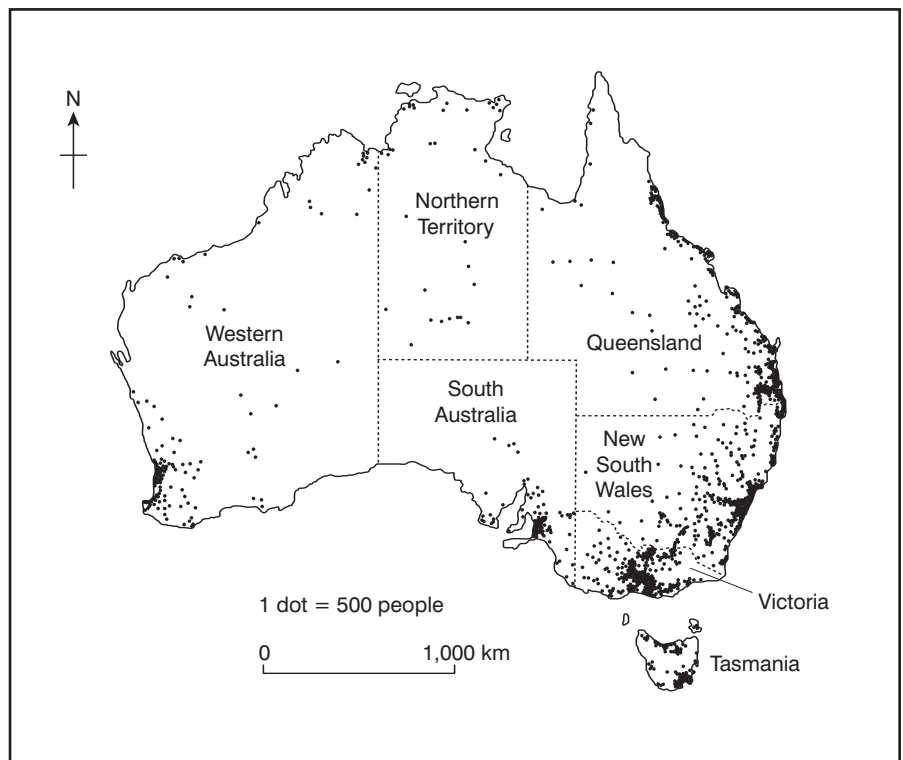


Figure 5: Australia's population distribution
Source: Australian Bureau of Statistics

Crop/Product	Average number of litres of water required to produce 1 kg
Beef	75,000
Clean wool	170,000
Wheat	733
Maize	585
Rice	1,775
Soybeans	1,925

Figure 6: Water use in agriculture
Source: Based on statistics from CSIRO Land & Water Unit

7 Study Figure 3, which shows an example of water restrictions in one state. Explain why watering the garden is restricted to early morning and late evening in stage 1.

Either

8 Study Figure 2, which shows the extent of the Murray-Darling river basin. Write a newspaper article reporting on the effect of the drought on the river system.

or

9 Imagine that you have been recruited by the Australian

government to implement its new 'Water Watch' campaign. The aim is to raise awareness of water conservation at home. You must design an eye-catching leaflet or poster that will educate the public about strategies they can use to reduce water consumption on a day-to-day basis.

ICT extension activities

10 Go to:
www.sydneywater.com.au/EnsuringtheFuture/Desalination/

Download the fact sheet 'Sydney's Desalination Project'. Use the information to produce a group PowerPoint or oral presentation explaining the process of **desalination**. You should research the method that is used to separate salts and minerals from the water, called **reverse osmosis**.

11 Group activity
Use the internet to research the targets of the Kyoto Protocol. Produce a report summarising the targets that have been set and listing countries that are / are not supporting the Protocol.