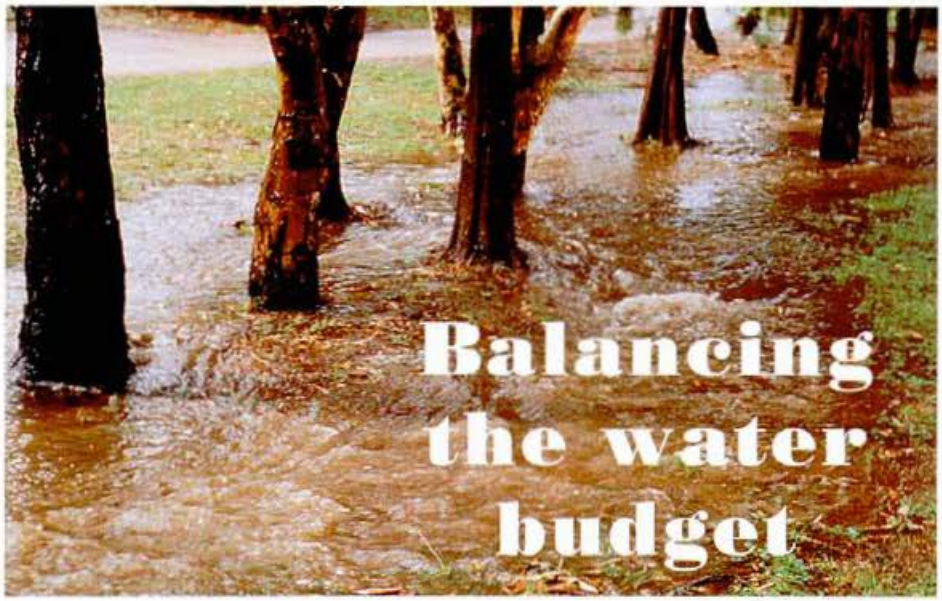


Bill van Aken

Balancing the water budget

IS Australia running out of water? It seems an easy question: just add up the available supplies, subtract how much is used and, 'hey presto', there's your answer.

Australia has lots of water. Oodles. It's just a matter of collecting it, treating it if necessary, delivering it to where it is needed and disposing of it afterward.

When Europeans settled Australia, they used the closest fresh-water streams for supply and for waste disposal. As the population grew, and water demand grew faster, they turned to ever-more expensive, distant and large-scale supplies and sewage-treatment plants. They built a growing infrastructure across the continent that is now worth an estimated $80 billion.

In theory this process could go on forever. No obvious technological barriers exist to prevent Australians harvesting ever more water, at an ever higher cost, from their environment. Even if we run out of water on the mainland, we can always desalinate seawater or drag icebergs from the Antarctic.

But is there a point at which the costs of obtaining more water, especially environmental costs, over-ride the benefits?

Many argue that Australia has reached that point; that it is time to include water issues in debates about our future population size. Others argue that the barrier, if there is one, is still far in the future, when Australia's population reaches 200 million or more.

The water debate in Australia is characterised by bewildering paradoxes:

- the world's driest continent is also one of the most water-rich nations;
- Australians pay less for water than do people in much wetter parts of the world; and
- many problems stem from us using too much, not from having too little.

Water, water everywhere

To an alien watching the Earth from space, it would seem crazy for humans to worry about a lack of water. The Earth is such a wet place. Some 70% of its surface is made up of oceans, and the rest is studded with lakes, rivers, swamps, snow and ice.

But 97% of the planet's water is salt, and most of the rest is locked up in ice-caps. The World Resources Institute estimates that only 0.008% of all the water on Earth is available fresh for human use. Even 0.008% is a lot of water, but it is distributed across the globe unevenly. And of all the continents, Australia has least.

Antarctica is often described as the driest continent, because its average precipitation is less than half Australia's annual 420 millimetres. But in Antarctica evaporation and soil-infiltration are very low, so most water runs off through glaciers to the sea.

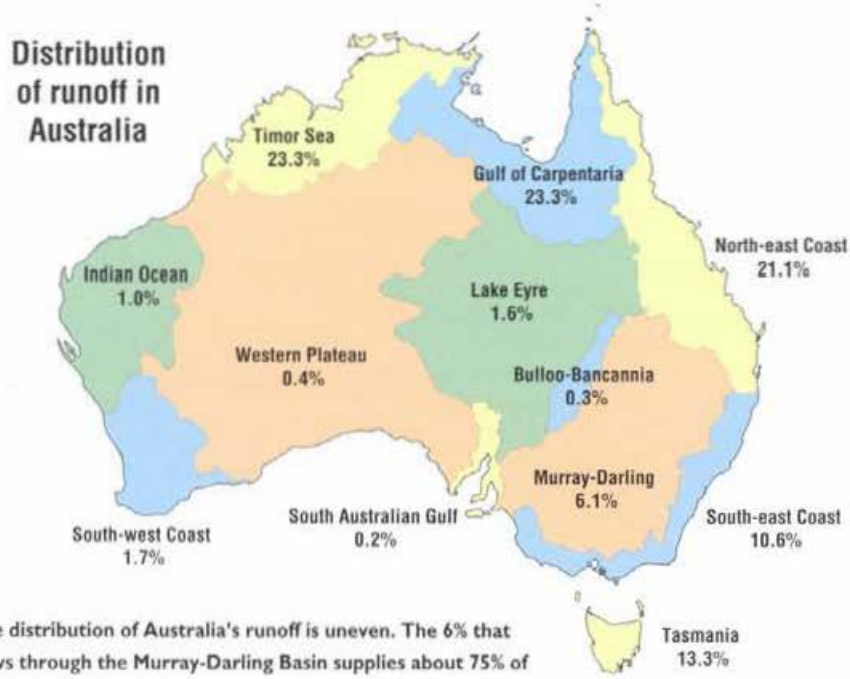
Only 48 millimetres of Australia's average rainfall runs off as surface water. Evaporation in Australia is so high, and the geography so flat and thirsty, that from nearly half the continent there is no outflow to the sea at all. Continental Australia has a land area roughly 28 times the size of New Zealand, but its total runoff is about the same: a quarter that of the United States. About a quarter of Australia's estimated 397 000 000 megalitres of runoff is classified as 'divertible'. So far only about a fifth of this divertible water has been tapped.

But the distribution of Australia's runoff is uneven. Some 65% is restricted to the north and north-east of the continent, the east coast and northern tip of Queensland, and the tops

*'Many problems stem from us **using too much**, not from having **too little**'*

Bill van Aken

Australia's water supply and treatment facilities are worth an estimated $80 billion. Debates about privatisation and the costs of decaying infrastructure sometimes obscure an underlying truth: over time the resource itself can only become more expensive.



The distribution of Australia's runoff is uneven. The 6% that flows through the Murray-Darling Basin supplies about 75% of the nation's irrigated agriculture. (Source of data: *Review of Australia's Water Resources and Water Use Vol. 1*, AGPS 1985.)

of the Northern Territory and Western Australia. Another 13% runs off Tasmania, leaving just 19% for the rest of the continent.

More than half of that 19% runs off east into the sea from the southern reaches of the Great Dividing Range. Just 6% of Australia's annual runoff flows through the Murray-Darling Basin and out to sea via the Murray River. But that meagre 6% supplies about 75% of the nation's irrigated agriculture.

Judged purely on the basis of runoff, Australia is the driest continent on Earth. But there's another factor at work which means even that very low runoff figure is inflated.

Australia also boasts one of the most variable climates on Earth, where rain can cause floods or not fall at all. Droughts rack the land, and the one great certainty over most of the continent is that you cannot depend on rain. Climate variability means that to meet the same demand, Australian reservoirs need to be about four times larger than European storages, as a hedge against drought.

But Mick Fleming from the Division of Water Resources at Canberra wonders whether even that is enough. He points to research by the Australian Institute of Marine Science into flood-water material incorporated into coral reefs over many thousands of years. The scientists have found gaps of 70 years or more between significant floods from Queensland's Burdekin River. Could modern Australia cope with a 70-year drought?

What price water?

Australians, like their rainfall, are not distributed evenly. In some areas, where most Australians live and grow crops, all the easy water supplies have long ago been tapped. The cost of bringing in water from further afield, and of extracting it from more inaccessible sources, is growing.

As their populations swell, Australia's cities are faced with the choice of paying more for water, or having less. Most are choosing a mix of both. Debates about privatisation and the costs of decaying infrastructure, mostly to do with the efficiency of delivering water, sometimes obscure an underlying truth: over time the resource itself can only become more expensive.

Water restrictions have become a fact of life in cities as far apart as Perth and Sydney. Everywhere the price of water is on the rise.

The irrigation industry, founded on free water granted by governments keen to develop Australia's outback, is facing the same harsh truth. With growing problems of water quality, irrigation-caused land degradation and competing demands, the price of water can move in only one direction: up. The question now is who should pay. Growers? Taxpayers? Consumers? Future generations? And how much, if any, of the water earmarked for irrigation should now be reallocated to the environment?

Cheap water has helped Australia become one of the world's major irrigation nations.

How do we compare?

AUSTRALIA is not short of water, Dr Graham Allison, former chief of CSIRO s Division of Water Resources, says. Allison says that, per head, Australians have more water than most people in the world. With 18 million people sharing the runoff of a whole continent, there are about 22 megalitres of fresh water a year for every Australian, compared with about 15 megalitres for each Indonesian and about seven megalitres for each person in the United States (see table below).

Jon Thomas from the division s Perth laboratory, agrees. He says the main problem is not a physical limit to water availability, but the growing economic and environmental burden of increasing supply and maintaining quality.

The CSIRO Division of Wildlife and Ecology s Ecumene Project, which is looking at Australia s environmental future, has reached similar conclusions. Dr Barney Foran says the economic and environmental costs of supplying water are rising. He says extracting ever-more water from the landscape triggers ever-more-profound ecological feedbacks, squeezing other resources, such as arable land and biodiversity, ever harder.

Available water per person* (cubic metres)

New Zealand	120 000
Canada	100 000
Argentina	27 000
Australia	22 000
Indonesia	15 000
United States	10 000
Italy	2 800
China	2 600
Netherlands	700
Israel	200
Egypt	20

*These figures are rough approximations only, adapted from two slightly differing sources: *Environmental Science* (Australian Academy of Science, 1994) and *Water 2000* (AGPS for Department of Resources and Energy, 1983).

Bill van Aken

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Water doesn't disappear after it is sullied and flushed down the drain. It spreads the effects of human activities far and wide. The really big question is not whether we run out of water, or how much it should cost, but whether we can keep it clean.

The irrigation industry, underpinned with an estimated $30 billion worth of infrastructure, contributes enormously to Australia's export earnings. Understandably, the prospect of dramatically increased water prices is a political hot potato. So is the prospect of reduced allocations.

Accurate figures on international price comparisons for irrigation water are hard to come by. However, Dr Wayne Meyer from the Division of Water Resources at Griffith, says one good yardstick is that Australian water is so cheap much of it is used to irrigate pasture for wool and beef grazing. Overseas, he says, the price of water is too high for pasture irrigation.

Urban water price comparisons are also tricky. Dr Tony Priestley from CSIRO's Division of Chemicals and Polymers in Melbourne cites one study which found that domestic water in Germany (the most expensive in Europe) cost about $2.50 a kilolitre, compared with only 68 cents in Melbourne.

Peter Martin of the Division of Water Resources in Adelaide gives a similar estimate, but cautions that sophisticated economic analysis is needed to make an accurate comparison.

The really big question, however, is not whether we'll run out of water, or how much it should cost, but whether we'll be able to keep it clean.

Water as pollution

Water's ability to transform landscapes and transport chemicals makes it one of the more dangerous substances that modern Australians have released into the environment.

Excess water from irrigation in the Murray-Darling Basin has mobilised a vast reservoir of salt from beneath the soil, raising saline water tables so once-productive land is progressively abandoned.

Water doesn't disappear after it is sullied and flushed down the drain. It carries the waste from cities, agriculture and industry across and under the landscape, and spreads the effects of human activities far and wide. Sewage from Toowoomba travels hundreds of kilometres to feed algal blooms in the Darling River; rain washes acid from Queensland soils into rivers causing fish kills; petrol spreads from leaking underground tanks to threaten Perth's water supplies; and Sydney's stormwater drains carry nutrients and heavy metals into nearby estuaries and the sea.

Sewage is more than 99% water, but that tiny percentage of contamination makes all the difference between a valuable resource and a difficult pollution problem. What happens to water after it is used by people is perhaps the biggest headache facing water authorities in Australia. Increasingly the research challenge is how to make sure a valuable resource does not become a dangerous waste, and how waste water can be used as a resource.

David Mussared

Seeking consensus when everybody's right

A PSYCHOLOGIST working for CSIRO? It may sound unlikely, but Geoff Syme from the Division of Water Resources at Perth has made a name for himself, and his Australian Research Centre for Water In Society (ARCWIS), since he was hired in the late 1970s by the division s chief, Dr Ray Perry.

CSIRO then was interested in what is now called demand management to reduce domestic water use. Perry wanted a psychologist to study household water use behaviour.

Since then it sort of developed much more into issues of water allocation, Syme says. How do we decide on fair processes to allocate water?

ARCWIS, now with a staff of nine, is frequently thrown into complex social and political wrangles. Often ARCWIS is hired by the water industry to help find out what the community wants, what it will pay, and who needs to be consulted. For example, in 1988 Syme s team conducted wide consultation in Perth for the Western Australian Water Authority, coming up with the surprise result that the community preferred occasional water restrictions to higher prices.

Recently ARCWIS has been conducting community consultation for the authority s attempt to predict the water and sewage needs of Perth for the next 40 years. The community is showing a clear preference for dealing with effluent on land, an option not at first thought feasible by the authority s water engineers. Syme says both sides of the consultation process have had a visible change in attitude.

There s now more of an understanding by both sides, the community and the engineers, of possible solutions, he says.

Similarly, in the Murrumbidgee Irrigation Area, Syme s team found some ethnic groups and smaller farmers were being left out of the consultation process. Authorities trying to work out how best to manage change in the irrigation industry tended to work with leading local farmers, and Syme s psychologists found that sections of the community were at risk of being left behind.

Syme says ARCWIS tries to facilitate the kinds of discussions which must happen before major decisions are made. Sometimes that means stepping into the midst of divisive community debates. We re not always in agreement, but I must say that arguments are very few and far between, Syme says. I guess our philosophy is: everybody s right .