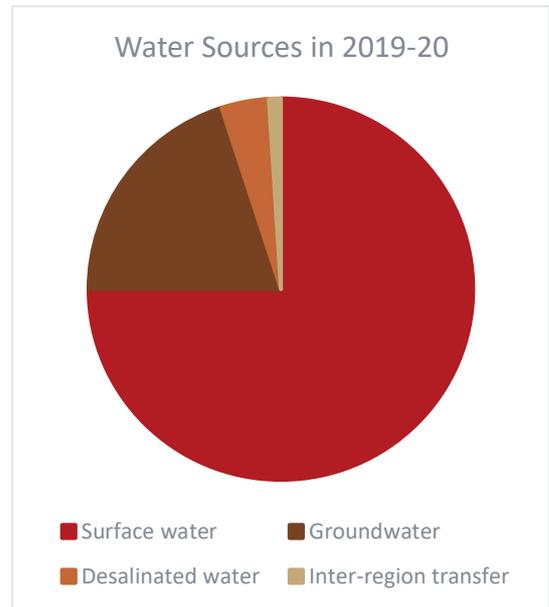




Australia is the driest inhabited continent with more than 5% of the world’s land and only about 1% of the available fresh water. The majority of water run-off is in tropical and sub-tropical areas, however most agriculture and industry are in temperate southern coastal areas. Agriculture accounts for approximately two thirds of fresh water use. Rainfall is inconsistent, with frequent droughts and floods. In addition, 85 – 95% of rainfall is lost to evaporation or transpiration. Water is a vital resource in Australia and requires careful management.

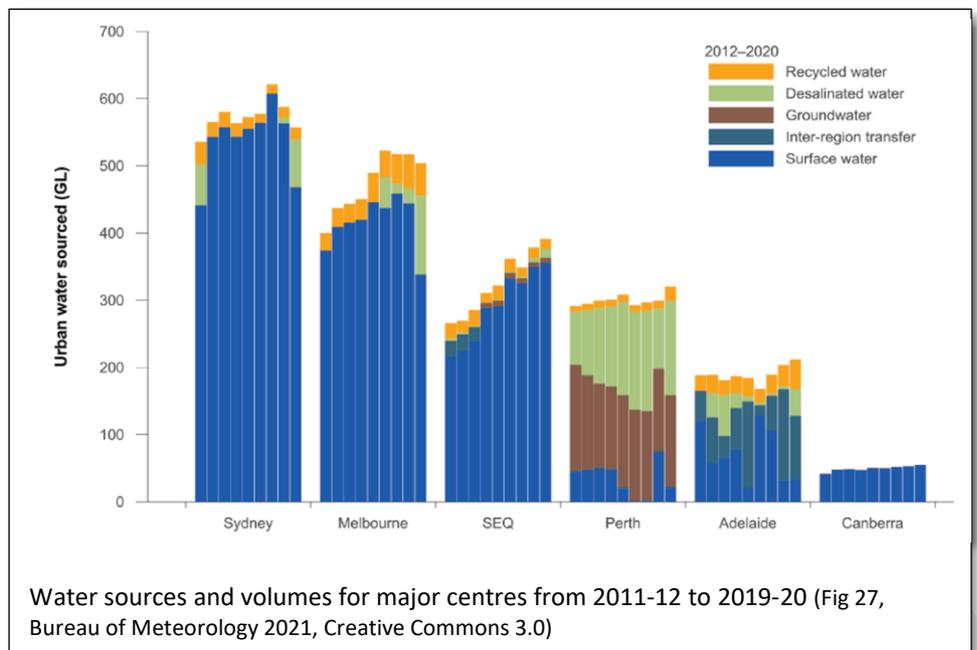
Where is Australia’s fresh water?

Most of the water used in Australia is from surface water. However, this varies by location and conditions. In the drought of 2018-19, more groundwater was used to make up for a lack of surface flows. Many aquifers declined as bore water was withdrawn for agriculture, particularly in the Murray-Darling Basin.



The Great Artesian Basin is the world’s largest aquifer and is 1.7 million km² in area, containing more than 65 million gigalitres (GL). It covers 20% of the Australian landmass, centred in Queensland and extending into the Northern Territory, South Australia and New South Wales.

Desalination is used in most states to provide urban water in times of drought. The Sydney desalination plant was built in 2012 although it did not commence operation until January 2019 when surface water storage dropped below 60%. In contrast, Perth uses desalination as a major source of urban water, along with groundwater, with little input from surface water. Canberra is supplied entirely by surface water.





Water use and management

Most of Australia's fresh water is used for agriculture (primarily for irrigation). In 2019-20, the breakdown was 67% agriculture, 22% urban and 11% industry. Due to the drought of 2018-19, overall water use decreased. There was a great decrease in surface water use for agriculture, while groundwater extraction increased. Most agricultural water use is in New South Wales and Victoria along the Murray-Darling River system.

Water management must balance many competing interests, including provision of municipal water, water for agriculture, Aboriginal cultural use, environmental use and industrial use. Water trading markets operate mainly among agricultural users. Drought conditions push prices up, while rain brings down the price of surface water. Scarce surface water results in less crop production and increased groundwater extraction, as well as drying of wetland habitats.

Sustainable water use

In 2019-20, recycled water accounted for 8% of urban water use in major centres. This percentage has been steadily increasing as new housing estates are built with dual pipe systems. Recycled water is used for irrigation, toilets and other non-potable uses. Recycled water is safe to drink although public hesitation has prevented its implementation in Australia. This has led to construction of desalination plants that produce fresh water at twice the cost of recycling. Recycled water is gradually being implemented in Australia, with a program in Perth injecting fully treated recycled water into groundwater reservoirs. Groundwater is then used for drinking water supply.

Up to a third of water in reservoirs and up to half of water in farm dams is lost to evaporation. Water banking in aquifers offers a solution to the unpredictable availability of surface water. Water can be injected into natural aquifers during rainy seasons and flooding, then withdrawn as needed during dry times. Utilising natural underground reservoirs means that surface land is available for use and not flooded to create a reservoir that may dry up in times of drought. Underground water banking must be carefully managed to avoid salinisation. Western Australia has implemented a groundwater replenishment scheme using recycled water in Perth's northern suburbs. Adelaide has a scheme that uses treated stormwater in the western suburbs.



An artificial wetland at Cooke Reserve is used to treat stormwater before aquifer storage in Adelaide (Bahudhara 2014, Creative Commons 3.0)

Harvesting stormwater for re-use is an important option for the future. Local councils are responsible for stormwater management, and many have implemented schemes to harvest stormwater to water parks, gardens, and sports fields. As noted above, treated stormwater can be injected into aquifers for storage. Householders can collect stormwater in tanks and use this for household purposes such as toilets and gardens. As urban areas become more crowded, sealed areas increase and stormwater runoff becomes a major source of erosion and pollution of local waterways. Water sensitive urban design includes features to slow water down and filter it through swales or artificial wetlands.



Past, present, and future importance of water resources

The presence of fresh water has been a determinant of where people live since the first Australians arrived more than 60 000 years ago. Water defines language boundaries, ceremonial places and is a major feature in Dreaming stories. Aboriginal peoples memorised the locations of water and used the presence of animals and plants to find water. Although the main sources of water were lakes and streams, Aboriginal peoples constructed dams, as well as using natural rock holes and hollow trees that collect water.

At present, Australia's surface water is highly managed. Dams are used to store water for use on individual properties and reservoirs supply urban areas. Water recycling facilities return water to local waterways or pump partially treated water out to sea. Agricultural water is regulated with licensing systems for both surface and groundwater resources. Fresh water supplies are supplemented with desalinated water in major centres. Water is used to generate electricity in hydroelectric schemes such as Snowy Hydro.

The supply of fresh water will be crucial to Australia's future on a warming planet. Aquifer storage, use of recycled water and stormwater will all play a part in supplying people and agriculture with water in the future. As the world moves to renewable energy, pumped hydro will become an important method of storing energy generated by intermittent renewable sources. Snow Hydro 2.0 is a large scheme for pumped hydro, but mine sites and other reservoirs may be used in the future.



A pumped hydroelectric storage facility in Michigan (USA) is used to store energy from the electricity grid and release it as needed. (US Government 2011, public domain)

Questions

1. Where does most of Australia's fresh water come from? _____

2. Outline some of the challenges Australia faces with respect to fresh water supply. _____



3. Describe one advantage and one disadvantage of desalinated water. _____

4. Describe two possible uses of groundwater aquifers. _____

5. What is stormwater and how can urban areas manage this? _____

6. How did Aboriginal peoples find and manage water? _____

7. What do you think will be the biggest challenge for water management in the future? _____



Extension

1. Find out what happens to wastewater from your house and/or school. Could this water be used more effectively? Explain your answer.
2. How is stormwater managed in your local area? What are the advantages and disadvantages of this method?
3. What permanent water sources are near your location? How are the needs of different stakeholders (traditional owners, agriculture, urban, environment) managed? Do you think this system is fair? Explain your answer.
4. Carry out a water quality analysis of stormwater in your local area before and after treatment. Use aquarium test strips to measure contaminants and pH; turbidity tubes to determine clarity.

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