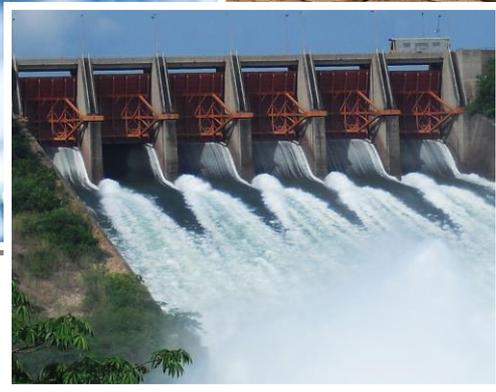


WATER RESOURCES

This factsheet was written for teachers and a general audience. A factsheet for primary school students aged 9-11 is also available on the website:

www.geolsoc.org.uk/factsheets



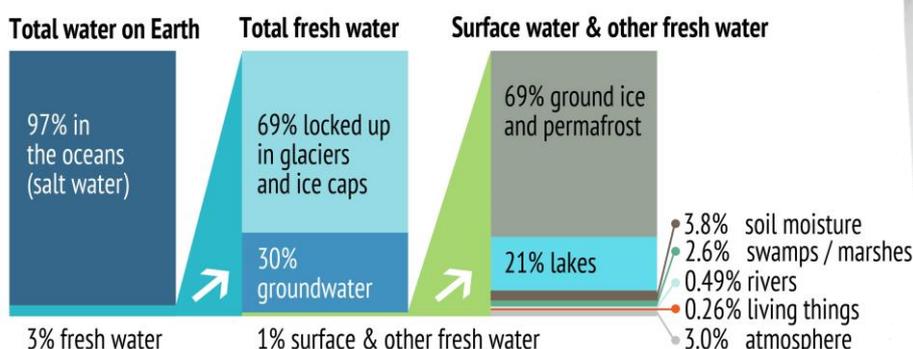
Left: Akosombo dam, Ghana (© ZSM, Wikimedia Commons)

Fresh water is needed for every part of our lives, from drinking water to farming and industry. Access to clean water is becoming increasingly difficult for millions around the world. With a growing population and changing climate, new discoveries and responsible management of water resources is more important than ever.

Where is water found on Earth?

Although much of the world's surface is covered with water, only 3% of Earth's water is fresh water, and only about a third of this is liquid. Some of this is **surface water** in rivers and lakes. However most is **groundwater**, or water which filters down into the ground after rainfall and is held in cracks and pore spaces within underground rocks below the **water table**.

For one in three people, groundwater is the only source of water. Groundwater can be extracted using wells or boreholes, and in places flows out naturally at the surface as springs. The diagram below shows the distribution of Earth's water resources.



The distribution of Earth's water resources. Percentages are rounded so may not add up to 100. (Adapted from diagram © USGS / Wikimedia Commons)

How do we use water?

Humans use the Earth's freshwater for three main purposes:



These proportions vary dramatically in different parts of the world. For example, in North America and Europe, about 50% of all freshwater is used for industrial processes. In Asia 85% of all water resources are used in agriculture.

DID YOU KNOW?

- About 9% of the global population, or **650 million** people, lack access to safe drinking water, mainly due to poverty.
- One approach that some water-stressed countries have invested in is removing the salt from seawater (**desalination**), for example in desert areas like the Middle East. Even the United Kingdom has a desalination plant; the Beckton plant in East London can produce 150 million litres of fresh water a day in times of severe drought.

WATER RESOURCES

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Exploring for groundwater

Hydrogeologists can find groundwater in all sorts of areas, including beneath deserts. Rocks containing groundwater which can be extracted are known as **aquifers**. Some rocks make better aquifers than others, and finding them isn't as simple as just digging a well. A range of methods are used to understand and predict groundwater.



Drilling a groundwater borehole in Ethiopia
(© UNICEF Ethiopia 2016 / Ayene / Flickr)

Exploration methods

Interpretation of satellite/ aerial photographs & maps Hydrogeologists study aerial photos together with maps of rivers, land height and geology. These are used to identify potential aquifer rocks which could store groundwater, areas where rainwater flows into an aquifer (**catchment areas**), and geological features such as faults and folds that could influence aquifer quality.

Borehole drilling

The only way to test if the groundwater can be exploited is to drill boreholes and try to pump water out (pumping tests). These provide direct data about the aquifer, such as information on rock pore spaces and fractures, and whether these are connected to allow water to flow. Samples can also be taken to test groundwater quality.

Groundwater modelling

Once they already have some information about the groundwater in an area, hydrogeologists build complex computer models to simulate how it might behave. This helps predict the best borehole locations, how much water can be used and if there is a risk of pollution.

Groundwater recharge and fossil groundwater

Groundwater levels change over time. To make sure the groundwater doesn't dry up, hydrogeologists use information on the regional climate, water cycle and geology to estimate how quickly the aquifer fills up with water after rain, (the **recharge rate**). Recharge can take anything from days to many years. In some areas the groundwater was recharged thousands of years ago, when the climate was wetter. Known as **fossil groundwater**, once that groundwater is used up, it will not be replenished. In these areas groundwater is viewed as a **non-renewable resource**.



Water stress (light blue) & Economic water scarcity (dark blue) around the world. Light green areas have no data. (© WWAP 2012)

Water scarcity around the world

Many parts of the world suffer from **water stress**, where the water supply in an area is less than the needs of the people living there. Large parts of the world, such as central Africa and parts of Latin America and Southern Asia, also suffer from **economic water scarcity**. This means that there is insufficient money or infrastructure to extract water and provide it to the population.

Poor access to safe water is rarely due to just a lack of rainfall. Drought may temporarily reduce the area's water resources, but long-term water issues are usually related to other factors. For example:



- The population may increase rapidly so more people need water
- There could be a lack of water resource management, infrastructure or exploration
- The water supplies could be polluted, for example by poor sewage treatment
- Climate change leads to dry areas becoming even drier (**desertification**)

Goal 6 of the United Nation's Sustainable Development Goals aims to ensure access to water and sanitation for all by tackling the above issues.

The world's largest aquifer

Groundwater aquifers can be truly vast. The world's largest aquifer is the **Great Artesian Basin** in Australia. It covers 1.7 million square km, equivalent to about a quarter of the entire country, or 7 times the area of the UK.



The Great Artesian Basin, Australia
(©Tentotwo, Wikimedia Commons)

The Great Artesian Basin is also the deepest aquifer in the world. The sandstone layers holding the groundwater extend to depths of 3 km in places, but elsewhere they outcrop at the surface and water flows out at springs.

Crucially, this is the only source of freshwater for the majority of inland Australia. As a result, groundwater pollution can cause problems for the millions of people living in this water-stressed area. Recently, the hydraulic fracturing ('fracking') industry was accused of polluting and over-using groundwater in the Basin while exploiting coal seams for natural gas.

FIND OUT MORE...

- Find out more about aquifers, groundwater flooding and where UK water supplies come from:

www.geolsoc.org.uk/factsheets

- Read our factsheet on hard and soft water:

www.geolsoc.org.uk/waterhardness