

Water scarcity, pollution and over-abstraction

Water Stress - the term used when annual supply of water per capita fall below $1,700\text{m}^3$. When this figure falls below $1,000\text{m}^3$ the term used is water scarcity.

Physical Water Scarcity - when more than 75% of a countries river flows are being used. Around 1/4 of the worlds population live in such areas, including some parts of the USA and Australia.

Economic Water Scarcity - when the development of blue water flow sources is limited by human and financial capacities. More than 1 billion people in areas such as Sub-Saharan Africa who use less than 25% of the river resources.

Human impacts on water availability

There are a number of different human impacts that affect the amount of water available in a country, these are:

1. **Pollution** - Around 400 billion tonnes of waste is generated each year globally. This waste is often industrial and contains chemicals and heavy metals that are dangerous when in water ways. In China the huge economic growth means that pollution is being discharged into rivers without regulation and treatment. The water here is graded from 1 (suitable for drinking) to 5 (unsuitable for agricultural use). A recent survey has shown that in the industrial province of Shanxi, home to 33.5 million people, 80% of water is graded 4 or below.
2. **Sewage** - By 2020 sewage disposal in developing countries is expected to cause 135 million deaths due to water borne diseases such as cholera and typhoid. The UK adds 1,400 million litres of sewage to our rivers daily. In China only 23% of the countries sewage is being treated before it is discharged into rivers, with only 50% being discharged into the ocean being treated, according to the UN. China though has invested \$41 billion into sewage treatment between 2006 and 2010.
3. **Dams** - The use of dams traps sediment and reduces the fertility of floodplains. They can also damage coastal fish stocks as there is reduced river discharge to the ocean, along with sediment change killing fish upstream as well. The Three Gorges Dam in China is an example of how dams can be damaging. Due to the dam the Yangtze River will become so sedimented that it will no longer reach the sea. As a result the high tide will move inland next to Shanghai and cause salt water contamination of aquifers there.
4. **Chemical Fertilisers** - The use of chemical fertilisers in farming means that ground water supplies can become contaminated. As a result this adds nutrients to water courses and results in an algal bloom. This causes marine plants to die, and degrade. The rotting of the plants is performed by bacteria which use all of the oxygen in the water. As a result other marine life dies, and greenhouse gases are produced. The Gulf of Mexico has high levels of algae due to the pollution being discharged from rivers here.



Overabstraction of water:

Groundwater sources are stored in aquifers. Impermeable rock is an aquiclude. Wells are sunk to extract water from aquifers, however these can be over-abstracted in some areas. If water is pumped out faster than it is recharged then as a result the water table will fall.

Lowering the water table can consequently cause the well to dry up. Near coasts, saltwater seeps naturally into permeable rocks. Usually freshwater floats on the top of the denser sea water. However if the water table drops and extraction from the well continues, salt water can be drawn into the well. This is known as salt water incursion and results in the contamination of that well.

CASE STUDY: The Mekong Delta, Vietnam:

Thousands of hectares of farmland and crops are being threatened in this region due to salt water incursion occurring. As much as 800,000 hectares of rice in the Delta may be affected, with water with a salt content of 0.4% already being found 30km inland. The over-abstraction of these coastal wells means that droughts are now occurring. Some estimate that the effect of the drought may mean incursion occurs up to 60km inland.

The salt water incursion has caused there to be a loss in the winter-spring crops, with estimated losses of around VND70 billion (\$3,600). Residents in the area have asked the Vietnamese government to allocate \$12.2 million for pumping fresh water for various sources to mitigate the impacts of the drought and salt water incursion.

CASE STUDY: The Citarum River, Java, Indonesia:

The Citarum River in Java is said to be the most polluted river in the world, with 9 million tonnes of refuse from 2000m³ of domestic sources entering the river each day. Along the river there are over 200 textile factories which discharge industrial waste containing dangerous arsenic, mercury and lead into the river.



The banks of the river used to be lined with rice paddies, however the increased pollution means that many of these have been shut down by the government. The river has a hydroelectric power plant, however due to the huge amount of rubbish and sediment in the river the turbines found in the hydroelectric dam are being corroded. As a result of corrosion the hydroelectric dam may shut down in 25 years, reducing the 1,400 MGW it produces.

In order to try and clean up this river, the Asian Development Bank has approved a \$500 million loan to clean up the Citarum River. The Asian Development Bank's assistance will provide safe water and sanitation facilities for poor families who currently use the polluted river water for bathing, laundry, and other uses. It will also provide 25,000 farming families with new rice paddy land, and provide 200,000 households in Jakarta with piped water increasing overall supply by 2.5%.

