

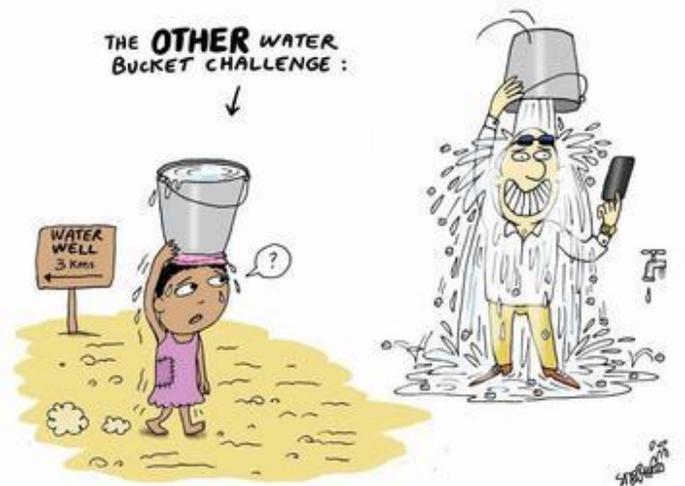
4.2 ACCESS TO FRESH WATER

Our water resources are under pressure. It has become evident that:

- Changes in climate are affecting water availability.
- Pollution, water diversions and uncertainties about the abundance of water are threatening economic growth, environment, and health.
- Underground water is often being overexploited and polluted.
- To augment water supply, traditional techniques – such as rainwater collection – are now being supplemented by newer technologies like desalination and water reuse.
- Political support is needed to improve information collection that can in turn enable better decision making about the management and use of water.

4.2.1 Access to an adequate freshwater supply varies widely

This is an example of unequal distribution and inequitable supply:



Water is an important part of our daily lives and not just for drinking: when we wake up, we might take a shower, or sip coffee or tea; quench our thirst with all types of beverages; water our gardens; wash the laundry and the dishes; and by the end of the day, the average person in a Western society has consumed some 150–200 l of freshwater. The household water consumption is a mere teaspoonful in a bathtub when compared with the amount of water used

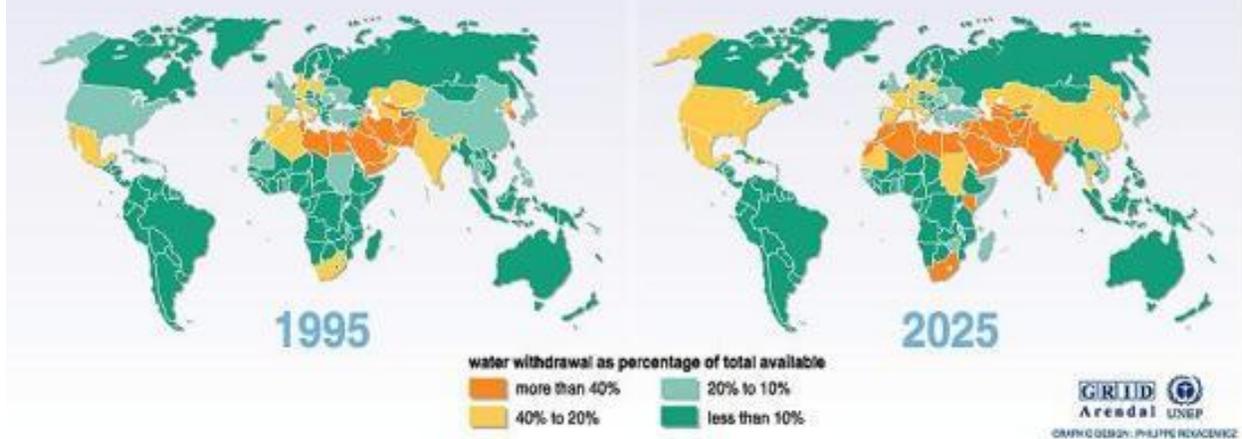
by agriculture and industry. The USA alone uses more than 500 billion litres of freshwater every day to cool electric power plants, and roughly the same amount is needed to irrigate crop fields.

In striking contrast, more than one billion people in developing nations do not have access to safe drinking water and two billion do not have adequate sanitation.

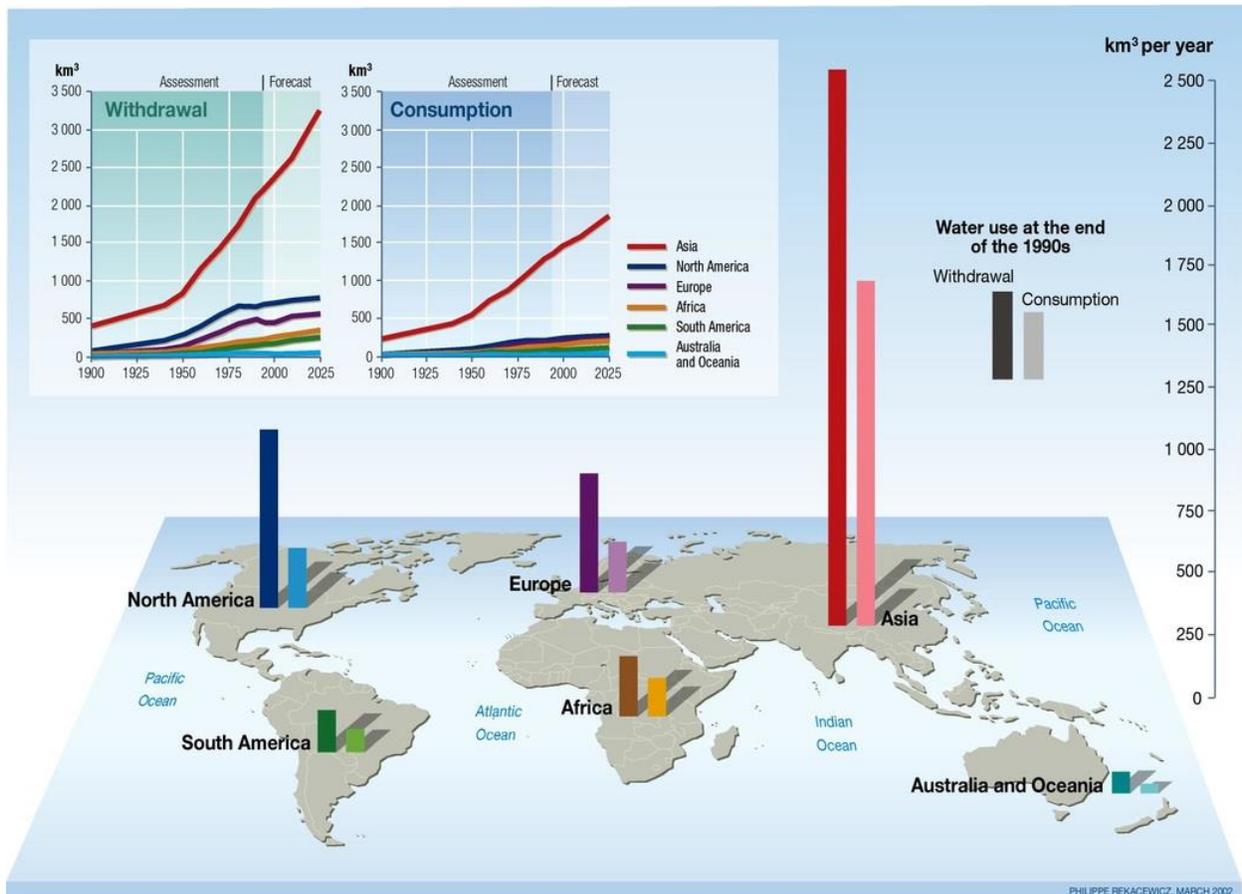
12 Facts About Water in Developing Countries (UN reports)

1. 884 million people in the world lack access to safe water supplies.
2. More than 840,000 people die each year from water-related disease.
3. Almost 2 in 3 people who need safe drinking water survive on less than \$2 a day.
4. In many developing countries, millions of women spend several hours a day collecting water from distant, often polluted sources.
5. Every minute a child dies of a water-related disease.
6. Tackle a campaign to make the world suck less.
7. Diarrhea caused by inadequate drinking water, sanitation, and hand hygiene kills an estimated 842,000 people every year globally, or approximately 2,300 people per day.
8. More than 1/2 of all primary schools in developing countries don't have adequate water facilities and nearly 2/3 lack adequate sanitation.
9. Clean water is one aspect of improving sustainable food production in order to reduce poverty and hunger.
10. More than 80% of sewage in developing countries is discharged untreated, polluting rivers, lakes and coastal areas.
11. By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world's population could be living under water stressed conditions.
12. Every \$1 spent on water and sanitation generates \$8 as a result of saved time, increased productivity and reduced health care costs.

Freshwater stress

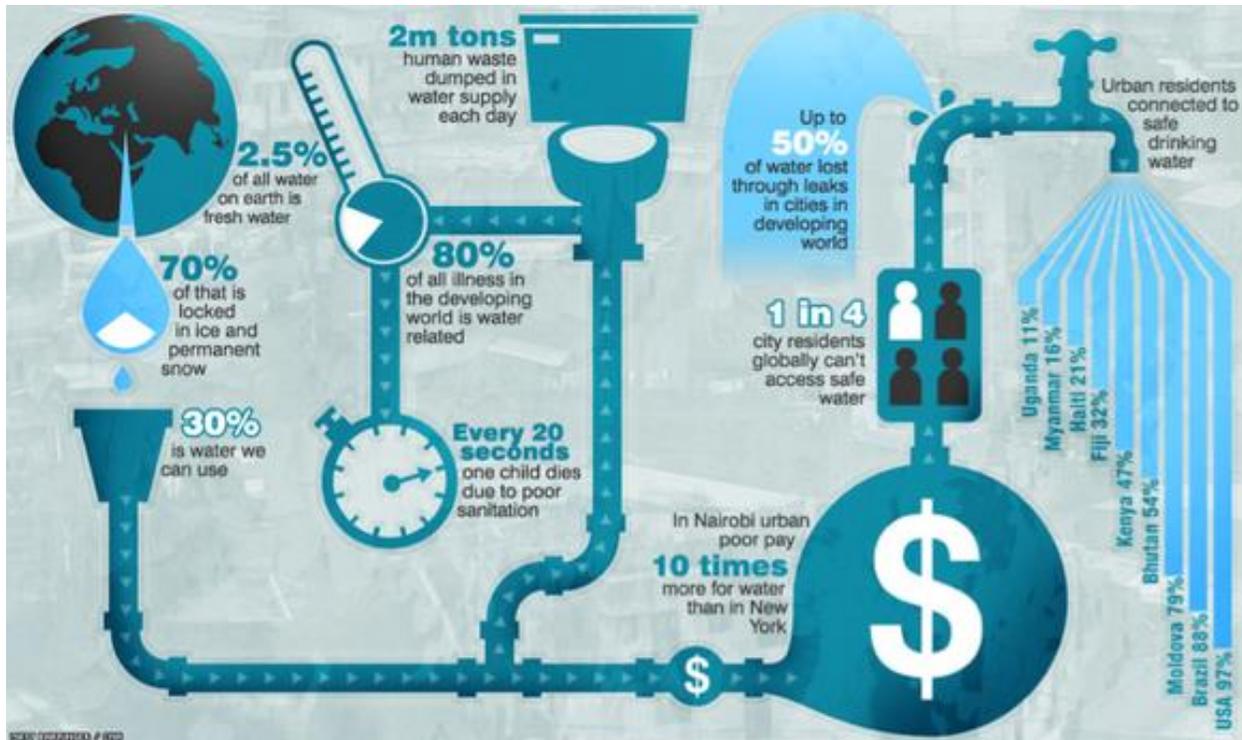


Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.



Source: Igor A. Shiklomanov, State Hydrological Institute (SHI, St. Petersburg) and United Nations Educational, Scientific and Cultural Organisation (UNESCO, Paris), 1999; *World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life*, World Resources Institute (WRI), Washington DC, 2000; Paul Harrison and Fred Pearce, *AAAS Atlas of Population 2001*, American Association for the Advancement of Science, University of California Press, Berkeley.

Source: www.unep.org



4.2.2 Climate change may disrupt rainfall patterns and further affect this access.

Temperature and moisture are among the key variables that determine the distribution, growth and productivity, and reproduction of plants and animals. Changes in climate can influence species in a variety of ways, but the most completely understood processes are those that link moisture availability with intrinsic thresholds that regulate productivity and reproduction. The changes in climate that are anticipated in the coming decades will have diverse effects on moisture availability, ranging from alterations in the timing and volume of streamflow to the lowering of water levels in many wetlands, the expansion of thermokarst (more ice) lakes in the Arctic, and a decline in mist water availability in tropical mountain forests.

4.2.3 Increase in population, irrigation and industrialization also increase the demand for fresh water

Irrigation, industrialization, and population increase all make demands on the supplies of fresh water. Global warming may disrupt rainfall patterns and water supplies. The hydrological cycle

gives humans fresh water but we are taking up so much water from the underground aquifers that there is no time for it to replenish.

The demand of water has increased in both MEDCs and LEDCs, as populations are increasing as well as agriculture changing and expanding industry. MEDCs need more water as they wash more often, water their gardens, and wash their cars. This means that the increasing use of water is making the demands higher. Water is not an infinite resource and has to be controlled more carefully, and new water resources need to be found.

Water can be managed if individuals and communities make changes and this should be supported by the government. Water should not be over used or wasted so that it is insured it can be enough for everyone.

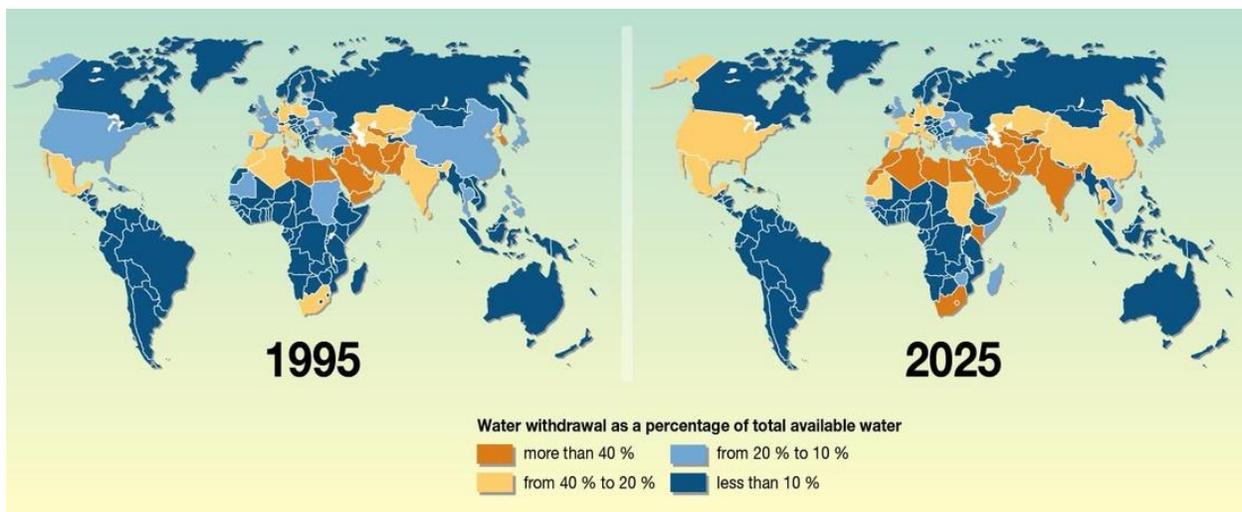
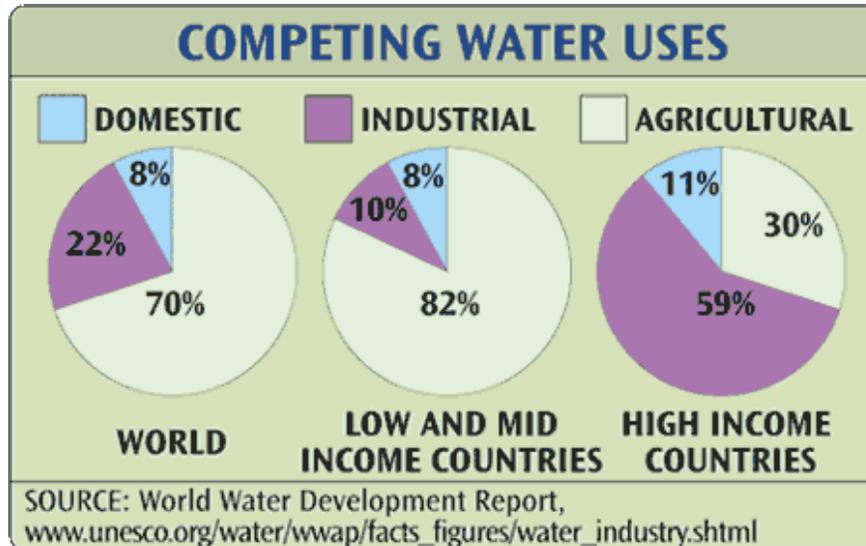
This can be reached by:

- making new buildings water efficient (rainwater for sanitation and showers)
- fitting new homes with more water-efficient appliances (dishwashers and toilets)
- expand metering to encourage households to use water more efficiently
- in some rural areas drought resistant crops should be planted to reduce the need for irrigation
- organic fertilizers cause less pollution and bio-control measures can be used to reduce crop pests

Water resources are now becoming a limiting factor in many societies, and the availability of water for drinking, industry and agriculture need to be considered. Many societies now are dependent on groundwater which is non-renewable. As societies develop, water needs to be increased. The increased demand for water can lead to inequity of use and political consequences. When water supplies fail, populations will be forced to take dramatic steps, such as mass migration. Water shortages may also lead to civil unrest and wars.

- India has 4% of the world's freshwater, but 16% of its population. Demand will probably exceed supply by 2020, as urban water demand is expected to double and industrial demand to triple. Hydrologists calculate that 43% of precipitation never reaches rivers or aquifers, and water tables are falling rapidly as 21 million wells abstract water.

- China has 8% of the world's freshwater but must meet the needs of 22% of the world's population. Two-thirds of Chinese cities do not have enough water all year round, and national water supplies are likely to reach stress levels by 2030. China uses irrigation to produce 70% of its food, mostly in the north and northeast, where the Yellow River and major aquifers are running dry. Huge engineering projects transfer water to this area from the water-rich south.



Source: www.unep.org

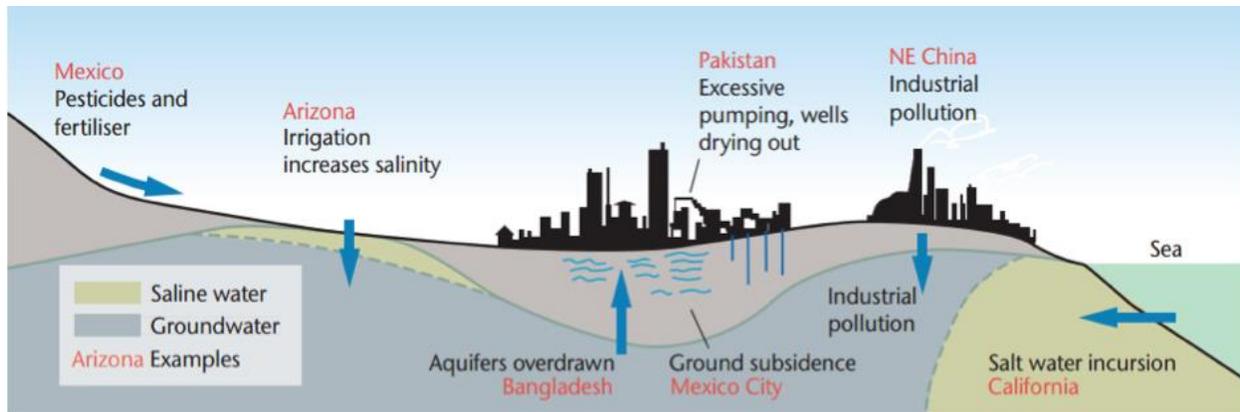
4.2.4 Freshwater supplies may become limited through contamination and unsustainable abstraction

Humans must drink potable water. In HICs water can be purified, for example in the Lea Valley, London, where wastewater is cleaned and used to recharge aquifers. Contaminated water carries diseases such as cholera, which is one of the diseases responsible for the high infant mortality rates in LICs. The 7th Millennium Development Goal (MDG7) aims to reduce by half the proportion of people without sustainable access to safe drinking water. This goal can be achieved through reliable supplies and waste treatment technology.

With a warmer climate, droughts and floods could become more frequent, severe and long-lasting. Droughts can have devastating effects on agriculture, livestock and water supplies, causing famine, malnutrition and the displacement of populations from one area to another. The land may become starved of nourishment or contaminated with mineral salts, so that even when it does rain the ground cannot support much vegetation growth. With climate change expected to reduce rainfall in some places and cause drought in others, some regions could become 'economic deserts', of no use to people or agriculture.

The Pearl River in China is highly polluted.

- The Delta, which accounts for 10% of China's GDP, has undergone rapid urbanisation. The rapid growth of cities has contributed to environmental degradation in the Delta.
- Polluted water is killing crops in the Pearl River Delta.
- Cities are rich enough to treat the water but they do not allow farmers to use the treated water, so people are forced to drink the polluted water. Those who do fall sick.
- 9,000 tonnes of heavy metals, 66,000 tonnes of nitrates and ammonia and 60,000 tonnes of petrol are deposited into the sea every year by the river.
- The World Bank has approved a US\$96 million loan to reduce water pollution.
- Guangzhou has built 30 water treatment plants which aim to cut sewage by 85%.



4.2.5 Water supplies can be enhanced through reservoirs, redistribution, desalination, artificial recharge of aquifers and rainwater harvesting schemes. Water conservation can help to reduce demand but often requires a change in attitude by the water consumers

Strategies used to meet an increasing demand for water:

Most water-short regions of the world with dry climates have long-standing water conservation traditions. To meet increased demands, water resource management practitioners are augmenting the limited natural water supply with desalination, water reuse, enhanced groundwater recharge and inter-basin transfers.

a) Rainwater harvesting

Rainwater has been collected for thousands of years in many parts of the world. Today, this technique is used in Asia to replenish underground supplies. It is relatively inexpensive and has the advantage of allowing local communities to develop and maintain the required structures themselves.

b) Diverting Surface Water

Diverting surface water into the ground can help reduce losses from evaporation, compensate for variations in flow, and improve quality. Middle East and Mediterranean regions are applying this strategy.

c) Dams and Reservoirs

Dams and reservoirs have been built to store water for irrigation and drinking. Moreover, dams can provide power and help control floods, but they can also bring about undesirable social and environmental impacts.

Transferring water between river basins can also help alleviate shortages. China, for instance, already has major interbasin links, and is planning more. The impact of these projects on people and the environment must be monitored closely.

d) Wastewater

Wastewater is now reused for different purposes in many countries, especially in the Middle East, and this practice is expected to grow. Worldwide, non-potable water is used for irrigation and industrial cooling. Cities are also turning to water re-use to supplement drinking water supplies, taking advantage of progress in water treatment.

e) Desalination

Desalinated water – seawater and other salty water that has been turned into freshwater – is used by cities and by industries, especially in the Middle East. The cost of this technique has dropped sharply, but it relies heavily on energy from fossil fuels and hence raises waste management and climate change issues.

4.2.6 The scarcity of water resources can lead to conflict between human populations, particularly where sources are shared



When the demand for water overtakes supply (**water scarcity**) and several stakeholders wish to use the same resource, there is a potential for conflict. Competing demands for water for irrigation, power generation, domestic use, recreation and conservation can also create tension both between and within countries (**water stress**).

The Middle Eastern water conflicts are exacerbated by low seasonal rainfall and growing population sizes. In the western part of this region, Israelis, Syrians, Jordanians, Lebanese and Palestinians are in dispute over shrinking water supplies. Security of water supplies was not the cause of the Arab-Israeli War, but was a contributory factor. Water in this region comes from two sources: the River Jordan (and its lakes) and three important aquifers. The division of these water resources between the neighbouring states is an ongoing challenge. In the eastern part of the region, Turkey plans to build dams to store and use water in the headwaters of the Tigris and Euphrates Rivers. This is strongly opposed by Syria and Iraq, where reduced water supplies threaten to hold back economic development and food production.

Treaties

The River Danube is a trans-boundary source, but international agreement has stopped conflicts.

- The Danube flows through 17 countries, and rises in the Black Forest Mountains in Germany and flows for 2,850km to the Black Sea.
- It provides drinking water for 10 million people and the International Commission for the Protection of the Danube River, comprising 13 member states and the EU, was set up in 1998 to promote and coordinate sustainable and equitable water management, including conservation, improvement and rational use of the water of the river, its tributaries and groundwater sources.

The River Nile is over-used, so conflict in the near future is likely.

- The Nile flows through 10 countries for 6,700km, draining more than 3 million km², about one-tenth of the entire African landmass, and is formed by three major tributaries, the White Nile, the Blue Nile and the Atbara.
- The primary problem facing the Nile and the countries has to do with the scarcity and over-use of the water.
- Before dams were built on the river, the discharge at Aswan varied widely throughout the year.

HOMEWORK:

4.2.7 Strategies that can be used to meet an increasing demand for fresh water

Around the world, human activity and natural forces are reducing available water resources. Although public awareness of the need to better manage and protect water has grown over the last decade, economic criteria and political considerations still tend to drive water policy at all levels. Science and best practice are rarely given adequate consideration. Pressures on water resources are increasing mainly as a result of human activity – namely urbanisation, population growth, increased living standards, growing competition for water, and pollution. These are aggravated by climate change and variations in natural conditions.

Using water resources sustainably is challenging because of the many factors involved, including changes in climate, the natural variability of the resource, as well as pressures due to human

activity. At present, most water policy is still driven by short-term economic and political concerns that do not take into account science and good stewardship. State-of-the-art solutions and more funding, along with more data on water resources, are needed especially in developing nations. To assess the state of our water resources, we must fully appreciate the roles of different parts of the water cycle – such as rain, meltwater from glaciers, and so on. Otherwise, it remains difficult to develop adequate protection and mitigation strategies.

Poor water quality and unsustainable use of water resources can limit the economic development of a country, harm health and affect livelihoods. On a positive note, more sustainable practices are starting to be adopted. When managing water resources, more attention should be paid to increasing existing natural resources and reducing demand and losses. The traditional response to rising demand for water was to store surface water in reservoirs, divert flow to dry regions and withdraw groundwater. Now these methods are increasingly supplemented by water reuse, desalination and rainfall harvesting. Certain regions are even going to the extreme of exploiting non-renewable groundwater resources.

Some countries have programs to reduce demand and losses from urban water distribution systems but more efforts are necessary. However, this will involve changes in behaviour requiring education and political commitment. Such efforts to conserve water and reduce demand are not only useful in regions where water is in short supply, they can also bring economic benefits in wetter regions.

Discuss, with reference to a case study, how shared freshwater resources have given rise to international conflict

As demand for water hits the limits of finite supply, potential conflicts are brewing between nations that share transboundary freshwater reserves. More than 50 countries on five continents might soon be caught up in water disputes unless they move quickly to establish agreements on how to share reservoirs, rivers, and underground water aquifers. The articles and analysis below examine international water disputes, civil disturbances caused by water shortages, and potential regulatory solutions to diffuse water conflict.

Case Study

At the heart of tensions between India and Bangladesh is the water supply from the River Ganges.

- For most of its 2,500km length, the Ganges flows through India, but the last part of its course takes it through Bangladesh before passing into the Bay of Bengal.
- In 1974 India opened the huge Farakka Barrage, just 11km from the Bangladeshi border. Further upstream, a series of dams divert water into irrigation systems and many of India's largest cities use the river to carry wastewater from domestic and industrial sources.
- Bangladesh is being deprived of much-needed water and has to suffer the effects of India's pollution of the river.
- The reduced flow of the river is affecting irrigation and food production. Fish stocks and the fishing industry are declining. Navigation and water-borne trade are becoming harder because of lower river levels, which are also increasing salinization. The delta is eroding because less silt is being carried and deposited. Seawater incursion is increasing as the delta dries out.

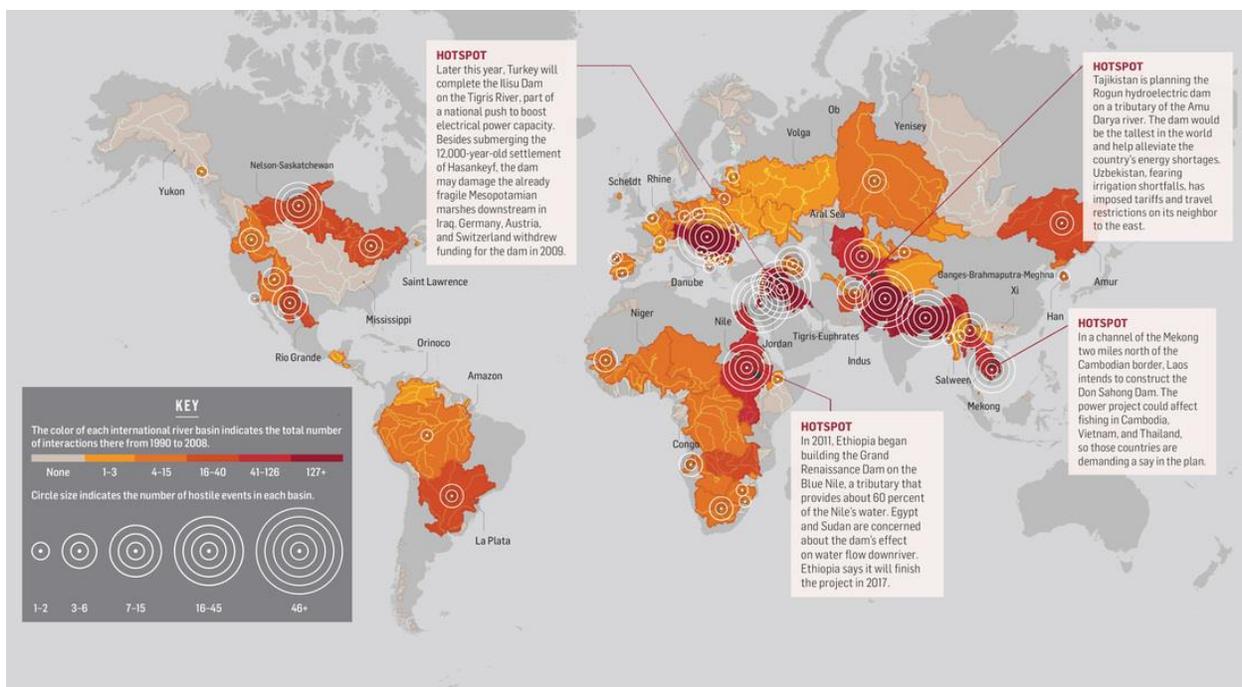


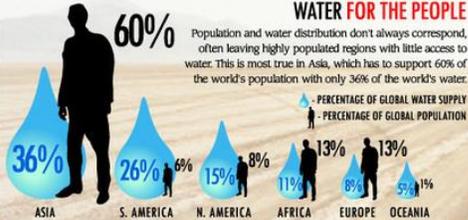
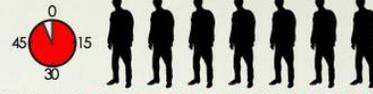
image from www.popsci.com

DOES THE SOLUTION LIE BENEATH US?

As lakes and rivers run dry and Earth's surface water disappears, the solution might lie beneath us, in the vast (and largely untapped) network of underground aquifers. The United Nations cites over 23,400,000 km³ of water in aquifers, 547 times more than all of Earth's rivers combined. 98% of Earth's accessible water is thought to reside in aquifers, much of it "fossil" water more than a million years old. Until recently deep aquifer pumping was out of the question (a cubic yard of water weighs one ton), but core-drilling technologies developed by the oil industry are changing the picture. Many of these aquifers span national borders, making access rights a huge matter of contention, and possibly a cause for future conflict.



Glass HALF EMPTY THE COMING WATER WARS



1970 WARNING SIGNS

In 1970, water consumption worldwide was half what is today. With 80% of all sickness in the developing world linked to polluted water, and with populations sharply on the rise, the urgency of water management became apparent.



2003 DRY AND DIRTY

Over 1.3 billion people have no access to clean water. At least 2.2 million people die annually from diseases related to poor sanitation and contaminated drinking water - that's about 10,000 deaths from bad water (or no water) each day.



2025 PARCHED POPULACE

The United Nations estimates that the world's per capita water supply will drop by 1/3 in the next 20 years. The worst strain will be in Africa and the Middle East, where populations are growing fast and rivers are running dry.



WILL THERE BE WAR?

Of all the water on Earth, only 2.5% is fresh, and less than 0.007% is readily available to people through rivers, lakes, and streams. As worldwide populations surge, temperatures rise, climates change, and diseases spread, clean water will become ever more essential (and ever more rare). In 2000, United Nations Secretary-General Kofi Annan warned that national rivalries over water could harbor "the seeds of violent conflict." Opinions are split on the likelihood of "Water Wars". In the past 50 years, there have been 1,831 water-related interactions between countries. Of these, the vast majority (1,228) ended peacefully. Only 21 involved actual military violence (18 between Israel and its neighbors). Furthermore, there are few places in the world where a water-poor country is in a military position to attack a water-rich neighbor. Still, many experts believe that as water shortages become increasingly urgent, countries (or at least local communities) will resort to violence to quench their thirsts.



- | BEST WATER | WORST WATER |
|-------------------|-------------|
| 1) Finland | 1) Belgium |
| 2) Canada | 2) Morocco |
| 3) New Zealand | 3) India |
| 4) United Kingdom | 4) Jordan |
| 5) Japan | 5) Sudan |



MAP BY JONATHAN HARRIS OF FLEETING TIGER PRODUCTIONS.

INA INTERNATIONAL NETWORKS ARCHIVE

SOURCES - UNITED NATIONS - MONTREAL GAZETTE - UNESCO - NEW YORK TIMES - INTER PRESS SERVICE