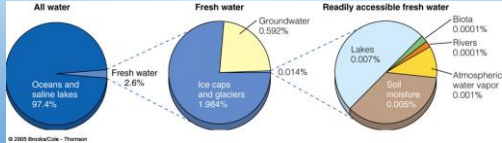


WATER, WATER POLLUTION AND WATER CRISIS

„WATER IS THE DRIVING FORCE OF ALL NATURE“
LEONARDO DA VINCI

Supply of water resources

- Earth's surface is covered by 71% water
- most of the freshwater (~ 3%) are locked in ice caps and glaciers, only less than 0.7% is available for human use
- essential for life – can survive only a few days without water



Volume of water stored in the water cycle's reservoirs

Reservoir	Volume of water (10 ⁶ km ³)	Percent of total
Ocean	1370	97.25
Ice caps & glaciers	29	2.05
Groundwater	9.5	0.68
Lakes	0.125	0.01
Soil Moisture	0.065	0.005
Atmosphere	0.013	0.001
Streams & rivers	0.0017	0.0001
Biosphere	0.0006	0.00004

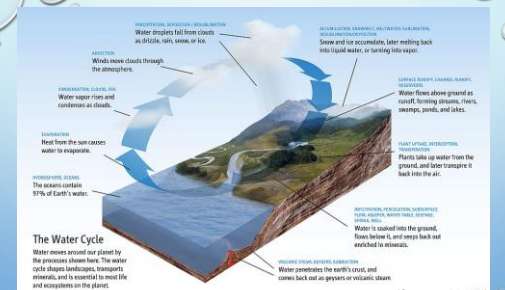
Water is a renewable resource when used **sustainably**. But in many places, it is not used carefully. As a result, lakes, rivers and oceans around the world are **polluted**, over-used and even dried up.

Of all the water in the world, 97 per cent is in the oceans, so our freshwater needs must be met from the remaining 3 per cent.

Average residence times of reservoirs

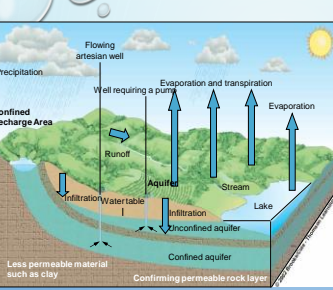
Reservoir	Average residence time
Antarctica	20,000 years
Oceans	3,200 years
Glaciers	20 to 100 years
Seasonal snow cover	2 to 6 months
Soil moisture	1 to 2 months
Groundwater: shallow	100 to 200 years
Groundwater: deep	10,000 years
Lakes	50 to 100 years
Rivers	1 to 6 months
Atmosphere	9 days

is the average time a water molecule will spend in that reservoir



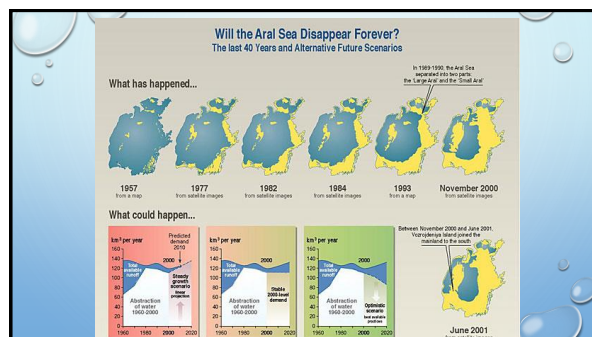
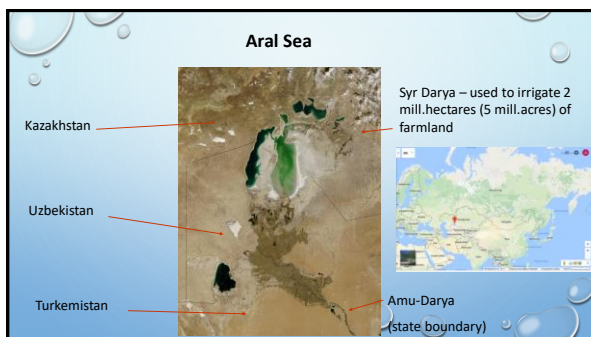
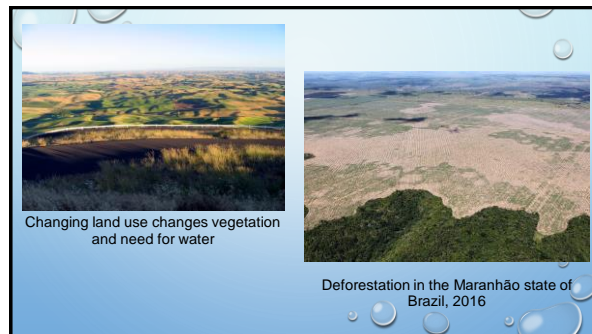
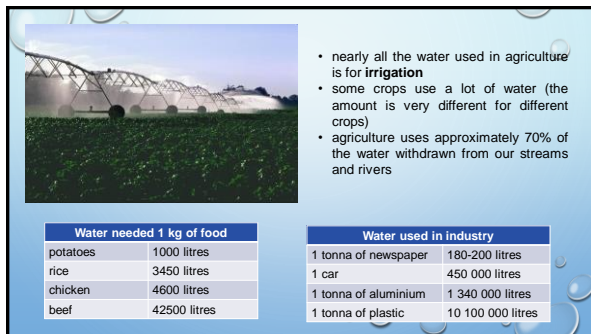
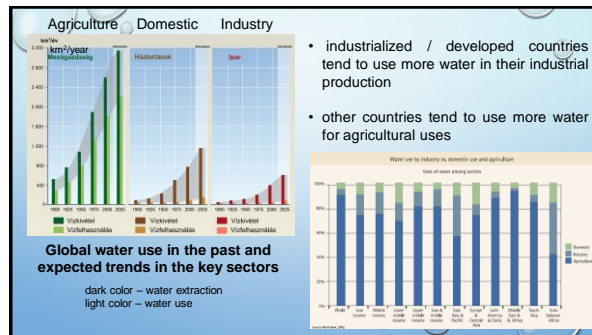
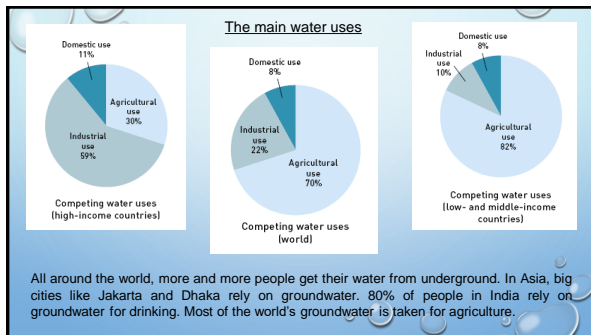
The Water Cycle
Water moves across our planet by the processes shown here. The water cycle shapes landscapes, transports minerals, and is essential to most life and ecosystems on the planet.

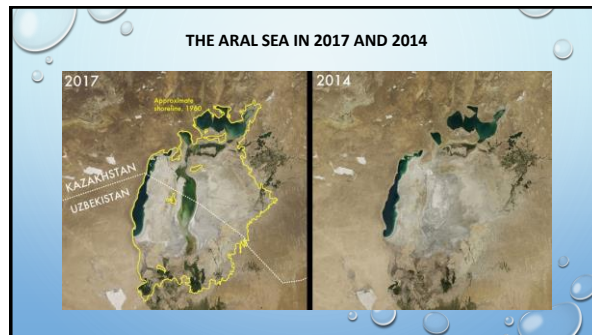
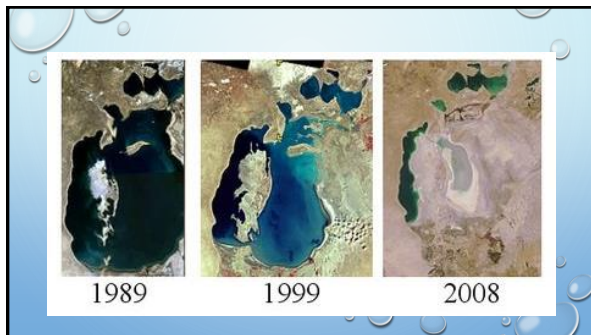
(Source: wikipedia)



surface runoff – 2/3 lost to floods and not available for human use

- water table – upper limit of the groundwater
- aquifer – the permeable material through which ground water flows
- many of the world's rivers, lakes and streams are supported by groundwater
- renews itself very slowly. Groundwater (shallow) usually stays in aquifers for 1400 years. So groundwater is a renewable resource but it has to be used carefully





Lake Chad

- economically important, providing water to more than 30 mill. people living in the 4 countries surrounding it on the edge of Sahara (Chad, Cameroon, Niger and Nigeria)

- by 2000, its extend had fallen to less than 5% of its original size
- because of the
 - overgrazing surroundings the lake, causing desertification and decline in vegetation
 - human water use, such as inefficient damming and irrigation methods

Water crisis on the Earth

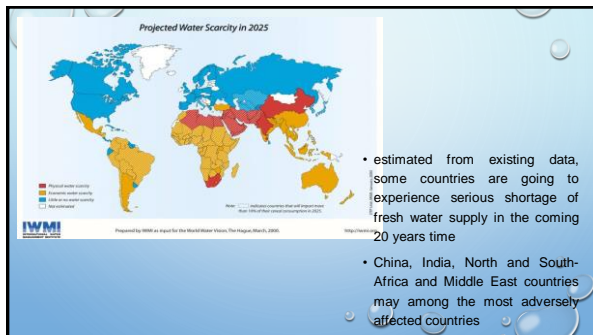
© 2005 Brookfield/ Thomson

Projected Water Scarcity in 2025

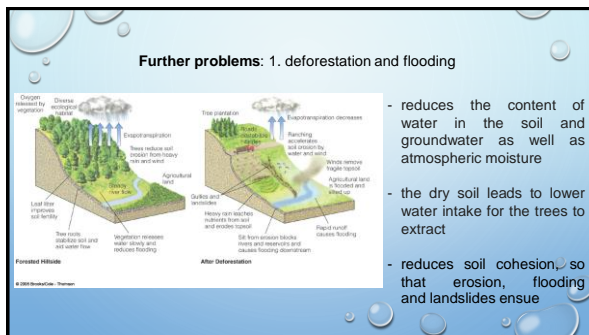
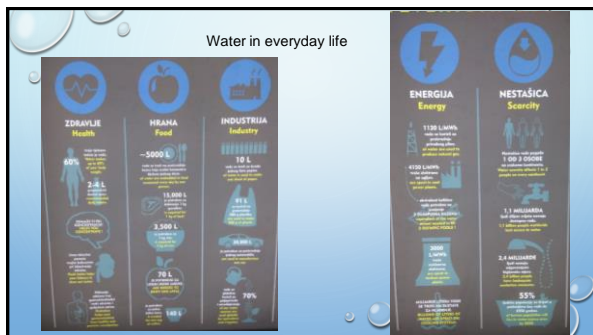
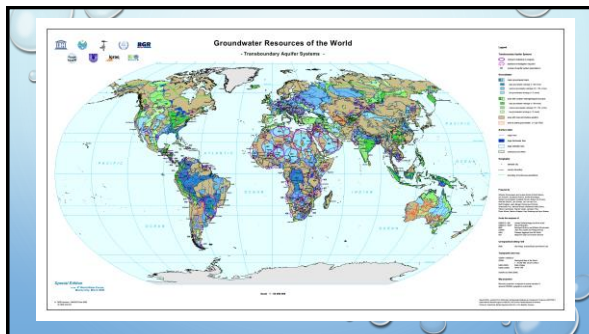
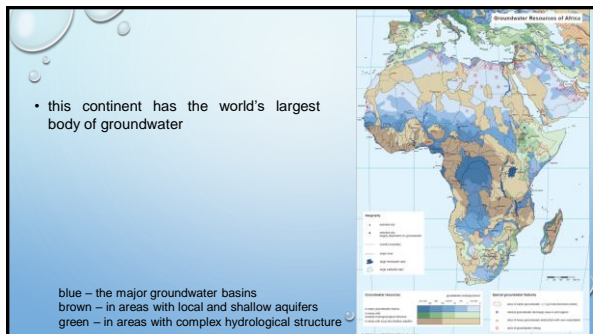
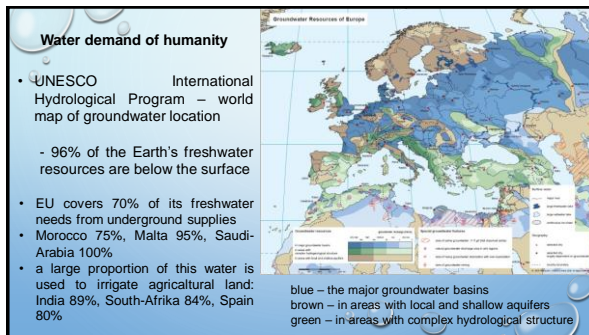
IWMI
Report: 2008-10 report for the World Water Forum, Rio de Janeiro, 2008

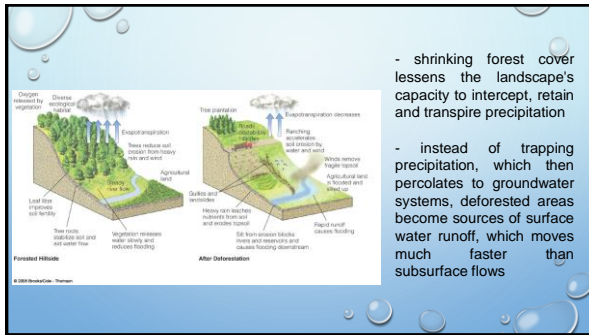
Problems related to water crisis

- inadequate access to safe drinking water by over 1.1 billion people
- groundwater overdrafting leading to diminished agricultural yields
- overuse and pollution of water resources harming biodiversity
- regional conflicts over scarce water resources sometimes resulting in warfare



- estimated from existing data, some countries are going to experience serious shortage of fresh water supply in the coming 20 years time
- China, India, North and South-Africa and Middle East countries may among the most adversely affected countries





- shrinking forest cover lessens the landscape's capacity to intercept, retain and transpire precipitation
- instead of trapping precipitation, which then percolates to groundwater systems, deforested areas become sources of surface water runoff, which moves much faster than subsurface flows

Landslide on Echeandia - Guaranda street in Ecuador (2017. április 12.)

- incorrect forest cuttings with heavy rainfall results a large surface runoff – land slides

<https://www.facebook.com/severeweatherEU/videos/1990853121137779/>



Further problems: 2. types of water pollution

water pollution source:

- point source = pollution comes from single, fixed, often large identifiable sources
 - smoke stacks
 - discharge drains
 - tanker spills
- non-point source = pollution comes from dispersed sources
 - agricultural runoff
 - street runoff

- sediment
 - logging, roadbuilding, erosion
- oxygen-demanding wastes
 - human waste, storm sewers, runoff from agriculture, grazing and logging, many others
- nutrient enrichment = eutrophication
 - Nitrogen (N), Phosphor (P) from fertilizers, detergents
 - leads to increased growth in aquatic systems, ultimately more non-living organic matter
 - eutrophication: well-fed, high nutrient levels present in a lake or river

- disease-causing organisms
 - from untreated sewage, runoff from feed lots
- toxic chemicals
 - pesticides, fertilizers, industrial chemicals
- heavy metals (lead, mercury)
- acids
- elevated temperatures = thermal pollution
 - water is used for cooling purposes, then heated water is returned to its original source
 - any increase in temperature, even a few degrees, may significantly alter some aquatic ecosystems

groundwater pollution

- agricultural products
- underground storage tanks
- landfills
- septic tanks
- surface impoundments

„You wrote...“

Water pollution reasons in Bangladesh

- Industrial Waste and Effluent
- Solid Waste and Sewage Disposal
- Inadequate Sanitary Facilities
- Arsenic Contamination of Ground Water

In the rural areas of China

- there are large garbage being put into the river, due to the lack of the necessary garbage and sewage treatment facilities. Because of this the garbage and the domestic sewage directly flow into the river

Further problems: 3. oil spills

- Exxon Valdez released 42 million liters of oil in Prince William Sound, contaminating 1500 km of Alaska coastline in 1989
- most marine oil pollution comes from non-point sources:
 - runoff from streets
 - improper disposal of used oil
 - discharge of oil-contaminated ballast water from tankers

Further problems: 4. growth of population

- supply & demand are in growing conflict – supply is finite – water management driven by values and needs
- increases demand/use of water
- increases land use and changes vegetation and permeability
- increases demand for instream values – instream flows are for people

Urban sprawl

Shanghai in 1984, on the left bank of Huangpu, away from Yangzhou (Yangtze River)

It now extends to Yangzhou, soon to be built on the island of Chongming, where the eco-city is built. Suzhou and Wuxi settlements fused into the city as an agglomeration area

Solutions sustainable water use

- not depleting aquifers
- preserving ecological health of aquatic systems
- preserving water quality
- integrated watershed management
- agreements among regions and countries sharing surface water resources
- outside party mediation of water disputes between nations
- marketing of water rights
- raising water prices
- wasting less water
- decreasing government subsidies for supplying water
- increasing government subsidies for reducing water waste
- slowing population growth

- https://www.youtube.com/attribution_link?a=f8nP7M19oqs&u=%2Fwatch%3Fv%3DX_OEScmCK2w%26feature%3Dshare

Cape Town water crisis – where is the water actually going

- <https://www.facebook.com/TheEconomist/videos/250145392369479/>

The Economist : America is securing its "energy independence" with oil and gas. But China is leading the way in creating more efficient renewable technologies

BOOK you learn from: www.sze.hu/~radicsa/
Michael Allaby: Basics of Environmental Science, pp. 1-135.