WATER

tutorial by Sharon Ashworth & Paul Rich

OUTLINE

1. Availability & Use
2. Hydrology
3. Shortages
4. Supplying more water
   - dams & reservoirs
   - water transfer
   - groundwater
   - using water more efficiently
5. Flooding

1. Availability & Use

Only a small fraction of Earth's water is fresh water & available for human use.

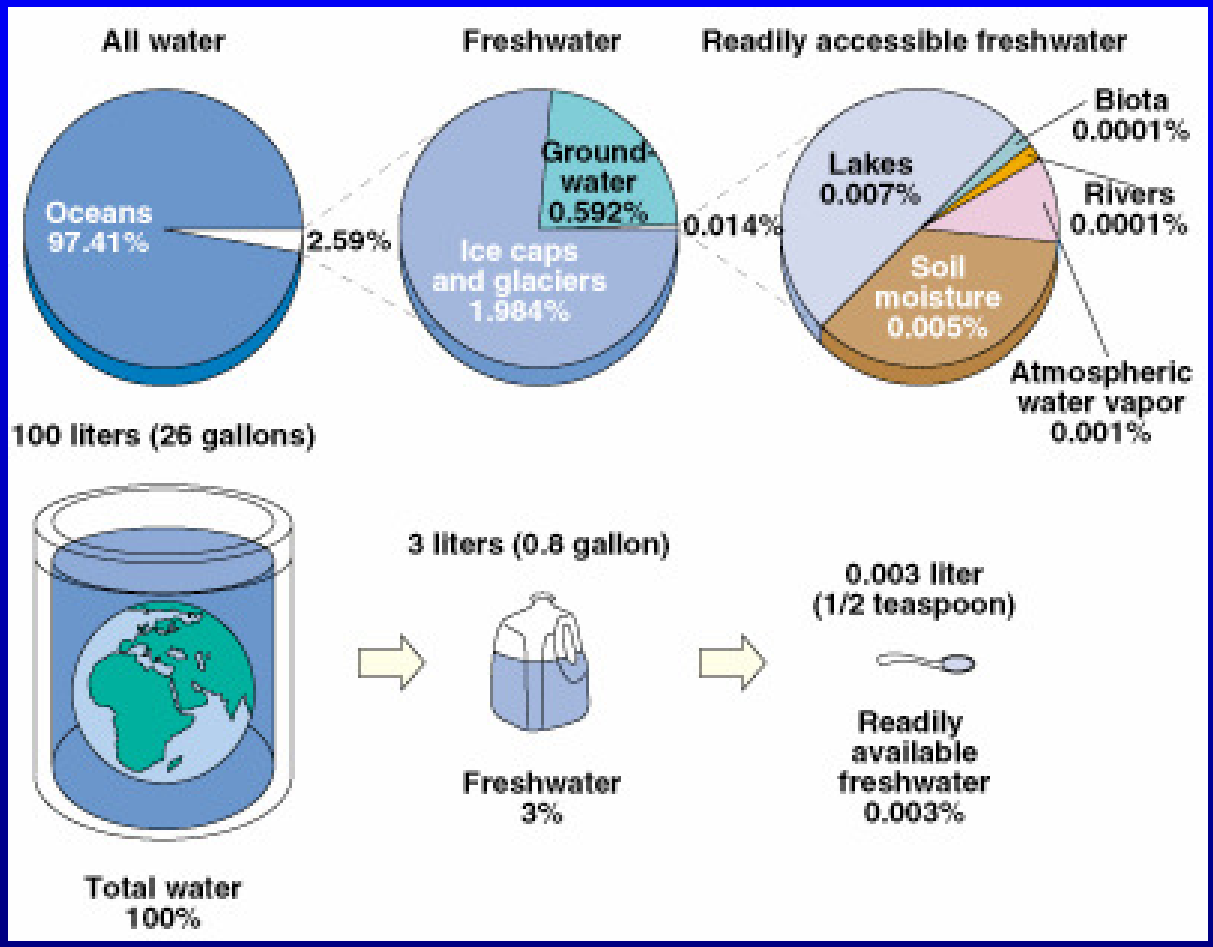


Fig. 13–2

Use of Fresh Water

- **69% for agriculture**
  most does not reach crops (60%–80% wasted)
  800 gallons = 1lb grain–beef
- **23% for industry** (energy production & various industry)
  100,000 gallons = 1 car
  1,000 gallons = 1lb of aluminum
- **8% for domestic & municipal use**

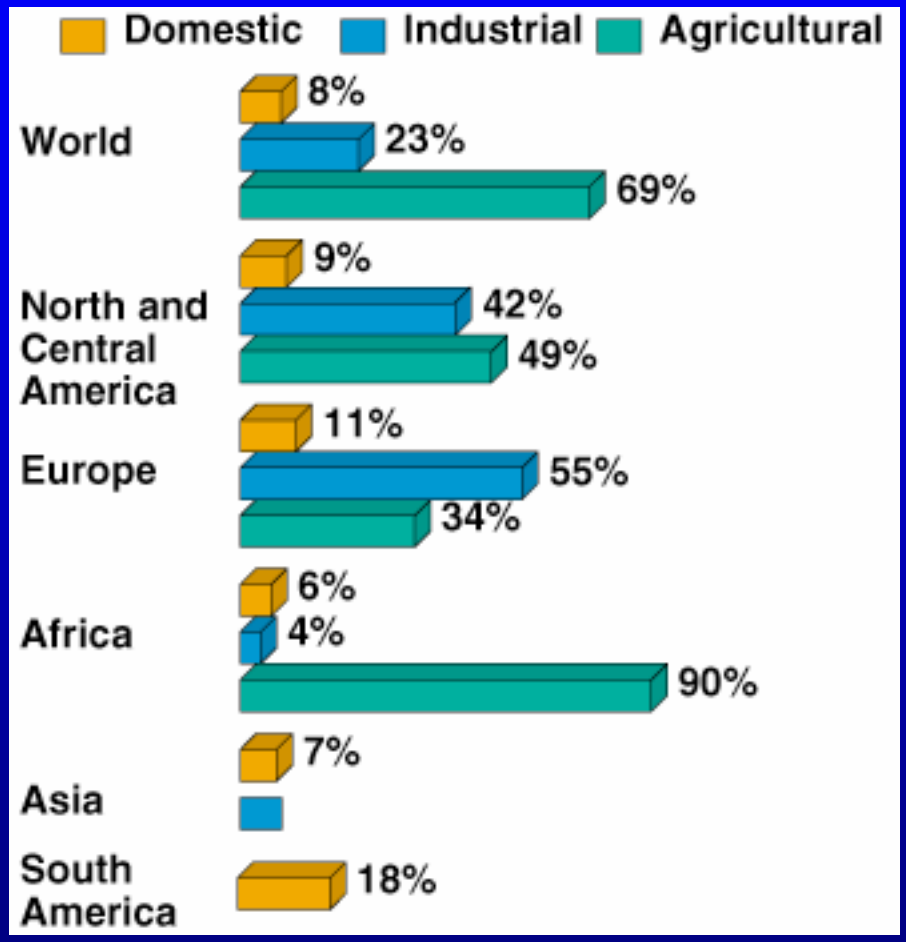
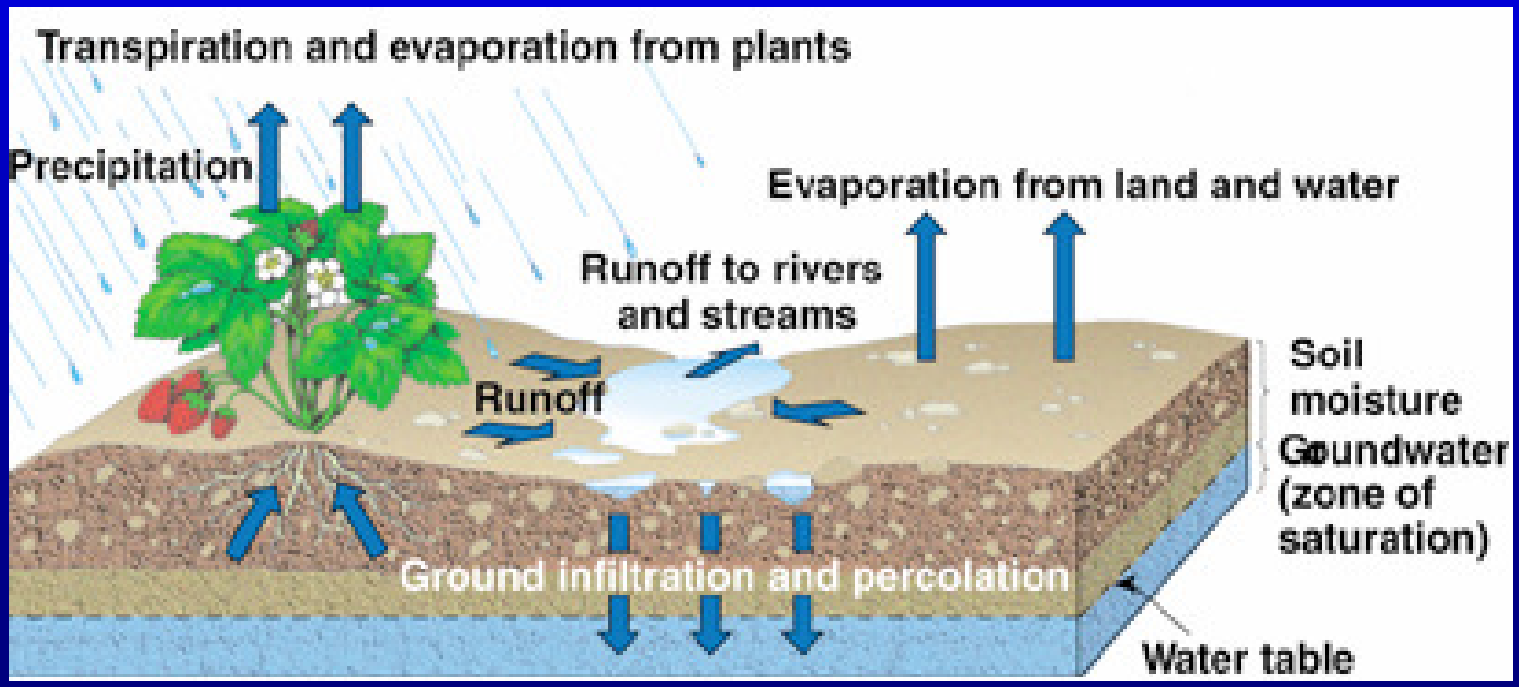


Fig. 13–5

2. Hydrology

Surface Hydrology

Local precipitation leads to surface runoff, ground infiltration, & evapotranspiration (evaporation + transpiration).



Groundwater Hydrology…a deep subject

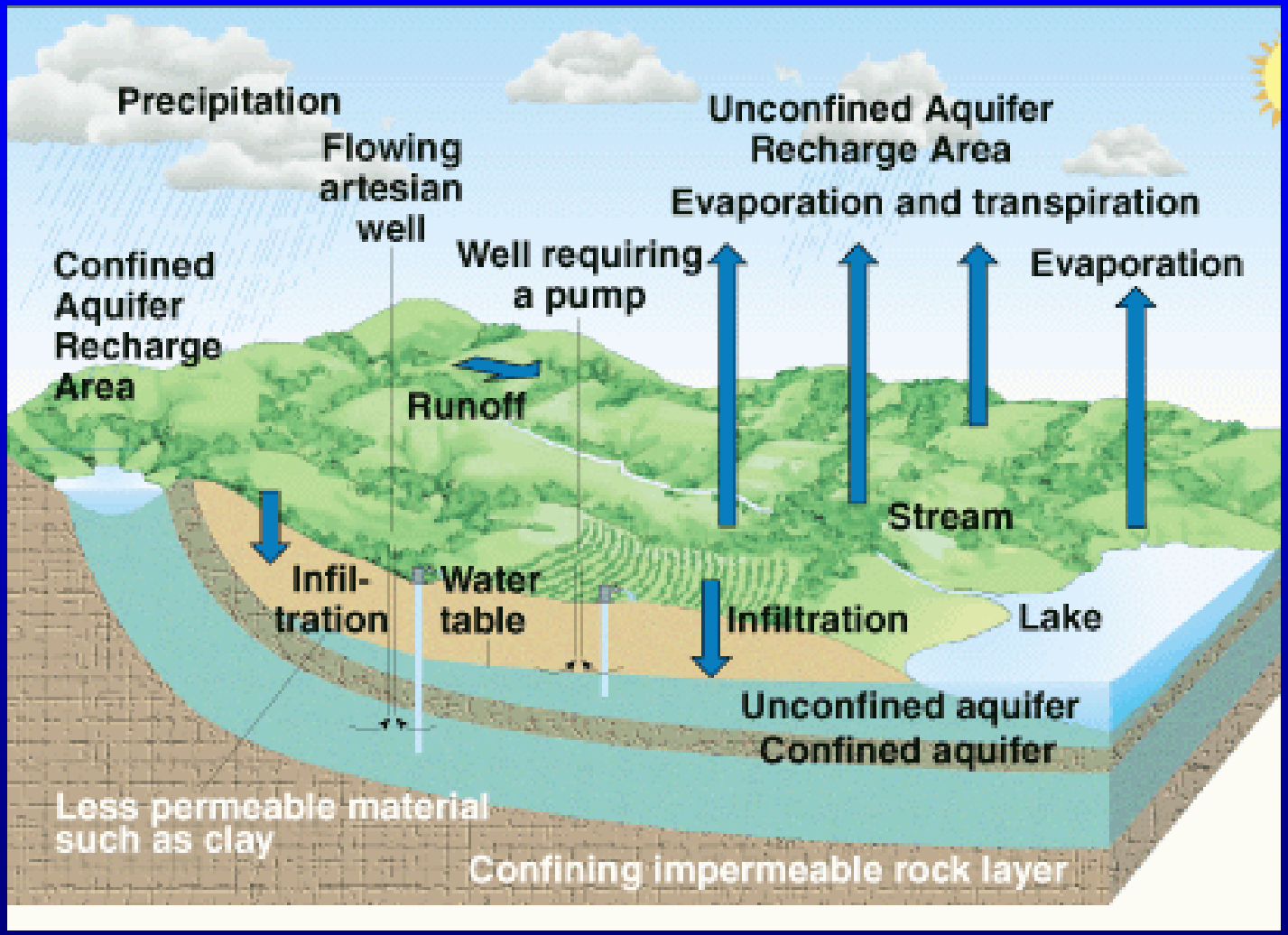


Fig. 13–4

“Hey, Ms. McClure… what’s a ‘flowing artesian well’?”

San Antonio, circa 1895

http://www.edwardsaquifer.net/intro.html

Highlights of Hydrology:

surface water: precipitation that does not infiltrate the ground or evaporate

watershed: region from which water drains into a water body

groundwater: water that infiltrates the ground & is stored in voids between soil particles

aquifers: porous, water–saturated layers of soil or rock through which groundwater flows

recharge area: any area of land through which water passes into an aquifer

Water infiltrates through soil to the water table.

Unconfined aquifers have a zone of infiltration above (unsaturated) & a water table below which is saturated.

Confined aquifers are bounded above & below by less permeable rock; groundwater in this type of aquifer is confined under pressure.

Groundwater moves from the recharge area through an aquifer & out to a discharge area (well, spring, lake, geyser, stream, or ocean)

3. Water Shortages

Causes:

- Dry climate
- Drought - a period in which precipitation is lower & evaporation is higher than normal
- Desiccation - drying of the soil as a result of deforestation & overgrazing
- Water stress – increasing demand for limited resource

Fresh Water Shortages

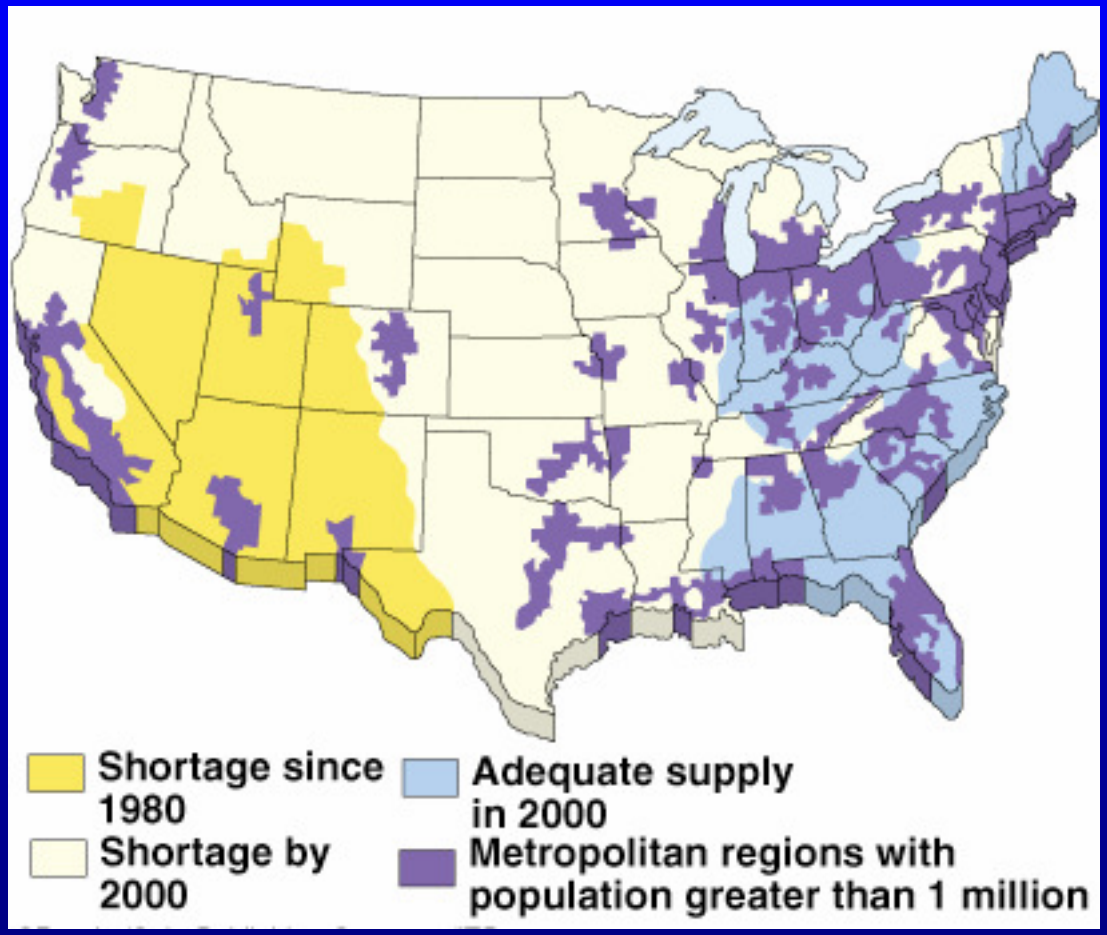


Fig. 13–8

4. Supplying More Water

Dams & Reservoirs

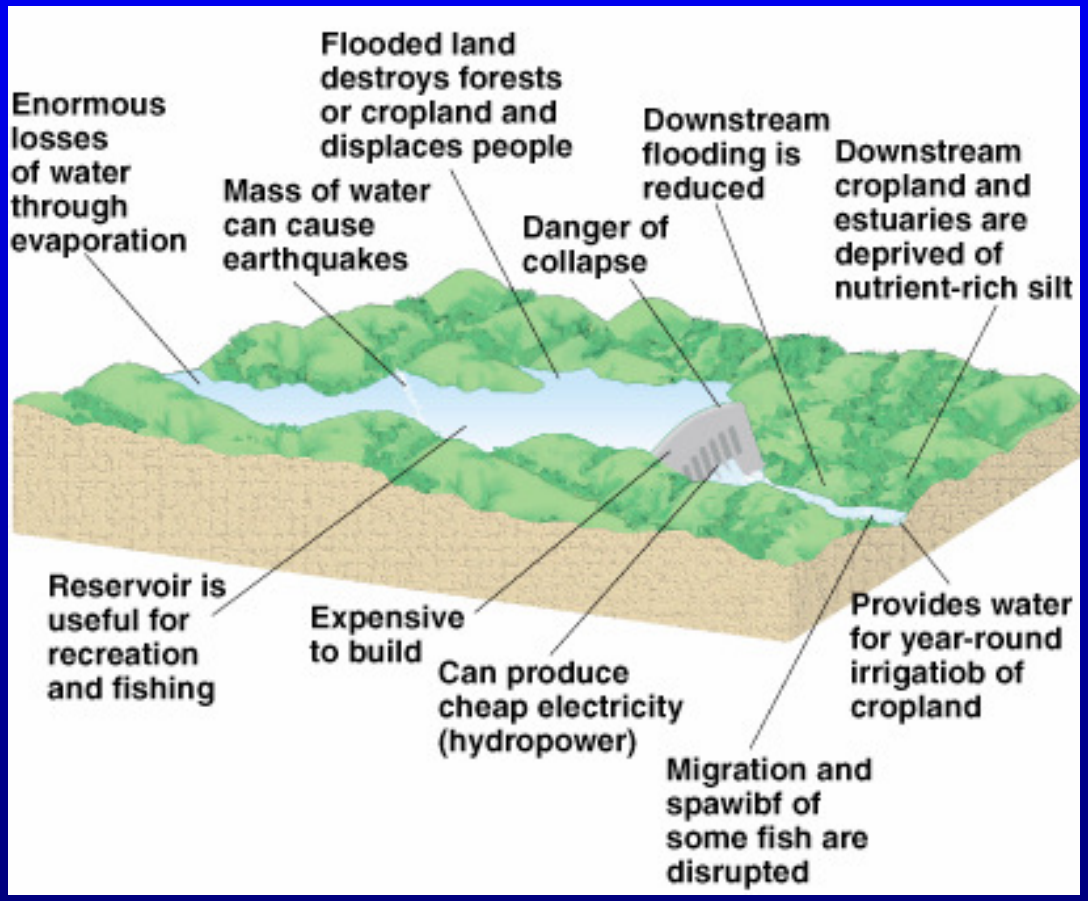


Fig. 13–10

Supplying More Water

Dams & Reservoirs – the Colorado River

- system of dams & canals provides electricity & cheap water for agriculture, industry, & cities

  availability of cheap water has led to wasteful practices

- limited water supply must be divided between farmers, ranchers, cities, Native Americans, Mexico, & wildlife

  currently, the Colorado River rarely makes it to the Gulf of California

- population growth in the lower basin is increasing demand beyond the allocated supply

Supplying More Water

Dams & Reservoirs – the Colorado River

GC Dam Video: http://video.nationalgeographic.com/video/player/environment/going-green-environment/conservation-in-action/glen-canyon.html

Supplying More Water

Water transfer – California Water Project

The Problem

- most of the rainfall is in northern California
- most of the population growth & agriculture is in southern California

The Solution

- water transferred to the south via dams, pumps, & aqueducts

The Controversy

- southern California wants more water for growing cities
- much of the water transferred is wasted by inefficient irrigation
- the north needs the water for fisheries & flushing pollutants out of San Francisco Bay

Supplying More Water

Water transfer – California Water Project

Fig. 13–12

Supplying More Water

Groundwater supplies

Groundwater in the U.S. is being withdrawn at about four times its replacement rate

Consequences:

- aquifer depletion
- aquifer subsidence land sinks when water is withdrawn
- saltwater intrusion

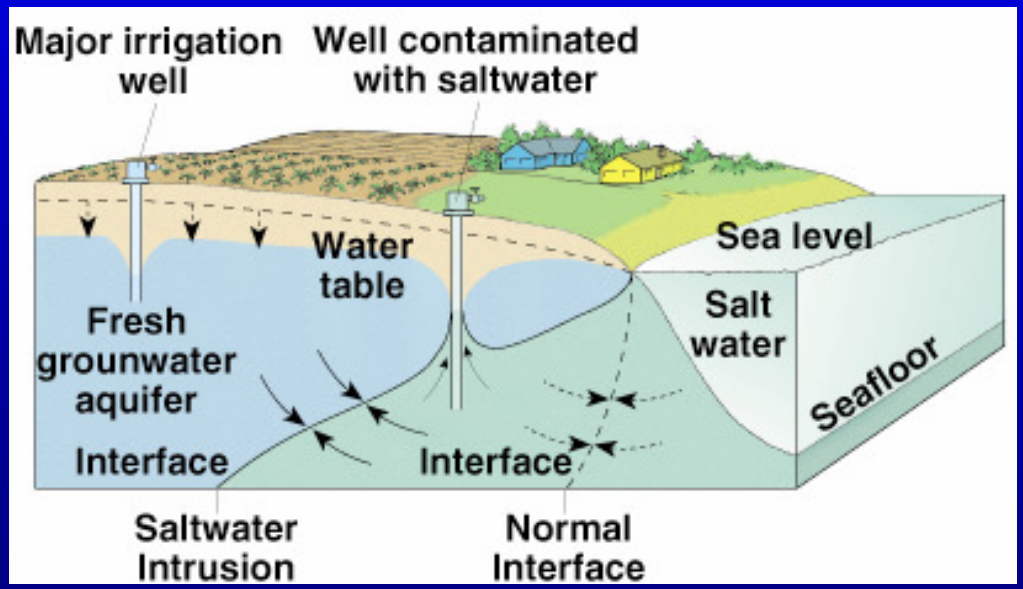


Fig. 13–16

Supplying More Water

Groundwater supplies

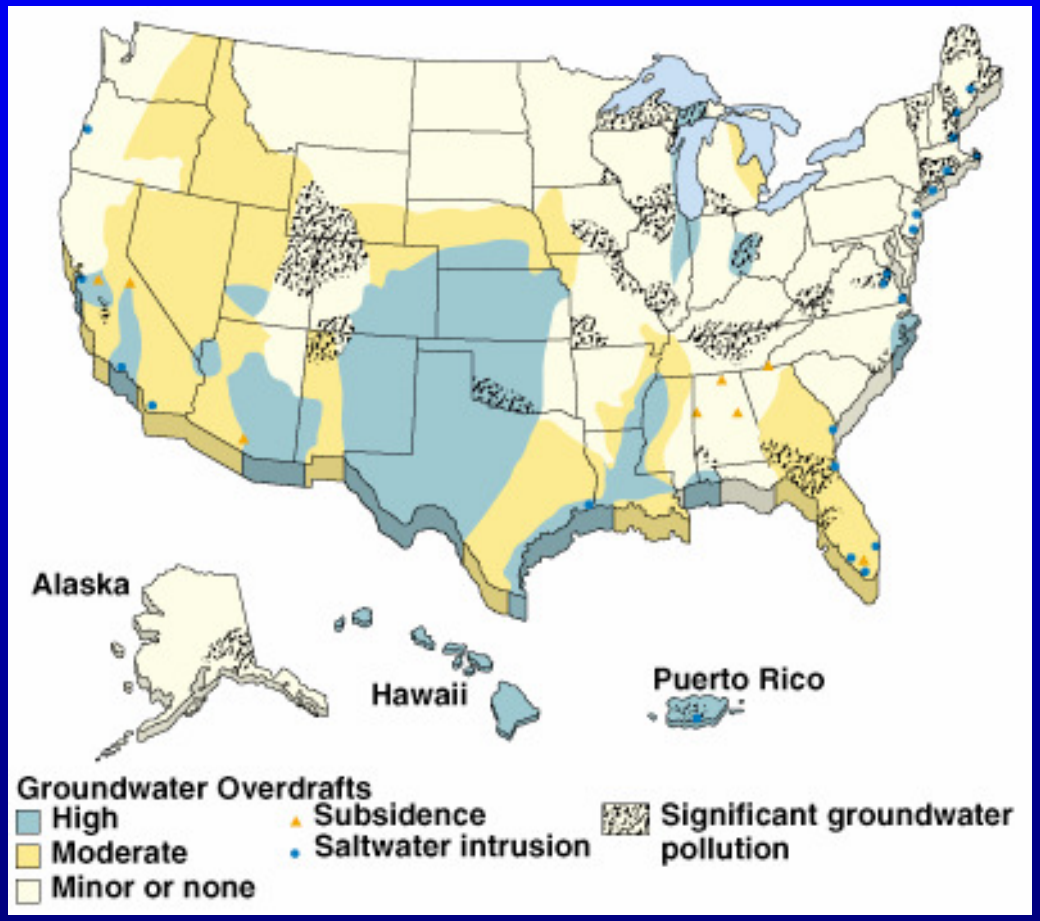


Fig. 13–15

Supplying More Water

Using water efficiently

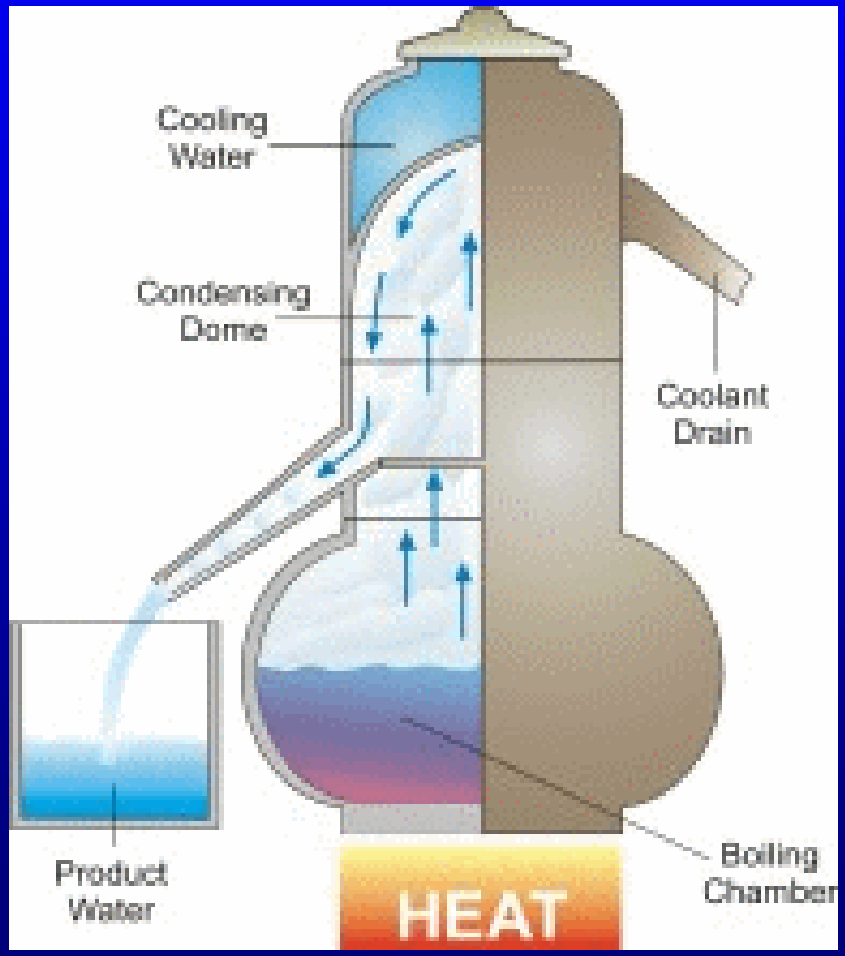
- increase efficiency of irrigation
  drip irrigation, central–pivot, computer monitoring
- use recycled water
  treat gray water from showers, washing machines for reuse
- fix leaky pipes
- water–saving toilets, faucets, & shower heads
- xeriscaping
  plant drought–tolerant vegetation in residential communities located in arid & semi–arid areas

Supplying More Water

Desalinization

Making fresh water from salt water

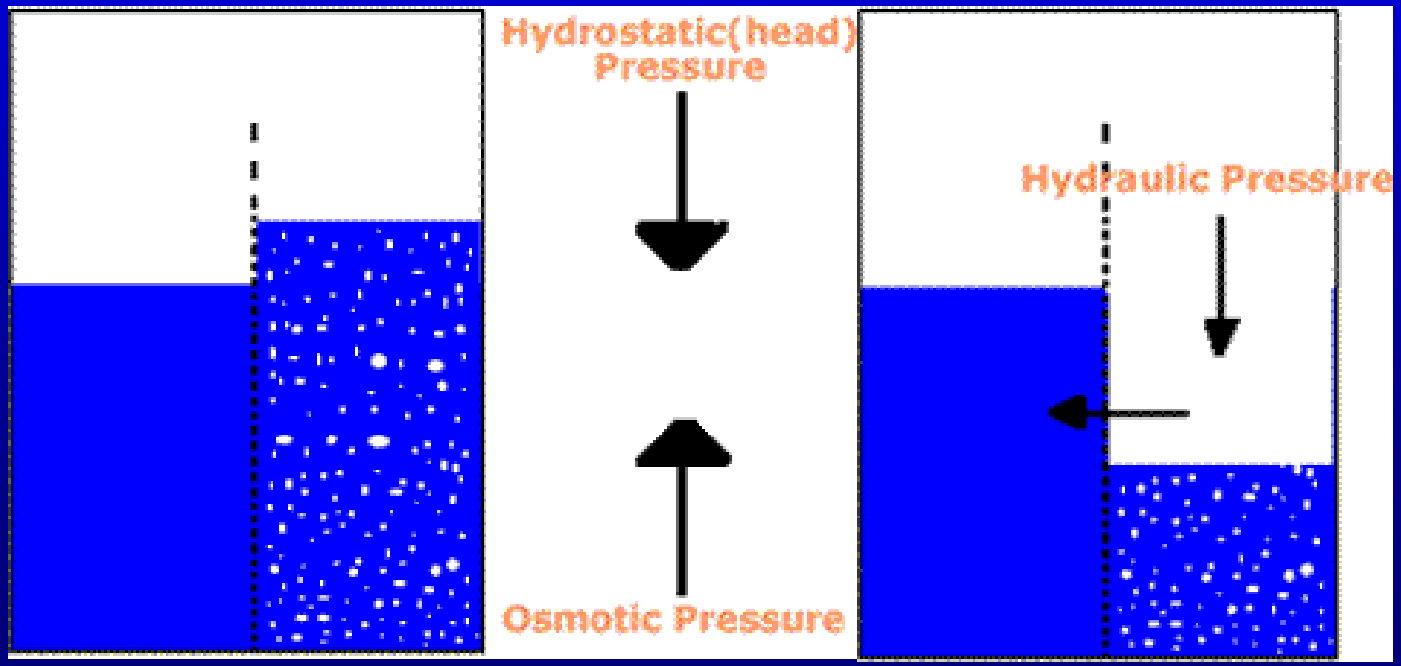
Desware: The Encylopedia of Desalination and Water Resources
http://ga.water.usgs.gov/edu/drinkseawater.html



Supplying More Water

Reverse Osmosis

Making fresh water from salt water



5. Flooding

Flooding is the result of heavy, prolonged rain or rapid snowmelt causing water in a river to overflow its channel

Human activities can exacerbate flooding, either increasing the probability of a flood or increasing the severity of a flood

Human activities that exacerbate flooding

- Removing vegetation, logging, overgrazing, forest fires, mining, urbanization
- Destruction of wetlands
  - wetlands absorb surface runoff & release it slowly to the river
- Building in floodplains & replacing vegetation with concrete
  - loss of vegetation causes rapid runoff of rainwater

Fig. 13–22