Ch. 13 - Water

Supply, Renewal and Use of Water Resources

Water -

97% by volume is found in the ocean (salt water)

3% is fresh water with 2.997% locked up in ice caps and glaciers

0.003% easily available as soil moisture, usable groundwater, water vapor, lakes and streams

Hydrologic Cycle (Ch.5)

Canada - 20% of world's fresh water

China - 7% of world's fresh water

Surface Water

Surface Runoff - water that flows into streams, lakes, wetlands and reservoirs

Watershed (drainage basin) -a region from which water drains into a stream, lake, reservoir, or other body of water.

Groundwater

Zone of Saturation - below the surface where voids are filled with water

Water Table - the surface of the zone of saturation

Aquifer - porous sand, gravel or bedrock through which groundwater flows

Aquitard – nonporous rock

Recharge area - an area of land through which water passes downward or laterally into an aquifer

Natural recharge or lateral recharge

Water mining - removal of water from an aquifer that exceeds its replenishment

How do we use the world's fresh water?

65% - irrigate farm land (agriculture)

25% - energy production

10% - domestic and municipal use

Too Little Water
Causes of Freshwater Shortages

Dry climate

Drought

Desiccation

Water Stress

How Can Water Supplies be Increased?

Build dams and reservoirs

Bring in surface water from another area

Withdraw groundwater

Desalination

Improve the efficiency of water use

Dams

Capture and store water from rain and melting snow; then released as desired to produce elec. power, irrigate land, control flooding below the reservoir and provide water to towns

can reduce downstream flow to a trickle (Colorado River)

reduce biodiversity

Danube's Iron Gate dam

China's Three Gorges project (Yangtze River)

Malaysia's Bakun dam - would be the world's highest

Transferring water from one place to another

James Bay Watershed

Aral Sea Watershed

Salt Rain - salty dust picked up by rain

How they are dealing with this problem of the Aral Sea

1. charging farmers more for irrigation water
2. decreasing irrigation water quotas
3. introducing water-saving technology
4. dev. a regional integrated water management plan
5. planting protective forest belts
6. using underground water
7. improving health services
8. slowing the area's rapid population growth

Tapping groundwater and converting salt water to fresh water

Overuse of groundwater can cause:

aquifer depletion

aquifer subsidence

intrusion of salt water into aquifers

Ways to slow groundwater depletion include controlling population growth, not planting water-thirsty plants in dry areas and wasting less irrigation water

Desalination:

Distillation

Reverse Osmosis

Uses vast amount of electricity. Distribution of desalinated water is also costly

Process produces large quantities of brine (contains high levels of salt and minerals)

Cloud Seeding

Add chemicals to clouds to promote rain

Legal issues over the ownership of water in clouds
Tow massive icebergs to arid coastal areas.

Using Water More Efficiently

65-70% of water used throughout the world is wasted: evaporation, leaks, etc.

In U.S., artificially low water prices - government subsidies

Multiple water resource management responsibility

How can we waste less water in irrigation?

Line irrigation ditches (50-60% efficiency)

Use high efficiency center-pivot sprinkler system (70-80% efficiency)

LEPA - low energy precision application sprinklers (75-85% efficiency)

High-efficiency trickle or drip irrigation systems (80-90% efficiency)

Computer-controlled systems to monitor soil moisture and irrigate as needed.

Organic Farming - requires ~1/4 water of conventional farming.

How can we waste less water in industry, homes and businesses?

Recycle aluminum (97% less water)

Xeriscaping (use of dry climate vegetation) and drip irrigation for gardens and other vegetation

Eliminate leaks

Eliminate single rate billing systems (apartments and 1/5 of US public water systems)

Rebates for installing water-saving devices (showerheads, toilets)

"Negaliters" or "Negagallons" are savings in water used.

Salmon - anadromous (living in both fresh and salt water environments)

salmon ranching

To build up the salmon runs

build hatcheries upstream

transport young salmon around dams

makes streams off limits for hydropower

obliterate old logging roads to reduce runoff of silt

Too Much Water

Natural flooding

Floodplain

Humans contribute to flood deaths and damage by removing vegetation, living in the floodplains, through urbanization (highways, parking lots, etc.).

How can we reduce flooding risks?

1. Channelization (straightening and deepening streams)

    reduces upstream flooding, increases upstream bank erosion and downstream flooding and deposition of sediment

2. Building levees and dams

    increases water's capacity for doing damage downstream

    destruction happens downstream from each levee

    the levee race

    Flood control dam - the reservoir gradually fills up with sediment

    gives a false sense of security

3. Restoring wetlands

4. Instituting floodplain management

    The best approach from an environment viewpoint

"Sooner or later the river (or ocean) always wins"

A Sustainable Water Future

    preserve the ecological integrity of water supply systems

    waste less water

    allow fair access to water

    give people a say in how water resources are developed and used.

Three underlying forces that can lead humans to use water in an unsustainable way:

depletion or degradation of a shared resource

population growth

unequal distribution or access

A key to reducing water waste is for governments to phase out subsidies