Water Use and Management

~Water- essential for all living processes: dissolves nutrients and distributes them to cells, regulates body temperature, supports structures, and removes waste products; 60% of our body is water and 70% of the world's surface is covered in it.
~The hydrologic cycle- the circulation of water as it evaporates from land, water, and organisms, enters the atmosphere, condenses and precipitates to the earth's surfaces, and moves underground by infiltration or overland by runoff into rivers lakes and seas: Allows for a fresh supply of water, maintains a habitable climate and moderates world temperatures. Plants help add water vapor to the air through transpiration.
Evaporation= process through which liquid is turned into a gas way below its boiling point
*Sublimation= when water moves from the solid to the gaseous form with out ever being liquid (occurs on bright, dry cold winter days)
*Saturation point= when a volume of air contains the most water vapor that it can at a given temperature
*Relative humidity= the amount of water vapor in the air expressed as a percentage in terms of the saturation point
*Condensation= when saturation point is exceeded and water molecules begin to aggregate
*Dew point= the temperature at which condensation occurs
*Condensation nuclei= tiny particles that help facilitate the condensation process (smoke, dust, sea salts, spores, etc)
*Cloud= accumulation of condensed water vapor in droplets or ice crystals
~Mountains have two different climates: the windward side is cool wet and cloudy; the leeward side is warm dry and sunny, ex. Himalayans (dry spot on mtn= rain shadow)
~Deserts lack moisture and have much evaporation due to the descending air masses. The air will condense under the higher pressure and warms through adiabatic heating. This typically occurs at 30 degree latitudes North and South of the equator. Typical deserts include the Sahara, Gobi, and Death Valley.
~Tropical rainforests receive much rain
~Oceans make up 86% of evaporation, 90% returns directly to the ocean: the other ten percent is carried onto the continents- once there some is incorporated into plants and animals, the rest seeps into the underground but all eventually returns to the ocean. 40,000 km2 of surface runoff and underground flow represents the renewable supply for us and freshwater-deep ecosystems.
~Evaporation and condensation help regulate the climate, as winds redistribute the heat and moisture
~Oceans= contain 90% of all bio mass and 97% of all the liquid in the world. They moderate the global temperature- warm water flow from tropics to poles and vice versa,
*Residence time= that length of time an individual molecule spends circulating in the ocean before evaporation, on average its 3,000 years
~Glaciers hold almost 90% of the earths freshwater. These frozen rivers slowly move downhill. Antarctic glaciers contain 85 % of all the ice in the world.

GROUNDWATER:
-Second largest freshwater reservoir
~Ground water= holds next largest amount of fresh water
*Infiltration= precipitation that doesn't evaporate and runs through fractures of the rocks in the soil
*Zone of aeration= upper soil layers that hold both air and water, moisture for plant growth comes from here. The depth varies.

*Zone of saturation= lower levels where all soil air spaces are filled with water. The top of the zone is called the water table and it is neither flat nor stationary. Aquifers: porous layers of sand etc. below water table
-Artesian well: water gushes out without being pumped

Should We Remove Dams?

YES!
*Storage reservoirs drown free-flowing rivers
*They can submerge towns, farms, and cemeteries and important historic sites
*Block fish migration- salmon migration routes impeded
*Can change aquatic habitats that were important to species
*Siltation of reservoir behind dam builds up requiring dredging.
*Nutrients carried within the silt and clay are lost to down stream farmlands that would normally be deposited during floods.
*Dam breakage could devastate communities living downstream.

NO!
*Stores water, and generates electricity
*Create jobs for workers
*Help economic development
*Allows arid and unfarmable lands to grow crops through irrigation of water

Main problem with dams are their inefficiency!!! Dams lose water through evaporation, and seepage through porous rocks~~~> wasting more water than they make available.
* Accumulating sediments can clog reservoirs and make dams completely useless~~~> lose a lot of valuable nutrients. Silts can be replaced with commercial fertilizers costing more than 100 million bucks a year!

LOSS OF FREE-FLOWING RIVERS

Hetch Hetchy Valley in Yosemite National Park: San Francisco wanted to dam the Tuolumne River in the park to produce hydroelectric power and provide water for the city. Some people liked it because it supported clean water and power. John Muir opposed the dam project (He founded the Sierra Club and Yosemite Park!! Wahoo!) He said that Hetch Hetchy valley's beauty should be protected. The people fought a hard fight but the dam builders won.

WATER MANAGEMENT AND CONSERVATION
*Goal: prevent flood damage and store water for future use instead of building dams and reservoirs.
Watershed-> also known as a "catchment" is all the land drained by a stream or river. Retaining vegetation and ground cover in watersheds help hold back rainwater and decrease downstream floods.
*More environmentally sound farming and forestry techniques can help reduce runoff.
*Retaining crop residue on fields can reduce flooding
*Minimizing plowing and forest cutting on steep slopes protect watersheds
*Conserving wetlands helps preserve natural water storage capacities and aquifer recharge zones.

Small dams can be just as useful as big dams:

Small dams on tributary streams have the ability to hold back water before it turns into a big flood. These dams can form ponds, and they provide useful wildlife habitats! Small dams can be built with simple equipment and local labor.
More than 60 million people in 33 states obtain their drinking water from national forest lands

DOMESTIC CONSERVATION
How can we help stop water shortages?
Take shorter showers!! Stop leaks!! Efficiently wash your cars, dishes, and clothes!!! What about appliances? Use low-volume showerheads, and efficient dishwashers and washing machines!! **If you plant native ground cover in a "natural lawn" or make a rock garden, landscape in harmony with the surrounding environment- xeriscaping (choosing plants that require little moisture) can be great instead of constantly watering and feeding a dry, arid garden.***
:0) Our biggest domestic water use is toilet flushing!! eeeew. We use about 13,000 gallons of drinking quality water annually to flush toilets. People are now creating low-volume and waterless toilets.

Domestic U.S. water use:

38% Toliet
31% Bathing
20% Laundry, Washing

RECYCLING AND WATER CONSERVATION
*In 3rd world countries 70% of all the agricultural water used is lost to leaks in irrigation canals, application to areas where plants don't grow, runoff, and evaporation. People have been trying to turn to new farming techniques such as leaving crop residue on fields and ground cover on drainage ways, using mulches, and low-volume irrigation in order to reduce water losses. And its been working!
*Cooling electric power plants = bad water usage
*Installing dry cooling systems= better water usage

PRICE MECHANISMS AND WATER POLICY
In the past, water policies were been against conservation. Some parts of the US were based on riparian use rights= people who lived near a river could use as much as they wanted as long as they didn't taint its quality or the limit others who wanted to access to the water down stream. In many places, like NYC, water used to be very cheap. People didn't have any incentive to repair leaks, or restrict usage. The drought of 1988 changed all of these practices...
*The US is currently saving 38 million gallons a day compared to per capita rates 20 yrs ago. However, we have 10% less water because of the growing population!
*Drip irrigation= AWESOME! It applies water directly to plant roots, but its very expensive. Used on only 1% of farmland worldwide.
*Charging higher proportion of costs to users of public water projects~~~> encourages conservation!