Class 15a: Water resources

- Water supply and demand
- Modification of waterways
- Water quality and pollution
Availability of water

- Only 3% of Earth’s water is fresh
- Only 0.003% is available
- Surface water: streams, lakes, etc.
- Groundwater: found in aquifers
Demand for water

- Since 1950, per capita water use has tripled: why?
- 1 billion people lack safe water
- Depends on climate, population, level of development
Demand for water

• U.S. individual use: 180 gallons/day
• Lettuce: 6 gallons
• Glass of milk: 48 gallons
• Eggs: 63 gallons each
• Loaf of bread: 145 gallons
• Pound of beef: 8,500 gallons
## Demand for water

<table>
<thead>
<tr>
<th></th>
<th>Agriculture</th>
<th>Industry/energy</th>
<th>Household</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>70%</td>
<td>25%</td>
<td>8%</td>
</tr>
<tr>
<td>U.S.</td>
<td>41%</td>
<td>49%</td>
<td>10%</td>
</tr>
<tr>
<td>SW U.S.</td>
<td>85%</td>
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</tbody>
</table>
Politics of water

- Military tool since 2500 B.C.
- Jordan R., Tigris and Euphrates, Nile, etc.
- “Environmental security”
- Cooperation among riparian nations needed
- Water wars?
Aral Sea

• Was the world’s fourth largest lake; now 80% gone
• Central Asian desert climate
• Irrigation on Amu Darya, Syr Darya
  – Cotton, rice
  – Commercial, not subsistence, farming
Aral Sea

- Increased salinization
- Fishing industry gone
- Salts and dust from dry lakebed
- Rivers slow, contaminated
- Climate even more continental
- “Ten times worse than Chernobyl”
Ogallala Aquifer

• Equivalent to a Great Lake; 25-100 years left
• Cattle, wheat, corn, cotton (1/5 of U.S. cropland)
• Drinking water for 2 million
• “Groundwater mining”
  – Potentially renewable resource
  – Used up to 22 times faster than replaced
Solutions?

- More groundwater (not long-term)
- Diverting rivers (Columbia? Ob?)
- Towing icebergs (expensive)
- Desalination (expensive, energy-intensive)
Solutions?

• Conservation!
• Est. 65-70% of water is lost (50% in U.S.)
• True pricing
  – Less federally subsidized water in West
  – More metering (Sacramento)
• More efficient irrigation
• Reclaiming and recycling
Modification of streams

- Your responsibility!
- Channelization
  - What and where
  - Downstream, upstream consequences
- Effects of cities, deforestation
What is water “quality”? 

• Depends on the use 
• Drinking, swimming, fishing, aquatic life, industry, etc. 
• 2000 EPA assessment: 40% of streams, 45% of lakes, 14% of coasts did not meet quality standards
Water quality and pollution

• Biological or chemical pollutants
  – Pathogens, silt, metals, chemicals
• Point sources: specific location
• Non-point sources: dispersed location
  – Agriculture, industry, mining, residences
Agricultural runoff

• 1/2 to 2/3 of stream pollution in U.S.
• Excess fertilizer
  – Eutrophication
  – Algae blooms, “dead zone”
• Herbicides, pesticides
• Animal wastes (factory farms)
Industrial/mining runoff

- Metals, arsenic from gold mining
- PCBs from industry
- Mercury from industry, mining
  - Concentration in Arctic
  - Cultural, health implications
Clean Water Act (1972)

- Set U.S. water quality standards
- Goal of no discharge by 1985
- Focus on “end of pipe”
  - Cheaper to violate?
- Eastern rivers, Great Lakes greatly improved
- Considered a legislative success story