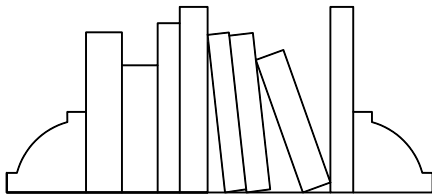


Water

Lecture Outline:

14. WATER QUANTITY
- Humans and the Water Cycle
 - Water Quantity
 - Obtaining More Water
 - Idaho's Water Resource



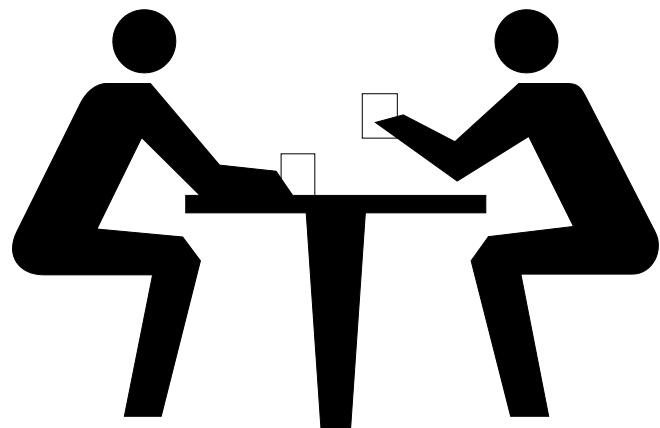
Learning Objectives:

When you are finished with this unit you should be able to:

- Describe and understand various processes in the water cycle.
- Describe the current water quantity crisis in the western USA and in arid areas of the world.
- Describe and evaluate the options for making water supplies go farther.
- Describe and evaluate various water conservation options.
- Describe water use in Idaho.
- Describe water quantity problems in Idaho.

Terms You Should Know:

- ❖ Surface water
- ❖ Groundwater
- ❖ Water table
- ❖ Aquifer
- ❖ Recharge area
- ❖ Mono Lake
- ❖ Land subsidence
- ❖ Desalinization
- ❖ Drip irrigation
- ❖ Aral Sea
- ❖ Appropriation Doctrine
- ❖ Groundwater mining
- ❖ Groundwater management area
- ❖ Critical groundwater area
- ❖ Water quality
- ❖ Water quantity
- ❖ Fresh water
- ❖ Consumptive use
- ❖ Nonconsumptive use
- ❖ Water cycle
- ❖ Hydrologic cycle
- ❖ Ogallala aquifer
- ❖ Sinkhole
- ❖ Saltwater intrusion
- ❖ Xeriscaping



Reading Assignment:

Brennan and Withgott:
Chapter 15; pages 400-419.

14. WATER QUANTITY

A. HUMANS AND THE WATER CYCLE

- All of the fresh water we use has to come out of the cycle somewhere
-

QUANTITATIVE:

QUALITATIVE:

1. Sources and Uses of Fresh Water

CONSUMPTIVE—water diverted is lost for future use

- irrigation for agriculture (water returns to river or aquifer at a different place)

NON-CONSUMPTIVE—the water remains available for the same or other uses if quality is adequate—or it can be treated

-
-
-

Sources of freshwater:

- rivers—
- lakes—
- groundwater—

- What is the source of freshwater on the UI campus?
for Boise? for Coeur d'Alene?

B. WATER QUANTITY

1. The World Situation:

- Fresh water is critically short in many areas of the world
- Currently, over 80% of the water used world-wide goes to agriculture
 -
 -
- Human need:
 -
 - 26 countries are short of this need:
 - ✓
 - ✓
 - ✓
 - ✓
 - more countries are joining this list every year
 -

2. Mounting Water Deficits

- Humans are using surface and groundwater at faster rates
-

- Falling water tables:

Water Deficits in Key Counties and Regions

County/Region	Est. Annual Water Deficit billion cubic meters/year
---------------	--

India

China

USA

North Africa

Saudia Arabia

Est. Global Total:

From Sandra Postel "Redesigning Irrigated Agriculture." In: *State of the World 2000*, Lester R. Brown

3. Surface Waters

SHORTAGES:

- Rule of thumb: no more than 30% of a river's average flow can be diverted without risking shortfall once every 20 years

-

- Los Angeles —

—

—

—

ECOLOGICAL EFFECTS:

-

- Wildlife depends on riparian areas

-

-

- Mono Lake—

4. Groundwater

Falling Water Tables and Depletion:

- In areas of the USA 75 X more groundwater is used than surface water
- When withdrawal rates exceed recharge rates, the water table drops, eventually groundwater can become depleted
-
-
- 3,500,000 acres will switch from irrigation to dryland farming over the next 15 to 20 years
- Mexico City—
-
- 22,000,000 people; what will happen when city runs out of water?

DIMINISHING SURFACE WATER:

-
- Streams, rivers, lakes—fed by groundwater

LAND SUBSIDENCE:

- Groundwater creates cavities in bedrock
-
-
-

SINKHOLES—underground caverns drained of water; collapses

–

–

SALTWATER INTRUSION:

•

- Water table depleted; salt water intrudes and contaminates supplies

5. Case Study: The Aral Sea

- Once the world's 4th largest lake

–

- Now the world's 11th largest lake

–

- over 60% of the lake has disappeared since 1960

–

- Aral Sea is the victim of irrigation water diversions from the rivers that feed it

–

–

- Prior to 1960 rivers delivered 13 cubic miles of water to the Aral Sea each year

–

- Problems due to shrinkage:

–

–

–

- sea no longer has a moderating effect on climate

✓

- dust and salts create adverse health impacts

✓

- Aral Sea is basically dead

–

–

–

C. OBTAINING MORE WATER

1. More

- Interbasin water transfer

Columbia River →

Snake River →

Snake River →

-

- Dams in the Third World

- potential wars over dams in the Third World

- resettlement of millions of people

- The Pros and Cons of Dams

- Benefits of Dams:

✓ Power generation

✓

✓

- ✓ Drinking water
- ✓
- ✓
- ✓ Recreation
- Costs of Dams:
 - ✓
 - ✓ Fishery decline
 - ✓
 - ✓
 - ✓ Disruption of flooding
 - ✓
 - ✓
- Desalinization plants
 -
 -
- Ogallala aquifer—

2. Using Less Water

-
-
- Competition between urban, agricultural, and wildlife use
 - a. Irrigation
 - In USA 7X more water used in agriculture than for residential consumption

Importance of Irrigation in Agriculture

Country	Irrigated Area million ha	Ag Land Irrigated %
India		
China		
USA		
Pakistan		
Uzbekistan		
Egypt		
Bangladesh		
World		

From Sandra Postel “Redesigning Irrigated Agriculture.” In: **State of the World 2000**, Lester R. Brown

- In Idaho 47X more water is used in agriculture than in residential consumption
- - 60% of water lost by:
 - ✓
 - ✓
 - ✓
- Newer more efficient agricultural irrigation systems should be installed
 - flood →
 - sprinkler →
- Increased cost
 -

b. Municipal Systems

- Get more water from agriculture (California)

- Some cities overdraw groundwater without agriculture pressures
- Current consumption is over 100 gallons/person/day
 - toilets:
 - showers:
 - laundry:
 - watering lawns
 - filling pools
 - washing dishes:

Alternatives:

- ***XERISCAPING***—landscaping with drought resistant plants
-
-
- watering lawns on certain days (Denver, CO)

How is water conserved in Moscow?

How is water conserved in your community?

3. Water Shifts and Potential Water Wars

a. USA

Shift from agriculture \longrightarrow urban use

1980: Agriculture

Urban

1993: Agriculture Urban

2020: Agriculture Urban

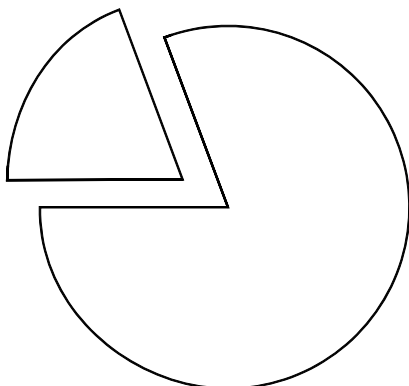
b. World Hot Spots

Water Resources	1999 Population	2025 population	Change
	----- million -----		%
Aral Sea			
Ganges (India, Bangladesh)			
Jordan River (Middle East)			
Nile			
Tigris-Euphrates			

D. IDAHO'S WATER RESOURCE

1. The Numbers

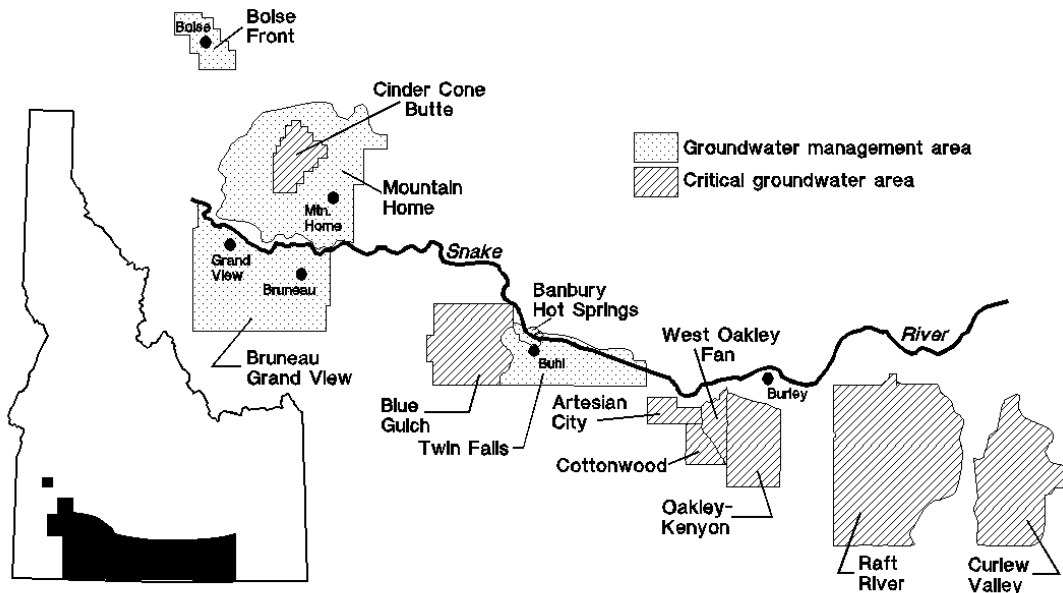
- Idaho is the sixth largest user of water in the USA
-
-
- Water Use:



- -
- Agriculture is Idaho's largest water user — 86% or 13,000,000,000 gallons/day
 -
- Trout farming
 -
 -
 -
- Commercial / Domestic Use
 -
 - 311 gallons/person/day in home
- Industrial / Mining
 -
- Recreation / Tourism
 -
 -
- Hydropower Generation
 -
 -
- Competing Interests
 -
 -
 -

2. Groundwater Problems

- Groundwater levels are becoming depleted in some areas of Idaho
- Groundwater management within Idaho is governed under the Appropriation Doctrine
 -
 - in times of shortage newest wells can be curtailed to provide water for senior wells
- Idaho Department of Water Resources (IDWR) issues permits for new wells
 -
- Groundwater mining (a drop in the water table) is a problem in southern Idaho
 -
 -
 -



- CGWAs

-

- groundwater levels are declining at a rate that threatens the supply for existing users

-

- GWMA

-

-

- IDWA must ensure that existing water rights in the area are affected by new construction

3. Comparison to Western USA

- Idaho's water resources are better (quality and quantity wise) than all other western states