Unit 8: Hydrogeology

Lecture 1

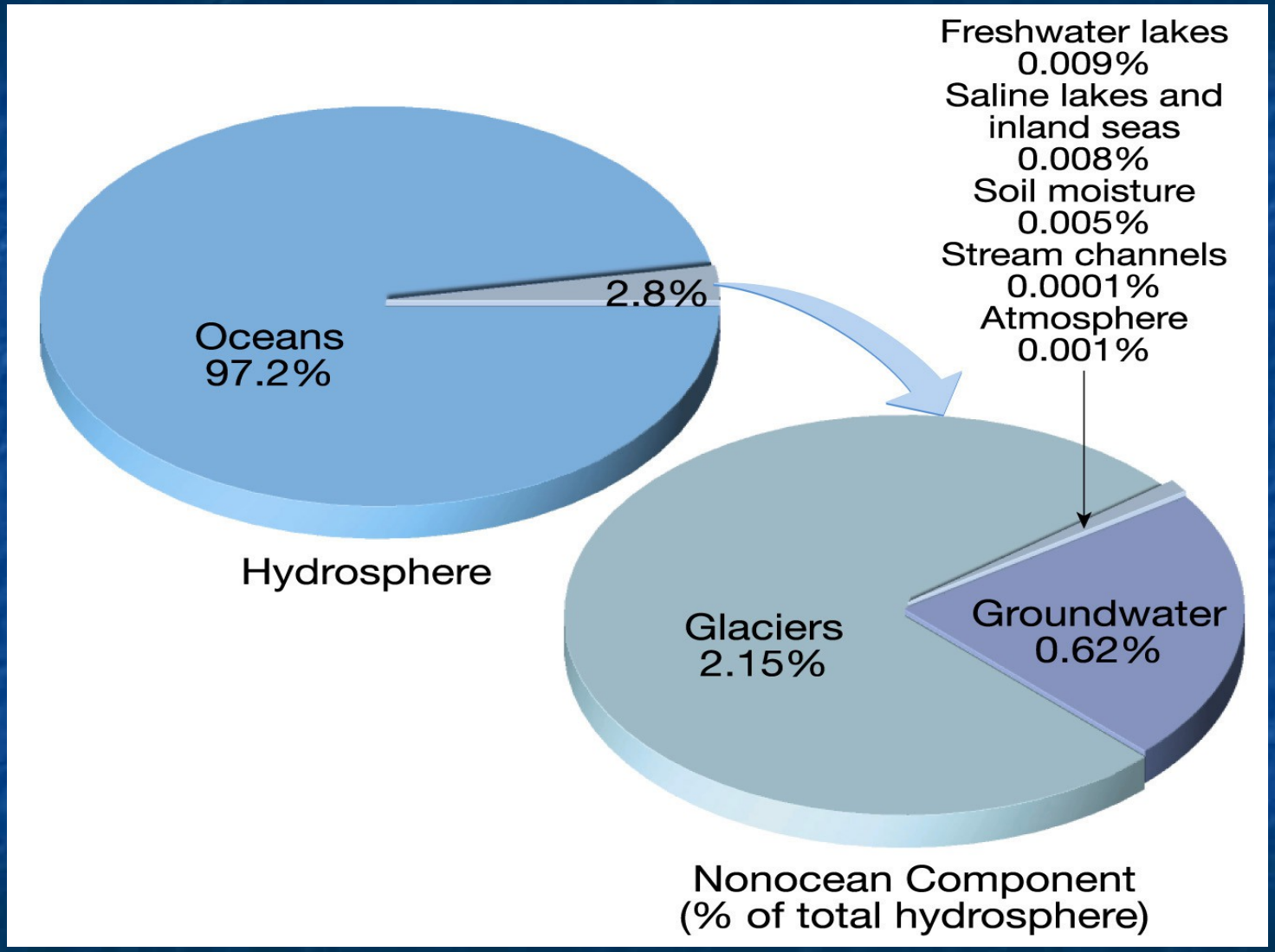
Objectives:

E4.1A - Compare and contrast surface water systems (lakes, rivers, streams, wetlands) and groundwater in regard to their relative size as Earth's freshwater reservoirs and the dynamics of water movement (inputs and outputs, residence times, sustainability).

E4.1B - Explain the features and processes of groundwater systems and how the sustainability of North American aquifers has changed in recent history (e.g., the past 100 years) qualitatively using the concepts of recharge, residence time, inputs and outputs.

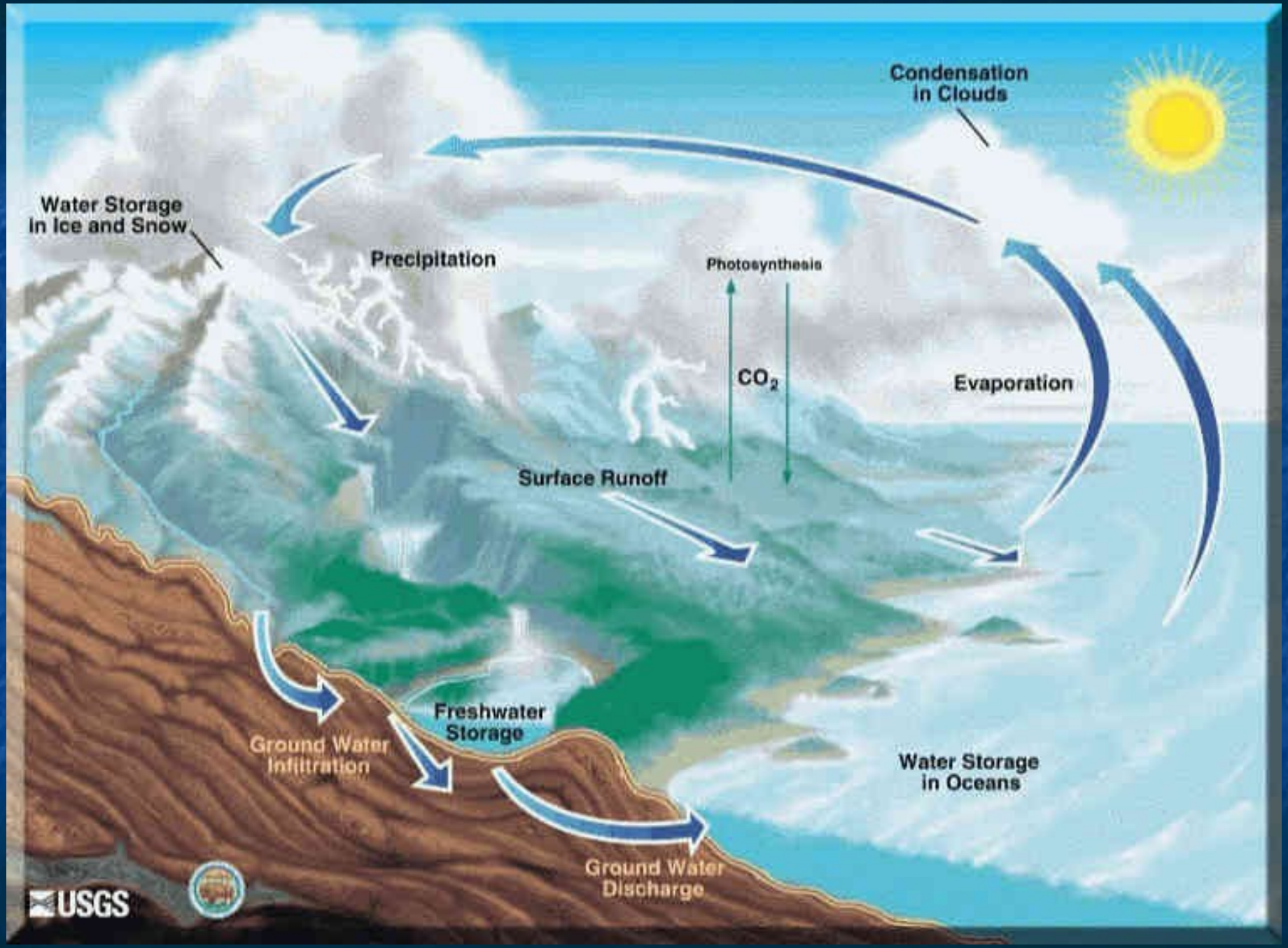
E4.1C - Explain how water quality in both groundwater and surface systems is impacted by land use decisions.

Sources of Earth's water



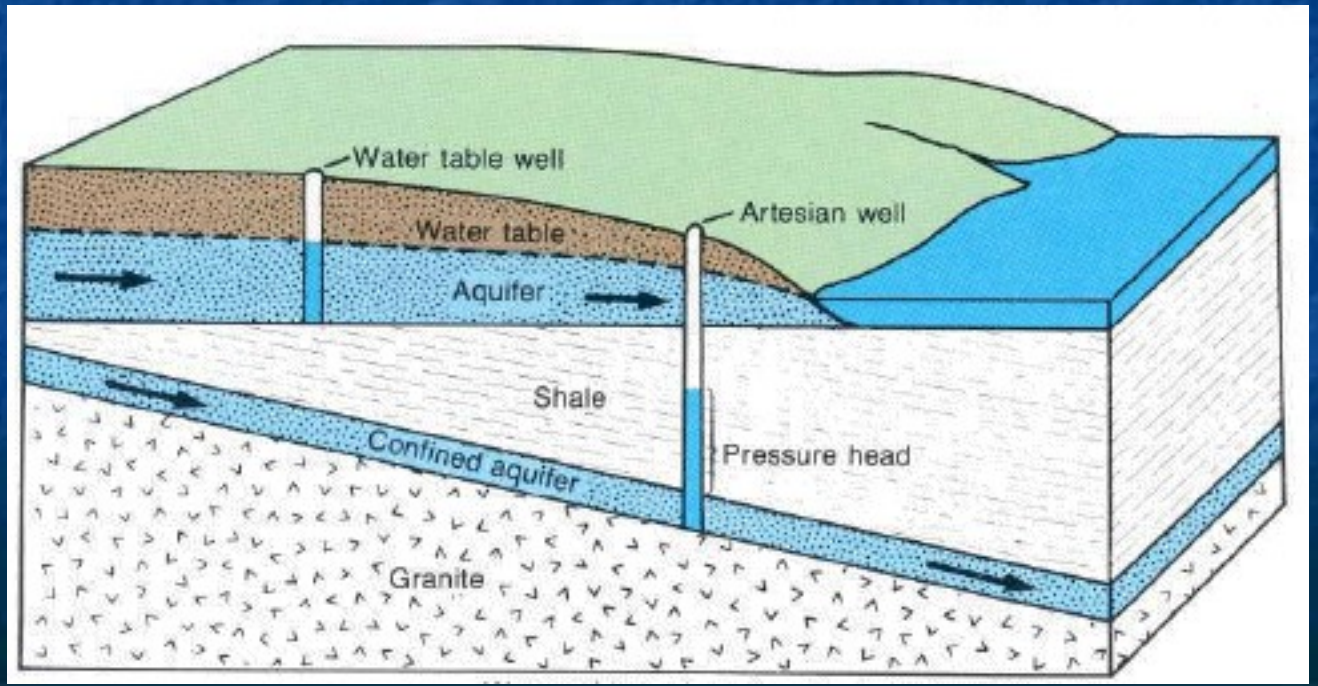
Sources of Earth's Water

* Movement of water = water cycle (hydrologic cycle)
* When it rains or snows (precipitates):
- some water evaporates
- some is soaked up by plants
- some is collected in ***surface water*** systems (lakes, rivers, streams)
- some ***infiltrates*** (seeps down) into the pores of rocks and soil
* Water as a resource
    * 75% of Earth is water
        ŧü 1% of that is ***groundwater***
    * 3% of Earth's water is fresh water
        ŧü 30% of that fresh water comes from ***groundwater***

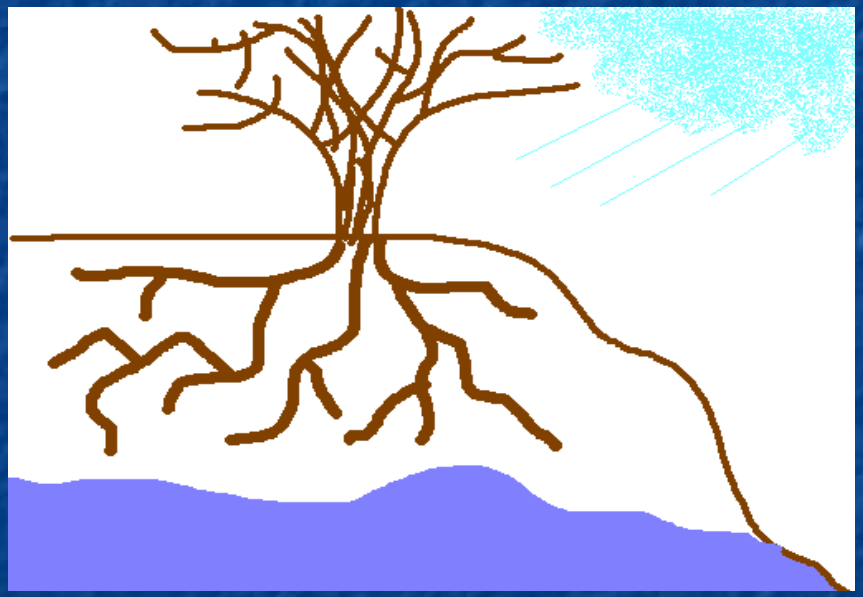

Condensation in Clouds
Water Storage in Ice and Snow
Precipitation
Photosynthesis
CO_2
Evaporation
Surface Runoff
Freshwater Storage
Ground Water Infiltration
Water Storage in Oceans
Ground Water Discharge
USGS

Aquifers

Underground layer of rock that contains or has the ability to contain water due to spaces in or in-between the rocks. Can be made of sand and/or gravel, layer of sandstone/limestone, or even a large, massive body of fractured (broken) rock



Recharge (inputs)

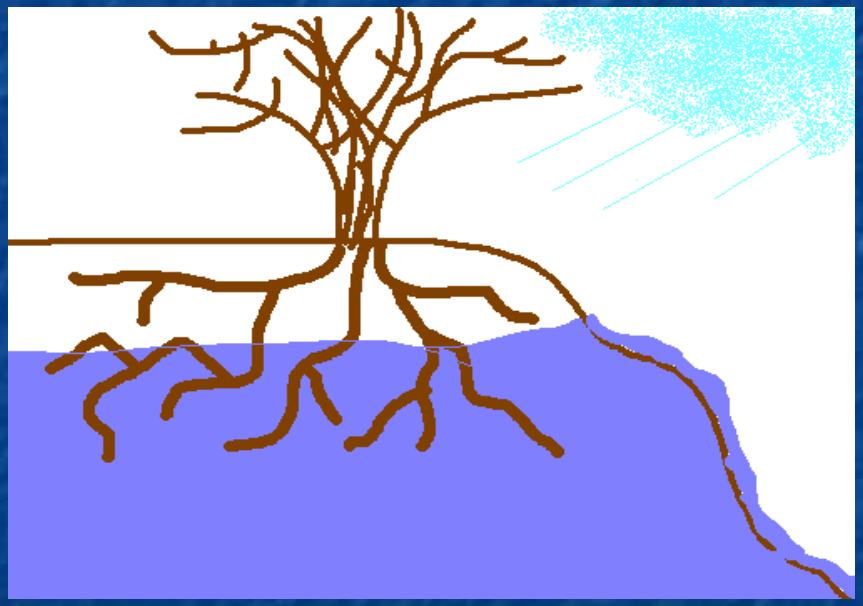


Naturally by precipitation and ***runoff.***

The deeper it is, the longer it takes to replenish. The drier areas take longer to replenish

Artificially by water spreading (via dams, ditches, furrows, or pits) or ***recharge*** wells where water is directly ***recharged*** into an ***aquifer*** (more expensive)

Surplus



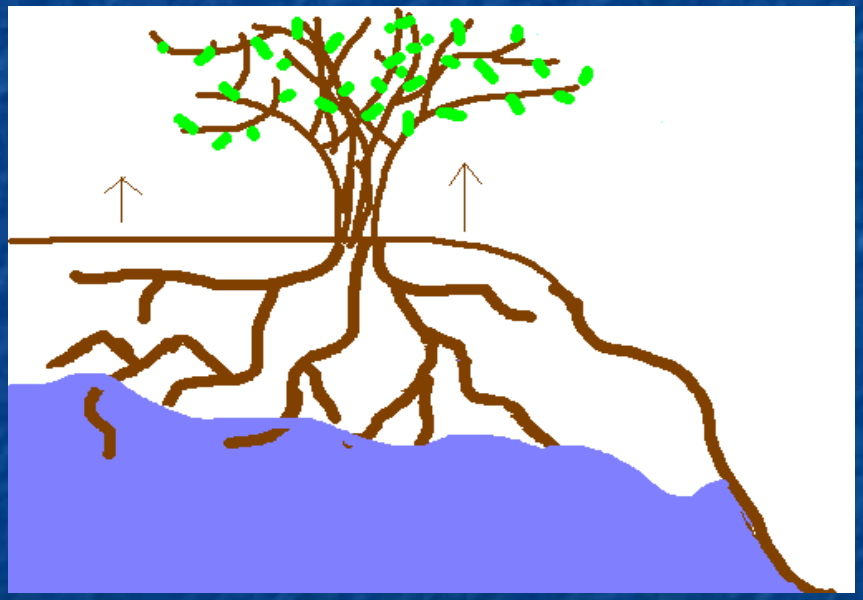
Rain Continues

Soil becomes full

Extra water runs off

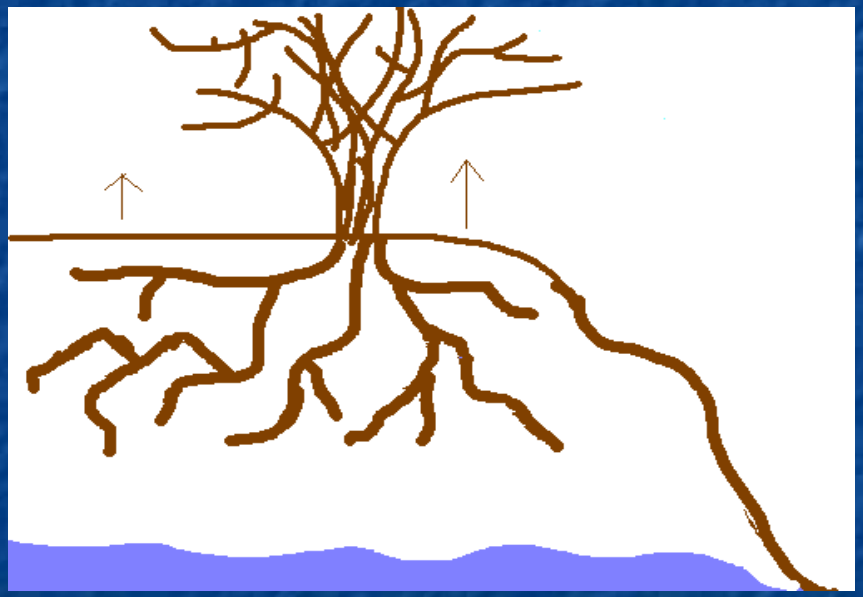
Water Table raises

Discharge (outputs)



- use by plants (***evapotranspiration***)
- wells and springs (and drains)
- human extraction
- underflow ***discharge*** (moving from one place in an ***aquifer*** to another)

Deficit



- Need for moisture continues
- Soil Storage runs out

Residence Time

-length of time water stays in a given reservoir.

- Shorter ***residence time*** because people are relying more on ***groundwater*** use. Making more deposits from ***groundwater***, so ***groundwater*** doesn't sit in ***aquifer*** for as long as it used to 100 years ago.

Water Budget Graphs

- Water budgets describe how much water is received and used in a region
- Graphs show the moisture supply versus the moisture need for a region

Groundwater Pollution
(Sustainability)

- Fertilizers, Toxic chemicals and even salt can get into groundwater as it moves through the soil
- Restricting use of these pollutants can help clean up water