

## Hydrological cycle and physiography of groundwater



## Lecture outline

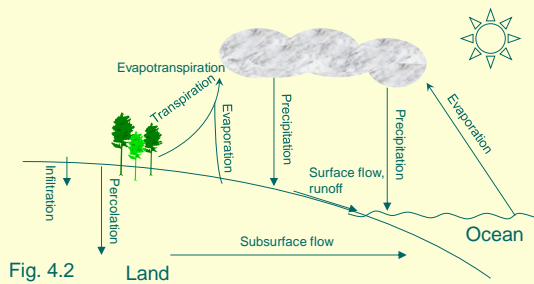
- Hydrologic cycle
- Water flow through soils and groundwater
- Threats to groundwater



Tim Curtis

## Hydrologic cycle

- Water moving across a landscape



## Connections among aquatic habitats

- A range of habitats occurring across a landscape are linked by hydrology
- Wetlands, streams, and lakes separated by land *aboveground* are not as distinct as you may think when hydrologic connections underground are considered
- Furthermore, what about *ecological* connections?

Winter and LaBaugh, HYDROLOGY OF ISOLATED WETLANDS

533

2003

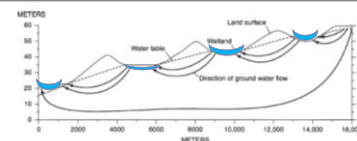


Figure 1. Ground-water flow system for setting where water-table mounds are not present between wetlands at different altitudes down a valley side. The wetlands are flow-through with respect to groundwater.

## Concerns about isolated wetlands

CWA protects wetlands connected to "waters of the US"

→ No surface connection? No problem. Migratory bird rule

→ 2001 SWANCC decision hates birds

→ What to do about "geographically isolated wetlands"?

WETLANDS, Vol. 23, No. 3, September 2003, pp. 663-684  
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### ISOLATED WETLANDS: STATE-OF-THE-SCIENCE AND FUTURE DIRECTIONS

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## Groundwater

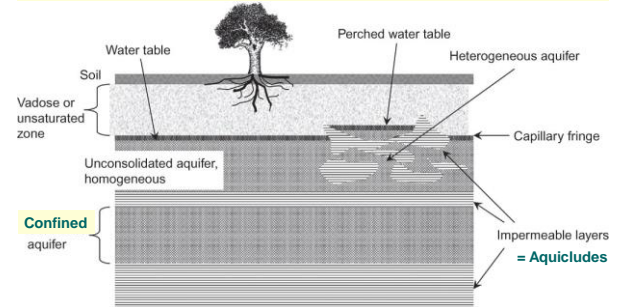
- Water at or below the **water table**
- AKA **phreatic zone** or **aquifer**
- Largest source of unfrozen freshwater in the world (=97%)
- ca. 21% of world's freshwater



## Subsurface habitats

- Where's the groundwater?

Fig. 4.3



## Sediments and water movement

- Does this have any effect locally?

Material	Particle size (mm)	Hydraulic conductivity ( $m\ d^{-1}$ )
Clay	0.004	0.0002
Silt	0.004 – 0.062	0.08
Coarse sand	0.5 – 1.0	45
Coarse gravel	16 - 32	150

Table 4.2

## Surface – subsurface water movement

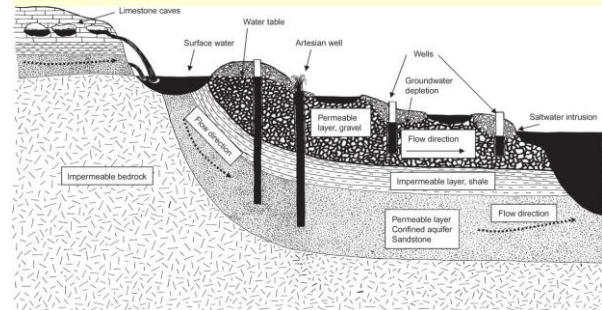


Fig. 4.6

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- Hydrologic cycle
- Water flow through soils and groundwater
- **Threats to groundwater**



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## Mining the Ogallala Aquifer

- Stretches from Nebraska to Texas
- Supplies 30% of irrigation water used in U.S.
- Being used 10 times as fast as being replenished
- Being replenished by threatened playas
- Arkansas River below aquifer is mostly dry since the early 1970s; above almost always flows
- Eventually it will cost too much to pump irrigation water up



Ogallala center pivots from the sky (NASA)

