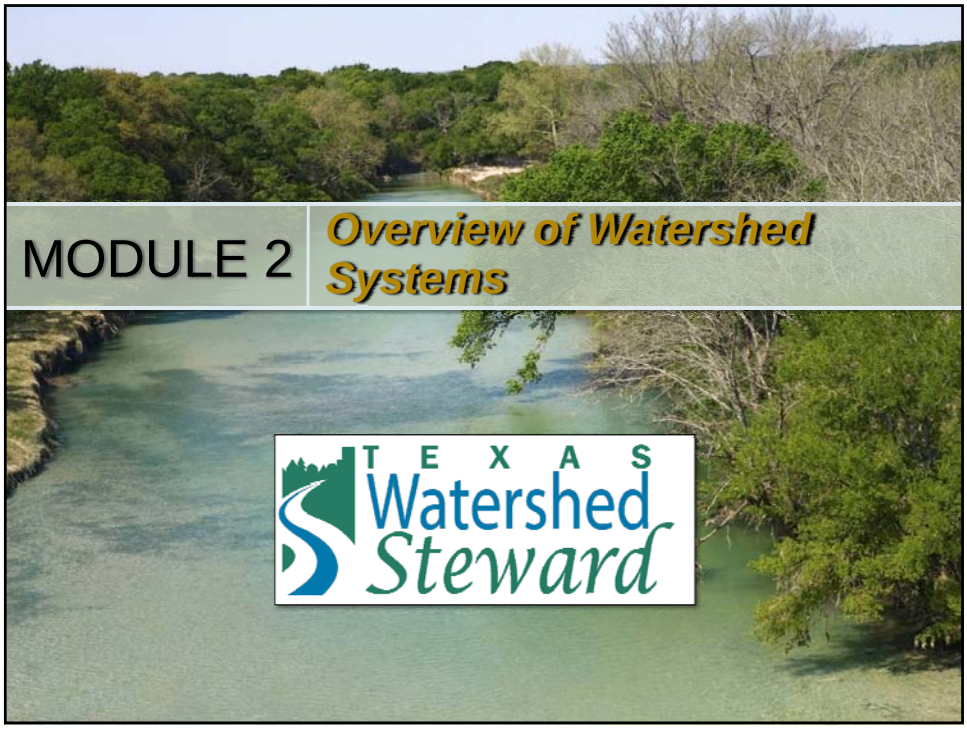
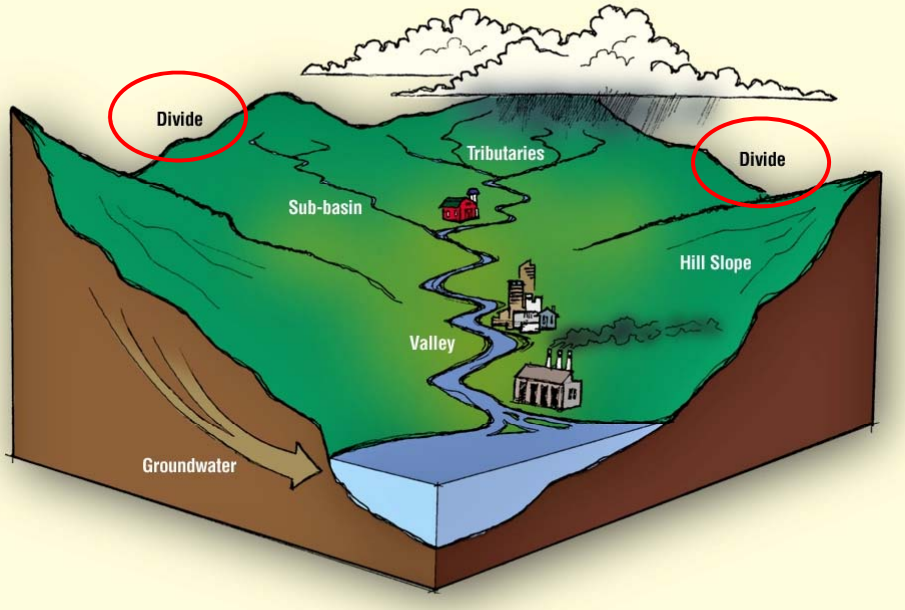


Module Outline

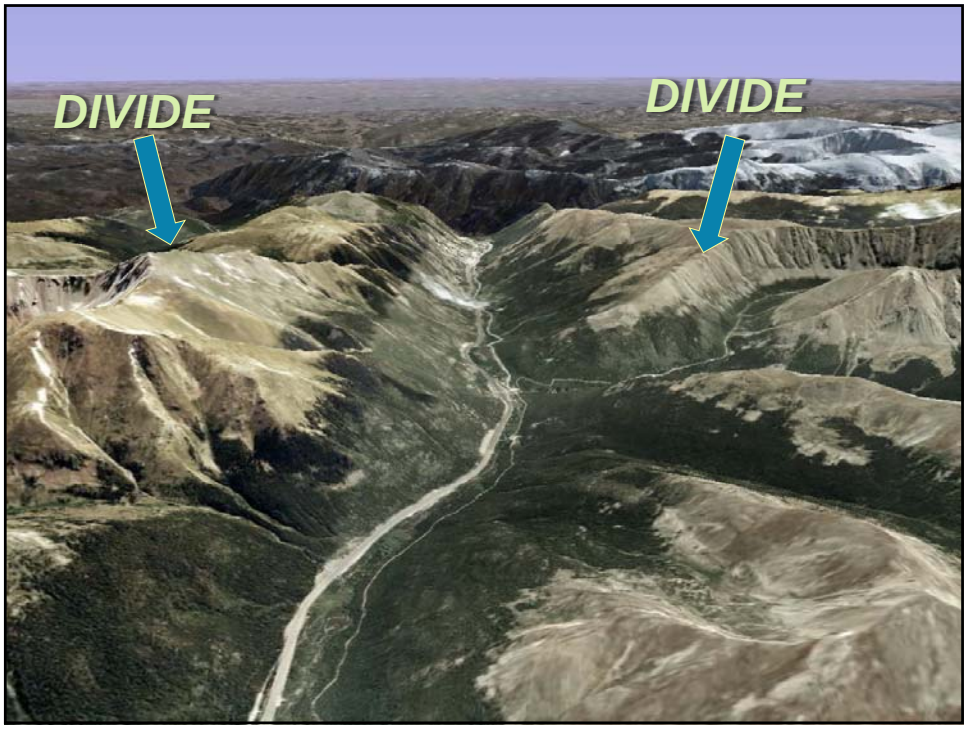
- What is a Watershed?
- Watersheds in Texas
- How do Texans Use Watersheds?
- Principles of Watershed Hydrology
- Natural Watershed Functions and Features

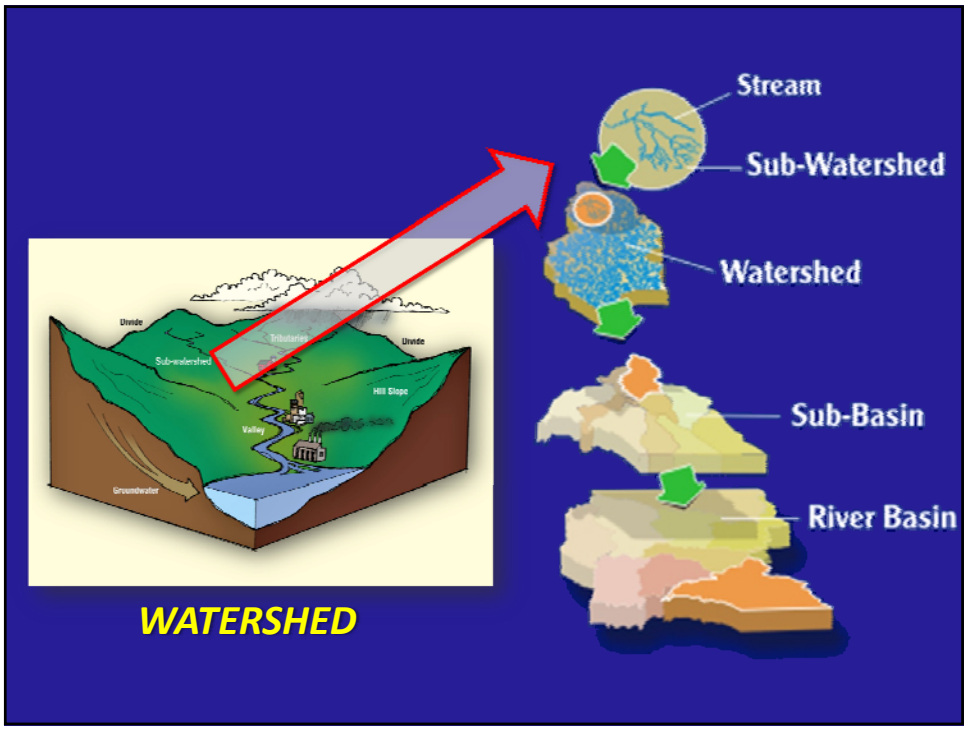
What is a Watershed?

- An area of land that water flows across, through, or under on its way to a stream, river, lake, ocean or other body of water.
- A watershed is like one big bathtub...



WATERSHED


DIVIDE
DIVIDE


Stream
Sub-Watershed
Watershed
Sub-Basin
River Basin
Divide
Tributaries
Divide
Sub-watershed
Hill Slope
Valley
Groundwater
WATERSHED

What Do Watersheds Look Like?

- Watersheds come in many different shapes and sizes:
  - Can include farmland, rangeland, small towns, or big cities.
  - Can have hills, mountains, or be nearly flat.
  - Can range from a few acres to millions of square miles.

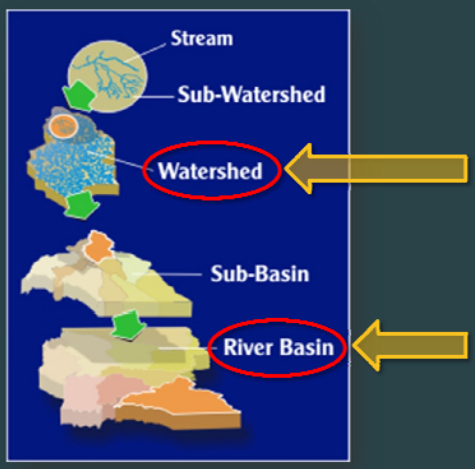
Where Are Watersheds Found?

We find watersheds ***EVERYWHERE***.

ALL land area is part of a watershed.

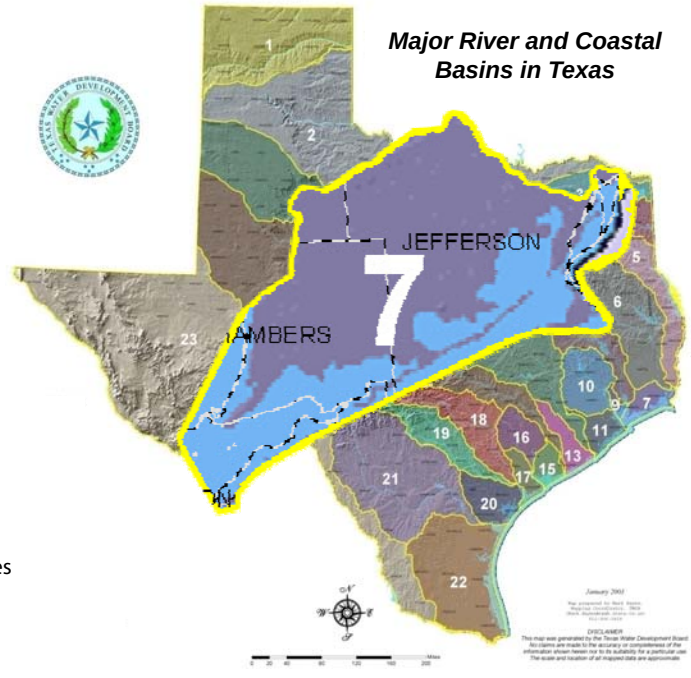
We ***ALL*** live in a watershed.

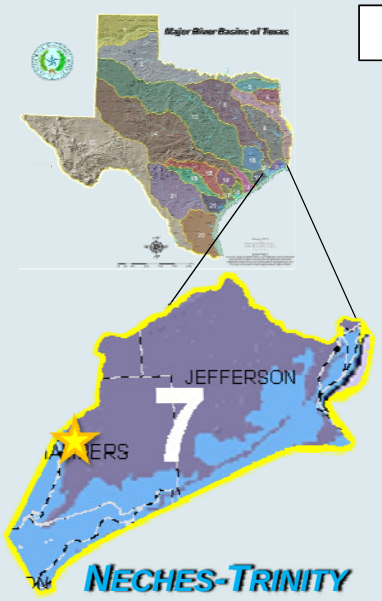
Texas River and Coastal Basins



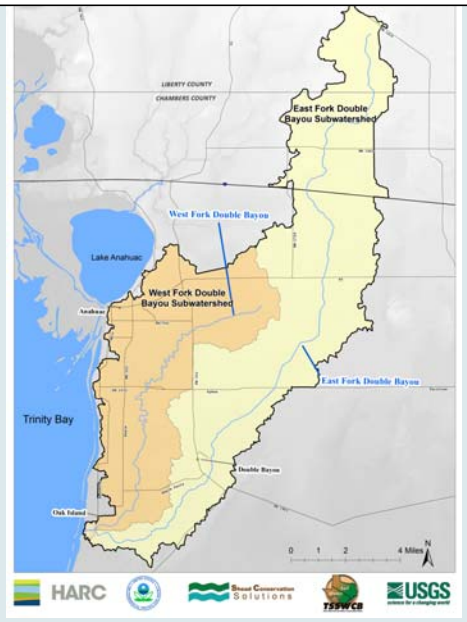
- 15 major river basins and 8 coastal basins
- 191,000 miles of streams and rivers!

1. Canadian
2. Red
3. Sulphur
4. Cypress
5. Sabine
6. Neches
7. Neches-Trinity
8. Trinity
9. Trinity-San Jacinto
10. San Jacinto
11. San Jacinto-Brazos
12. Brazos
13. Brazos-Colorado
14. Colorado
15. Colorado-Lavaca
16. Lavaca
17. Lavaca-Guadalupe
18. Guadalupe
19. San Antonio
20. San Antonio-Nueces
21. Nueces
22. Nueces-Rio Grande
23. Rio Grande

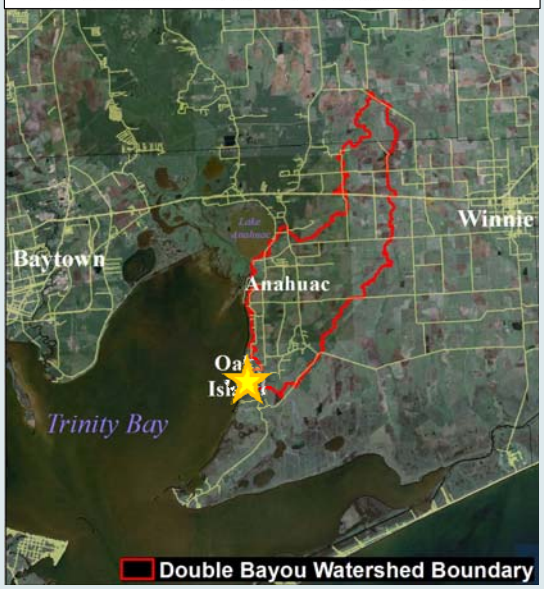




DOUBLE BAYOU WATERSHED



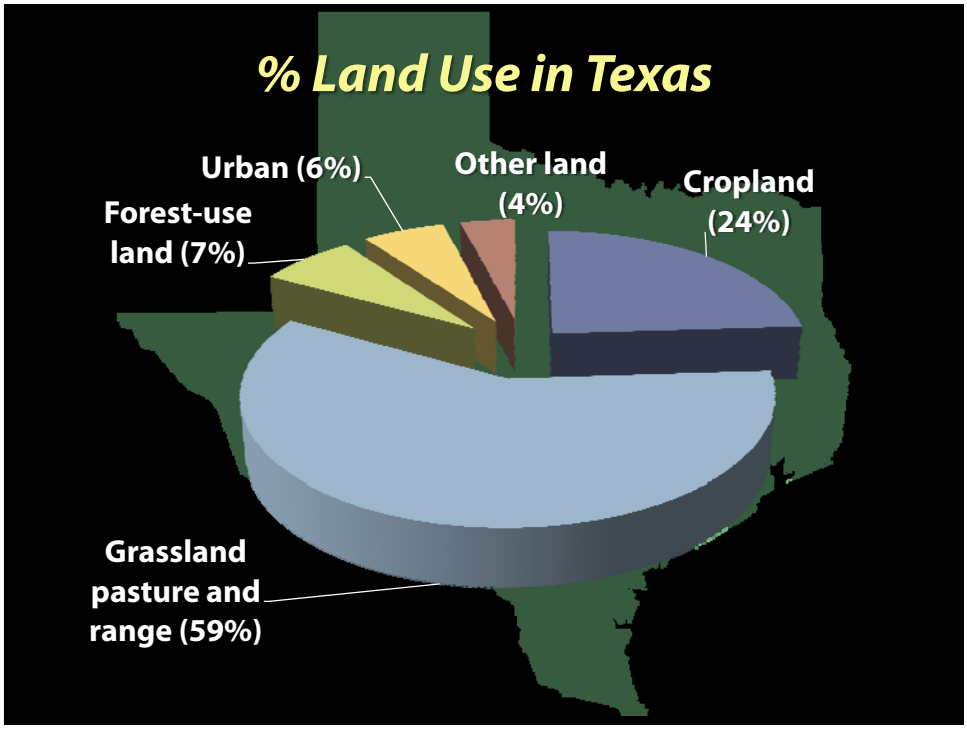
DOUBLE BAYOU WATERSHED



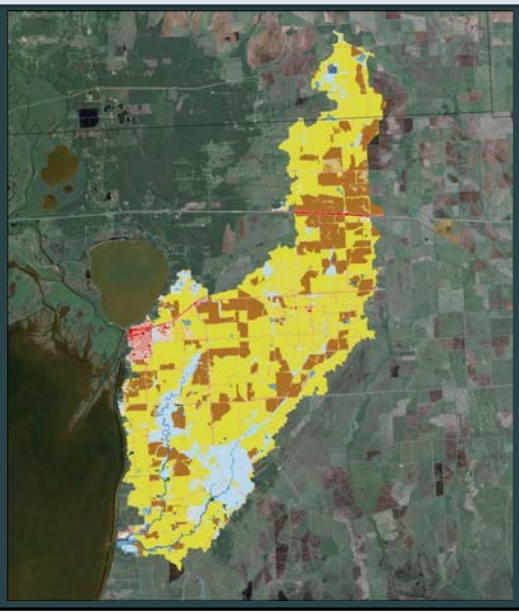
- The Double Bayou Watershed drains an area of **98 sq. miles** or **61,445 ac**.
- The bayou begins in Southern Liberty County and drains into Trinity Bay at Oak Island.
- ***Population centers:***
  - Anahuac: 2,243
  - Oak Island: 363
- ***# Animals in Chambers County:***
  - Cattle: 30,362
  - Horses: 1,428
  - Poultry: 1,381
  - Pets?
  - Deer and Feral Hogs?

How Do Texans Use Watersheds?

% Land Use in Texas



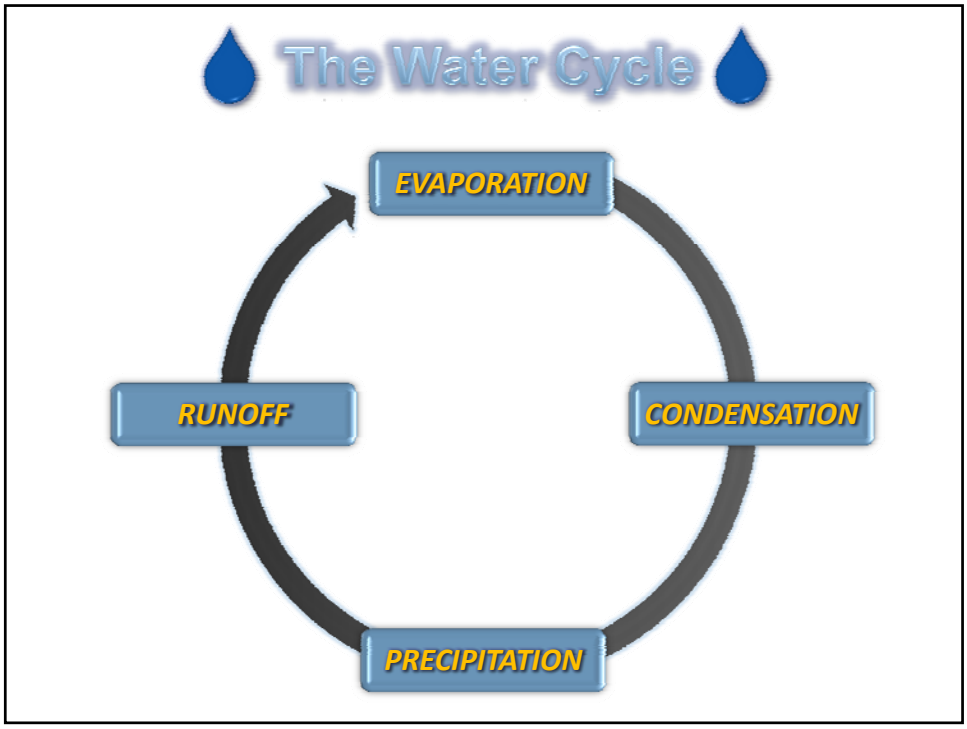
2006 NLCD Land Use/Land Cover

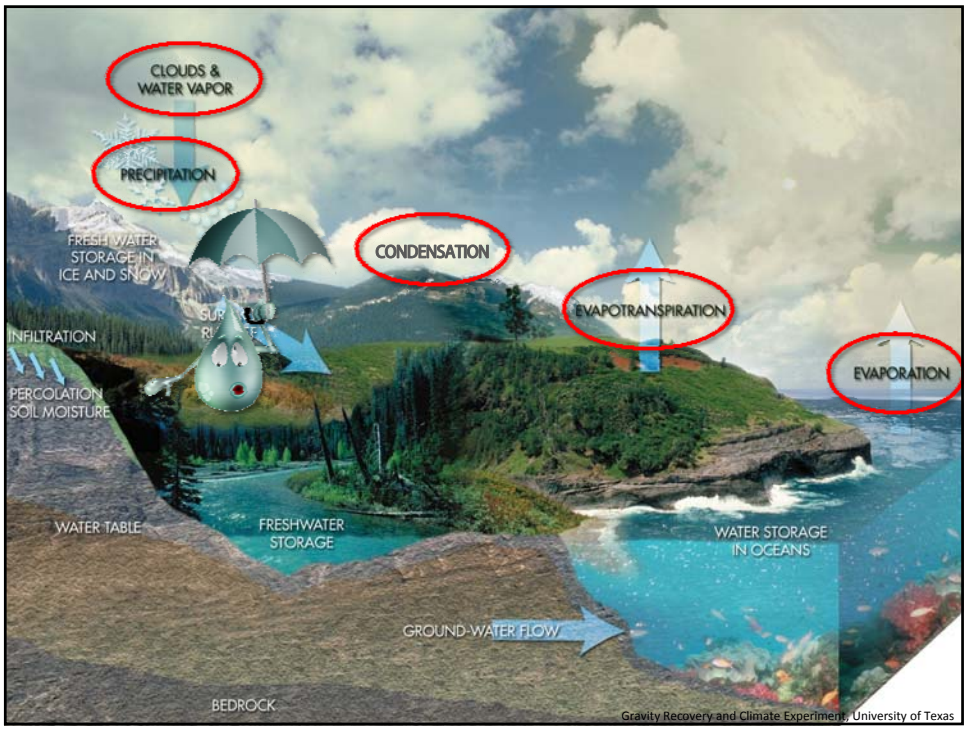


1.0%	Open Water
3.7%	Developed, Open
3.9%	Developed, Low
0.4%	Developed, Med.
0.1%	Developed, High
<0.1%	Barren Land
<0.1%	Deciduous Forest
0.2%	Evergreen Forest
0.1%	Mixed Forest
1.4%	Shrub/Scrub
1.0%	Herbaceuous
56.0%	Hay/Pasture
20.4%	Cultivated Crops
10.6%	Woody Wetlands
1.1%	Emerg. Wetland

Principles of Watershed Hydrology

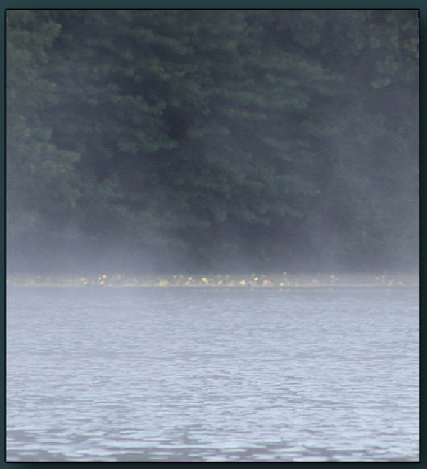
- *Hydrology* = "study of water"
- Nearly **75%** of the Earth's surface is covered with water.
- Water is constantly cycling via an endless process known as the *water cycle*, or the *hydrologic cycle*.


The Water Cycle
EVAPORATION
CONDENSATION
PRECIPITATION
RUNOFF


CLOUDS & WATER VAPOR
PRECIPITATION
FRESH WATER STORAGE IN ICE AND SNOW
CONDENSATION
EVAPOTRANSPIRATION
EVAPORATION
INFILTRATION
PERCOLATION SOIL MOISTURE
WATER TABLE
FRESHWATER STORAGE
WATER STORAGE IN OCEANS
GROUND-WATER FLOW
BEDROCK
Gravity Recovery and Climate Experiment, University of Texas

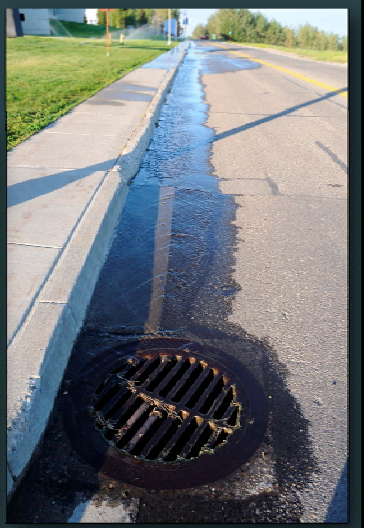
Where Does Precipitation Go?

4. It can evaporate



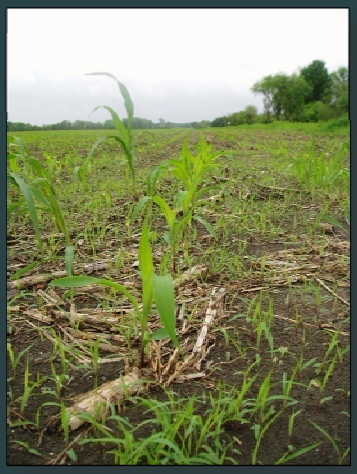
Where Does Precipitation Go?

1. It can *run off*



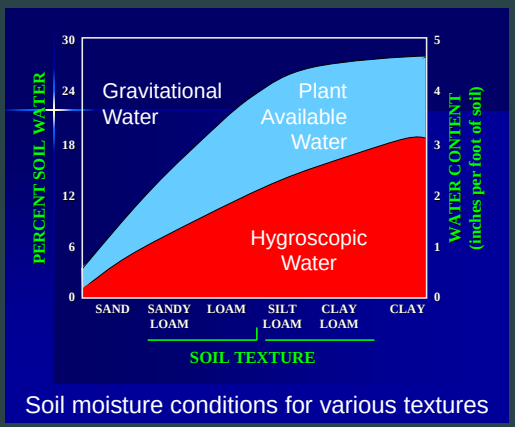
Where Does Precipitation Go?

2. It can be absorbed by plants and used for photosynthesis and other biological processes

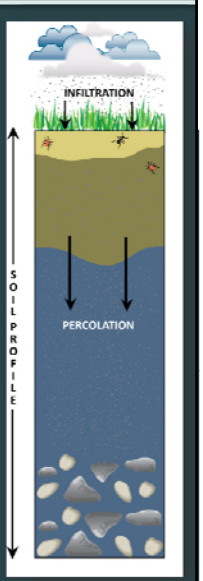


Where Does Precipitation Go?

3. It can *infiltrate* through the soil surface and percolate downward to groundwater *aquifers*

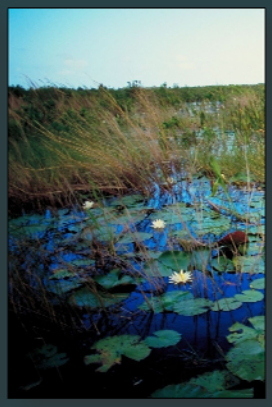
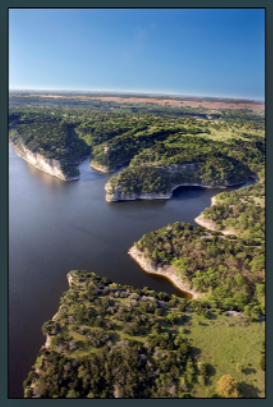


Soil moisture conditions for various textures



Where Does Precipitation Go?

5. It can be stored in ice caps, glaciers, lakes, reservoirs and other surface bodies of water

Land Use/Land Cover Changes

- *Land use* = how land is used by humans:
  - Agriculture
  - Industry
  - Urban
  - Residential
  - Recreation

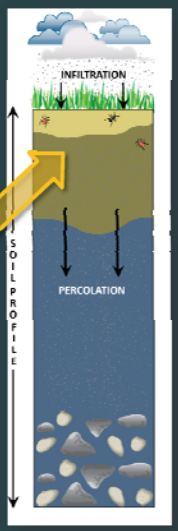
- *Land cover* = biological or physical features of land:
  - Forests
  - Grasslands
  - Agricultural fields
  - Rivers, lakes
  - Buildings, parking lots

Natural Watershed Functions

- Hydrological Functions
  - Water capture
  - Water storage
  - Water release
- Ecological Functions
  - Provide diverse sites for *biogeochemical* reactions
  - Provide habitat for plants and animals

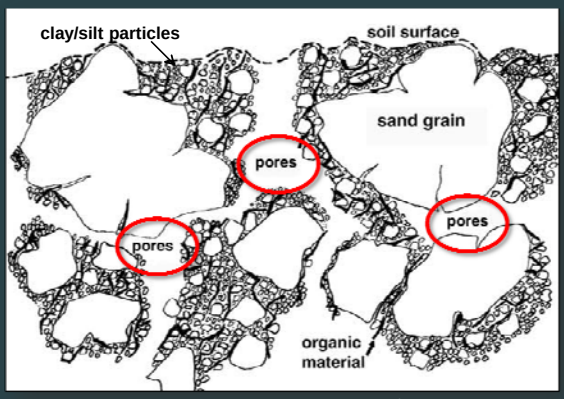
Hydro Function #1: Water Capture

- H_2O is transferred from atmosphere and is "captured" in the soil
- H_2O can then infiltrate through soil surface and percolate downward into *soil profile*



Hydro Function #1: Water Capture

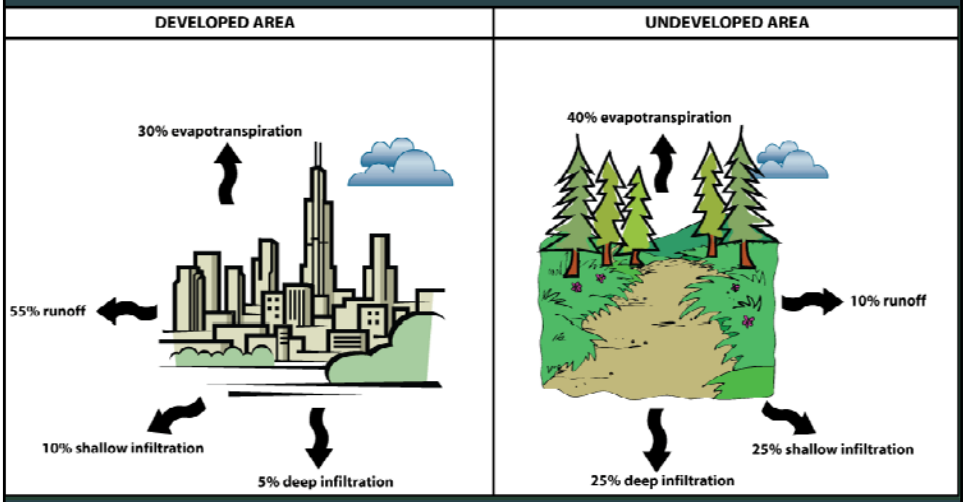
- Water is stored in the pores (air spaces) between soil particles in the soil profile.



Department of Primary Industries, Australia

Hydro Function #1: Water Capture

Hydro Function #1: Water Capture



Hydro Function #2: Water Storage

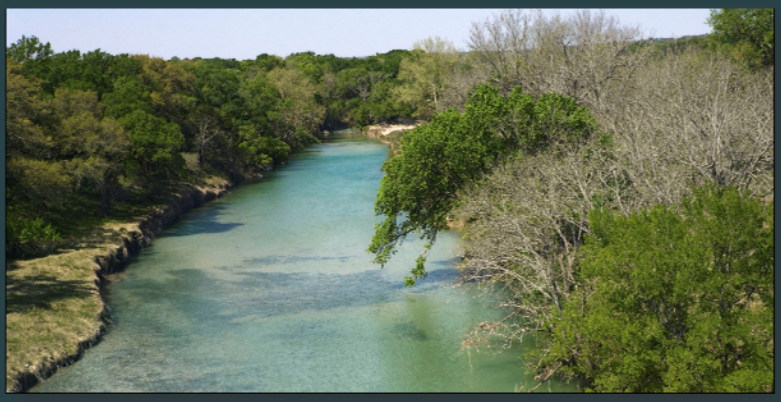
Lakes, ponds, rivers, streams, etc.

Soil profile

Aquifers

Hydro Function #3: Water Release

- Water moves underground, through the soil profile, or across the land surface as runoff

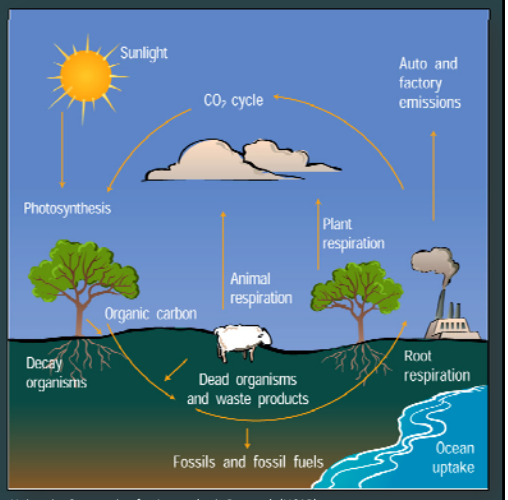


Natural Watershed Functions

- Hydrological Functions
  - Water capture
  - Water storage
  - Water release
- Ecological Functions
  - Provide diverse sites for biogeochemical reactions
  - Provide habitat for plants and animals

Eco Function #1: Biogeochemical Reactions

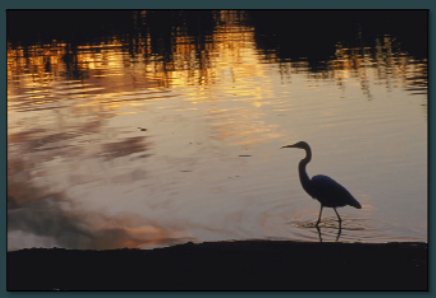
- *Biogeochemical cycling* = the biological, physical and chemical transformations of nutrients that are found in soil, water, and air.
- Very complex interactions that help maintain plant and microbial communities.

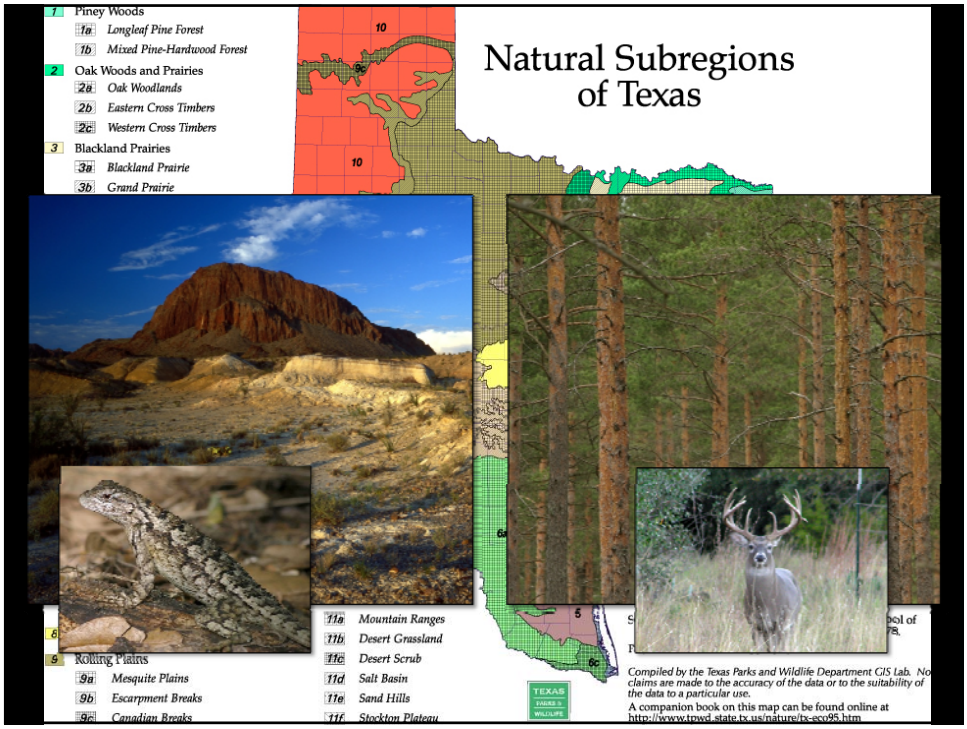


University Corporation for Atmospheric Research (UCAR)

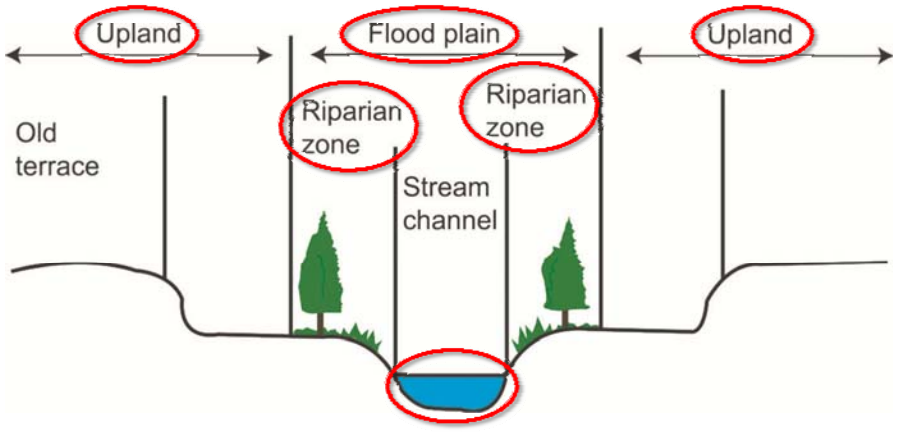
Eco Function #2: Habitat

- *Habitat* = "home"
- Watersheds provide critical habitat for all kinds of plants and animals



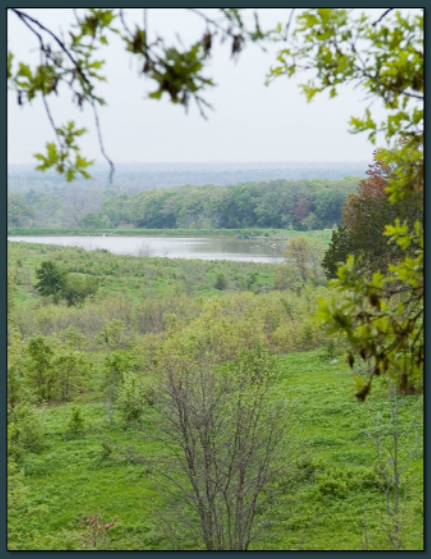


Natural Watershed Features



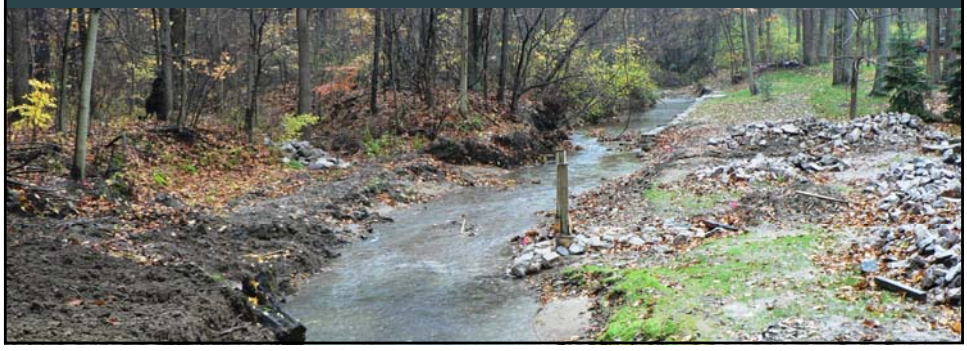
Watershed Feature #1: Upland

- *Upland* = area of land at a higher elevation above a water body
- Forms watershed boundaries, or *divides*
- Provides habitat, stabilizes soil, minimizes soil erosion, filters surface runoff



Watershed Feature #2: Floodplain

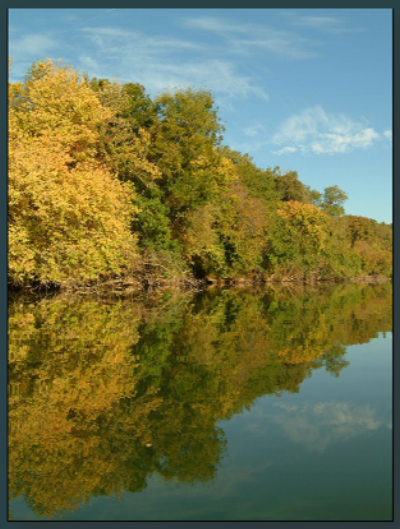
- *Floodplain* = flat area of land surrounding a water body that is subject to periodic flooding
- Holds excess water after precipitation events, filters out sediment, provides habitat, and recreation for humans



Watershed Feature #3: Riparian Zone

- *Riparian* = "of the river"
- The non-cultivated, vegetated land that touches and immediately surrounds a body of water
- Often includes *wetlands* which help to:

Watershed Feature #4: Water Body



- Any stream, river, pond, lake estuary, ocean, or other body of water
- Water bodies can be flowing *(lotic)* or non-flowing *(lentic)*
- Flow of water greatly affected by topography, slope, soils and vegetation

Key Points to Remember…

- A watershed is an area of land that water flows across or under as it drains to a body of water.
- Watersheds are everywhere!
- Watersheds are used for many different purposes.
- Watersheds are a critical component of the water cycle, which is an endless process that cycles water and distributes it across the Earth.
- Watersheds have hydrological and ecological functions.
- Watersheds have natural features that help them perform their hydrological and ecological functions.