

TOPIC 4.6

WATERSHEDS

Enduring Understanding: Earth systems interact, resulting in a state of balance over time.

Learning Objective: Describe the characteristics of a watershed.

What is a watershed?

- Simply put, a **watershed** is a precipitation collector.
 - A watershed is an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.
 - Also referred to as **drainage basins** or **catchment basins**.
- Within a watershed, water runs off and flows downhill picking up contaminants from the surroundings by:
 - dissolving them (soluble chemicals, NO_3^- , MgCl_2 , H_2SO_4 , etc)
 - physically transporting them (oils, sediments)
- These pollutants end up accumulating in larger bodies of water downstream in the watershed.
 - Larger rivers and streams, reservoirs, bays, and ultimately, the oceans.



Parts of a Watershed

• Headwaters

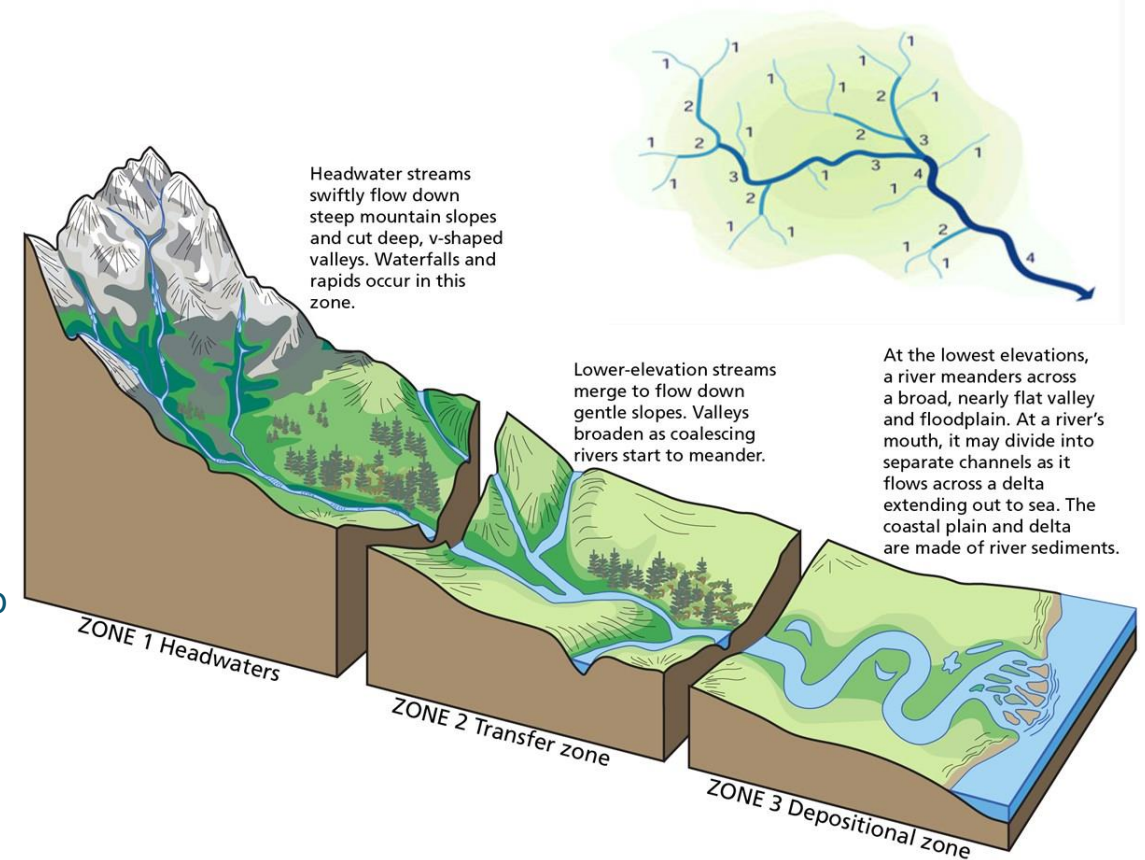
- Zone at the upslope end of a watershed where runoff begins to accumulate
 - small volume, fast flowing streams in small, narrow, deep valleys.
 - Runoff and streams begin to pick up sediment and pollutants

• Transfer zone

- Lower elevation zone where headwater streams merge together into **tributaries**, forming braided rivers.
 - Higher volume, generally slower flowing streams
 - Water has accumulated sediments and pollutants from further upstream and continues to transport these materials

• Depositional Zone

- At the lowest elevations the river valley opens up into **flood plains**.
 - the river is now a single channel with the highest volume of water, but moving at a slower rate.
 - The channel wanders back and forth, seeking the path of least resistance, forming a **meandering river**.
 - Sediments and pollutants carried from upstream begin to settle out along the banks of the river.



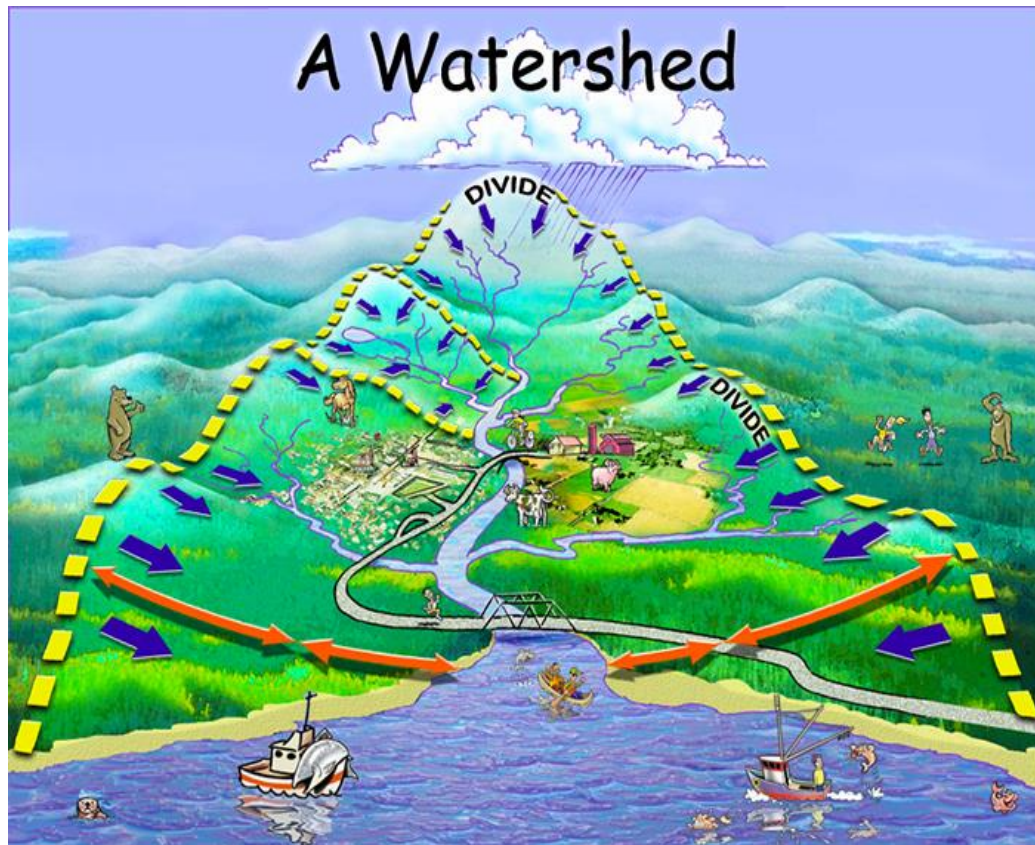
Characteristics of Watersheds

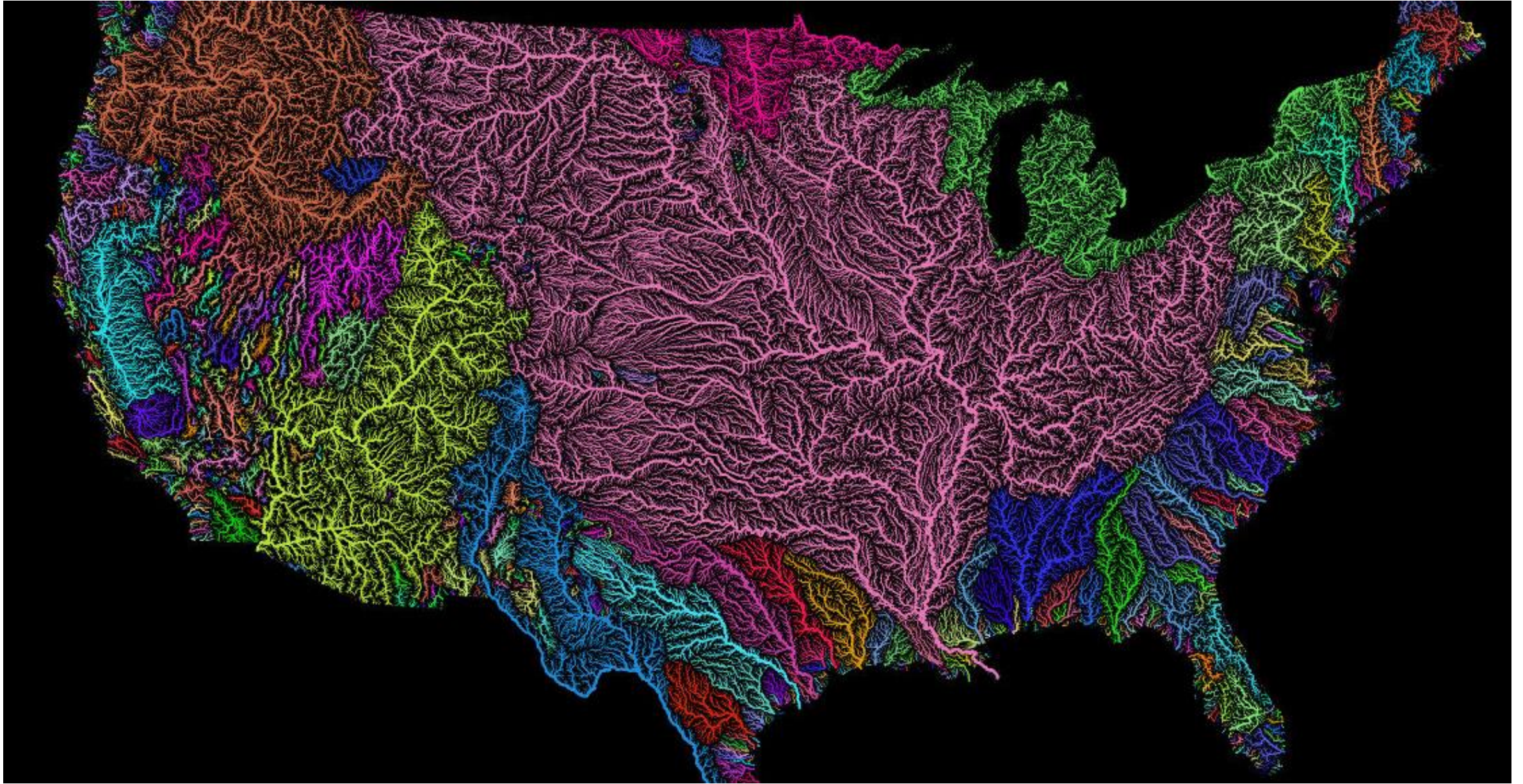
- No two watersheds are identical.
- Descriptive characteristics of watersheds include:
 - Divides with adjoining watersheds
 - Area
 - Length
 - Slope
 - Climate
 - Groundcover (vegetation type(s), soil, and land use)



Divides With Other Watersheds

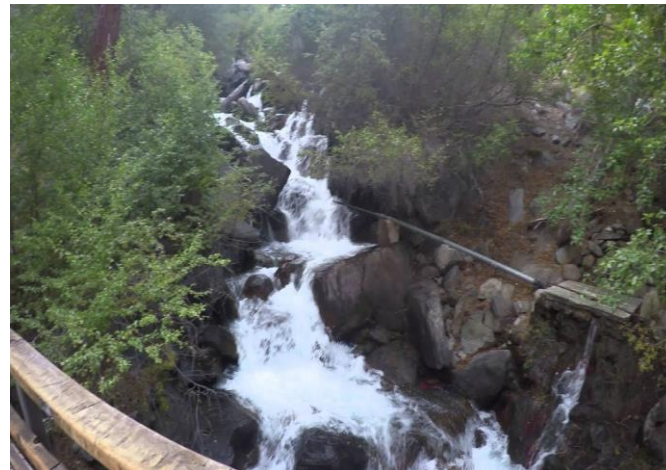
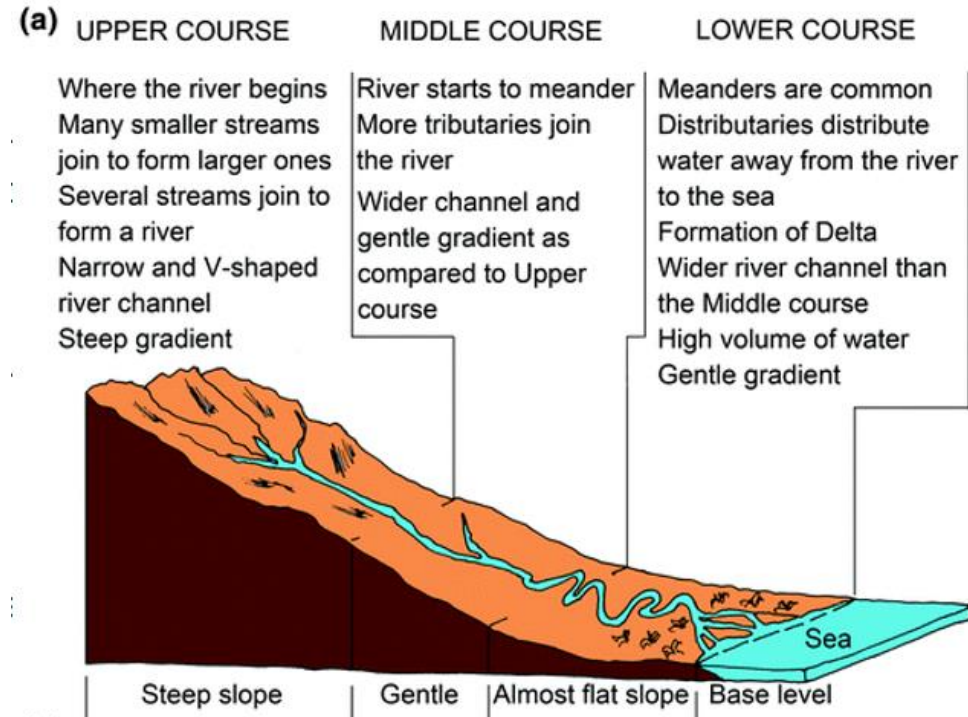
- Peaks with connecting ridgelines the define the borders of a watershed





Slope

- **Watershed slope** is another characteristic of watersheds that is important in determining the speed at which water travels through the watershed and its momentum.
 - Water travels downhill due to gravity.
 - The steeper the slope the faster the water will travel.
 - Slopes are usually steepest in the headwaters of a watershed.
 - In the flood plains, the slope of the watershed may be almost imperceptible.
 - Fast moving water has more momentum and therefore more erosive power than an equal volume of slower moving water.
 - Fast moving water can transport sediments more easily.



Climate

- Climate of a watershed will affect the volume of water moving through the watershed.
- **Precipitation**
 - Frequency: How often through the year?
 - Duration: How long does it last?
 - Intensity: How fast does it fall?
- **Evapotranspiration** (evaporation and transpiration)
 - Not all water in a watershed will run off and flow out through streams and rivers. Some of it will leave by infiltration, transpiration and evaporation.
 - The amount of evapotranspiration depends on temperature, solar radiation, relative humidity, and wind.
 - Water can evaporate from surface waters or after infiltrating into the pores of soils.
 - The root systems of plants absorb water from the surrounding soil in various amounts. Most of this water moves through the plant and escapes into the atmosphere through the stomata of leaves, by the process of transpiration.
- Climate of a watershed will also effect the vegetation type and soils of a watershed, which also further characterize the watershed.



Groundcover (Vegetation Type, Soils, and Land Use)

- More densely vegetated watersheds:
 - Reduce run off speed due leaf litter, roots and stems acting as barriers to water flow, allowing more time for infiltration to occur.
 - Reduce runoff volume as plants take up some of the water and transpire, reducing erosion and sediment in surface waters.
 - Add organic matter to the soil which helps to retain soil moisture and slow evaporation.
 - Have denser tree canopies to keep water cool, slowing evaporation, and preventing thermal pollution.
 - Buffers rivers and streams from effects of pollution by trapping and absorbing some pollutants from runoff before they enter surface waters (sediments, chemicals, nutrients).
- Sandy soils have large pore spaces that increase permeability of soils, increasing infiltration
- Land use types can affect the volume and speed of runoff by altering the amount of vegetation and the permeability of surfaces (logging, agriculture, pavement).





I'LL DRAIN
WEST!

I'LL TRICKLE
EAST!

I'LL RUN SOUTH!
SEE YOU IN THE SEA!