



# Cycles of Matter

Objective: Students will construct an explanation for how matter is transferred between the living and nonliving parts of an ecosystem.

Students will explain how matter is conserved in an ecosystem.

# Lesson 3 Cycles of Matter

**01 Conservation of matter and energy**

**02 Water Cycle**

**03 Carbon and Oxygen Cycles**

**04 Nitrogen Cycle in Ecosystems**





# Get thinking...


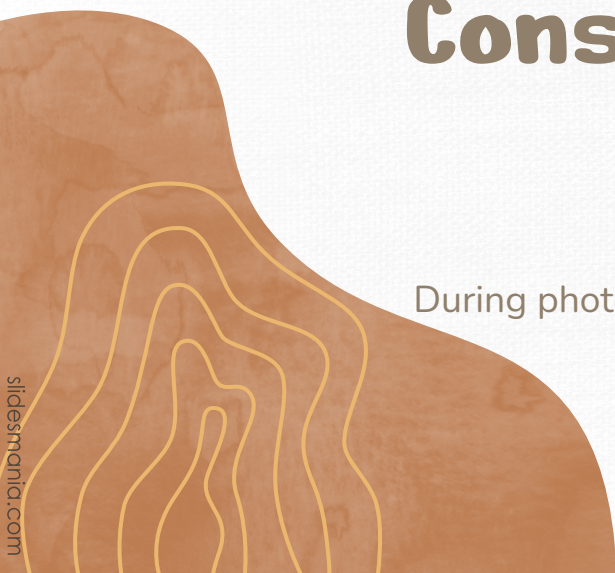
Is a fish bowl or an aquarium an open or closed system? How do you know this?



# 01

## Conservation of Matter and Energy

During photosynthesis and cellular respiration, matter (mass) and energy can only change form.



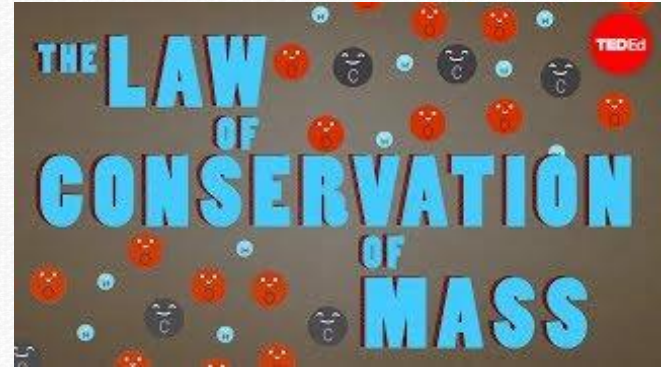


# The Laws of Conservation of...

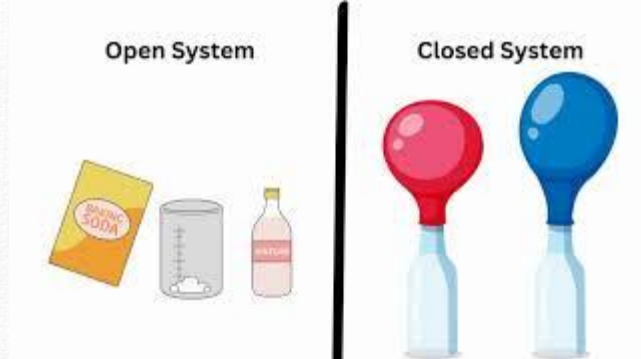
**Mass-** states that matter is neither created nor destroyed during any chemical or physical change.

**Energy-**states that when one form of energy is transformed to another, no energy is lost in the process.

Energy cannot be created or destroyed, but it can change from one form to another.



# Systems



**Closed system-** a closed system is when matter cannot enter or exit.

**Open system-**an open system can exchange matter, energy, or information with its surroundings.

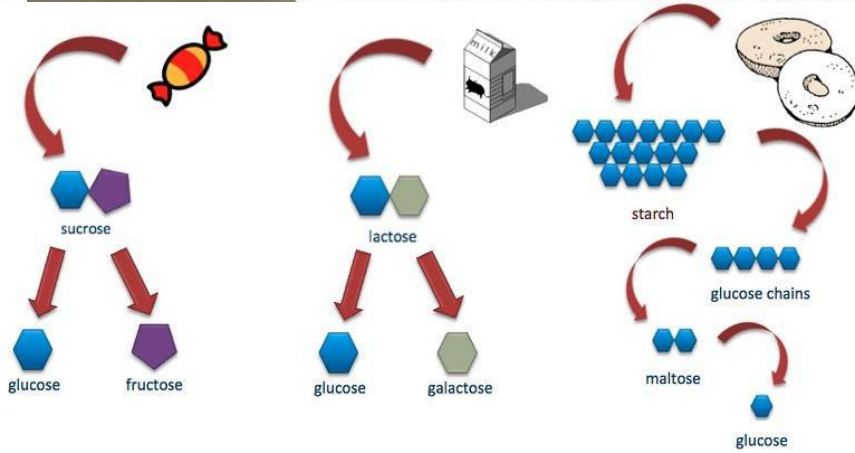
**Components of the system-**include the plants, soil, rocks, water, microorganisms, animals, and air in the terrarium. The components may change over time, but their total mass will remain the same.

Just like in the video mass and energy are cycling through different forms without being created or destroyed.



# Closure

**What would you tell a classmate who claims that food is destroyed when you eat it?**



The background features several organic, abstract shapes in shades of brown and tan. In the top left, there's a brown shape with thin white contour lines. In the top right, a tan shape contains a dark green leafy branch. In the bottom left, a tan shape has a dark green monstera-style leaf. In the bottom right, a brown shape has thin white contour lines.

# Ecosystem in a Bottle

*Objective:* Students will construct a model of an ecosystem that shows the cycling of matter and flow of energy in the ecosystem.





## Materials Needed

- Clear plastic bottle with cap (2-liter size works well)
- Gravel or small rocks from the Santa Cruz River
- Soil/Sand from the Santa Cruz River
- Small plants (from the Santa Cruz River)
- Water from the river

## Steps to Create Your Ecosystem

1. **Prepare the Bottle:**
  - Rinse out the bottle and remove any labels.
  - Carefully cut the top off the bottle to create an opening large enough to work in. Keep the top to use as a lid.
2. **Layering:**
  - Add a 1-inch layer of gravel or small rocks to the bottom of the bottle for drainage.
  - Add a 2-3 inch layer of soil/sand on top of the gravel.
3. **Planting:**
  - Plant your small plants in the soil. Make sure they have enough space to grow.
  - If you are including aquatic animals, create a small pond area with water and plants that thrive in water.
4. **Watering:**
  - Lightly water the soil until it is moist but not soaked. If you have a pond, fill it with enough water for the aquatic plants and animals.
5. **Covering:**
  - Place the top of the bottle back on to cover your ecosystem. This will help maintain humidity and create a stable environment.

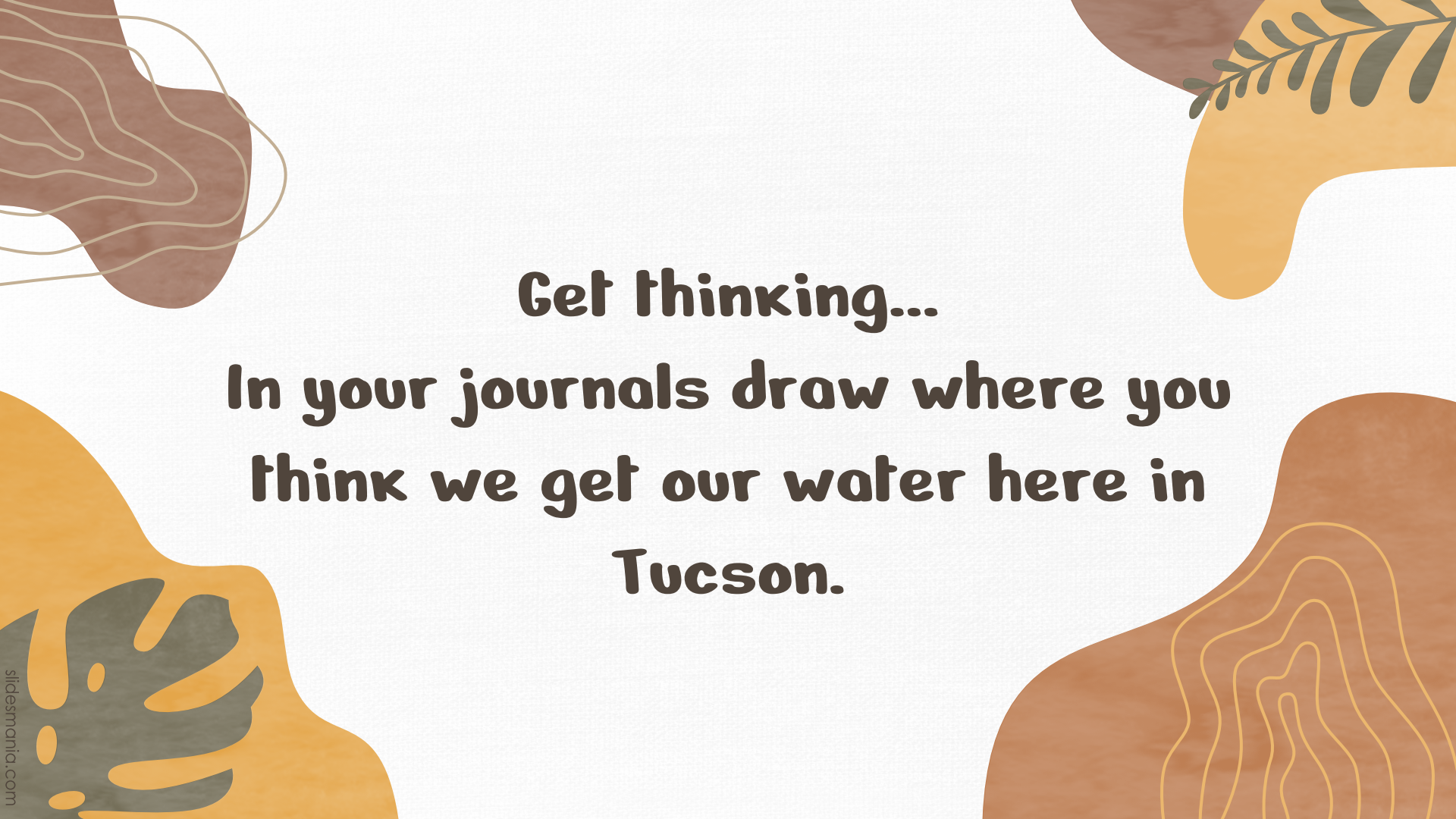


02

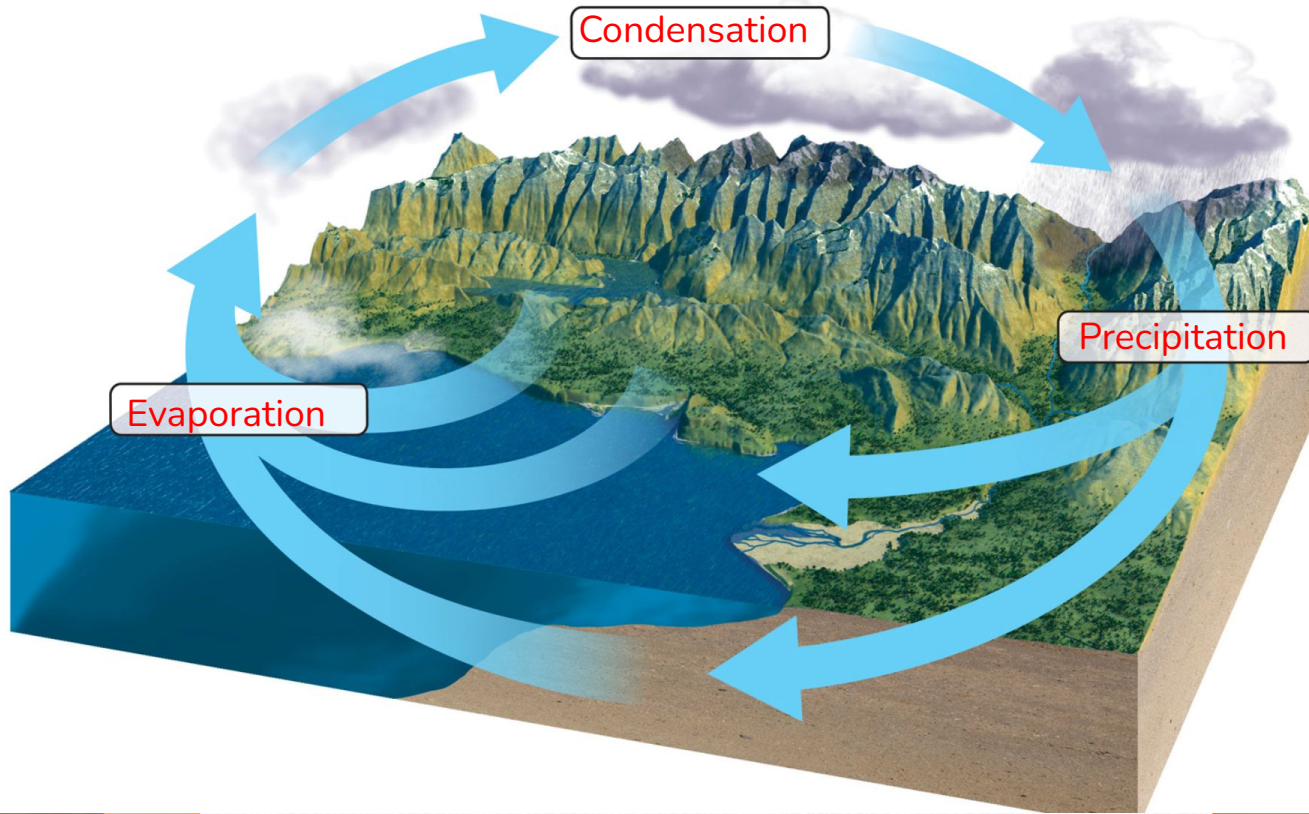
# Water Cycle





The background features several abstract, organic shapes in shades of brown, tan, and orange. In the top left, there's a brown shape with thin white contour lines. In the top right, a tan shape contains a dark green leafy branch. In the bottom left, a large orange shape has a dark green monstera-style leaf. In the bottom right, a brown shape has thin white contour lines. The central text is in a bold, black, sans-serif font.

**Get thinking...**  
**In your journals draw where you**  
**think we get our water here in**  
**Tucson.**



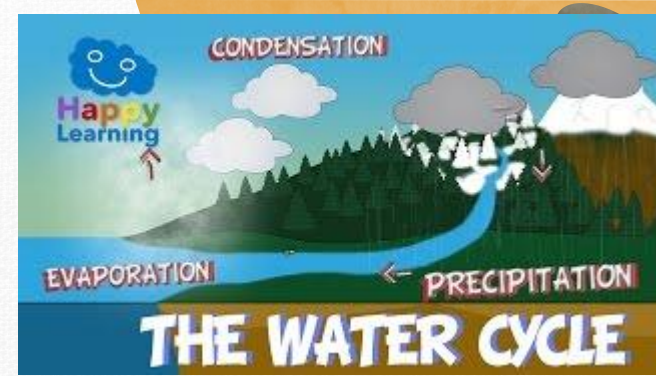
On page 59 label the three processes of the water cycle.



# The Water Cycle

**Evaporation**-is the process by which molecules at the surface of liquid water absorb enough energy to change to a gas. The energy needed for evaporation comes from sunlight.

**Condensation**-is the process of when water vapors cool and turn back into small droplets of water in a liquid state. The water droplets collect around dust particles and eventually form clouds.



**Precipitation**- when the drops continue to grow larger, they become heavier and will eventually fall in the form of rain, sleet, snow, or hail.

Precipitation falling on land may soak into the soil and become groundwater.



# Groundwater

How much do we count on groundwater?

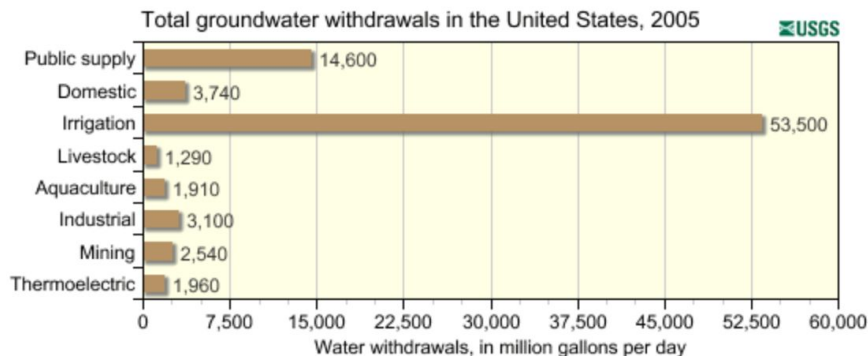
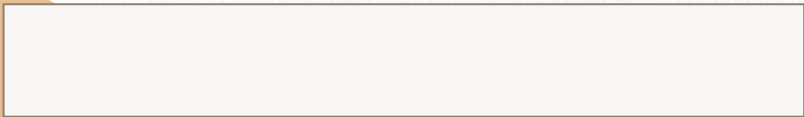
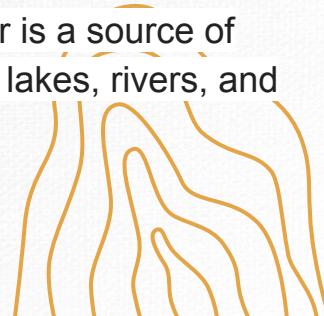
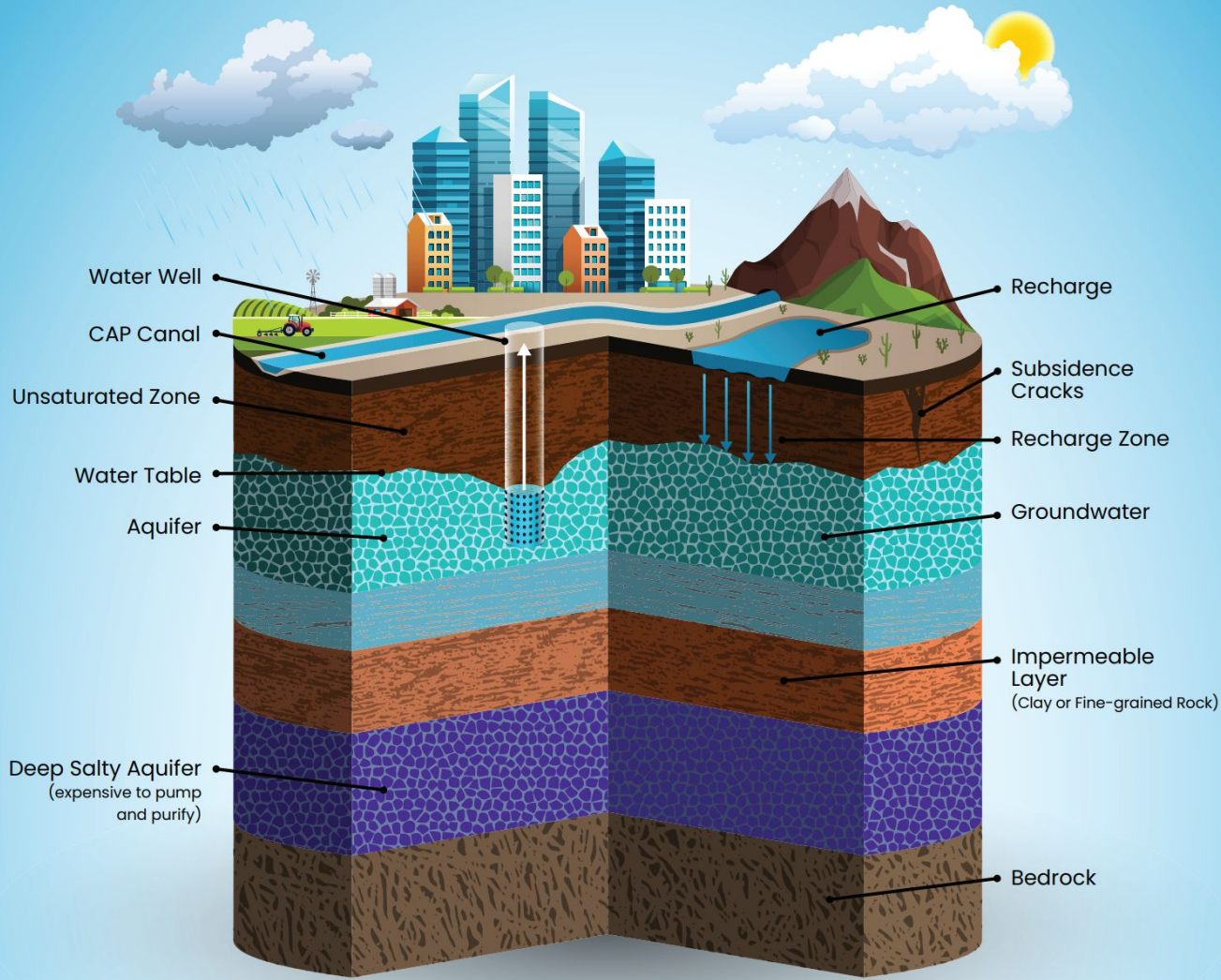


Image and figures courtesy of the U.S. Geological Survey

- Groundwater supplies drinking water for 51% of the total U.S. population and 99% of the rural population.
- Groundwater helps grow our food. 64% of groundwater is used for irrigation to grow crops.
- Groundwater is an important component in many industrial processes.
- Groundwater is a source of recharge for lakes, rivers, and wetlands.







What  
Arizona's  
groundwater  
system looks  
like.

# Closure

Explain how water vapor in the air can end up as water in our groundwater.