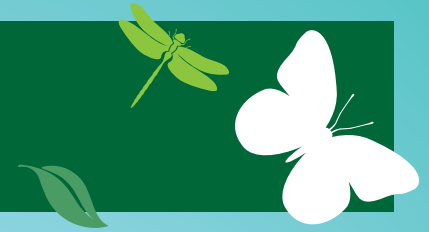


# The Water Cycle

Participants observe how water is continuously cycled between land, water formations and the atmosphere



## Grade Level:

2-8

## Time:

Two hours plus observation time on several days following

## Learning Objectives:

Students will be able to:

- Explain how the water cycle recycles the Earth's water supply
- Make use of the knowledge of land and water formations
- Form a hypothesis on how/why the water cycle works
- Connect the concepts of precipitation, condensation and evaporation

## Materials:

- Water
- Potting soil
- Spray bottle
- Small margarine container
- Large, clear plastic container or aquarium
- Plastic wrap
- Germinating seeds (fast, reliable: herbs, lima beans, marigolds)
- Tape or rubber bands
- Bag of ice
- Heat lamp
- Copies of Water Cycle Worksheets

## Background

By creating a terrarium, participants will examine first-hand how water is continuously cycled between the Earth and the atmosphere. In the water cycle, the sun heats the Earth's surface, which causes water to **evaporate** into water vapor collecting in clouds that rise in cold air. When water vapor collects on tiny dust particles and forms a cloud, this process is called **condensation** (in a terrarium, condensation occurs as beads of water on the walls or the plastic cover). When clouds become too heavy to float, they release their moisture as **precipitation** (rain, snow, hail, etc.). The precipitation collects in freshwater systems like lakes or rivers, and often ends up in the oceans. Precipitation can reach these bodies of water directly; or it may reach them via runoff from the land, as water runs downhill.

Another path rainwater (or ice and snow) may take, which will be difficult to show in a terrarium, is to **percolate**, or filter, its way through layers of soil into large underground reservoirs of water. The water in these "underground rivers" is called **ground water**. Ground water often reaches waterways by trickling back up to the surface.

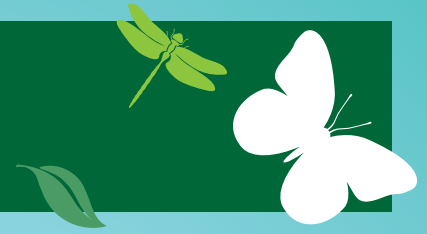
Once precipitation reaches a water body; much of it may evaporate into the air, repeating the cycle once again, though there are many other opportunities for water to evaporate along the way. It may evaporate off the land surface after a rain. It may also evaporate off of people and other animals as we perspire. Plants are the most efficient movers of water, however, as they soak it in through their roots and pull it up to create food and transport it throughout their systems. In a process called **transpiration**, some of the water that reaches the leaves of plants evaporates off into the air as water vapor (participants can see this in a terrarium as water condenses around the glass near the plants).

## Procedure

1. Begin a discussion on the different parts of the water cycle: evaporation, precipitation, and condensation. Review the illustration of the water cycle (see worksheet). Ask, *What are clouds? What are they made of? What is rain? Why does it rain? Where does the rain go when it falls? How does water get into lakes and rivers?*
2. Have participants help to assemble terrariums. Depending on the size of the group, this can be done in pairs or small groups. They should arrange the soil in the container to resemble mountains, plateaus, hills, etc. Next, they should place the margarine bowl in a depression in the soil and fill it with water. Following instructions on the package, participants should plant a few seeds in the soil, and water them. If participants wish to place plastic trees, animals, or houses in the terrarium, they should decide how they



## The Water Cycle (continued)



want these props arranged. Have them cover the entire terrarium with the plastic wrap and secure it tightly with tape or a rubber band. Have participants label terrariums and place them in a sunny spot.

3. Discuss with participants what they think will happen in their terrariums and form a hypotheses.
4. Tell participants to watch for condensation on the plastic “sky” of the container. When enough moisture collects, it should fall onto the various landforms as precipitation. Some of the precipitation will collect in the margarine bowl “lake” directly or flow into the “lake” from the land.
5. Have participants observe their terrariums over a few days and record their observations in a journal, in writing and/or pictures. They may also use the worksheet included in this activity. Encourage participants to draw what they observe using arrows that indicate precipitation, condensation, and evaporation. Participants should make observations at different times of day and/or during different weather conditions. For example, they might make observations in the morning, in the middle of the day, and right before they leave for the day. Or they might observe in the middle of the day, every day, and try to be sure they observe on at least one cloudy and one clear day. Participants should make hypotheses as to what will happen at different times of day or on a cloudy vs. a clear day. For example, one participant might state his or her guess that there will be less condensation on the inside of the terrarium on a cloudy day.
6. Have participants use a bag of ice to cool the terrarium down by placing it on one end of the cover, and a heat lamp to warm the terrarium up. Have participants develop hypotheses on the cooling and warming effects on the water cycle and the growth of their seeds.

### For Older Participants (Grades 9-12):

Follow most of the same basic procedures above, but have participants create two or more terrariums to determine the role of different substances in the water cycle. For example, one test terrarium might include the elements mentioned above (soil, a margarine container with water, a cover, etc.) except for the seedlings. Another might contain only enough soil to keep the plants alive, and another might have no “atmosphere” (the cover). Participants can keep track of the water levels by dividing the margarine container into different volume levels (so they would, for example, mark each 250 milliliters on the inside of the container), and/or by placing a rain gauge on the wall of the terrarium.

Have participants compare water levels on different days, and make conclusions. Ask participants to determine what each of these elements represent in the water cycle. *When certain elements are removed or altered in the actual water cycle, what happens? How do people affect the water cycle? How can they make their impact a more positive one?*

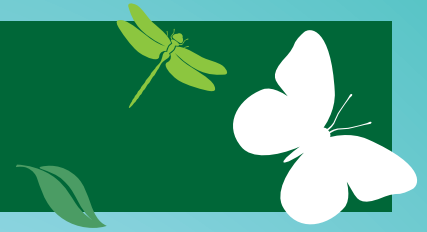
### Questions:

- Where does the rain come from?
- What are some of the different things that happen to rainwater when it falls to the ground?
- Why is it called the water cycle?



# The Water Cycle

## (continued)



### Adaptations:

#### **Hearing Disabilities:**

Consider creating an interactive water cycle display for participants to explore. For example, use a watering can to create precipitation, with some of the precipitation being diverted as runoff. Use a sponge (to represent soil) sitting in a pan of water to simulate ground water. If you have a hot plate or another way to heat water, you can create evaporation. Have participants hold their hand above the hot water so they can feel the humidity of the water molecules in the air. Make sure participants do not get close enough to the hot water to burn themselves. Simulate condensation by spraying a plant with water, allowing participants to touch the dew-drenched leaves. Make sure to describe the process in detail and work with the sign language interpreter as participants go through it.

#### **Learning/Cognitive Disabilities:**

- Consider creating an interactive water cycle display for participants to explore. For example: use a watering can to create precipitation being diverted as runoff. Use a sponge (to represent soil) sitting in a pan of water to simulate ground water. If you have a hot plate or another way to heat water, you can create evaporation. Have participants hold their hand above the hot water so they can feel the humidity of the water molecules in the air. Make sure participants do not get close enough to the hot water to burn themselves. Make sure to describe the process in detail as participants go through it.
- Demonstrate each step as you explain how to create a terrarium. Have a finished terrarium on display for participants to model as needed.
- Have partners assist with terrarium assembly and journaling as needed. An alternative is to assist participants who have difficulty writing or drawing to take instant photos of their terrariums and to assemble a water cycle poster or photo journal of their project.
- Have pre-made labels available.
- Assist participants in forming their hypotheses as needed. Ask them, *What do you think will happen to the water cycle when we cool your terrarium? When it is warmed?*

#### **Motor Disabilities:**

##### **Overall:**

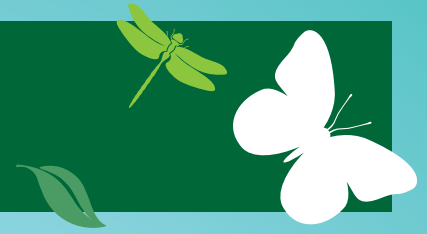
Adjust height and angle of work surface as needed. You may need to set the container on a chair so participants can reach down into it to fill it.

##### **For participants with limited muscle strength, coordination, or dexterity of the hands:**

- Build up the handles on pencils with tape, foam, or putty.
- Have participants who have difficulty writing use a small tape recorder or dictate their answers to a partner. An alternative is to assist participants who have difficulty writing or drawing to take photos of their terrariums and to assemble a water cycle poster or photo journal of their project.
- Have pre-made labels available.
- Have partners assist with assembly as needed.
- Use lima bean seeds that are easier to manipulate than smaller seeds.
- Have adaptive garden trowels available or build up the handles on long-handled spoons or trowels with tape, foam, or bandage material as needed. You may also use ice cream scoops.



## **Water, Water, Everywhere?** **(continued)**



- Use larger items (e.g., plastic trees, animals, etc.) that are easier to manipulate.
- Suspend the watering can from a table or chair for participants who have difficulty holding it or assist as needed.

### **Visual Disabilities:**

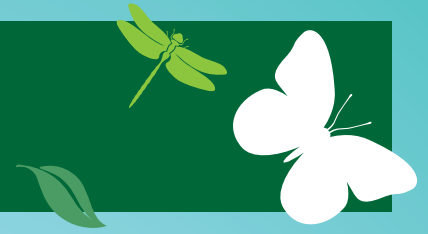
#### **For participants with low vision:**

- Enlarge the water cycle table worksheet or create a poster-sized version labeled in large print.
- Provide thick black markers for use in journaling.
- Use brightly colored objects (e.g., plastic trees, animals, etc.) that provide contrast in the terrariums.

#### **For participants who are blind:**

- Make a water cycle poster with different fabrics representing each of the stages. Connect the stages with arrows made from raised lines of glue or yarn; label in Braille. Another option is to create an interactive water cycle display for participants to explore. For example: use a watering can to create precipitation, with some of the precipitation being diverted as runoff. Use a sponge (to represent soil) sitting in a pan of water to simulate ground water. If you have a hot plate or another way to heat water, you can create evaporation. Have participants hold their hand above the hot water so they can feel the humidity of the water molecules in the air. Make sure participants do not get close enough to the hot water to burn themselves. Simulate condensation by spraying a plant with water, allowing participants to touch the dew-drenched leaves. Make sure to describe the process in detail as participants go through it.
- Have partners verbally guide participants through the assembly process. Make sure that partners are not doing the entire project.
- Have a Braille labeler available.
- Have participants feel the container to get familiar with its dimensions before they begin.
- Have participants feel the finished product immediately after the plastic is added. Over the course of several days, have them feel the plastic as their partners observe what is happening. Once condensation starts to form, participants should be able to feel the plastic sag and cave-in in places. Have partners vividly explain what they see in the terrarium to participants who are blind (e.g., “There are small beads of water clinging to the inside of the plastic.”).

# The Water Cycle Worksheet



**Draw a picture of your terrarium:**

A large, empty rectangular box with a black border, intended for drawing a picture of a terrarium.

**Draw a picture of the water cycle in your terrarium:**

*(Make sure to use arrows to show the direction water travels, and include at least these three stages: Precipitation, Evaporation, and Condensation. Other important things that are harder to see in a terrarium include: transpiration from plants, runoff from land into waterways, and percolate into the ground water.)*

A large, empty rectangular box with a black border, intended for drawing a picture of the water cycle in a terrarium.

# The Water Cycle Diagram

