

# WATCHING THE WEATHER

Weather impacts our lives and our gardens in so many ways—the rotation of the earth brings the seasons, cold temperatures can damage or inhibit growth of most plants, rain brings the water plants need but too much can damage them, wind changes the temperature and the evaporation of water plants experience and high winds can damage plants. A weather station in your garden can be used to check weather for an immediate need or can be used for a long term weather study where students check the weather daily or weekly and chart changes in weather patterns as well as effects on plant growth. Possible elements of a weather station include:

1. Thermometers to measure air and soil temperature
2. Barometer to measure changes in air pressure that signal a coming change in weather
3. Rain gauge to measure precipitation
4. Flag or Wind Vane to indicate wind direction
5. Wind meter to measure wind speed

Certain items (thermometers, barometer, and wind meter) must be purchased and properly installed in the garden. You may also purchase a rain gauge and wind vane, or you can make them yourself. A flag can serve as a basic wind vane. Students activities are (1) Make a rain gauge and (2) Using a weather station.

## Activity #1: Make a Rain Gauge

**Objective:** Students will understand that all plants need water to grow and that we can measure precipitation or water from irrigation with a rain gauge.

**Activity:** Students will make and install a rain gauge and use it to measure rainfall and/or irrigation in their garden or at home.

**Grades:** 3-8

### Materials:

- 1 recycled 2-liter soda bottle with straight sides per group of 3-4 students
- Exacto knife or sharp scissors
- Duct tape
- Black permanent marker
- 1-2 cups of small rocks or sand
- Ruler

**Location:** Inside, or outside if you have work table space for all students.

**Before Activity:** Depending on grade level, you may want to pre-cut soda bottle and have students only do the assembly.

**Lesson:** All plants need water to grow. Gardeners and meteorologists use rain gauges to measure the amount of precipitation that falls on the earth in a particular location. It is important to know this

information so that gardeners know if the rain brought enough water for the plants or if they still need to add additional water by hand or by turning on their irrigation. Two important considerations in order to get accurate information from your rain gauge:

1. Place your rain gauge in a garden location away from plants, trees or buildings that could prevent the rainfall from hitting the gauge.
2. You must check the gauge as soon after the rain as possible because the water in the gauge will begin to evaporate soon after the rain stops.
3. In addition to charting the rainfall at their school or home over time, students can compare the measurements that they get from their rain gauge to precipitation measurements provided by their local weather service (newspaper or internet). Why do they think theirs might be different?

### Directions:

1. Rinse out soda bottle well and throw away cap.
2. Cut water top of water bottle off  $\frac{1}{2}$ " (1 cm) (below where the neck of the bottle ends and straight sides begin. Be sure to cut straight across and cleanly (cut off any jagged edges). Set aside the bottle top for the moment. \*The bottle cutting step may not be appropriate for younger students—teacher may pre-cut bottle.
3. On the bottom half of the bottle about 2" (4 cm) below where you cut the top off, cut a  $\frac{1}{2}$ -1" (1-2 cm) opening or flap that can be used to drain water out of the rain gauge. \*The bottle-cutting step may not be appropriate for younger students—teacher may pre-cut bottle.
4. Have students add small rocks or sand to the bottom half of the bottle, until they are just above the molded indents of the bottom (about  $1\frac{1}{2}$  to 2" [3-4 cm]).
5. Students invert the top of the soda bottle and insert it into the bottle base to make a funnel. The funnel will help minimize water evaporation from your gauge. Use duct tape all the way around the top edge to secure the two pieces together and also to cover any sharp cut edges.
6. Using the ruler and permanent marker, students draw a thick black line 3" (6 cm) up from the bottom of the bottle and label it "0." It will be the baseline for your gauge. Starting from the 0, they make marks every  $\frac{1}{4}$  inch,  $\frac{1}{2}$  and 1 inch up to 4-5 inches (every cm up to 8-10 cm).
7. Students fill the gauge with water just until the black baseline marked "0."
8. Students place the gauge out in the garden where it is not covered or near a plant, tree or building overhang that could prevent the rain from falling directly on the gauge.
9. After every rain, have students take the measurement and log it in their weather log for the season. After taking the measurement, students should empty the gauge out so that the water in the gauge is back to the baseline marked "0." At least weekly when there has not been rain, have students check gauge to be sure the standing water has not evaporated and is still at the "0" baseline. You may want to have students empty and refill the gauge at that time to keep the water in the gauge fresh.

## Activity #2: The Weather Station

**Objective:** Students will learn how to use various instruments to determine the weather: thermometer, barometer, and wind vane or flag.

**Activity:** Students take turns using the instruments in their weather station.

**Grades:** 2-8

**Before Activity:** Place soil thermometer in soil at least 15 minutes prior to using it to determine the temperature. It needs some time in order to register the temperature.

Materials:

- Thermometer for measuring air temperature
- Thermometer for measuring soil temperature
- Barometer
- Wind vane or flag
- Compass
- Materials to secure weather station instruments to their locations in the garden or school grounds.

**Location:** Inside, unless weather instruments are permanently installed outdoors.

**Lesson:** Here are some basic instructions for students for each instrument:

- 1. Air thermometer:** The liquid in the thermometer rises as the temperature increases. The top of the liquid indicates the current temperature. Most thermometers are labeled for both Celsius and Fahrenheit. Be clear with students which scale you want them to use when gathering weather data.
- 2. Soil thermometer:** Soil thermometers read the same way as air thermometers. Again, be clear if you want students to use Celsius or Fahrenheit for the data. It is very instructional to measure the soil and air temperature over time to see how variations in the air temperature eventually affect the soil temperature. Plant roots and seeds can be very sensitive to changes in the soil temperature and those changes can affect their growth and survival. You may not want to keep a soil thermometer in the soil all the time to minimize chances of breakage. Be sure to place the thermometer
- 3. Barometer:** Barometers measure the pressure of the air here on earth. They are used to predict upcoming changes in the weather. Air pressure is created by gravity pulling the air to earth. The air pressure is constantly changing. Significant changes in air pressure signal a coming change in weather. If the pressure is high, the pressure keeps the existing weather in place. A drop in the air pressure signals a likely change in the weather. Higher air pressure usually means drier and warmer temperatures. Low air pressure usually means a storm is coming.
- 4. Wind vane:** The temperature of wind can vary greatly depending on from where the wind is blowing; and the temperature of the wind affects the overall air temperature. Wind blowing up from the warm desert will warm the air temperature. Conversely, wind blowing from the direction of snowy mountains in cold areas, meteorologists often give the daily temperature as a pure thermometer reading, but then will add the temperature as it “feels” as a result of wind. This is called the “wind chill factor.” Anything easily blown by wind can be used as a wind vane. You may purchase an actual weather vane or just install a flag on a pole. But to utilize it as a weather device, rather than just an indicator that wind is blowing, you will need to mark the compass directions below the wind vane.
  - a. To use a compass, hold it flat and horizontal to the ground. Line it up so that the arrow points to the N for north (some compasses will have a red arrow outline underneath the moving arrow so you just line it up so that the arrow is within its line.
  - b. On ground, mark the 8 primary compass headings: North (N), Northeast (NE), East (E), Southeast (SE), South (S), Southwest (SW), West (W) and Northwest (NW). Painted rocks with the compass letters on the ground in a circle is a great way if you are using a flag on a pole.
  - c. When reading the wind vane, you are looking for the direction from where the wind is coming.

So for a flag, you would be looking at the pole side, the opposite direction from where the tip of the flag is waving.

**Directions:**

1. Set up weather station or have students help you do it:
  - a. Air thermometer: Should not be in direct sunlight. Secure tightly to flat, vertical surface to minimize chance of breaking.
  - b. Soil thermometer: The soil thermometer should be placed in the same location every time. It should be a place safe from foot traffic. Select where you will place the soil thermometer and put it in place at least 15 minutes before you expect students to take measurements. Be sure that bulb is fully below soil, preferably about ½-1” below surface. Direct students not to pick up thermometer when taking their readings.
  - c. Barometer: Should not be in direct sunlight. Secure tightly to a flat, vertical surface to minimize breaking.
  - d. Wind vane or flag: Vane or flag should be located high enough to be above fences or buildings that would otherwise impact direction of wind. Compass rocks or other markers should be placed using compass in a circle around or adjacent to the flag or vane.
  - e. Make sure all instruments except flag or vane are located low enough so the youngest, shortest children can still get a reading.
  - f. groups of 4-6 and give each group a jar.
2. Review with students altogether how to take reading from each instrument.
3. Divide students into groups of 4-5 students and have the groups rotate to the different instruments to take readings. Provide worksheets for students that include that have a separate place to record measurements from each instrument. A sample worksheet is attached.
4. Have students also describe the weather that they can see and feel—is it sunny or cloudy, clear or rainy, windy or still? If it is cloudy, are the clouds low-lying fog or high flying floating by or do they look dark and stormy?
5. Determine how often you want students to collect weather data—Daily? Weekly? After storms?