Florida Irrigation

Brief Description:

This lesson and associated experiments will introduce students to the reasons why irrigation is needed to feed the world and the different types of irrigation being used.

Objective:

Students will be able to:

1. Learn about some of the unique characteristics of rainfall in Florida.
2. Explore the different types of irrigation practices.
3. Create their own drip irrigation system.

Materials:

- PowerPoint presentation software
- Projector/Smart-board
- Activity Sheets
  - Materials for each activity are listed out on the sheets

Time:

Two to three 45-minute class periods

Vocabulary:

aquifer, best management practices (BMP), drip irrigation, control valve, fertigation, fittings, flow, flow meter, irrigation, precipitation, pressure and pressure regulator

Background:

Taken from USGS Water School (http://water.usgs.gov/edu/wuir.html)

Throughout the world, irrigation (water for agriculture or growing crops) is probably the most important use of water (except for drinking and washing a smelly dog, perhaps). Estimates vary, but about 70 percent of all the world's freshwater withdrawals go toward irrigation uses (http://www.globalagriculture.org/report-topics/water.html). Large-scale farming could not provide food for the world's large populations without the irrigation of crop fields by water gotten from rivers, lakes, reservoirs and wells. Without irrigation, crops could never be grown in the deserts of California, Israel or my tomato patch.

Irrigation has been around for as long as humans have been cultivating plants. Man's first invention after he learned how to grow plants from seeds was probably a bucket. Ancient people must have had strong backs from having to haul buckets full of water to pour on their first plants. Pouring water on fields is still a common irrigation method used today—but other, more efficient and mechanized methods are also used. One of the more popular mechanized methods is the center-pivot irrigation system, which uses moving spray guns or dripping faucet heads on wheeled tubes that pivot around a central source of water. The fields irrigated by these systems are easily seen from the air as green circles. There are many more irrigation techniques farmers use today, since there is always a need to find more efficient ways to use water for irrigation.

When we use water in our home, or when an industry uses water, about 90 percent of the water used is eventually returned to the environment where it replenishes water sources (water goes back into a stream or down into the ground) and can be used for other purposes. But of the water used for irrigation, only about one-half is reusable. The rest is lost by evaporation into the air, evapotranspiration from plants, or is lost in transit, by a leaking pipe, for example.

Florida Standards:

SC.6.E.6.1, SS.6.G.3.1 SC.7.N.1.1, SC.7.L.17.3, SC.8.N.1.1, SC.8.N.4.2, SC.912.E.7.1, SC.912.L.17.1, SC.912.L.17.12, SC.912.L.17.15, SC.912.L.17.16, SC.912.L.17.17

Introduction:

1. Teach the PowerPoint (found at www.faitc.org/teachers/STEMming-Up) in class to ensure students understand rainfall, soil irrigation and its importance in agriculture.

Activity 1:

1. Students will conduct a soil moisture experiment to show the importance of controlled irrigations.
2. See *Soil Moisture Experiment* handout for instructions, materials and discussion questions.

Activity 2:

1. Students will conduct a drip irrigation experiment to demonstrate irrigation in action.
2. See *Drip Irrigation Experiment* handout for instructions and materials.

Activity 3:

1. Students now have a basic understanding of how water moves through soil and how to set up drip irrigation. It is time to design. Problem - The school garden does not have irrigation.
2. Have students measure the current school garden or the area where the school garden will be placed to determine the square footage.
3. Once the square footage of the garden is determined, students will work in groups to design an irrigation plan and devise the most cost effective form of drip irrigation. Designs and cost estimates have to be turned into the teacher for approval.
4. Students will set up the garden and test the effectiveness of the irrigation by setting up a soil moisture test in multiple points in the garden.

Evaluation:

1. Grade students on cooperative group work for Soil Moisture and Drip Irrigation experiments.
2. Grade students on thoroughness and effectiveness of garden irrigation design.

Soil Moisture Experiment

Objectives:
Students will learn about the importance of controlled irrigation.

Materials:
- Dry sponges (two per set of students)
- Dixie cups (two per set of students)
- Small spray bottles (one per set of students)
- Measuring cups (optional)
- Water
- Aluminum baking pans (one per set of students)
- Book
- Markers
- Ruler

Procedure:
1. Divide the students into pairs and pass out the materials.
2. Have the students use a ruler to draw lines every half inch on the Dixie cups and fill them equally with water. Make sure the students note how much water is in both cups (i.e., two inches of water).
3. Place one edge of the pan on the book, so that it tilts to one side.
4. Place one of the dry sponges on the elevated side of the pan.
5. Take the Dixie cup of water and pour all of the water on top of the sponge.
6. Have the students work together to pour the water that has collected in the low side of the pan back into the Dixie cup.
7. Have the students make observations about what happened with the first sponge.
8. Now, ask the students to replace the first sponge with the dry sponge.
9. Pour the other cup of water into a spray bottle and use the bottle to spray the water onto the new sponge.
10. Once the students have used all of the water from the spray bottle, have them repeat the step of collecting the water at the lower side of the pan and measuring the water.
11. Have the students compare the results from both of the sponges and methods for distributing the water.

Discussion Questions:
1. Why do you think the water was absorbed so quickly?
2. Give an example of how this experiment would appear in nature.
3. What would happen if you had applied fertilizer to the first sponge?

Drip Irrigation Experiment

Adapted from TinkerCrate: https://www.youtube.com/watch?v=aUUcq-DGKPQ

Objectives:
Students will create their own drip irrigation systems in the classroom and begin growing plants from seeds to take home.

Materials:
- Water bottles (one per three to four students)
- Peat pots (pack of 26 is $2 at local hardware/garden stores)
- Seeds (herbs, flowers, vegetables)
- Plastic tubing
- Pushpin
- Scissors
- Planting soil
- Clay
- Water
- Syringe
- Plastic cups (10 ounce)
- Markers
- Small binder clips

Procedure:
1. Cut a 18- to 24-inch length of tubing and a hole in the top of the water bottle, large enough so the tubing can be put inside of the bottle. Set these aside for now.
2. Put together the plant pots. Attach a small binder clip to the edge of a plastic cup.
3. Put one of the peat pots inside the plastic cup and fill the peat pot with soil (about a little more than half full).
4. Make sure to follow the instructions for planting the individual seeds your class/students have chosen to grow.
5. Stretch out the tubing in front of the cups and poke a hole in the tubing with the pushpin. Make sure not to push the pin all the way through the tubing.
6. Fill the water bottle with water and put one end of the tubing into the bottle. You can seal this opening using some clay. Thread the other end of the tubing through the opening of the clips, making sure that the holes in the tubing line up over the plants.
7. Using a syringe, place it at the end of the tubing (not in the bottle) and pull water into the tube until it is outside of the bottle and has started down the curve. Water should begin to flow through the rest of the tube. Remove the syringe and use clay to stop up the end of the tubing.
8. Water should slowly drip from the tubing and into the pots. If not, use the pushpins to make the hole slightly bigger.

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Sample Pre-Post Test Assessment

Directions: Answer each question to the best of your ability.

1. Define irrigation.

2. Name two types of irrigation.

3. How is rainfall important to irrigation?

4. What is an aquifer?

5. How does the soil type/texture affect the type of irrigation needed?