Create Your Own Center Pivot

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Make your own model center pivot!

Center pivot irrigation is used widely in varying climates and topography. The equipment can water a wide range of soil types, from extremely sandy to fine-textured clay soils. It can draw on many water sources, using groundwater from aquifers, surface water from streams and ponds, and even wastewater.

Key Topics: Irrigation, Groundwater, Water availability/water use, surface water

Grade Level: 5 - 9

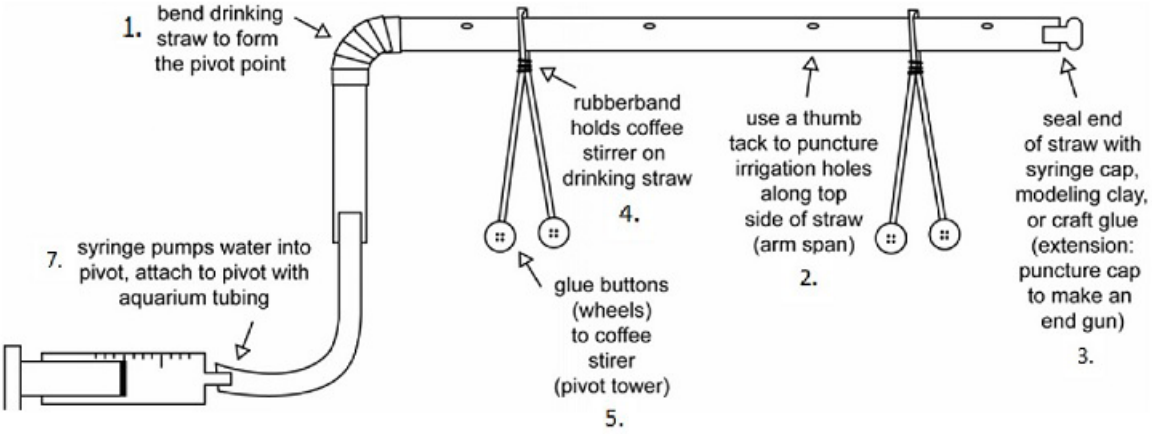
Duration: 30 - 45 minutes

Objectives:

To recognize a center pivot irrigation system, to understand the basics of how a center pivot system works, to be able to build a model of a center pivot irrigation system, to operate the system, and to learn how center pivots transfer water to crops.

Items Needed:

- Bendable drinking straw
- Two coffee/cocktail stirring straws (flexible)
- Four buttons (1/2" to 1" diameter)
- Two rubber bands, small
- Thumb tack
- Scissors
- Electrical tape
- Quick dry craft glue, modeling clay, or plumber's putty
- Aquarium airline tubing, 8" length
- Lure tip, or other needle-less oral syringe (obtain from a medical supply company, veterinarian or pharmacy)
- 1/2 yard of felt, fabric, butcher paper, or craft paper
- Yarn, 4 pieces cut to (roughly) 3" long
- Darning needle



Activity Steps:

1. Begin to construct miniature model center pivots. Students can be divided into small groups of 2-3 or build a model individually depending on the amount of materials, space, and time available. Refer to illustration for assembly assistance.
2. Bend drinking straw at neck to create an "L" shape. The short section of this drinking straw represents the pivot point. The pivot point is the point at which a center pivot is fixed to the earth. It is equipped with a pipe which pushes water into the arm of the pivot. The longer section of the drinking straw represents the arm of the pivot.
3. Use the thumb tack to puncture 4 holes, evenly spaced, in a row along the top of the pivot arm. Water delivered to the arm of the pivot will escape through these holes (which we will refer to as nozzles in this exercise) watering the ground below.
4. Plug the hole at the end of the longer section of drinking straw with clay or a bead of glue.
5. Bend both coffee stirrers in half, and drape them over the center pivot arm. These coffee stirrers will be used to make legs to support the arm of the center pivot. Use a small rubber band to affix legs together and secure to arm of pivot.
6. Glue buttons to the end of each pivot leg to represent wheels.
7. Discuss how a center pivot works by moving pivot in an arc pattern while holding the pivot point stationary.
8. Ask students how water enters the center pivot system. Water is pumped into the pivot point from an underground aquifer (groundwater) or a stream/pond (surface water). This water is pushed down the length of the pivot arm and out of the nozzles. The wheels keep the pivot moving to evenly disperse water over the crops.
9. Insert the aquarium tubing inside the drinking straw. Because drinking straw diameters can vary from brand to brand, you might have to create a water-tight seal with clay or electrical tape.
10. Fill syringe with water and attach syringe to other end of aquarium tubing.
11. Slowly press the plunger on the syringe and watch the flow of water into and out of the center

pivot model. Practice a few times. (You may want to try this step outside or over a large plastic storage bin/bath towel to absorb water.)

12. Once you have practiced irrigating in a circle, place a piece of dry felt/fabric/paper beneath pivot. Refill the syringe and make a 360 degree rotation. Discuss the pattern. Does the rate of speed at which the center pivot moves affect the pattern? Does the force or amount of water that is pushed through the system affect the pattern?
13. Discuss how this center pivot could be more efficient at conserving water resources. Ask students to take evaporation and the crop height into consideration. One way farmers reduce the amount of water lost to evaporation is through the use of "drop tubes". A drop tube is a rubber hose that transports water from the arm of the pivot and releases it directly on the crop, inches from the soil surface. Drop tubes are designed to distribute water closer to the roots, thus reducing the amount of irrigation water lost to evaporation.
14. Add drop tubes to your model by threading the darning needle with yarn. Poke the needle all the way through the arm of the pivot (use the existing holes as guides). Maintain a length of string hanging on the underside of the center pivot; this length should reach about ½" above the ground. Knot each end to secure.
15. Prime your model by refilling the syringe and slowly pushing water into the center pivot. Once the yarn drop tubes become saturated, they will drip.
16. Place a piece of dry felt/fabric/paper beneath pivot. Refill the syringe and make another 360 degree rotation. Discuss the pattern and volume of water used. How does it compare to earlier results?
17. Review lessons learned.

For More Fun:

1. Center pivots can measure up to 1/2 mile in length and irrigate over 500 acres of crop during a single rotation. However, most center pivots measure 1/4 mile long with 6 or more towers to irrigate approximately 130 acres. Make your model center pivot longer by adding additional straws, towers and wheels. How does the increased length affect your results?
2. Many center pivots are fitted with "end guns". End guns are high powered nozzles used to extend the reach of water to the corners of a field. Use a thumb tack to puncture a small hole in the end of your pivot (puncture the cap/clay). See how far you can get the water to travel with the end gun. Does this technique use more or less water? Does this technique require more or less pressure from your syringe?