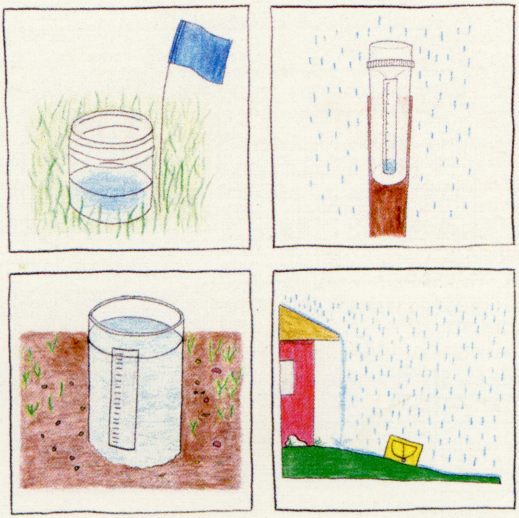


School Water Budget

Evaporation Team

College of Natural Sciences
Education & Outreach Center

Colorado State University

NATIONAL PARK SERVICE

Evaporation Team

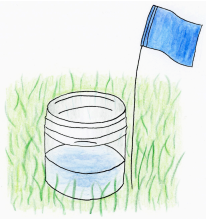
Andrew Warnock
Brad Blank
Dave Swartz
Tom Noel

Nature Active Publishing

This project was partially supported by a grant from the National Science Foundation: Culturally Relevant Ecology, Learning Progressions and Environmental Literacy (NSF-0832173). Special thanks to Bess Caplan, Kristin Gunckel, Beth Covitt, and Aubrey Cano.

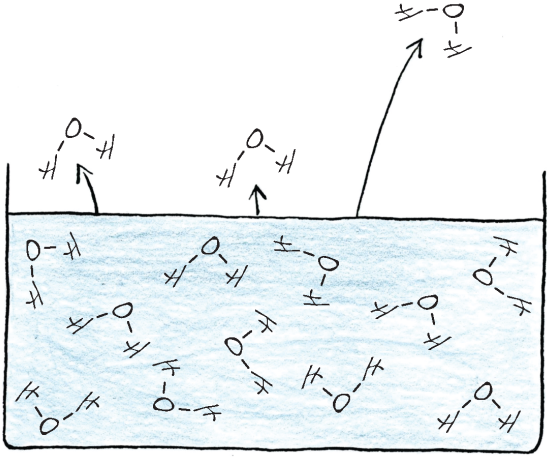
Published by Nature Active Publishing
www.natureactive.com

Handcrafted in Colorado on recycled paper.



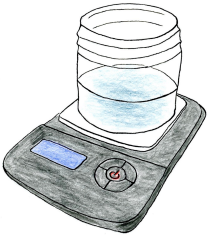
Introduction

Water that falls from the sky as precipitation can follow several different pathways as it hits the ground. It can Evaporate, Infiltrate, be used by plants and animals, or Runoff. Your team will focus on Evaporation. Evaporation can't be seen, but it can be measured! The rate of evaporation depends on temperature, relative humidity, and wind speed. You will design an experiment to test the effects of temperature and wind.



The Evaporation Team has Four Tasks:

1. Learn what controls the rate of evaporation.
2. Make a map showing where evaporation is the greatest.
3. Teach the rest of the class what Evaporation is and how you measure it.
4. Answer a challenge question that will be used in the final class discussion.



How to Measure Evaporation

You are going to place four jars of water in different locations in the study site. It is up to you to decide what factors you want to test: sun vs. shade, windy vs calm, surface type, etc.

Do This:

1. Copy the data sheet template (page 7) into your science notebook.

2. Fill four jars half full with lukewarm tap water. Each jar should have a unique label marked with a permanent marker (e.g. Team 1 Jar 1, Team 1 Jar 2, etc.)

3. Thoroughly dry the outside of the jar with a paper towel.

4. Tare the digital scale before placing the jar of water on the metal plate. Make sure that the units are in grams. There should be a "g" in the upper right corner. If there is no "g", press the Mode button until the "g" appears. Weigh each jar

carefully on the digital scale. Record your data on the data recording sheet. You may have to shield the balance from the wind.

5. Carefully transport the jar to a location in your study site without splashing the water. Choose sites to compare (sun, shade, sheltered, windy, dark colored surface, light colored surface, etc.)

6. Place the jar on the ground and mark its location with a blue pin flag so that nobody steps on it.

7. Once all four jars are in place, start the stopwatch.

8. Let them sit undisturbed for 20 minutes. (Measure the humidity of the air while you wait)

9. After 20 minutes, weigh each jar again.

10. Use the calculator to determine how much water evaporated over the 20 minutes.

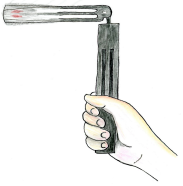
Science notebook:

Draw a quick sketch map of where your jars were placed within the field site. Describe what environmental factors may have caused one area to evaporate faster or slower than another.

Evaporation Data Recording Table

A	B	C	D	E	F
Jar Number	Initial Weight (grams)	Final Weight (grams)	Weight Loss (B – C)	Conversion Factor *	Evaporation rate (inches/hour) (D x E)
1				0.06	
2				0.06	
3				0.06	
4				0.06	

*** The conversion factor lets you convert grams to inches and minutes to hours.**



How to Measure Humidity

A sling psychrometer allows you to measure the amount of moisture in the air. It works on the principle that as water evaporates, it takes away heat. (This is why you shiver when you get out of the swimming pool on a hot day. Water evaporating from your skin takes away heat, making you feel cold.) The psychrometer has two thermometers, one that is completely dry and the other that has a wet cotton wick on the bulb. As you swing the psychrometer around in circles, the dry thermometer equilibrates with the air temperature. The wet thermometer will become cooler as water evaporates from the cotton. The difference between the readings of the two thermometers is proportional to the relative humidity of the air.

Do this:

1. Copy the data template on page 10 into your science notebook.

2. Pull the slide with the thermometers out of the Sling Psychrometer. Using the small dropper bottle of water, thoroughly wet the cotton wick on the thermometer, be sure to keep the other thermometer dry.

3. Swing the psychrometer around at a rate of 2 revolutions per second. Keep swinging it for 1 minute.

4. Record the temperatures from both thermometers in your science notebook.

5. Use the calculator to determine the wet bulb depression.

6. Use the chart on page 11 to find the closest relative humidity.

7. Repeat this measurement 3 more times and take the average. Make sure everyone in your team gets a chance to take a measurement.

Science notebook: What controls the amount of moisture in the air? What controls the rate of evaporation? Where does water that evaporates go? Explain.

****Be prepared to teach the rest of the class what you learned.**

Air Moisture Measurement

Dry Temperature (°C)	
Wet Temperature (°C)	
Wet Bulb Depression (°C) (Dry minus Wet Temperatures)	
Relative Humidity (%) (Use table below)	

Relative Humidity (%)

Wet Bulb Depression (°C)

Dry Temperature (°C)

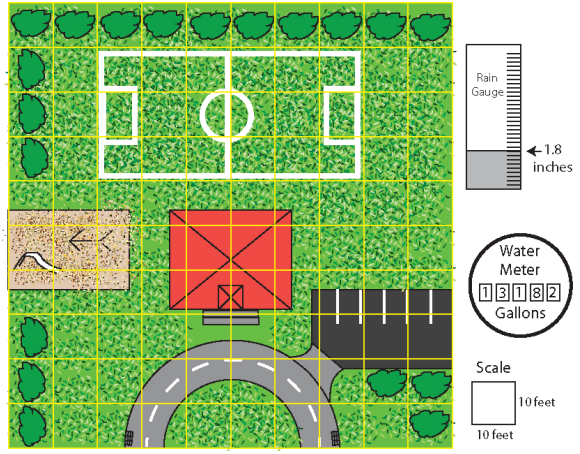
	0	1	2	3	4	5	10	15	20
5	100	86	71	58	45	32			
10	100	88	76	65	54	44			
15	100	90	80	70	61	52	12		
20	100	91	82	74	66	58	24		
25	100	92	84	77	70	63	32	7	
30	100	93	86	79	73	67	39	16	
35	100	93	87	81	75	69	44	23	6

Team Challenge

There were four rainstorms last month at Clearview School. The ground remained wet for two days after each storm. The rain gauge shows how much rain fell last month. The water meter shows how much water was used by the school last month.

A. If the evaporation rate was 0.5” per day, what percent of the precipitation evaporated? Record your calculations in your science notebook. Does your answer seem reasonable to you?

B. Within your team, discuss the following question: Does pollution go with the water as it evaporates into the air? Record your ideas in your science notebook.



How Much Water Does Your School Use?

Can you use the skills and techniques we learned to figure out how much water falls on your entire school lot in a year? How much evaporates, infiltrates, and runs off? Ask your principal to tell you how much water the school uses in a year. Is it more or less than what falls from the sky? If your school uses more water, where does the extra water come from? Is your school using water in a sustainable way?

Tip: The website: www.arcgis.com/explorer/ has a nice map measuring tool that you can use to quickly measure your school grounds.

Materials Needed

Digital scale (battery operated)
4 plastic jars, no lids (60 ml)
Half liter bottle of water
Stopwatch
Calculator
4 Blue Pin flags
Sling Psychrometer
Dropper bottle of water
Science notebooks and colored pencils

For more information, visit:
www.cns-eoc.colostate.edu/
schoolwaterbudget.html

Nature Active Publishing