



### Every Drop Counts Pre Visit

Thank you for scheduling an educational experience at the Putnam Museum. In this thirty-five minute program, the Putnam Museum's Education Specialist will lead your hands-on program in which your students will explore how important it is to keep our river waters clean. We look forward to seeing you and thank you for your interest in the Putnam Museum's education programs.

Sincerely,  
Kara Fedje  
Education Specialist

**Project Title:** Every Drop Counts

**Focus:** River Ecology

**Target Audience:** Grades 3-8

**Focus Question:** What happens to river systems if water is polluted?

#### Learning Objectives:

1. Students will learn how much water is available for drinking.
2. Students will begin to ask themselves how to clean water.
3. Students will test river water for pollutants and see a diorama of a watershed.
4. Students will brainstorm ideas of how they would clean up an oil spill.

**Background Information:** This "wet" program will explore river systems, our water needs and efforts to keep river systems healthy. Hands-on activities will increase awareness of our connection to rivers and water supply.

#### Key Words:

Active Carbon- Active carbon is a highly porous and adsorptive form of carbon used to remove color or impurities from liquids and gases

Biodiversity- Also known as biological diversity, biodiversity is the variability among living organisms and ecosystems with genetic variation within species, the variety of species in an area, and the variety of habitat types within a landscape.

Nitrate- Nitrate is a nutrient needed by all aquatic plants and animals to build protein. If water contains too much nitrate, dissolved oxygen will decrease.

Phosphate- Phosphate is a nutrient needed for plant and animal growth and is a fundamental element in metabolic reactions.

Non-point source Pollution- Non-point source pollution does not result from a specific single location but results from pollution and rain mixing.

PH- pH is the measurement of the acidic or basic quality of water. The scale ranges from 0 (very acidic) to 14 (very basic), with 7 being neutral. The pH of natural water is usually between 6.5 and 8.2.

Pollutant- Pollutant is a substance or toxic condition that contaminates air, water, or soil. Pollutants can be artificial substances, such as pesticides, or naturally occurring substances, such as oil or carbon dioxide, that occur in harmful concentrations in a given environment.

Polymer-a polymer is a large molecule composed of repeating structural units and can be synthetic or natural.

Point Source Pollution- Point Source Pollution flows from pipes or comes from specific points.

River- A river is a large natural stream of water emptying into an ocean, lake, or other body of water and usually fed along its course by converging tributaries.

Watershed- A watershed is a region or area draining to a particular body of water.

### **Standards and Curriculum:**

Iowa Core Curriculum: Earth and Space 3-5, Earth and Space 6-8

Illinois Learning Standards: Late Elementary: 13.B.2d, 13.B.2e Middle/Jr. High: 13.B.3d, 13.B.3e

### **For More Information:**

Clean Water Science kits: [www.4M-IND.com](http://www.4M-IND.com)

Enviroscope: T&A, inc.202-833-3380

Hydrocarbon Stabilization Polymer: [www.stevespanglerscience.com](http://www.stevespanglerscience.com)

The Ocean Portal Smithsonian Institution: [www.ocean.si.edu](http://www.ocean.si.edu)

National Oceanic and Atmospheric Administration (NOAA): [www.noaa.gov](http://www.noaa.gov)

National Aeronautics and Space Administration (NASA): [www.nasa.gov](http://www.nasa.gov)

Water Calculations: <http://ga.water.usgs.gov/edu/>

Watershed Field Trip kit: [www.earthforce.org](http://www.earthforce.org)

### **Further Activities for your Classroom:**

Water is needed to produce everything we use today. Often you can not tell by the appearance of food how much water was used to produce them. Water is supplied by either natural or human made processes during the growing and production process. How many gallons does it take to produce each of the following products?

- |              |                      |
|--------------|----------------------|
| 1. Bread     | 7. Orange            |
| 2. Chicken   | 8. Paper             |
| 3. Coffee    | 9. Potato            |
| 4. Corn      | 10. One Cotton Shirt |
| 5. Eggs      | 11. Steel            |
| 6. Hamburger | 12. Wheat            |

### **Answers:**

1. Bread, 1 slice, about 1 ounce:

Correct answer: 10 gallons

10 gallons is a good global average. Producing wheat takes about 150 gallons per pound.

Source: Water Footprint

2. Chicken, 1 pound of meat:

Correct answer: 500 gallons

Water is not only needed for the chicken to drink and to maintain the "chicken house" but also to grow the grains that the chicken eats.

Source: The Water Content of Things.

3. Coffee, 1 cup:

Correct answer: 35 gallons

The world population requires about 120 billion cubic meters of water per year in order to be able to drink coffee. This is equivalent to 1.5 times the annual Rhine runoff and constitutes 2 % of the global water use for crop production.

Source: Water Footprint

4. Corn, 1 pound:

Correct answer: 110 gallons

Maize (corn) consumes about 550 billion cubic meters of water annually, which is 8 % of the global water use for crop production.

Source: Water Footprint

5. Eggs, 1 egg:

Correct answer: 400 gallons

Most of the water is required for feeding the chickens.

Source: Water Footprint

6. Hamburger, 1/3 lb.:

Correct answer: 4,000-18,000 gallons

Estimates vary a lot due to different conditions of raising cows and to the extent of the production chain of water that is used. It takes a lot of water to grow grain, forage, and roughage to feed a cow, as well as water to drink and to service the cow.

Source: The Water Content of Things.

7. Orange:

Correct answer: 13 gallons

One glass of orange juice (200 ml) takes about 45 gallons liters of water, which includes growing the orange, of course.

Source: Water Footprint

8. Paper:

Correct answer: 3 gallons

This number has a lot of variation and depends on the source of the wood. Particularly, forest evapotranspiration and wood yield vary from forest to forest. The number will likely fall in a range of 1/2 gallon to 8 gallons per sheet (A4 size).

Source: Water Footprint

9. Potato:

Correct answer: 100 gallons

Source: The Water Content of Things.

10. One cotton shirt:

Correct answer: 700 gallons

Of this total water volume, 45% is irrigation water consumed (evaporated) by the cotton plant; 41% is rainwater evaporated from the cotton field during the growing period; and 14% is water required to dilute the wastewater flows that result from the use of fertilizers in the field and the use of chemicals in the textile industry.

Source: Water Footprint

11. Steel:

Correct answer: 30 gallons

Source: The Water Content of Things.

12. Wheat:

Correct answer: 110-250 gallons

Wheat consumes about 790 billion cubic meters of water annually, which constitutes 12 % of the global water use for crop production.

Source: The Water Content of Things.

Sources of information:

- \* The Water Footprint Network (<http://www.waterfootprint.org/>)
- \* Water Content of Things: The World's Water 2008-2009, Peter Gleick, The Pacific Institute (<http://www.worldwater.org/data.html>)

Note: These numbers are only estimates. It is not only very difficult to come up with accurate water-use numbers but the large variety of food-growing and production techniques used worldwide means that the amount of water needed can vary by a huge amount. Also (yes, another "consideration") is how deep you go in the chain of production to estimate water use. For beef, some estimates consider water for cattle drink and to maintain the animals, while other sources may consider the water needed to grow the food that the cow eats. So, the data is meant to give you a general idea and please note the limitations and uncertainties in coming up with these estimates.

### **Learning Probe:**

The following trivia questions should be posed to your students both before and after the students visit the museum. The idea of a learning probe is to evaluate or measure their knowledge pre-visit and post-visit. This helps the teachers provide a proper assessment of the exposure of information.

1. If a gallon of water represents the entire earth's water, how much of that gallon would be freshwater available for humans to drink? 1 half gallon, 1 pint, 1 cup, ½ cup, 1 tablespoon, 1 drop (answer: 1 drop)
2. What are some materials that can filter water?  
(Answer: gravel, sand, cloth or paper, active carbon)
3. What is a non point source pollutant?  
(Answer: A non-point source pollutant is a pollutant that does not result from a specific single location but generally results from pollution and rain mixing)
4. What are some tests that scientists do when looking for pollutants?  
(Answer: pH, temperature, phosphate, nitrate, dissolved oxygen, etc.)
5. What are some ways you would clean up an oil spill?  
(Answer: use straw or sawdust, water pressure, burn it, pumps, polymers)