Lesson Summary

Students learn how much water is needed to produce food, and use math skills to create a menu that helps conserve water.

Overview

In this lesson, students will:
- Analyze a typical daily diet.
- Estimate amount of water needed to produce food for a day.
- Refer to list of food options and create a new daily menu that reduces amount of water needed by half.

Background

Water is the most abundant substance on earth, covering three-fourths of its surface. Only .34% of that water, however, is available as freshwater that we can use for drinking, cooking, growing food, and other purposes like manufacturing.

More than half of the freshwater supply in California and the United States is used to grow crops to feed cattle and other livestock. These cattle become food items like steak, hamburgers, taco meat, and other red meat items. Raising cattle for food uses a lot of water, because cattle eat tons of crops that need to be grown (using water) to feed them during the course of their lifetime. It takes 25 gallons of water to grow one serving of rice, 63 gallons of water to produce one egg, and 625 gallons of water to make one quarter-pound hamburger. To produce one pound of beef requires up to 100 times more water than to produce one pound of wheat. So, one way to conserve water is to eat less beef!

The typical American diet includes a lot of beef. Most doctors agree that plant-based diets full of whole grains, fresh fruits, vegetables, legumes, nuts and seeds are much healthier for our bodies and can help prevent obesity, diabetes, heart attacks, and cancer that are often associated with a high intake of beef and other animal products. Many different ethnic cuisines like Chinese, Indian, Thai, Mexican, Middle Eastern and Vietnamese foods offer a variety of healthy dishes that mostly contain plant-based foods. The lower we eat on the food chain (i.e. the more plant-based foods we eat versus animal-based foods) the less water, energy, and other natural resources we use. Eating less beef is better for the environment and better for our health.
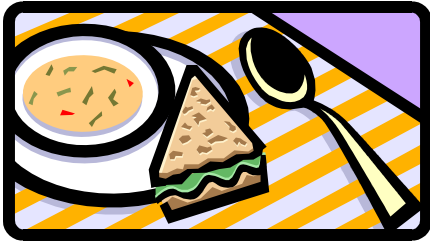
Time

Two 45-minute class periods

Materials

- "Wet" Your Appetite Student Handout
- Scratch paper
- One gallon of water
- *Our Water* Fact Sheet & Comprehension Questions (optional)

Menu of Typical U.S. American Diet

Breakfast
2 eggs-124 gal.
2 slices bacon-100 gal.
2 pc. toast w/butter-110 gal
1 glass orange juice-49 gal.

Lunch
1 1/4 lb hamburger—625 gal.
1 order French fries—15 gal.
1 serving carrots—6 gal.
1 cookie—55 gal.
1 glass milk—48 gal.

Dinner
1 beef steak—1200 gal.
1 serving rice—25 gal.
1 garden salad—15 gal.
1 soda—10 gal.
1 slice apple pie—90 gal.

How much water does it take to produce…? (typical serving)

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Lettuce	3 gallons
Tomato	8 gallons
Orange	14 gallons
French fries	15 gallons
Bread–2 slices	20 gallons
Rice	25 gallons
Milk–1 glass	48 gallons
Cheese	56 gallons
One egg	62 gallons
Chicken	330 gallons
Pork	400 gallons
Beef steak	1200 gallons

Preparation
- Copy student worksheet.
- On chalkboard, or overhead projector, write foods listed above <u>without</u> gallon amounts. Also write entire M*enu of a Typical U.S. American Diet* at left. Cover menu so students can't see.
- (optional) Make copies of *Our Water* Fact Sheet and Comprehension Questions.

Pre-Activity Question
Ask students:
1. What are two things water provides us with that we literally could not live without? (*drinking water; food*)
2. What are other uses for water, generally speaking? (*household use; municipal use; manufacturing; supporting nature and ecosystems*)
3. Of all the water on Earth, 97% is salt water. How much of all water on Earth is found as fresh water? (*3%*)
4. Do we have access to all this fresh water? Can we use it all? (*No, we can only use a fraction of the fresh water on earth because much of it is in glaciers, mist, and in groundwater sources too deep to access. Of all the water on Earth, we can only use .34% of it for our fresh water uses!*)
5. Now let's discuss what we drink. How much water do you think you drink every day, including water added to other beverages like juice, tea or soda? (*Answers will vary, but generally it's 4-8 glasses (32-64 oz.) of water a day per person.*)
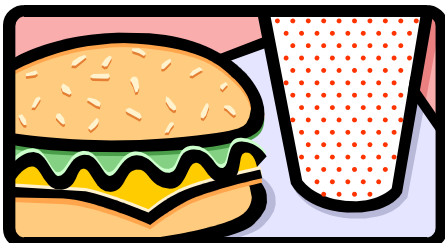
6. Now let's discuss what we eat. Since much of our water is used for agriculture--to grow food and other crops--are there some foods that require more water than other foods to be produced? Why? (*Animal products, especially beef, use more water than plant products. To produce food from animals like cows, pigs or chickens, water is needed to grow crops to feed these animals during their lifetime before they provide us with eggs, dairy or meat products. It takes up to 100 times more water to grow a pound of beef than it does to grow a pound of wheat.*)

Procedure

1. Hold up the gallon of water to show how much water 1 gallon is. Students will now play a game to predict how many gallons of water are needed to grow a typical serving of the foods listed on the board. Call on two or three students to guess amounts for each food listed. This lets all students participate in the game.

2. After the first predictions are made for the first food (*i.e. lettuce*) write the correct answer on the board and move to next item on list, asking for more predictions. Do this for entire list.

3. Are students surprised by these findings? If so, spend a few minutes answering questions and discussing their observations.

4. Explain that most of the water we consume in our lifetime comes from producing the foods we eat every day. Uncover menu on board and explain that this resembles a typical U.S. American diet. Ask students if they eat any of the foods listed.

5. Since water is always required to produce foods we eat, have students figure out how many gallons of water are needed to produce the food for each meal listed on the board, and then to figure out the total water needed for all three meals. They can do the math on scratch paper. Call on students for answers. (*Breakfast-383 gal.; Lunch-749 gal.; Dinner-1340 gal.; Total for all meals-2472 gal.*)

6. Which foods consume the most water. Why? (*See answer above in the Pre-Activity Question #6.*)

7. Students will now create a Water-Wise Menu that requires only half the amount of water. Distribute handout to each student and put them into groups of four or five. Referring to the list of foods and gallons of water needed to produce each food, students will create a new daily menu to share with the class. The goal is to reduce water use by approximately half. Since there are many ways to do this, their task is to create a menu that most closely represents what they would eat, while being balanced and nutritious. In other words, no substituting cookies for sand-wiches, and no lettuce-only lunches!
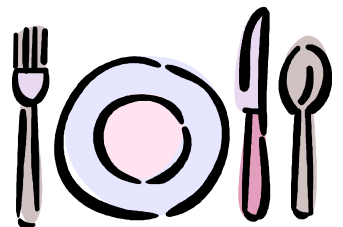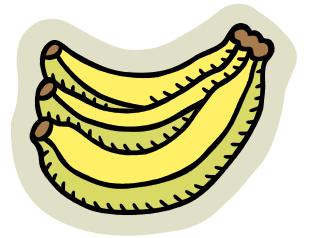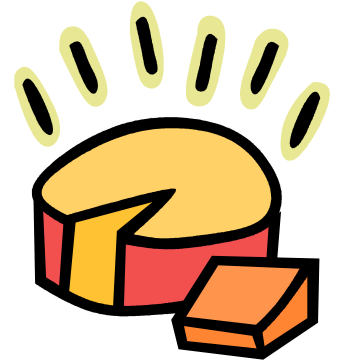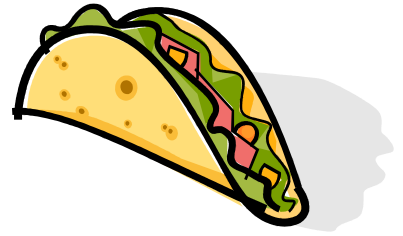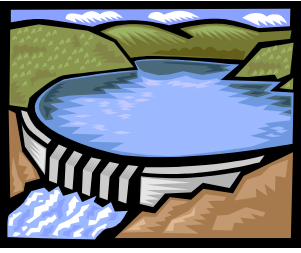
8. Have each group share their Water-Wise Menu with the class. Write new menus on board including total water needed for each meal and entire day.
9. Discuss the findings by investigating the following:
   - Are the meals listed balanced and nutritious?
   - What considerations did students make in creating their new menus?
   - Do meals include animal products or are they all plant-based?
   - What about beef? Did students notice that by reducing the amount of beef they ate (and replacing it with either plant-based foods or food from smaller animals like chicken) that they could save a lot of water?
   - Is it possible to eat meat--including beef--and still conserve water? (*Note: It is not necessary to be a vegetarian to reduce water use by half when consuming food. This especially makes sense when looking at a weekly diet. If beef is eaten four times a week, it can be halved to twice a week for water conservation benefits.*)
10. Pick one of the Water-Wise Menus. Students will now figure out how much water is needed to produce one week's worth of food in the Water-Wise Menu and also in the Typical U.S. American Diet Menu. Referring to the daily gallon totals from each menu on the board, have students figure out total amounts of water needed for each menu for one week (7 days) and one month (30 days). Is there a significant change in water use between both menus after a week? A month? (*Typical American Menu: one week =17,304 gal.; one month=30 days=74,160 gal.*)
11. Discuss findings. How does food choice affect water consumption and con-servation? Will this new information affect their food choices when they are allowed to choose what they eat? *(Note: Some students don't have much choice at home regarding what foods are served to them. If they mention this, explain they usually have choice when ordering meals at a restaurant and that they will have freedom to choose what they eat when they are older. Whatever foods are served at home, it is important to be thankful to the family for providing that food! The goal is to raise awareness about the impact food choices have on our water supply and to empower students with knowledge they can use throughout their lives.)*

Extensions
- Have students follow their Water-Wise Menu one day at home.
- Discuss traditional foods eaten in Mexico, Lebanon, India, Japan and China. Have students research plant-based foods of these countries and do a collage.
- Bring in a variety of menus from American and ethnic restaurants. Compare menu items and have students identify meatless foods theyd enjoy eating.

CA State Standards
Grade 4 Reading Comprehension 2.0 • Listening and Speaking 1.1
Number Sense 3.0, 3.1

Grade 5 Reading Comprehension 2.3 • Mathematical Reasoning 1.2, 2.3
Earth Sciences 3, 3a, 3d

San Francisco
Water
Power
Sewer

Services of the San Francisco
Public Utilities Commission

Name_____   Date_____

Create a balanced and realistic daily menu that uses half (or less) of the amount of water needed for the Typical American Diet. *(Note: Fish is not included because it is too complicated to use for this purpose.)*

Menu of Typical U.S. American Diet

Breakfast
2 eggs-124 gal.
2 slices bacon-100 gal.
2 pc. toast w/butter-110 gal
1 glass orange juice-49 gal.

Lunch
1 1/4 lb hamburger–626 gal.
1 order French fries–15 gal.
1 serving carrots–6 gal.
1 cookie–55 gal.
1 glass milk–48 gal.

Dinner
1 beef steak–1200 gal.
1 serving rice–25 gal.
1 garden salad–15 gal.
1 soda–10 gal.
1 slice apple pie–90 gal.

Breakfast Foods
Bacon (1 slice) - 50 gal.
Bagel - 20 gal.
Butter (1 pat) - 45 gal.
Cereal (w/out milk) - 20 gal.
Cereal with milk - 68 gal.
Cream cheese - 56 gal.
Egg (one) - 62 gal.
French toast (1 slice) - 45 gal.
Fruit salad - 25 gal.

Ham (1 slice) - 100 gal.
Hash browns - 10 gal.
Muffin - 45 gal.
Pancakes (1 large) - 45 gal.
Sausage (1 link) - 100 gal.
Toast–(1 slice) - 10 gal.
Waffles (1 slice) - 45 gal
Yogurt (plain) - 48 gal.
Soy yogurt (plain) - 40 gal.

Lunch Foods
Bologna sandwich - 300 gal.
Cheese sandwich - 66 gal.
Chicken sandwich - 175 gal.
Egg salad sandwich - 100 gal.
Ham sandwich - 240 gal.
Hamburger - 625 gal.
Peanut butter sandwich - 100 gal.
Pizza (pepperoni) - 285 gal.
Pizza (cheese) -155 gal.
Quesadilla - 140 gal.

Dinner Foods
Baked beans (no pork) - 65 gal.
Baked beans w/pork - 265 gal.
Bean burrito - 125 gal.
Beef burrito - 425 gal.
Beef hot dog - 325 gal.
Beef steak - 1200 gal.
Chicken - 330 gal.
Chicken burger - 185 gal.
Hamburger - 625 gal.
Lasagna w/cheese - 135 gal.
Lasagna w/beef - 435 gal.
Macaroni and cheese - 110 gal.
Pasta w/tomato sauce - 55 gal.
Pasta w/meatballs - 670 gal.
Rice - 25 gal.
Noodles - 25 gal.
Tamale w/beef - 340 gal.
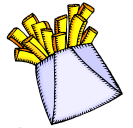Tamale w/chicken -195 gal.
Tofu burger - 80 gal.

Tofu hot dog - 80 gal.
Turkey - 330 gal.
Veggie stir-fry - 45 gal.
Veg. stir-fry w/meat - 345 gal.

Fruits & Vegetables
Apple - 10 gal.
Broccoli - 11 gal.
Cantaloupe - 40 gal.
Carrots - 6 gal.
Corn - 20 gal.
French fries - 15 gal.
Fruit salad - 25 gal.
Mashed potatoes -15 gal.
Orange - 14 gal.
Potato - 6 gallons
Salad w/dressing - 15 gal.
Tomato - 8 gal.
Watermelon - 100 gal.

Desserts
Apple pie–90 gal.
Cake–90 gal.
Cookie–55 gal.
Ice cream–150 gal.
Non-dairy ice cream–120 gal.

Snacks
Almonds–80 gal.
Corn chips–40 gal
Crackers–20 gal.
Popcorn–20 gal.
Potato chips–10 gal.

Beverages
Apple juice–45 gal.
Milk–48 gal.
Soy milk–40 gal.
Milkshake–95 gal.
Orange juice–49 gal.
Soda–10 gal.
Water–8 ounces

Breakfast		Lunch		Dinner	
Total Gallons:		**Total Gallons:**		**Total Gallons:**	

Daily Total Gallons Used: