Approaching Walden Lesson Plans

July-August, 2010

Title of Unit	**Trees and Climate Change**
Name	Maria Blewitt
Duration of Unit	Weekly work through the first semester
School	Austin Preparatory School
School City and State	Reading, MA
Subject	Grade 7 Life Science
Date	August, 2010

Abstract: In the first semester of school, I do two projects with my 7th graders. I do a project with Harvard Forest called "Buds, Leaves and Global Warming", in which students label trees and perform weekly phenology studies to determine the time of autumn leaf color and leaf drop on their trees. At the close of 1st semester, I also run a global climate change forum, in which students learn to express their own opinions and listen to the opinions of others on what the course of action should be to limit climate change. The lessons I have planned using information learned through Approaching Walden will serve to link these two previously separate units.

Title of Lesson	**How Much CO_2 Can a Tree Hold?**
Duration of Unit	Part of class outside, part of class in the computer lab
Subject	Grade 7 Life Science
Related Subjects	Grade 7 Math
Date	August, 2010

Abstract: To weave together the concepts of photosynthesis and global climate change, students will do calculations of how much CO_2 a living tree can hold. They will do this by going outside and measuring diameter at breast height (dbh) of the tree they have been observing on the Austin Preparatory property, and then using an online carbon calculator to determine how much carbon their tree stores.

Goals/Objectives: The goal of this lesson is to get students to relate photosynthesis and their phenology project to global climate change.

Materials:
Tree Carbon Calculator available at:

http://www.fs.fed.us/ccrc/topics/urban-forests/ctcc/ . June 4, 2010. *Urban Forests and Climate Change*. USDA Forest Service.

Teachers should download the tree carbon calculator to a computer(s) before class.

Tape measure
Yard stick
Calculator – make sure to tell students to bring their calculator in to class if they have their own. Otherwise, calculators with π buttons should be available.

Student worksheet on next page

Procedure:
1. In the classroom, discuss that scientists use dbh, diameter at breast height, and measure approximately how large a tree is. Have students begin the worksheet on the following page.
2. Take the students outside, and have them take the measurements for dbh.
3. Bring the students back to the classroom, and have them calculate dbh. Show students how to use the carbon calculator and their dbh to determine how much carbon their tree has stored in it. Teachers should use the calculator themselves first, before presenting it to the students, to make sure they understand how to use the program.
4. The teacher and students should discuss the answers to the worksheet.

How Much Carbon Does Your Tree Hold?

Carbon is an element on the periodic table. Carbon can mix with other elements in the periodic table. When it does, we say carbon has formed a compound. Carbon mixed with oxygen can form a gas, carbon dioxide (CO_2). When mixed with hydrogen and oxygen, carbon can form sugars and other compounds needed by living things. These are not gases – they are solids. Carbon dioxide, the gas, makes global climate change worse by trapping more heat. As a solid mixed with hydrogen and oxygen, carbon does not trap heat in the atmosphere.

1. Review the equation for photosynthesis. Under each symbol, write down the name of the symbol in words.

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$$

2. Which symbol above is the symbol for carbon in a form that is a gas which traps heat? Which symbol is a form of carbon that is a solid and does not trap heat?

3. Do trees use or make the heat trapping form of carbon? Do trees make or use the non-heat trapping form of carbon?

4. In your own words, explain how the amount of photosynthesis performed by a plant could help store the heat-trapping form of carbon.

5. To estimate how much carbon a tree can store, we need to know its diameter at breast height (dbh) Here are the steps needed to figure out dbh. Please answer all of the questions.

A. Look carefully at the base of your tree. Why would it not be a good idea to measure dbh at the bottom of the tree? Now look carefully at the top of your tree. Why would it be difficult to measure dbh at the top of the tree?

B. Use the yardstick to measure up 4.5 feet above the ground on your tree. This is where foresters in the US measure dbh.

C. Using your field tape, measure the circumference of your tree 4.5 feet above the ground. Write down the circumference here. What are your units?

Circumference = _____

D. Calculate the dbh by using the equation dbh = c/π. If you don't know where your π button is on your calculator, ask me for help. Write down your calculations and your answer here. Make sure you write down your units.

Dbh = c/π

dbh = _____.

6. I will show you on the Smart Board how to use the carbon calculator and your dbh to find out how much carbon your tree has stored in it. I will then help you do the calculations for your tree on the Smart Board.
Make sure to write down the number for total CO_2 stored. Be careful, the calculator gives the number in kg and in pounds (lbs). Since we have been using English instead of metric for our calculations, you should give the number in lbs.

Total carbon stored for my tree = _____

7. Explain how planting more of your tree would help control global climate change.

Title of Lesson	**What Do Things Really Cost?**
Duration of Unit	1 class in the computer lab, or use as homework
Subject	Grade 7 Life Science
Related Subjects	Grade 7 Math
Date	August, 2010

Abstract: Seventh grade students are often unaware of the cost of things, both literally in terms of dollars, and their environmental impact. This lesson seeks to bring awareness of the meaning of the term cost in both of its uses.

Goals/Objectives: The goal of this lesson is to get students to start thinking about dollar costs and environmental impact of the choices humans make. Understanding science well enough to comprehend the impact of humans on the globe is an important skill.

Materials:
Johnson, D.B. (2000). *Henry Hikes to Fitchburg*. Houghton Mifflin Company. New York.

Student worksheet on next page, including embedded website

Procedure:
1. Read the story *Henry Hikes to Fitchburg* out loud to your class. The story deals with the true cost of travel. In the story, it takes Henry just as long to walk to Fitchburg as it does for a friend of his to earn the cost of train fare, and then take the train to Fitchburg. Discuss the meaning of the word cost with the class.
2. Have students complete the following worksheet, which looks at the cost of taking a shower vs. a bath, and allows students to draw conclusions about the cost and environmental impact of keeping clean.
3. In class, have students who are willing discuss their results on the bath/shower cost in terms of money, the bath/shower cost in terms of fossil fuels, and discuss student answers to the bonus question.

Conserving Water

Shower or Tub?

1. Go to Home Depot's website.
http://www.homedepot.com/?cm_mmc=SEM|RPM|ST_Branded|YHO_2897

2. Pick out a bathtub for your new bathroom you are pretending to build. Go wild if you want to.

3. Find out how many gallons it takes to fill the tub. You can do this by pressing on the "specifications" tab on the home depot website. If the model you choose doesn't tell the number of gallons to fill, then either chose a bathtub that does, or try to search the web for that model to find the number of gallons.

4. Assume you will fill the tub to ¾ full. Calculate how many gallons that will be by taking the answer to #3 and multiplying it by ¾.

5. Now go pick out a shower head. Get one with fancy gadgets if you want.

6. Find out the flow rate in gallons per minute (GPM) using the "specification" tab.

7. Time yourself next time you are in the shower – how many minutes do you take in the shower?

8. Figure out how many gallons of water you would use if you used the shower head you picked out.

9. Now compare – would you use more water taking a bath or taking a shower?

10. Which would cost more – taking a shower or taking a bath?

11. Now figure out how much water you would save by taking a shower half as long as you actually took.

12. Find out from your parents how your water is heated. Thinking about climate change, what is the environmental cost of heating water for your shower? Thinking about the family budget, is there a money cost for heating the water you used?

13. Go back to the Home Depot website, and find a shower head that will use less water than the head you originally picked , and calculate how much water you would save(assume that same number of shower minutes as in #7).

14. For a 1 point bonus, think about what other costs – both money and for the environment – that your shower or bath costs.

Title of Lesson	**Do We See Evidence of Climate Change?**
Duration of Unit	2 class periods
Subject	Grade 7 Life Science
Related Subjects	Grade 7 Reading
Date	August, 2010

Abstract: In his essay *Autumnal Tints*, Henry David Thoreau records dates of peak autumn color for the time he lived. Students will compare their fall tree phenology study to his dates to see if they see evidence of climate change.

Goals/Objectives: The goal of this lesson is to have students understand that scientific claims are built on evidence.

Materials:
Thoreau, H.D. (1862). *Autumnal Tints*. Reprinted by Applewood Books. Bedford, MA.

Student worksheets on following pages, including embedded website.

Procedure:
1. Have students read the article from Science News for Kids on Global Climate Change, and complete the worksheet. Science News for Kids is an internet resource provided by the Society for Science and the Public, which also publishes the journal Science News.
2. Later in the fall, after observing when their tree reaches peak foliage color, have the students do the second worksheet and relate their trees to global climate change.

Why Should We Study the Effects of Climate Change on Fall Leaves

Go to http://www.sciencenewsforkids.org/articles/20090415/Feature1.asp.

Please read the article online and answer the following questions:
1. What are some ways that scientists have studied that show that spring is starting earlier than ever before?

2. What is causing the spring to start earlier?

3. Why does it make a difference when spring is?

4. Why does it take a long time to study climate change?

5. Abe Miller-Rushing and Richard Primack are two scientists who study the effects of climate change on plants. Where did they go to get information about seasonal dates in the Boston area from a long time ago?

6. After these scientists studied old information, what did they do to gather information about the seasons in Boston right now?

7. What did they find about the blooming time of flowers?

8. Why could an earlier bloom time hurt the Boston ecosystems – not just the plants that bloom earlier, but the animals in the area?

9. How did Christine Rogers find that climate change could affect kids with allergies?

10. What do you think a citizen scientist is?

11. What is phenology?

12. What is the National Phenology network? BTW, Harvard forest has one of the lilacs that has been planted around the country to track changes in bloom time.

13. Can you guess who is going to be a citizen scientist working on fall phenology this autumn?

14. Use the power words section to define climate change.

15. Thinking about this article, how do you think climate change could affect the changing colors and falling off of the leaves on the trees on Austin's campus?

Do We See Evidence for Climate Change in our Trees?

Do you remember reading about Dr. Primack and Dr. Miller-Rushing? They used Henry David Thoreau's journals to determine when flowers bloomed in spring during the Thoreau's time (1850's – 1860's). In 1862, Thoreau wrote an article for a magazine. The title of the article was *Autumnal Tints*, and Thoreau recorded his observations on when trees reached peak color in the fall. We can do the same kind of research as Drs. Primack and Miller-Rushing, and compare when Thoreau said peak color was in 1862, and when we see peak colors now.

1. Gather up your data sheets for your tree. Find when you tree reached peak fall color – when 100% of the leaves had changed color. Write down that date here.

Date:_____

2. Now let's compare to when Thoreau said the trees were at peak color. As a class, we will record all of the dates for our trees, and fill in this entire chart.

Tree	Thoreau Peak Fall Color Data - 1862	Austin Peak Fall Color Data - 2010
Red Maple	Sept. 25	
Sugar Maple	Oct. 2	
Scarlet Oak – Thoreau Black Oak – Austin	Oct. 26	
Quaking Aspen	Oct. 26	

3. Does there appear to be any evidence that global climate change is affecting our fall foliage? Support your answer with evidence.