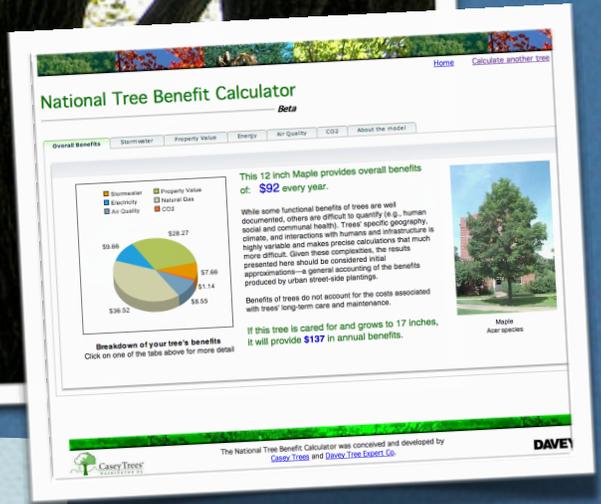


i-TREE LEARNING LAB

Using i-Tree in the Classroom



NSTA Web Seminar

April 23, 2009

“Carbon, Oxygen, Water and Shade: Putting a Price on the Benefits of Your School Yard Trees”



Curriculum for High School Classrooms
Spring 2009

For more information please visit www.itreetools.org/education

i-Tree Lite Learning Lab



Beta v.2.1 Classroom/Lab Exercise

Overview

In this activity, students will discover the benefits of the urban forest around them. They will take an inventory of trees growing on their school-grounds and calculate the environmental benefits provided by those the trees.



Background

The i-Tree Learning Lab is an exercise that will help students discover the benefits of the urban forest around them.

Using a system called i-Tree Educational, the students will learn how to conduct an inventory of the trees growing in their school yard. After identifying and measuring the trees, they will enter their data into an online calculator to determine the value and benefit that the trees provide. This exercise will show them how the data they collected can be used to calculate the benefits of their school's trees.

Objectives Students, using a computer model, will be able to quantify the dollar value of annual environmental and aesthetic benefits: energy conservation, air quality improvement, CO₂ reduction, stormwater control, and property value of a tree or set of trees.

Lab Exercise Details **Grade Level:** High

SchoolTime: 60 minutes

Materials and Equipment:

- Measuring tape(s) (or string and rulers)
- Inventory Worksheets
- Tree ID book(s)
- Notebook and pencil(s)
- Digital Camera (optional)

Other Support Materials The i-Tree software suite of tools has an online website that provides background and support materials for urban forest inventory and assessment field exercises. This information may be of value to students who would like to learn more about tree inventories. The information can be accessed at www.itreetools.org



This activity is based on using a modified version of the original i-Tree software, which Urban Foresters and many other professionals use to assess the benefits and costs associated with urban trees.

The software was developed by the U.S. Forest Service and its partners.

Instructional Procedures

Using the tree benefits calculator, the students will learn how to calculate the benefits of trees in their school yard. When they are finished with their outside field work, the teacher will help the students to enter the inventory information into an online calculator. This will help students understand the connection between field data collection and the calculated benefits of trees.



Organization and Outcomes

Divide the class into small groups (2's or 3's, depending on how many trees you wish to survey). Each group will identify and measure their trees. Back in the classroom, students will input this information into a simple web-based calculator to determine the value and benefit of their trees.

Outside on the School Grounds – Tree Identification and Diameter Measurement

Refer to the Tree Inventory Sheets and Tree Diameter Measurement sections. Take the students outside with measuring tapes, simple tree ID field guides, and tree inventory sheets. Have each group look at a different tree and complete their measurements using the tree diameter measurement section. Next, have them identify their tree genus using simple tree identification guides, or have them gather a couple of leaves, or photos of the tree that will help identify it, and take it back to the classroom to use the computer to help determine the type of tree. The Arbor Day Foundation has a great on-line tree identification guide: <http://arbordayfoundation.org/trees/whattree/fullonline.cfm>



Back in the Classroom

Refer to the Tree Benefits Calculator section. Have the students transfer the field information into the computer using this website: treebenefits.com. Once this is completed, the students will get information on the benefits and value of the trees growing on the school grounds. Use the tabs to explore detailed information about each tree's stormwater, property value, energy, and CO2 benefits.





Wrap-Up

Once the value and benefits of the trees that were surveyed are established, the class would be asked to briefly discuss why this information is valuable, from an environmental and practical perspective.



Assessment Report

Have the students write up a summary on their work, and report to the class what they did and the analysis and information they were able to calculate using the i-Tree Lite model. This could lead to further discussion and extension of the exercise activities.



Extensions

Students could make maps of the school yard, including the trees. To improve their school yard, students can plant a new tree or a collection of trees that will help establish a sustainable tree canopy on the school grounds. Using native trees is preferred and you can find out which trees would be best for the location by contacting your state forester, extension agent or by utilizing web resources. Students may want to use this same tool for trees in their neighborhood.



Resources

Many web-based resources are available that will help students get the most out of this hands-on exercise and explore the fundamentals of urban forests and the value of trees in our cities. Please refer to www.itreetools.org/education for more information.

MEASURING TREE DIAMETER



DBH - Diameter at Breast Height



Overview

DBH stands for Diameter at Breast Height. It is a method of measuring tree trunk diameter at a standard level and is used by foresters and arborists to determine the approximate size and age of a tree. If you will be measuring many trees, the tree measurer may want to note where 4.5 feet is on their body so they don't have to measure from the ground each time.



Procedure

If you have access to one, use a DBH tape, but don't worry if you don't as a regular measuring tape or even a piece of string will work with a little math lesson added in. (*A diameter tape (DBH tape, d-tape) differs from a standard measuring tape in that it is calibrated to measure tree diameter by dividing circumference by π (pi).*)



To measuring the tree, wrap the measuring tape completely around the tree (as though putting on a belt) until zero on the tape reaches the tape again. Read the number where zero meets the tape. This is the circumference of the tree at breast height. [Note: If using a DBH tape – your number will be the actual DBH]

MEASURING TREE DIAMETER



**DBH -
Diameter at Breast Height**



DBH with a Standard Measuring Tape



1. Measure 4.5 feet from the ground (this is Diameter at Breast Height - DBH).
2. Wrap the measuring tape completely around the tree (as though putting on a belt) until zero on the tape reaches the tape again. Read the number where zero meets the tape. This is the circumference of the tree at breast height. [If using a DBH tape – your number will be the DBH]
3. Record the circumference for this tree in inches.
4. Find the diameter by taking the circumference and dividing by the number π (3.14)

Example: If the circumference of the tree is 46.5 inches,
Diameter = $46.5/3.14$
Diameter = ~ 14.8 - this would be your DBH

TREE BENEFITS CALCULATOR

The Tree Benefit Calculator allows anyone to make a simple estimation of the benefits individual street-side trees provide. This tool is based on i-Tree's street tree assessment tool called STRATUM. With input of zip code, location, species and diameter, users will get an understanding of the environmental and economic value trees provide on an annual basis.

www.treebenefits.com/calculator

The screenshot shows the National Tree Benefit Calculator interface. At the top, there is a banner image of trees. Below it, the title "National Tree Benefit Calculator" is displayed in green, with "Beta" in the top right corner. To the left is a form with the following sections:

- Instructions:** "Species: If you're looking for a Willow Oak it's listed as 'Oak, Willow'. If your tree isn't listed, use the general 'Other' listings." "Diameter: How wide is your tree at about 4.5 feet from the ground?"
- Enter your tree info:** "Enter your tree's species:" with a dropdown menu showing "Apple". "Enter your tree's diameter (between 0 and 45 inches):" with an empty input field. "What land-use type is this tree nearest?" with a dropdown menu showing "Single family residential". A "Calculate" button is at the bottom right of the form.

To the right of the form, the text reads: "Trees in urban areas provide a number of important benefits. They help to clean the air, curb stormwater runoff, raise property values, sequester carbon, and reduce energy costs." Below this, it says "You have chosen:" followed by "Zip Code: 01107", "City: SPRINGFIELD, MA", and "Climate Zone: Northeast" with a "change" link. A paragraph at the bottom right explains: "Enter information about a street-side tree and learn about the benefits it provides. Street-side trees are typically located in front yards, medians, parkways, planting strips or other common planting areas adjacent to streets."

At the bottom of the page, there is a green banner with the Casey Trees logo (Washington DC) on the left, the text "The National Tree Benefit Calculator was conceived and developed by Casey Trees and Davey Tree Expert Co." in the center, and the Davey logo on the right.

You will be using the National Tree Benefits Calculator to place a value on the benefits that are provided by the trees on your school's grounds. You can use the calculator to determine the value and benefit of a single, individual tree or of a specific genus type growing on the school grounds.

TREE BENEFITS CALCULATOR

Instructions

Species: If you're looking for a Willow Oak it's listed as "Oak, Willow". If your tree isn't listed, use the general "Other" listings.

Diameter: How wide is your tree at about 4.5 feet from the ground?

Enter your tree info:

Enter your tree's species:

*

Enter your tree's diameter (between 0 and 45 inches):

*

What land-use type is this tree nearest?

*

Calculate

Input Your Inventory Results and Run Calculation

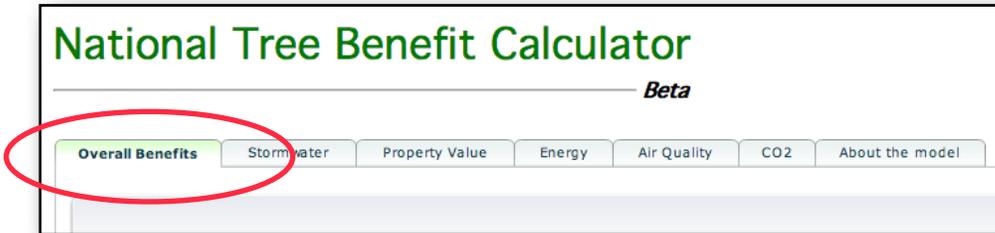
The Tree Benefits Calculator will allow you to determine the value and benefits provided by the trees growing on your school's grounds. There are various ways to explore the use of the calculator, but it should be simplest to use either of the following sequences --

- * For a simple analysis, you can determine the benefits provided by any single, individual tree growing on the school grounds by entering the genus/species, size and choose small commercial business (which is the category that is similar to many school grounds).
- * For an overall analysis of all the trees on the school grounds, you will run an analysis for the AVERAGE sized tree from each genus/species and add up the totals of each genus/species to determine the overall value and benefits of all of the trees that you have inventoried.

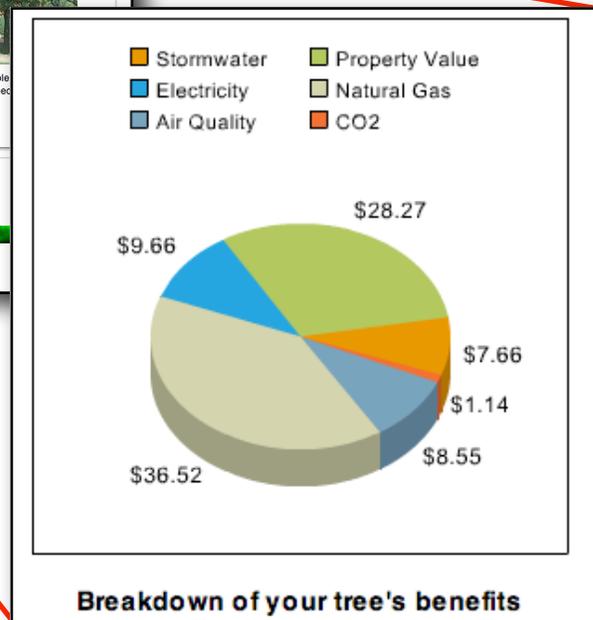
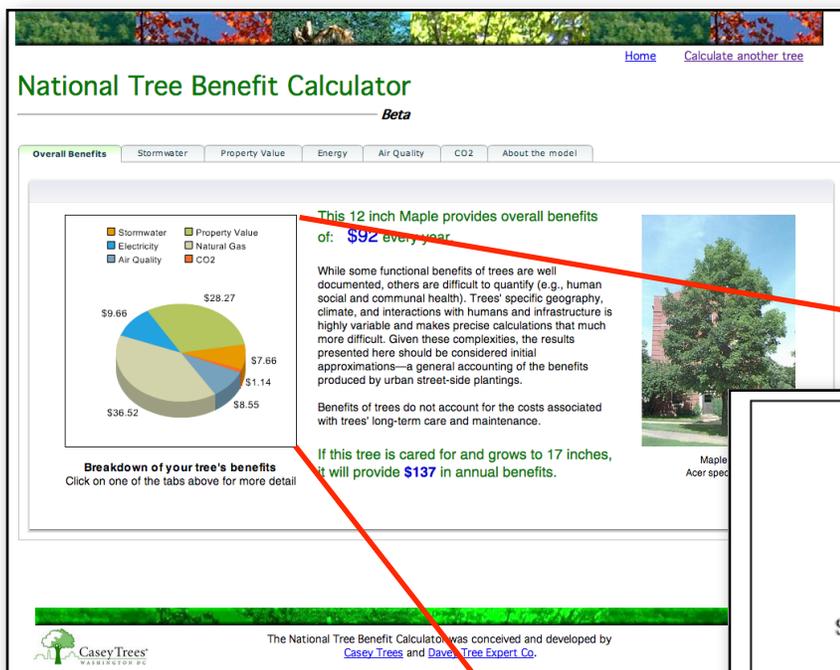
TREE BENEFITS CALCULATOR

Choose Your Benefit Category & View The Benefits

The Calculator has a series of tabs across the top menu bar which will allow you to calculate and view the results of several environmental benefit categories. These include the following: General Benefits, Stormwater Benefits, Property Value Increase, Energy Savings, Air Quality Improvements, and CO2 Reduction



You Can Choose a Benefit Category for Analysis.



Correlation to National Education Standards

Using i-Tree Lite, the students are going to learn how to conduct a tree inventory of trees on their school's property. When they are finished with their outside field work, the teacher will then help the students enter their inventory information into a website, which will let them see how the data that they collected actually is beneficial to how their urban forest is managed.



Science as inquiry - *Abilities necessary to do scientific inquiry*

Design and conduct a scientific investigation

Think critically and logically to make the relationships between evidence and explanations

Life science - *Populations and ecosystems*

For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis. That energy then passes from organism to organism in food webs.

Earth and space science - *Structure of the earth system*

The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations

Science in Personal and Social Perspectives - *Science and technology in society*

Science cannot answer all questions and technology cannot solve all human problems or meet all human needs

History and nature of science - *Science as a human endeavor*

The work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity— as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas

History and nature of science - *Nature of science*

Scientists formulate and test their explanations using observation, experiments, and theoretical and mathematical models

Mathematics - *Compute fluently and make reasonable estimates*

Develop and use strategies to estimate the results of rational-number computations and judge the reasonableness of the results

APPENDIX

The following pages contain extensions that may be used during expanded study of the trees on your school's grounds, or in the nearby forest.



as of April 20, 2009

Appendix 1 - Online Tree Benefits Web Resources

Appendix 2 - Assessing a Tree's Condition

Appendix 3 - Field Survey Data Collection Sheet (with condition category)

APPENDIX 1

ON-LINE TREE BENEFITS RESOURCES

U.S. Forest Service Natural Inquirer Science Education Journal:

The Natural Inquirer is a middle-school science education journal that brings Forest Service research to life. There are numerous editions of NI, with many articles related to tree benefits topics. Natural Inquirers can be downloaded from the Web site, or limited copies of printed journals can be ordered free from the program.

<http://www.naturalinquirer.org>

Examples:

Urban Forest Edition: *Don't Be So Fuelish: How Much Fuel is Saved When Cars Are Parked in the Shade?* Energy, transportation

<http://www.naturalinquirer.org/How-Much-Fuel-is-Saved-When-Cars-Are-Parked-in-the-Shade.-a-59.html>

Facts to the Future Edition: Articles on fresh water, trees, fish

<http://www.naturalinquirer.org/Facts-to-the-Future-i-7.html>

Urban Forest Edition: *I've Got You Covered: The Amount of Pavement Covered by Street Trees*

<http://www.naturalinquirer.org/The-Amount-of-Pavement-Covered-by-Street-Trees-a-55.html>

Others:

Carbon cycle poster:

<http://www.fs.fed.us/climatechange/documents/carbon.pdf>

U.S. Forest Service Climate Change Home Page:

<http://www.fs.fed.us/climatechange/>

National Wildlife Federation's certified wildlife habitat program info:

<http://www.nwf.org/gardenforwildlife/>

EPA greenhouse gas equivalent calculator:

<http://www.epa.gov/cleanenergy/energy-resources/calculator.html>

EPA waste education resources:

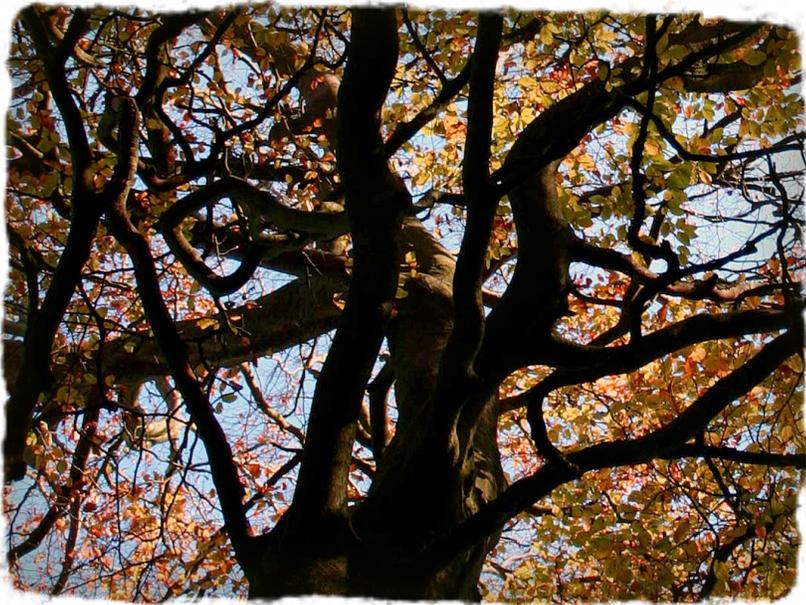
<http://www.epa.gov/epawaste/education/index.htm>

Download Woodsy Owl's Activity Guide (elementary): Activities on water, recycling, energy

<http://symbols.gov/woody/toolbox/teachers/activity-guide/activity-guide.shtml>

ASSESSING TREE CONDITION

During your tree inventory, assessing a tree's condition may also be undertaken. The following guidelines will help you to determine how to rate your trees condition. You can use similar types of trees in the area to base your judgments of what the tree you are rating should look



-  Good
-  Fair
-  Poor
-  Dead



Overview

During your inventory of the trees on your school grounds, you should also try to rate the condition of the trees. The following guidelines will help you to determine how to rate your tree's condition. Keep in mind that if you think a tree does not look healthy it probably isn't. You can use similar types of trees in the area to base your judgments of what the tree you are rating should look like. Once you become more familiar with how specific trees are supposed to look, rating their condition will be easy.



Procedure

Evaluating tree condition is a somewhat subjective exercise, because such evaluations rely on visual assessments made by observers. The simplest scales rate the condition of living trees as good, fair, or poor. In your schoolyard, you will take a look at each tree from a distance to view the entire canopy (top and branches) and then move closer to the tree to observe any characteristics that will help you rate the condition of the tree. Finally, look closely at the trunk and where the trunk goes into the ground.

ASSESSING TREE CONDITION



GOOD

- Full canopy
- Minimal to no mechanical damage to trunk
- No dieback of branches over 2" diameter in the upper crown
- No suckering (upright shoots growing from the roots or branches and appear out of place)



FAIR

- Thinning canopy (the tree might look different than similar trees around it)
- Significant damage to trunk caused by Insects or disease
- Premature fall coloring on foliage (leaves turn colors before they are supposed too)



POOR

- Tree is declining
- Visible dead branches over 2" diameter in canopy
- Significant dieback of living branches (the tips have no leaves)
- Severe mechanical damage to trunk, including decay
- Bark may be beginning to peel in dead or dying areas



DEAD

- No live foliage visible during trees growing season (spring through fall).

About this Curriculum



April 20, 2009 - This educational curriculum is being presented here as a second beta draft of a proposed laboratory exercise that is being developed by the i-Tree Project Team, and is very preliminary in scope. The NSTA Conference, and the subsequent NSTA Webinar, provides a great opportunity to introduce this conceptual model to teachers across the country, and was developed specifically for use by the conference session attendees. Your feedback, input and ideas are greatly encouraged, and necessary to bring this exercise, and upcoming associated modules up to ‘classroom ready’ standards.

It is requested that you please visit www.itreetools.org/education to keep updated on the latest developments regarding the curriculum development. You are also asked to bring any ideas, suggestions, comments and constructive review to the project team via e-mail. Please contact Vicki Arthur, US Forest Service at varthur@fs.fed.us or David Bloniarz, US Forest Service at dbloniarz@fs.fed.us with your suggestions.

Notes: