Harvard Forest Schoolyard Ecology

Woolly Bully: Hemlock Trees and the Invasive Pest, the Woolly Adelgid

Project Overview

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2007 Revision Committee: Christine Perham, Kate Bennett
2011 Revision by Dr. Orwig, and P. Snow
2015 Revision by P. Snow

May, 2015

I. Schoolyard Study Questions:

A. Big Ideas- Questions for Long Term Study:

Will the Hemlock Woolly Adelgid (HWA) destroy our hemlock trees forever?
How will our forest change if the hemlock disappears?

B. Concrete Concepts-Questions for Here and Now:

Is the Hemlock Woolly Adelgid currently present in our local field site?
If so, is the population of HWA increasing or decreasing this year?
If so, how is the HWA affecting our hemlock trees and/or surrounding forest now?

II. Related Research:

A. Harvard Forest: Forest ecologist, **Dr. David Orwig**, is studying the forest response to the exotic pest, the hemlock woolly adelgid. Perhaps this study will help us learn to limit its spread, or at least how best to adapt to the inevitable changes it will bring to our forests (see Hemlock Woolly Adelgid Studies).

III. Field Time:

A. Minimum number of data collection field visits: 2 field sessions total.

1. Autumn: Begin in early September to introduce field study and field site and measure new growth.
2. Winter or Spring: From late November through Spring, new woolly egg sacs are potentially visible if HWA is present.

IV. Project Objectives:

A. Students learn how to do field research by participating in a program associated with the Harvard Forest Long Term Ecological Research Site.

B. Teacher and students **collect field data** seasonally.

C. Data is given to HF to **share with citizen scientists as well as HF scientists.**

D. The autumn and spring protocols should be combined in order to **monitor the status of Hemlock Woolly Adelgid presence** at your schoolyard. When you do this project annually, and compare with other long term studies on a larger scale, you can begin to see the patterns of HWA spreading regionally and within individual trees and its impact on forest species distribution, habitat, etc.

V. Connections to Science Frameworks: See a specific list of which frameworks are addressed in Our Schoolyard projects at:

2009 Mass. State Frameworks connections HF-sLTER
2013 Draft Mass. State Framework incorp. NGSS connect to HF-sLTER

VI. Materials:

Flagging and/or metal tags
Data sheets
clipboards/pencils
Tree and Plant Field guides
Centimeter ruler
Permanent marker
Pictures of HWA to aid ID

Optional Materials:
Thermometer

10X hand lenses or seeing wool and egg sacs

VII. Choosing a Schoolyard Study Site: Project coaches will support teachers in choosing and flagging research sites based at a location in walking distance to school.
Sites with a variety of native hemlock trees with multiple branches in easy reach of students, located in an easily monitored area, are best for this project.

A. Guidelines for Choosing Study Trees:

1. **Trees in reach**: Ideally each tree in your study site will have two or more branches that allow students to reach branch tips to check for HWA.
2. **Trees that will last the duration**: These are the same trees you will study in the autumn and the spring, as well as in future years.
3. **Number of branches and trees to include**: Use enough trees to provide at least 1 branch per student research team (2-4 students). Based on the number of classes, class size, team size, and number of branches studied per team, you can determine the amount of trees to include in your study. Determine the appropriate team size for your students and whether you have time for your teams to study one or two branches each. Be sure to use at least 2 branches per tree for replication. An example of how this may work for "the average class" of 20 students would be to divide into 10 teams of 2. In that case, you would mark 2 branches on each of 5 trees included in study site, to allow for a total of 10 study branches. Each team of 2 would focus on one branch in the study.

VIII. Site preparation:

A. Labeling branches: Teachers choose, flag, and identify Individual trees. At least two branches on opposite sides of each tree will be flagged and labeled. Assign numbers to each tree 1 through x, x being the total # of trees, and assign letters to each branch on each tree. For example a branch may be labeled 1A. 1 being the number of the tree, and A being the branch you are studying. Another tree will have a branch marked 5B, which shows it is tree 5, branch B.

B. If a branch or tree is removed/destroyed: Sometimes the inevitable hand of change strikes your study site, and that means you may find a branch

or even a tree has died, been cut down, or struck by lightning... In these cases, you need to identify a substitute branch or tree to include in your study.

1. **To substitute branches, follow these steps:**
   a. Locate a different branch on same tree in reach of students and label it the same tree number and the same letter as previous branch, but add an asterisk. For example if 4A broke off, label the new branch 4A*. And then if another branch needs replacement 4A**
   b. If there is no other branch in reach on that tree, try to find an additional branch on another hemlock tree in reach of students and label it a different tree number and proceed as above in A., recording that it is a new tree
   c. To substitute trees, try to find a tree of the same species and relative size if possible and assign it a new number. If you previously had 5 trees in study, label this one 6, and so on.

C. Optional site preparation activities: We recommend that you take the time to map and describe your field site either with or without students. The following sheets can be found in the activity section of your teacher notebook.

1. Mapping site- See sample map attached [under construction]
2. Site description sheet
3. Site history sheet

IX. Data Coordination:

A. Information from each data sheet should be transferred to the Harvard Forest HWA Excel Template on the computer by either students or teachers.
The HWA project Excel template is available online at:

http://harvardforest.fas.harvard.edu/museum/data/sy002/hwa.xls

B. Teachers must email completed autumn templates to the Harvard Forest Schoolyard Coordinator within 2 weeks of the November seminar, and spring templates by June 1st. This allows us to share your data with scientists, other students, and citizens who are interested in finding out about how the length of the growing season is related to climate. Data submittal is required of all