**Harvard Forest Schoolyard Ecology**
**Buds, Leaves, and Global Warming**

# Spring Protocol: Budburst

**Revised July 2012-J.O. and P.S.**

**Objective:** Students will record the progression of bud swelling and budburst to monitor the start of the local growing season. The end of the growing season is monitored in the fall for this project. This means if you do this annually, one class will pass on data to be used by next year's class.

> **What is Budburst exactly?** We are defining budburst as the point where the bud scales have opened AND leaves are fully visible. Leaves may be tiny but the entire leaf can be seen. Budburst indicates when the growing season begins and leaves begin making food for the tree.

## Data Collection:

- **Begin and end dates:** Spring data collection should begin in early to mid April (before the buds have become very swollen), and continue until all or most buds have burst, and leaves are fully emerged. Ideally, continue until June 1st or as close to the end of the school-year as is feasible for your schedule. Dr. O'Keefe completes his study when all trees in his field site have 75% leaf development (leaves are 75% of their expected final size estimated from measurements taken the previous fall). This is generally in mid to late June.

- **How often to collect data:** Collect data at least once a week during study time. We recommend going out twice a week if possible when the buds are very swollen and budburst appears imminent, as that would pin point budburst more accurately.

- **Observe the specific branch(s) and buds assigned and labeled.** These will be the six buds nearest the branch tip, not counting the terminal (tip) bud. See Section VIII (Site Preparation) in the Study Overview.

# "Student Data Sheet-Spring"

Observe and record whether each bud is completely closed (not puffy), or almost ready (puffy or opening with a green leaf tip visible but not unfolded yet), or open (budburst - the emerging leaf is unfolded/whole leaf is visible) by putting a check in the proper category on the data sheet.

**1. Number of buds open:** Record on the data sheet how many of the labeled and observed buds (0-6) are closed, puffy, and open. Please refer to photos of buds enclosed in teacher notebook and posted online at: http://harvardforest.fas.harvard.edu/museum/data/sy001/budburst-chart.pdf **to clarify the differences between "puffy", "open"and "closed"**.

**2. "Bud fallen off"**-Please note if the bud is no longer on the branch. Place a check mark in appropriate box. If no buds remain on a branch, replace the branch with another branch with live buds. Data from earlier branch should be reported to HF as "NA" (missing).

**3. Leaf measurement:** If the leaves are fully open, select the largest leaf and record its length. Measure the blade of the leaf only, not including the stem (also called the petiole). Note: If there is more than one leaf growing from each bud, measure the largest leaf only. If the leaf is compound (multiple leaflets are attached to a main leaf stem/petiole), measure from the tip of the entire leaf down to the base of the lowest leaflets where they meet the leaf stem for the leaf length. For width, measure the widest part of the whole leaf-as in the widest pair of leaflets.

**4. Field Notes/Observations:** This part of data collection is **optional**. Scientists usually take field notes when collecting data. If you choose to include it, record any notes about field conditions – climate (temperature, cloud cover, precipitation), wildlife, what is happening with other plants, moisture, snow, or human activity - that you notice while collecting data. As time allows you may discuss these optional data with students.

**5. Teacher Note:** In order to prepare data for submission to Harvard Forest, you must combine data from all branches on the same tree to create tree-level data to enter into Excel and email to Harvard Forest.