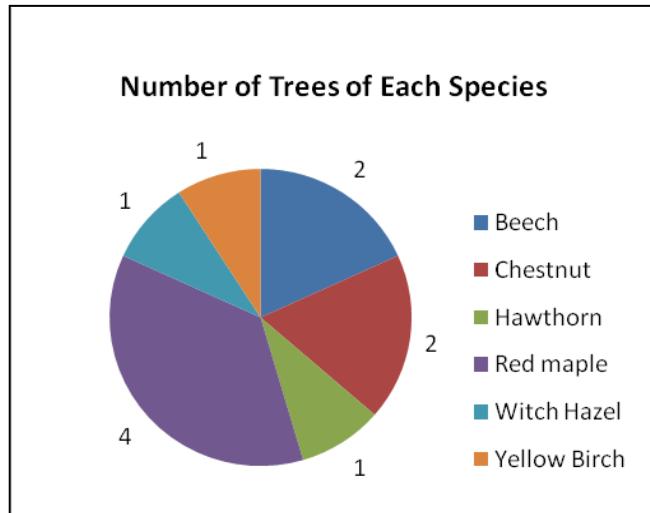


## Graphing Exercise 1. Create a Pie Graph by Selecting a Data Table

This exercise selects the data in an existing data table and creates a pie graph of the data (Figure G1).

Figure G1. Tree species sampled in schoolyard phenology study at Athol-Royalston Middle School, 2004-2007.



### Educational Goals of Exercise

Become comfortable with working within a spreadsheet to:

- Select data you want to graph
- Choose a graph type for your data
- Create a graph
- Format the graph
- Consider the mathematics involved in creating a pie chart

### Summary of Steps\*

1. Input a new data table of tree-species data into your worksheet (Table G1).
2. Select both columns of Tree Species data in the table you created.
3. Instruct the computer to insert a pie graph.
4. Format and edit the completed graph as you choose.<sup>1</sup>

\*If you are using a program other than Excel, the steps may differ somewhat from those presented here.

Table G1. Breakdown of sampled trees by species,  
ARM Schoolyard Phenology Study, 2004-2007.

<u>Tree Species</u>	<u>Number of Trees</u>
Beech	2
Chestnut	2
Hawthorn	1
Red maple	4
Witch Hazel	1
Yellow Birch	1

<sup>1</sup>NOTE: Formatting and editing a pie chart can include specifying a title, adjusting the legend, changing colors for individual pieces of the pie, deciding whether to include data values on the graph and where to put them, choosing whether to have a solid pie or one with the pieces exploded, and various other options. Take the time to explore ways to change the appearance of the pie chart you have created, and consider how the changes enhance or fail to enhance the story you want to tell.

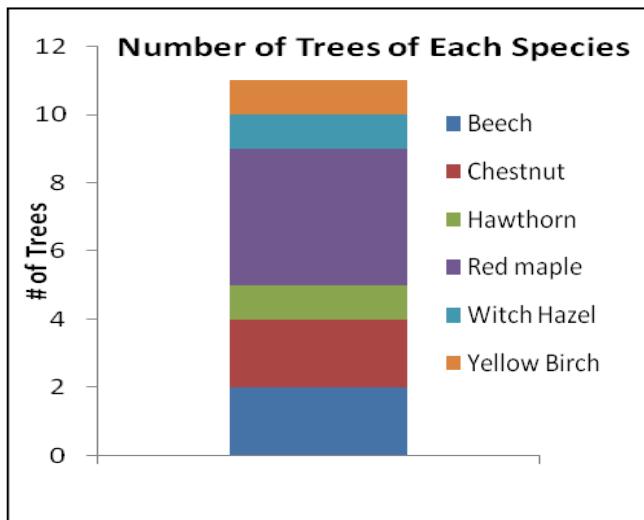
## **Graphing Exercise 2. Create a Stacked Bar Graph Using Source Data Dialog Boxes in Excel, or Comparable Tools in Other Graphing Programs**

This exercise introduces the Source Data dialog boxes in Excel. If you are using a different graphing program, you should follow its instructions for creating a stacked bar graph by selecting individual data points or sets of data from a spreadsheet.

In Excel, and in many other graphing programs that work with spreadsheets, Source Data dialog boxes allow you to specify the data that you are going to graph very precisely. It is easy to create a simple bar graph using the methods employed above for the pie graph, but the simple nature of the data table lends itself to use as an example. Once you are familiar with the Source Data dialog boxes, it will save you time in creating more complex graphs of data on leaf fall, bud burst, water-level changes, hemlock woolly adelgid infestation, and other field variables you and your students measure over time for schoolyard ecology studies.

For this exercise we will graph the same tree-species data as in the pie graph in Graphing Exercise 1, but we will use the Source Data dialog boxes to specify the data we will be using to create a stacked bar graph, as in Figure G2.

Figure G2. Trees sampled in fall phenology study by students at Athol-Royalston Regional Middle School, 2004-2007.



## **Educational Goals of Exercise**

Practice, and become comfortable with, specifying data to be graphed using Data Source dialog boxes in Excel, or comparable graph-creation methods in other graphing programs.

### **Summary of Steps\***

1. Click on a blank cell in your worksheet.
2. Tell the computer to insert a graph, and select the type of graph you want to create.
3. Use the Data Source dialog box to select a data range for graphing from a data table.
4. Use the Data Source dialog box to specify individual data to be graphed, creating a series.
5. Format/edit the graph, as appropriate – format axis titles, change font size, adjust the range, alter fonts and colors, and make other changes to make your graph attractive and informative.
6. Take a few minutes to consider how different formatting options enhance or otherwise contribute to (or detract from) the message conveyed by the graph. Also, compare the graph you just made with the pie chart made in Exercise 1. Does one do a better job, in your opinion, of showing the information you want a viewer to see?

\*If you are using a program other than Excel, the steps may differ somewhat from those presented here.

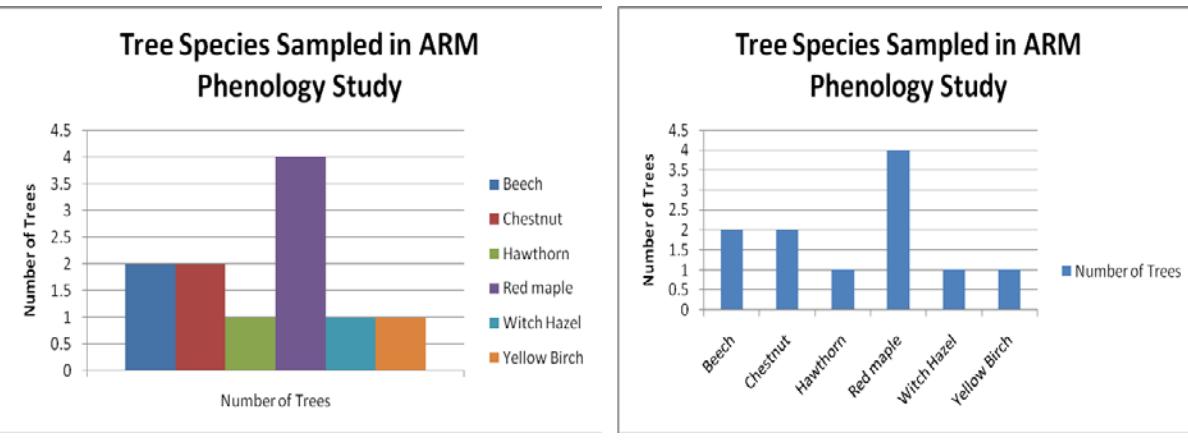
### Graphing Exercise 3. Creating a Simple Bar Graph from an Existing Graph

Most graphing programs allow you to convert one kind of graph into another kind without having to go through all the steps involved in creating the graph from a data table. In this exercise, you will use the Chart Type dialog box in Excel, or the comparable tools in other graphing programs, to convert an existing graph into another kind of graph, specifically the simple bar graphs shown in Figure G3.

Figure G3. Two versions of simple bar graphs produced from the pie graph and stacked bar graph in Figures G1 and G2.

Left, graph produced by specifying that data are in rows.

Right, graph produced by specifying that data are in columns.



### Educational Goals of Exercise

Develop facility with tools provided by your graphing program to change an existing graph into another kind of graph.

- In Excel, become familiar with commands such as Switch Rows/Columns command, the Change Chart Type dialog, and the Source Data dialog boxes
- In other graphing programs, practice using the comparable tools.

## **Summary of Steps\***

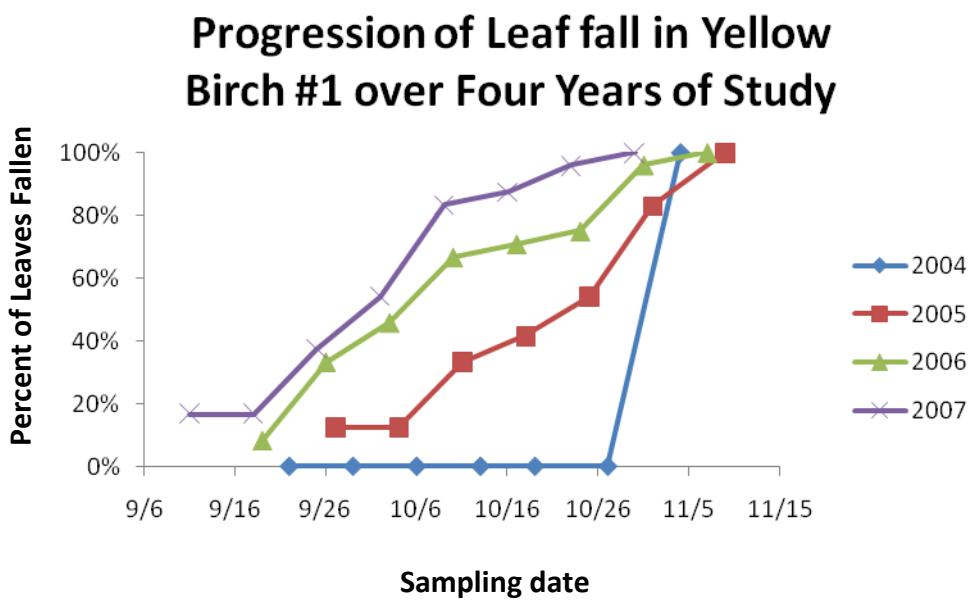
1. Select an existing graph, such as the pie chart you created in Exercise 1.
2. Use the Change Chart Type dialog box and/or the Source Data dialog box in Excel, or the comparable tools in other graphing programs, to convert the graph into a simple bar graph with the number of individuals sampled for each species shown as a separate vertical bar.
3. Edit the graph as needed.
4. Once you are happy with the appearance of the graph, use the Switch Row/Column command in Excel, or the appropriate tool in your graphing program, to switch between the two versions of bar graphs shown in Figure G3.
5. Spend a few minutes thinking about the different ways you have depicted the same set of data. Do the different graphs tell slightly different stories? Do they suggest different questions? Do you find one more compelling than another?

\*If you are using a program other than Excel, the steps may differ somewhat from those presented here.

## Graphing Exercise 4. Graph Leaf-Fall Data from One Tree

This exercise will graph leaf fall from a single tree over four years of sampling. The graph will be similar to Figure G4.

Figure G4. Progression of leaf fall in a yellow birch sampled in 2004-2007 by students at Athol-Royalston Middle School



## Educational Objectives of Exercise

Build on what you learned in the earlier exercises to create a complex graph from multiple years of data.

- Review and practice sorting data in an Excel spreadsheet
- Learn how to convert count data in a spreadsheet to percentages
- Become comfortable with using the Source Data dialog to create a complex graph.
- Increase confidence in formatting the graph to produce a clear presentation of the results
- Further develop skills in interpreting the message the graph provides

## **Summary of Steps\***

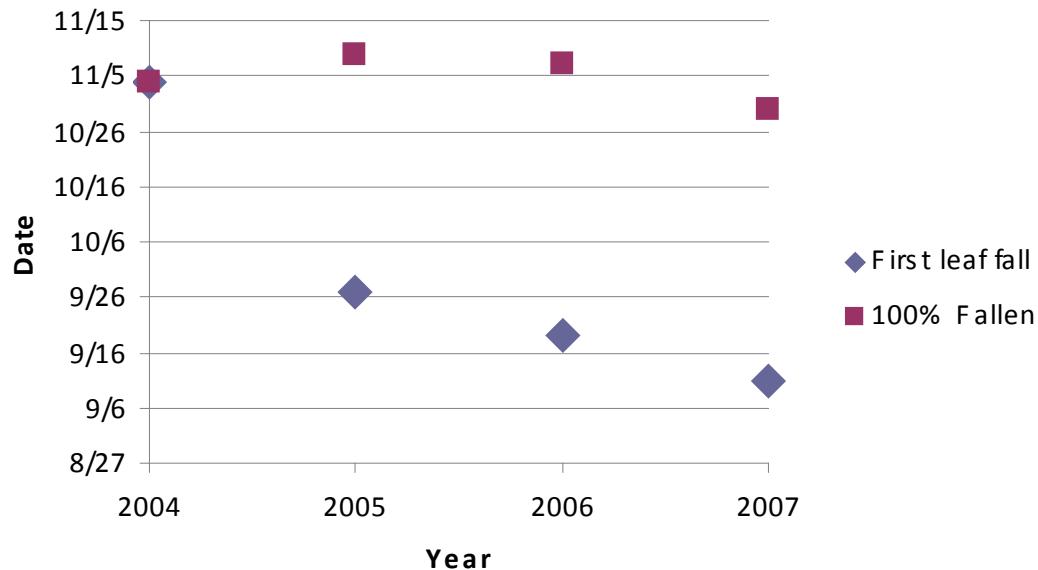
1. Download fall data from Athol-Royalston Middle School (ARM).
2. Sort the data to organize the data by tree, so each tree's data are presented chronologically, together.
3. Add a new column to the data table, and in this column insert the percent of leaves fallen for each tree on each date. (The data set shows number of leaves fallen, so you will need to convert the number fallen on each date into a percent of all leaves observed on that date.)
4. Insert a new graph that will show percent of leaves fallen vs. date. Specify that you want a scatter plot with lines connecting the points.
5. Use the Source Data dialog boxes in Excel, or the comparable tool in a different graphing program, to add the leaf-fall data for Yellow Birch Tree YB1 from 2004, 2005, 2006, and 2007 (you may add data from later years, if you wish).
6. Edit the graph, as appropriate. You may want to adjust the symbols used for the different years, their colors, and their sizes; edit the legend; format the axes to make them more readable; or make other changes to make the graph more effective at showing the results of the study.
7. Spend a few minutes looking at the graph and thinking about the story it tells and questions that it generates.

\*If you are using a program other than Excel, the steps may differ somewhat from those presented here.

## Graphing Exercise 5. Graph First and Last Leaf-fall Dates

In this exercise, we will compare the first and last dates when leaves were observed to fall from Yellow Birch #1 during the four years of the study. The graph is shown in Figure reproduce Figure G5-1. To create this graph, it is necessary to create a new data table with the first and last leaf-fall dates for tree YB1, organized by year.

Figure G5-1. First and Last Dates of Leaf Fall in Yellow Birch #1, 2004-2007.



## Educational Goals for Exercise

- Become comfortable with manipulating schoolyard data to extract additional information from the original field results
- Explore multiple ways of graphing data on first and last dates of observed leaf fall over multiple years
- Practice reformatting axes to present time in different ways
- Think further about how different ways of presenting the same data set can provide different information to the viewer

## **Summary of Steps\***

1. Create a new Data Table showing dates of first and last leaf fall
2. Select the data table, including column headings
3. Insert a graph, and format as necessary.

\*If you are using a program other than Excel, the steps may differ somewhat from those presented here.

Table G5. Data Table for first and last leaf-fall dates for tree YB1, 2004-2007

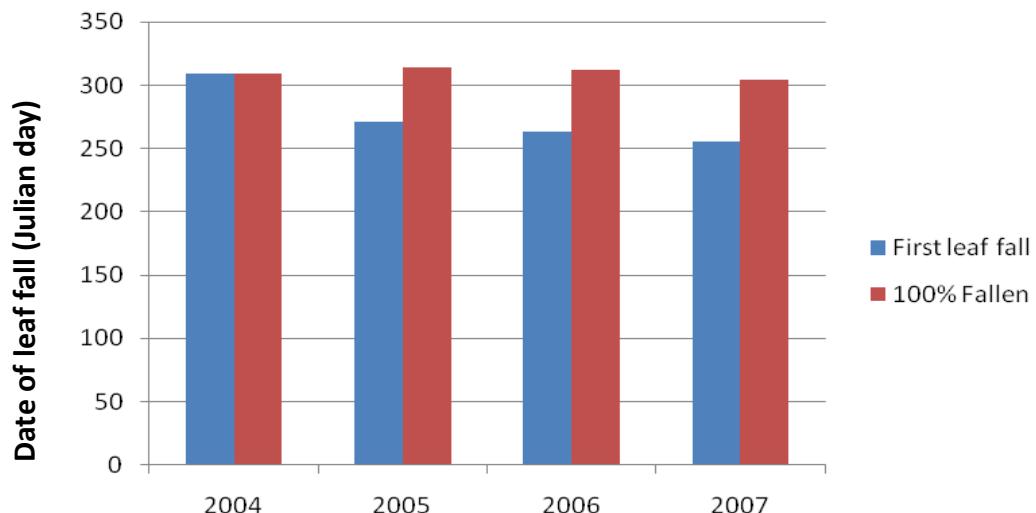
Year	First leaf fall	100% Fallen
2004	309	309
2005	271	314
2006	263	312
2007	255	304

## **Optional Variation: Graph the Data as a Bar Graph.**

In Figure G5-2, the data in Figure G5-1 are graphed as a bar or column graph comparing matched pairs of data. As with the initial scatter chart that simply presented the data as points, it is easy to see how the dates when the students observed the first fallen leaves became earlier each year over the four years for which data are available. The similar but less consistent trend in the date of last leaf fall is also visible.

You can either create a bar graph from scratch, using the same process you used to make your scatter plot, or you can use the graphing program's option for change an existing graph into another kind of graph.

Figure G5-2. First and last dates of leaf fall in Yellow Birch #1, 2004-2007.



When you have completed your graphs, once again, take a few minutes to look at them carefully. Is there further formatting that would make them more informative? Think about the “story” the graphs tell, and identify questions that are raised by the graphs. Are there some anomalies that might need to be explained? Some questions that suggest additional research that is needed?