Name_____

The Timing of Red Maple Leaf-Out

In the spring, red maples grow new leaves to replace the leaves that were shed in preparation for winter. This yearly event is called leaf-out. Triggers in the environment, such as the temperature, amount of precipitation and the length of daylight can affect the timing of leaf-out. In this activity, you will use the data provided to explore the timing of leaf-out in northern New England.

Part A

Do red maple trees leaf-out at the same time each year?

Signs of the Seasons observers have been recording the day that leaves are first visible on red maple trees for the past four spring seasons. Create a graph that compares recorded leaf-out days by year. A box plot for each year is one possible way to compare them.

2011: 123, 124, 124, 128, 129, 130, 132, 133, 137, 142

2012: 92, 105, 108, 108, 108, 110, 111, 113, 113, 115, 115, 115, 121, 121, 121, 123, 123, 130, 135

2013: 118, 120, 121, 122, 122, 122, 123, 129, 129, 130, 134

2014: 124, 128, 128, 133, 134, 134, 134, 134, 140, 140

Data from the Nature's Notebook Database; first recorded day of visible leaves per site at a phenophase intensity of <50%

Analysis

1. What does the graph suggest about the yearly timing of red maple leaf out?

2. What are some similarities between the years? What are some differences?

During the spring, the sun travels higher through the sky, providing more hours of daylight and additional warmth. Many species are sensitive to these seasonal changes and some will adjust their life cycle events (phenophases) based on the surrounding environmental conditions. In this activity, you will use a data set to examine temperature as a possible trigger for leaf-out in red maples.

Part B

Is there a correlation between the day of leaf out and spring temperatures?

Spring Temperature (March-May, average)	Day of Leaf Out
35.5	134
35.5	140
38.7	133
40	128
40	134
40	126
41.3	124
42	124
42.9	132
44	129
44.5	121
44.6	110
45.8	108
46.5	108
48.2	105

Data from NOAA National Climatic Data Center; average spring temperature at various New England sites over the period of March-May in the year of recorded leaf out (http://www.ncdc.noaa.gov/climate-information)

Using data from the NOAA archives, an average spring temperature was calculated for each site that reported leaf-out. Create a scatter plot to determine if there is a relationship between the average spring temperature and the timing of leaf-out at a site.

Analysis

1. Does this graph support or refute the hypothesis that leaf-out is related to spring temperatures?

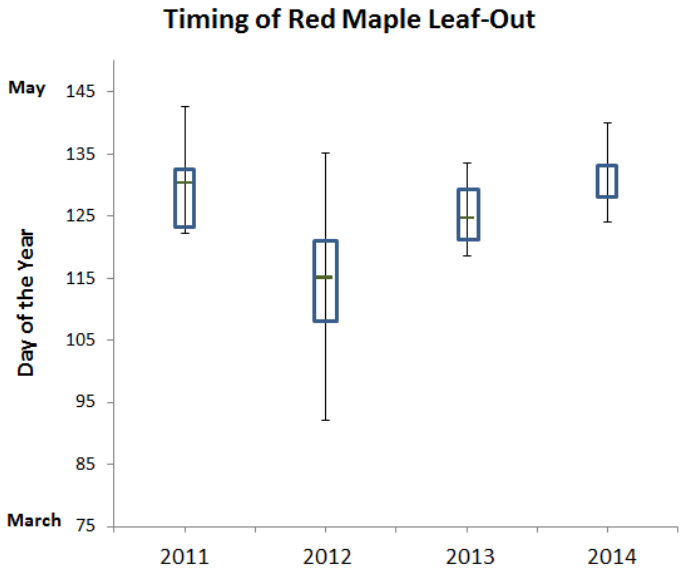
2. Based on the graph, how would you describe the relationship between spring temperatures and leaf-out?

Teacher's Guide

Part A

Do red maple trees leaf-out at the same time each year?

The box plot shows that leaf-out does not occur at the same time each year. In 2012, leaf out was earlier than the other three years.

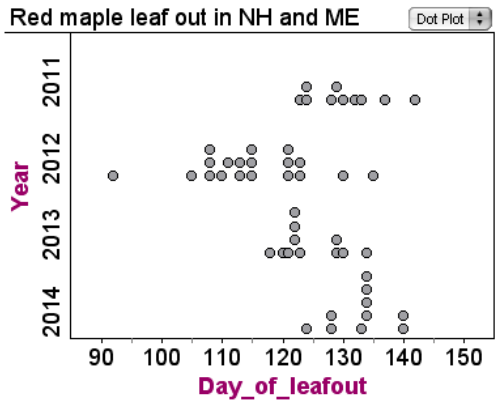


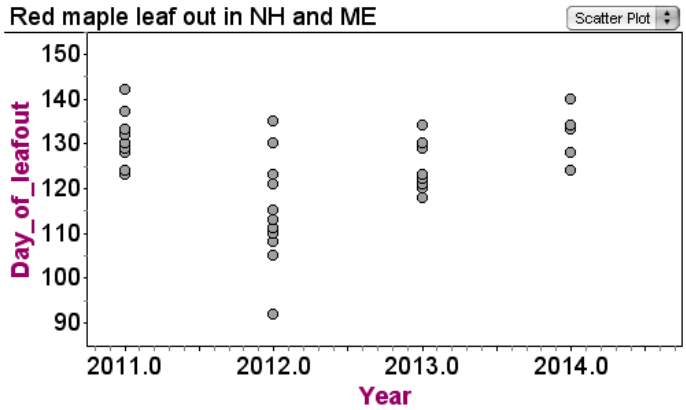
Year	2011	2012	2013	2014
Min	123	92	118	124
First Quartile	124	108	121	128
Median	130	115	122	134
Third Quartile	133	121	129	134
Max	142	135	134	140

Extension: *Why is a box plot an appropriate way to display this information?*

A box plot allows us to compare the variability of multiple data sets and to examine variability within each group of data points. The 2012 data set shows greater variability among all the observation sites than the other years do.

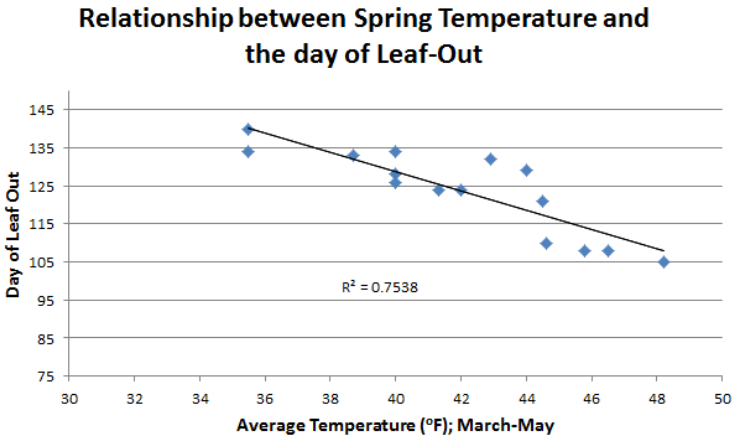
Other possible graphs:





Part B

Is there a correlation between the day of leaf out and spring temperatures?



Does this graph support or refute the hypothesis that leaf-out is related to spring temperatures?
The graph supports this hypothesis.

What is the relationship between spring temperatures and leaf-out?
Leaf-out occurs earlier in warmer years. The trend could be described as a moderately strong correlation or a negative correlation.

Extension: *Why might it be advantageous for a plant species to leaf-out earlier?*
Plants that are able to grow leaves earlier in the season can capture sunlight before neighboring species. Chloroplasts in the leaves perform photosynthesis, providing energy for the plant that it can use to grow and reproduce. An earlier leaf-out can lengthen the total growing season and allow one plant to block sunlight from reaching its neighbors, slowing the growth of competing species.

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Signs of the Seasons http://umaine.edu/signs-of-the-seasons/