



## Harvard Forest Schoolyard Ecology Online Graphing Exercises

### Buds, Leaves and Global Warming

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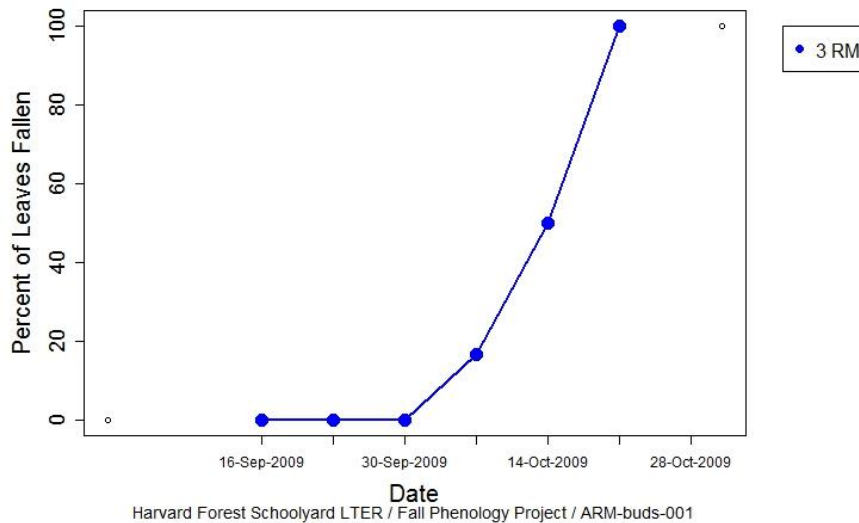
The following exercises have been designed for teachers participating in the Harvard Forest Schoolyard LTER Program, using the online graphing tools that are built into the HF Schoolyard Database.

To access the HF online graphing tools, go to:

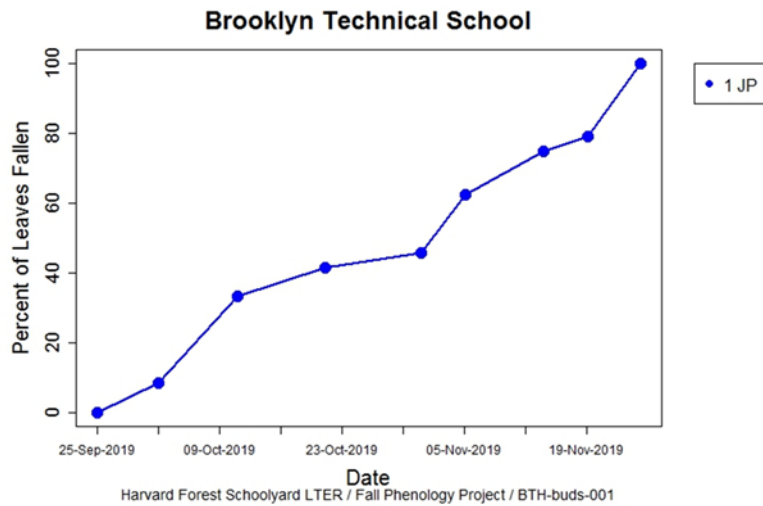
[https://harvardforest2.fas.harvard.edu/asp/hf/php/k12/k12\\_graph.php](https://harvardforest2.fas.harvard.edu/asp/hf/php/k12/k12_graph.php)

Please respond to each of the following questions. Then try to create similar graphs as the samples provided for the project(s) you are working on, using your own site's data and/or the sites shown on cross-site graphs.

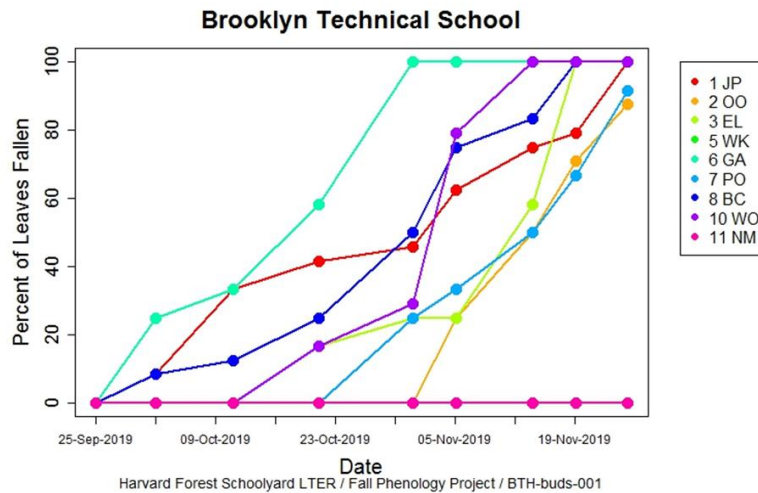
#### Athol-Royalston Middle School



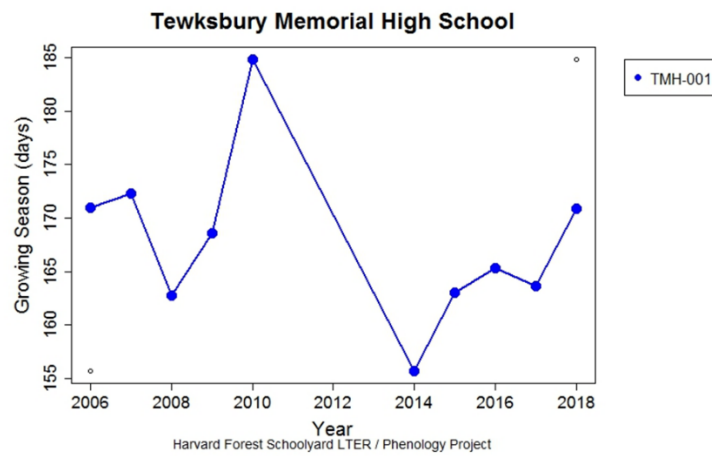
1. What story is this graph telling?



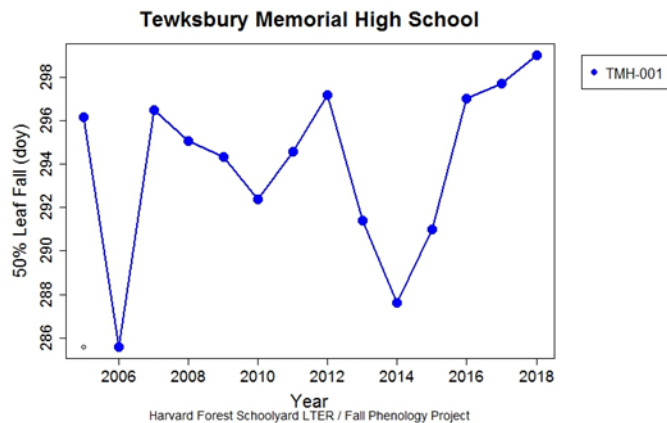
- In this graph, notice that there are more data points because this class recorded more field observations of leaf drop than the class at the other site. The more data points, the more complete the story is for us to interpret. Also notice that the leaves drop later in the season than the leaves in the other graph. What differences might account for later leaf fall, especially for these trees and their locations?



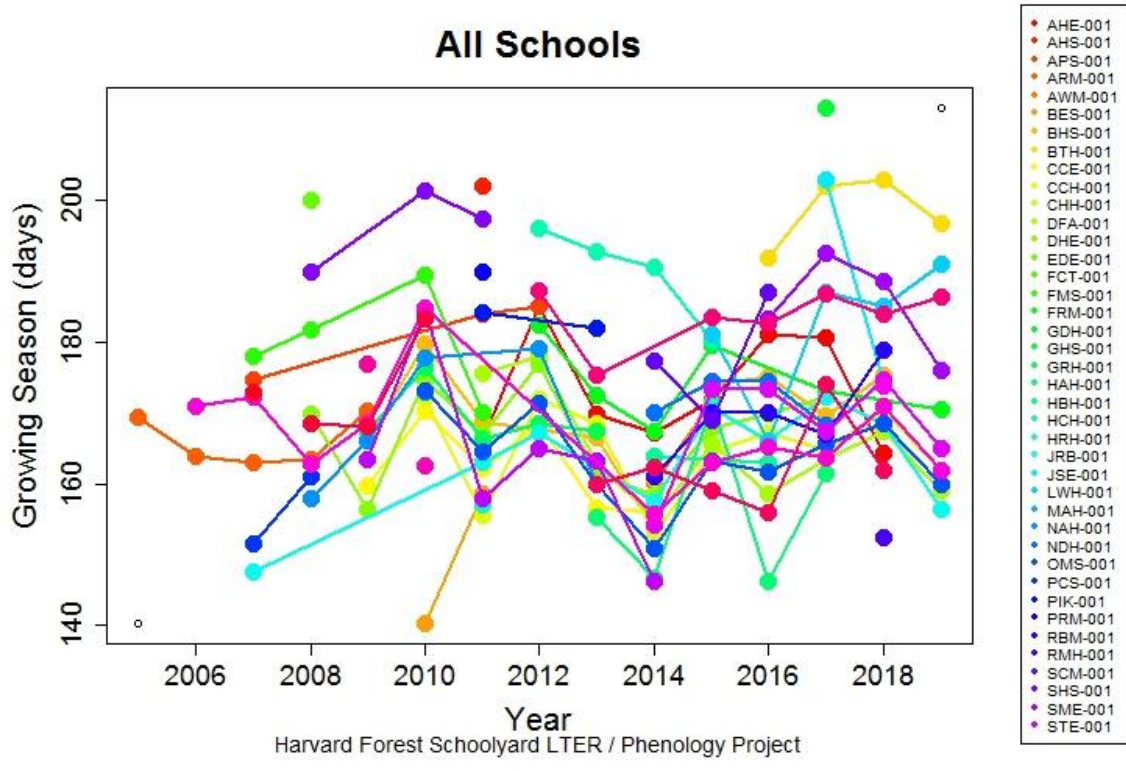
- How is the story this graph is telling similar to the first 2 graphs?
- What is different about this graph from the last one?



5. Instead of looking at leaf drop only, this graph is showing the length of the growing season for one tree. Which year had the longest growing season? Which year had the shortest growing season?
  
6. Can you answer the study question of whether the growing season is getting longer at this site, based on this graph? Why or why not?



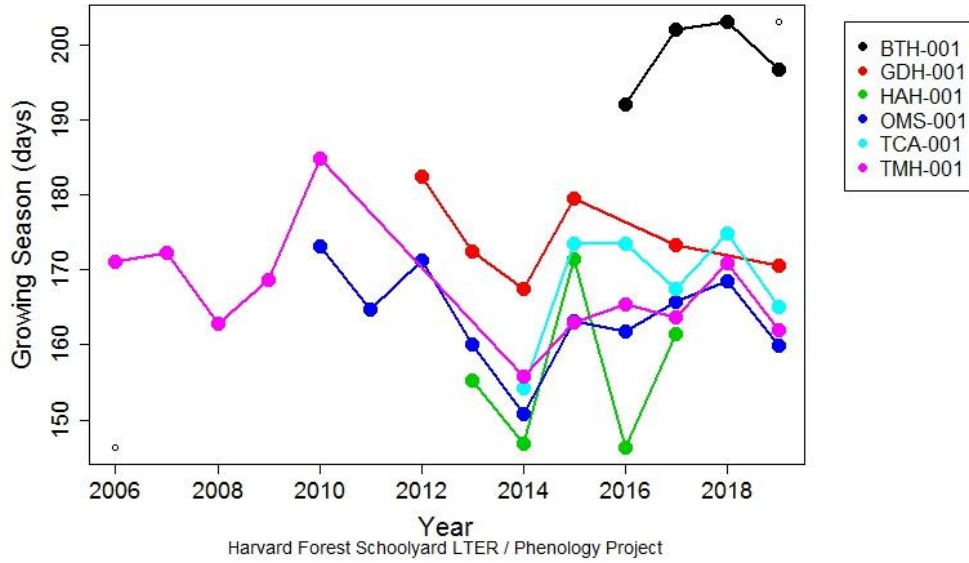
7. The graphing tool also allows one to graph the 50% leaf fall (or budburst) date. Why is this useful? How does this compare to the previous graph?



8. In looking at this graph, showing the growing season for every site in the Phenology study from 2005-2019, do you see any short or long-term patterns?

9. Does anything stand out for you in looking at this graph? If so, please describe specifically.

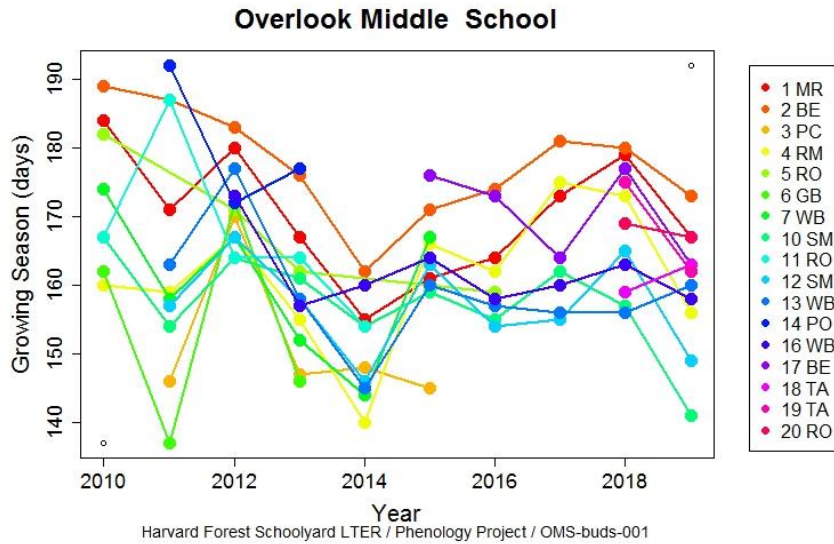
### All Schools



School Code	School Name	Location
BTH	Brooklyn Technical HS	Brooklyn, New York
GDH	Groton-Dunstable HS	North Central Mass.
HAH	Hanover HS	New Hampshire
OMS	Overlook Middle School	North Central Mass. (high elevation)
TCA	Trinity Catholic Academy	Central Mass.
TMH	Tewksbury Memorial HS	Northeastern Mass.

In choosing particular sites that have 3 or more years of data and including some of the southern-most and northern-most sites in our network, we are hoping you can tell a clearer story.

10. What do you notice about the length of the growing season in the northern most site in New Hampshire compared with the southern most site in New York?
11. In which year do you see the most variance in the length of the growing season? What ideas do you have for what might have happened that year?



Instead of comparing across sites, here we are looking at how the growing season varied across specific trees at the same site.

12. What patterns do you notice in the length of the growing season for most trees at this site?
  
13. What questions does this graph raise for you that might inspire you to look back at the data or choose one or more trees to graph individually to better understand?

**Once you have created graphs like each of these above using your own site's data or the same cross-site data, depending on the graph and the data available, you may choose one of the following options:**

- Complete the online graphing exercises for one or more other projects.
- Begin the Level 2 Graphing Exercises by Dr. Betsy Colburn.
- Play with the online graphing tool to create more varieties of graphs based on your own scientific questions.
- Develop a lesson plan for your students using the online graphing tool to meet your educational goals.