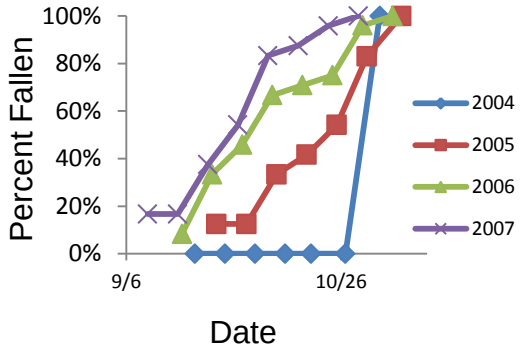
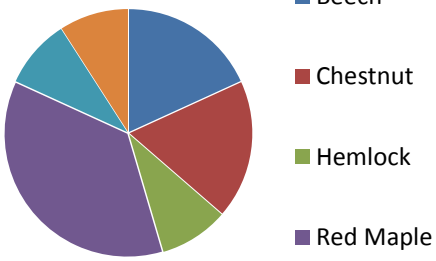
Show Me a Picture, Tell Me A Story

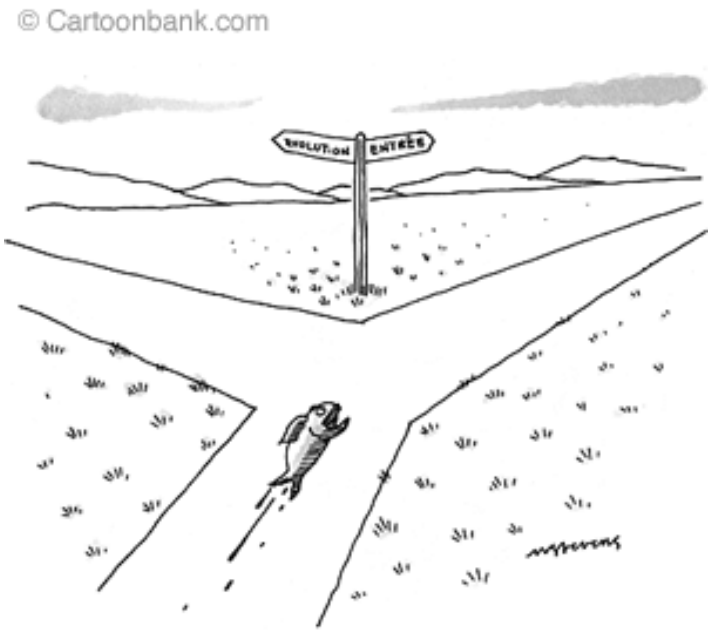
Harvard Forest Schoolyard Ecology Program:

Level II & III Data Analysis Workshop

Date	Sampled	Fallen
9/22/2004	10	0
9/29/2004	10	0
10/6/2004	10	0
10/13/2004	10	0
10/19/2004	10	0
10/27/2004	10	0
11/4/2004	5	5
9/28/2005	24	3
10/5/2005	24	3
10/12/2005	24	8
10/19/2005	24	10
10/26/2005	24	13
11/2/2005	24	20
11/10/2005	24	24
9/20/2006	24	2
9/27/2006	18	6
10/4/2006	24	11
10/11/2006	24	16
10/18/2006	24	17
10/25/2006	24	18
11/1/2006	24	23
11/8/2006	12	12
9/12/2007	24	4
9/19/2007	24	4
9/26/2007	24	9
10/3/2007	24	13
10/10/2007	24	20
10/17/2007	24	21
10/24/2007	24	23
10/31/2007	6	6







Thursday, December 3, 2015

Harvard Forest, Petersham, MA

Morning Presentation

- Schoolyard Data
- Preparing data for analysis
- Data analysis
- Graphing considerations
- Kinds of graphs – examples from HF research and Schoolyard Ecology data

Level 2 teachers – Creating graphs by hand or using graphics programs with structured exercises

Level 3 teachers – Organizing your students' data and creating and interpreting graphs of the data, or otherwise working with data to meet your individual goals for today

After Lunch

- Additional practice graphing schoolyard data
- Further opportunity to practice making calculations and graphing the modified data
- Sharing graphs, ideas, questions

Evaluation and feedback

Schoolyard Science phenology data set in comma-delimited text (.csv) format, as on the Harvard Forest Schoolyard Science website, and in a spreadsheet.

.csv

```
School,Teacher,Date,Julian,TreeID,Species,Ltotal,Lfallen,Tcolor
ARM,Miller,2004-09-06,250,2,CH,5,0,NA
ARM,Miller,2004-09-22,266,1,YB,10,0,NA
ARM,Miller,2004-09-22,266,2,CH,10,0,NA
ARM,Miller,2004-09-22,266,3,RM,5,0,NA
ARM,Miller,2004-09-22,266,4,RM,5,0,NA
ARM,Miller,2004-09-22,266,5,CH,10,0,NA
ARM,Miller,2004-09-22,266,6,WH,10,0,NA
ARM,Miller,2004-09-22,266,7,RM,5,0,NA
ARM,Miller,2004-09-29,273,1,YB,10,0,NA
ARM,Miller,2004-09-29,273,2,CH,5,0,NA
ARM,Miller,2004-09-29,273,3,RM,5,0,NA
ARM,Miller,2004-09-29,273,4,RM,5,0,NA
ARM,Miller,2004-09-29,273,5,CH,10,0,NA
ARM,Miller,2004-09-29,273,6,WH,10,0,NA
ARM,Miller,2004-09-29,273,7,RM,5,0,NA
ARM,Miller,2004-10-06,280,1,YB,10,0,NA
ARM,Miller,2004-10-06,280,2,CH,10,0,NA
ARM,Miller,2004-10-06,280,3,RM,5,2,NA
```

spreadsheet

School	Teacher	Date	Julian	TreeID	Species	Ltotal	Lfallen	Tcolor
ARM	Miller	9/6/2004	250	2	CH	5	0	NA
ARM	Miller	9/22/2004	266	1	YB	10	0	NA
ARM	Miller	9/22/2004	266	2	CH	10	0	NA
ARM	Miller	9/22/2004	266	3	RM	5	0	NA
ARM	Miller	9/22/2004	266	4	RM	5	0	NA
ARM	Miller	9/22/2004	266	5	CH	10	0	NA
ARM	Miller	9/22/2004	266	6	WH	10	0	NA
ARM	Miller	9/22/2004	266	7	RM	5	0	NA
ARM	Miller	9/29/2004	273	1	YB	10	0	NA
ARM	Miller	9/29/2004	273	2	CH	5	0	NA
ARM	Miller	9/29/2004	273	3	RM	5	0	NA
ARM	Miller	9/29/2004	273	4	RM	5	0	NA
ARM	Miller	9/29/2004	273	5	CH	10	0	NA
ARM	Miller	9/29/2004	273	6	WH	10	0	NA
ARM	Miller	9/29/2004	273	7	RM	5	0	NA
ARM	Miller	10/6/2004	280	1	YB	10	0	NA
ARM	Miller	10/6/2004	280	2	CH	10	0	NA
ARM	Miller	10/6/2004	280	3	RM	5	2	NA

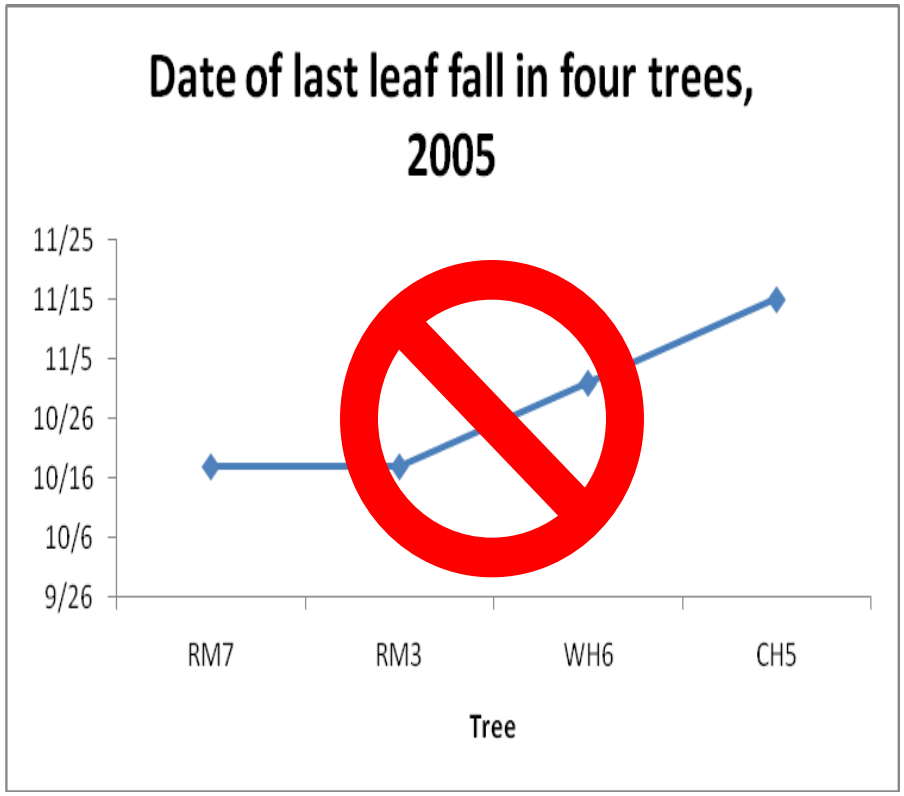
Data Analysis – Understanding Results of Sampling

- Spreadsheets and Tables
- Graphs and Figures
- Statistics

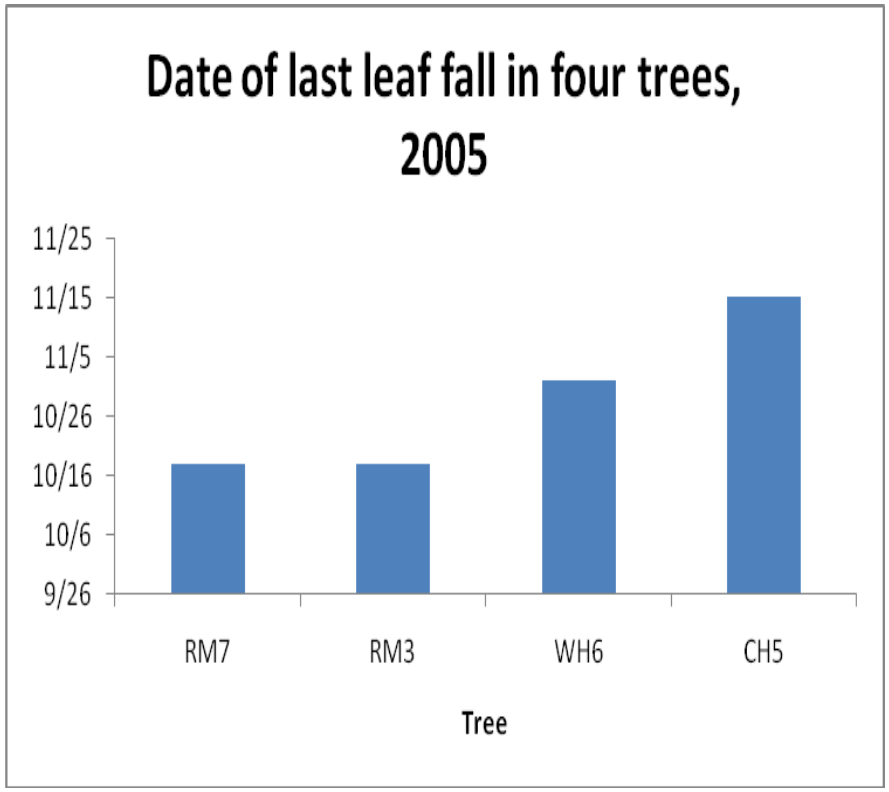
Considerations for Analyzing & Graphing Data

- What do you have for data?
- What do you want to find out? (What are the questions you are asking of your data?)
- What kind of graphs(s) [or statistics] can help you address your questions?
- What graphs [or statistics] can help you tell your story effectively?

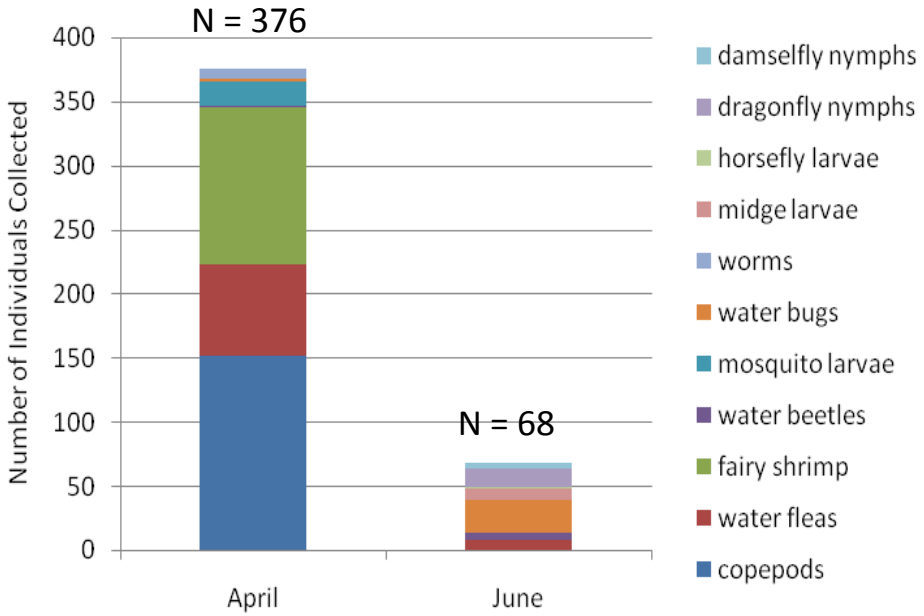
a. Line graph – not appropriate

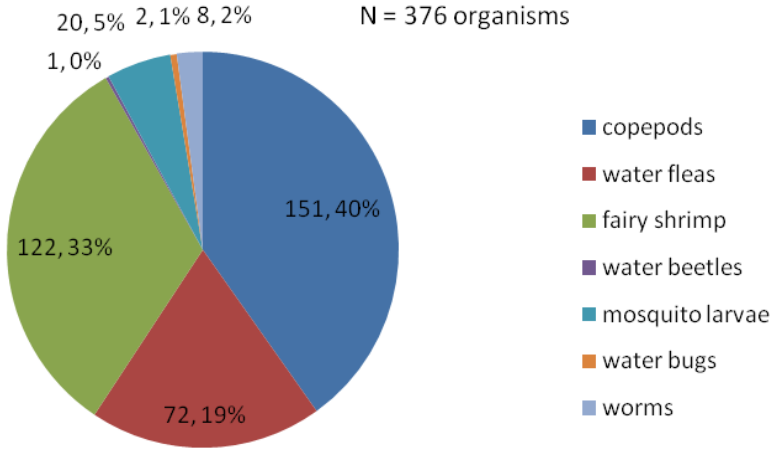


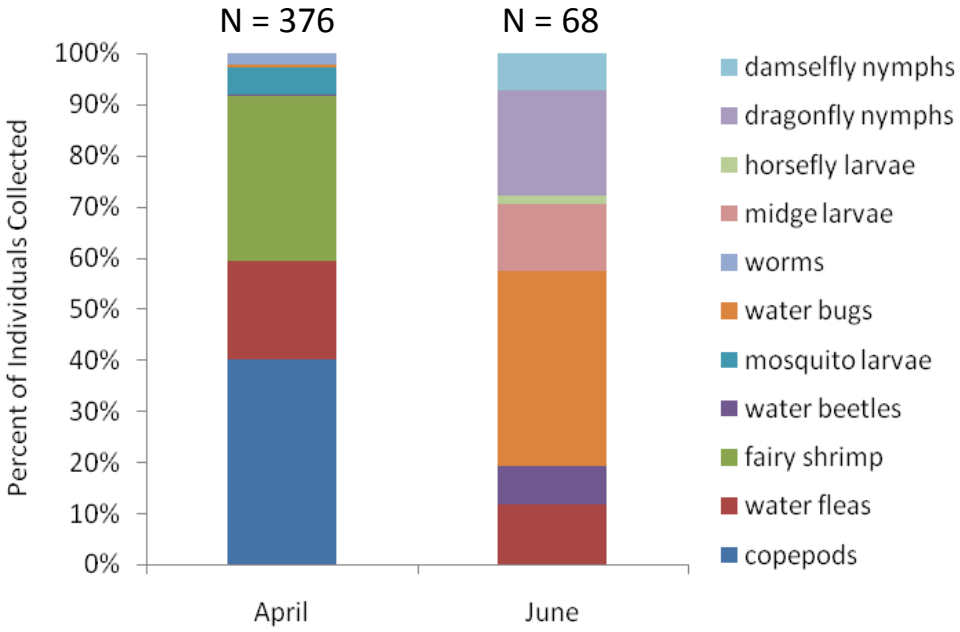
b. Bar graph – appropriate

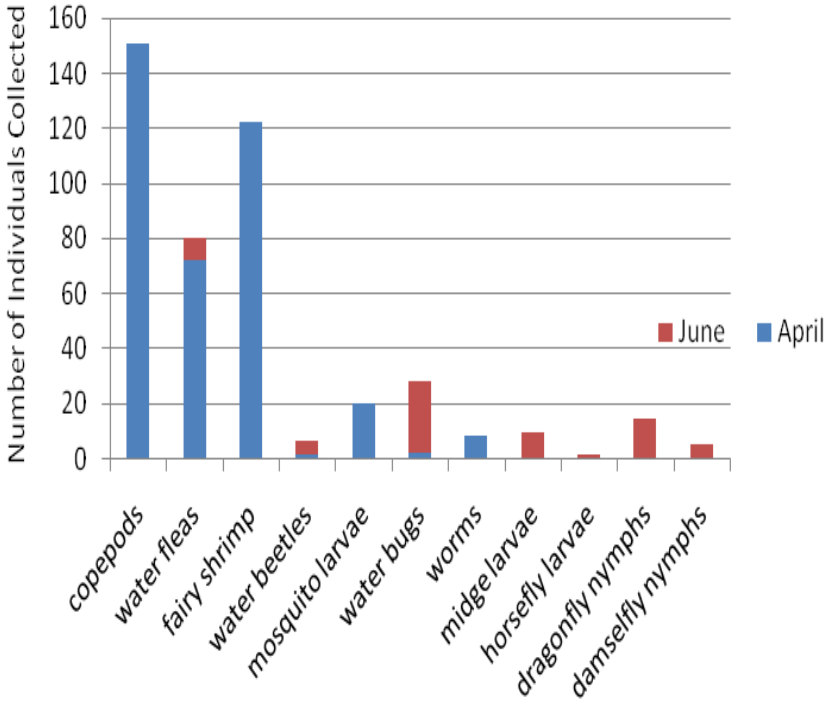


Macroinvertebrate communities in a Cape Cod Vernal Pool, April and June, 1996. Data from EA Colburn



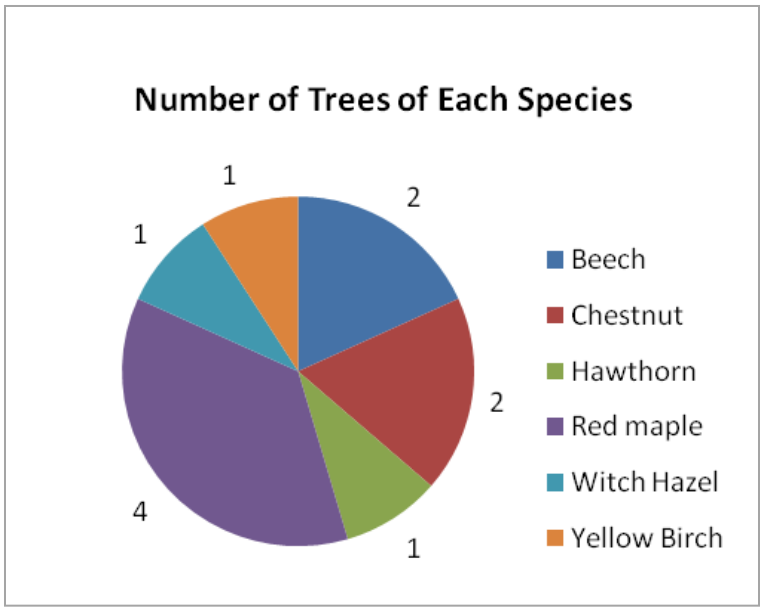




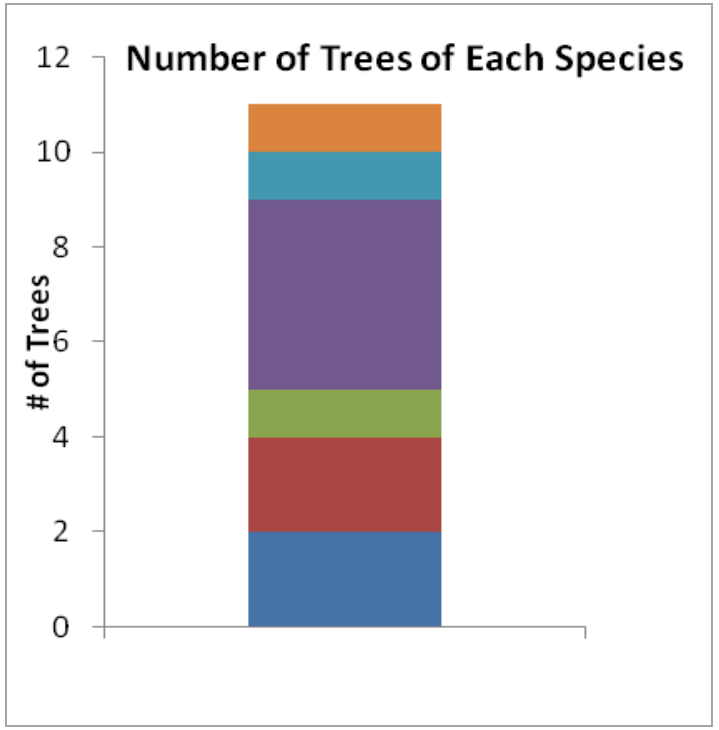


Tree species sampled in a schoolyard phenology study. ARM Schoolyard data. a. Pie graph. b. Stacked bar graph. (Species codes as in a.) c. Bar graph.

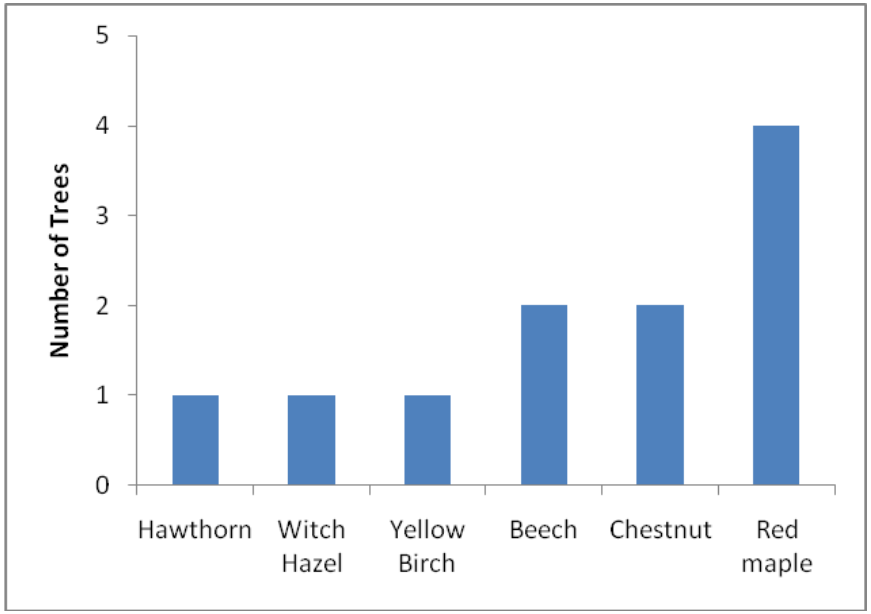
a .



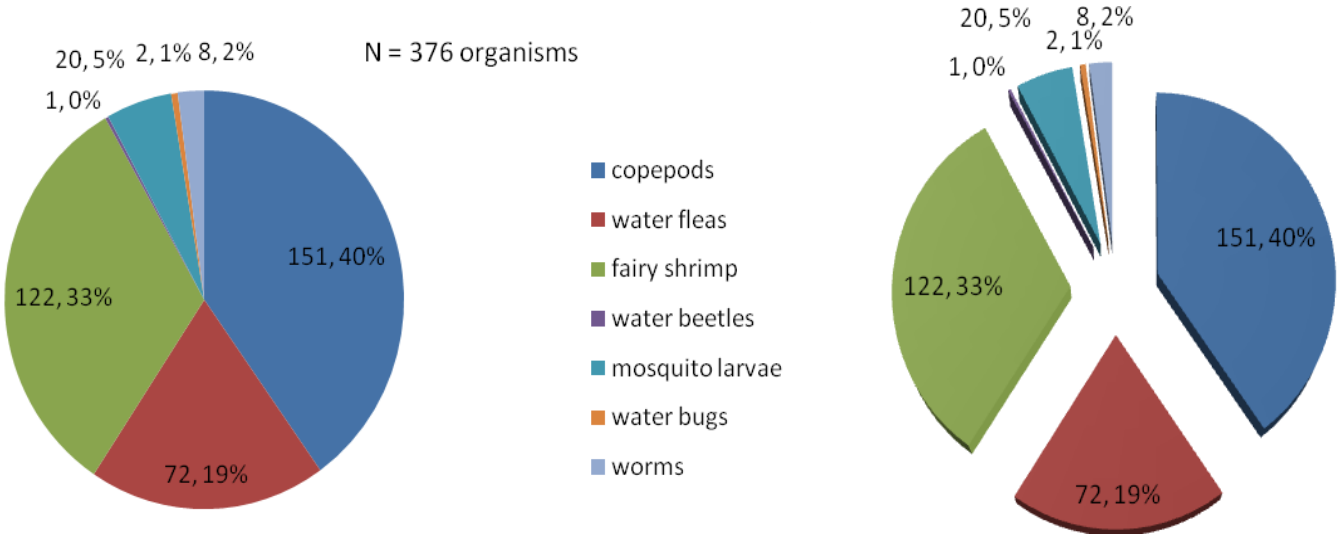
b.



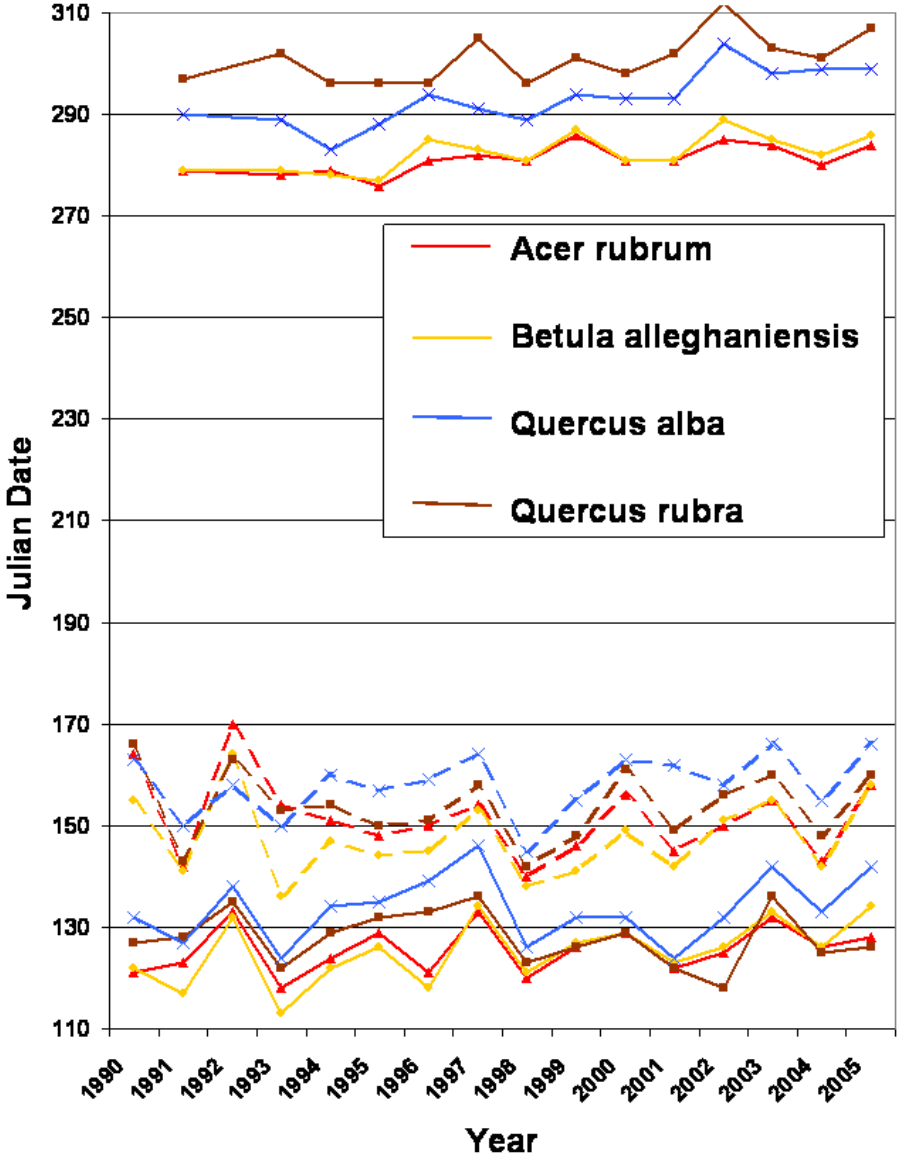
c.



Aquatic Macroinvertebrates in a Cape Cod Vernal Pool in April, 1996. Data from EA Colburn



Spring leaf emergence and autumn leaf fall in four tree species at the Harvard Forest. Data from J O'Keefe



Fall:

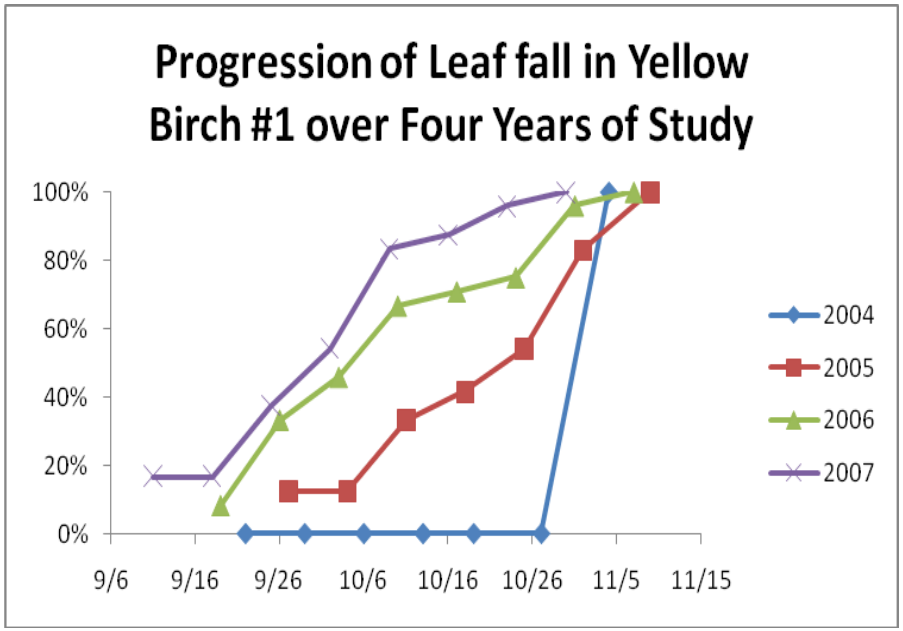
——— Date of 50% leaf drop

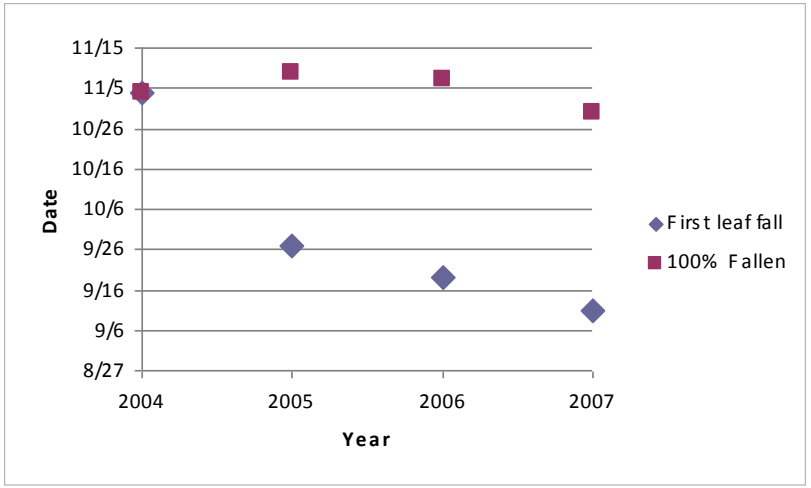
Spring:

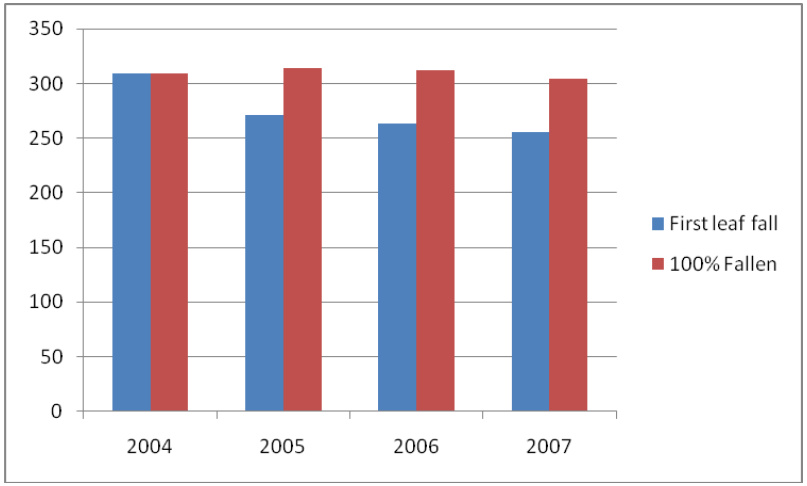
- - - - Date of 75% leaf development

——— Date of 50% bud break

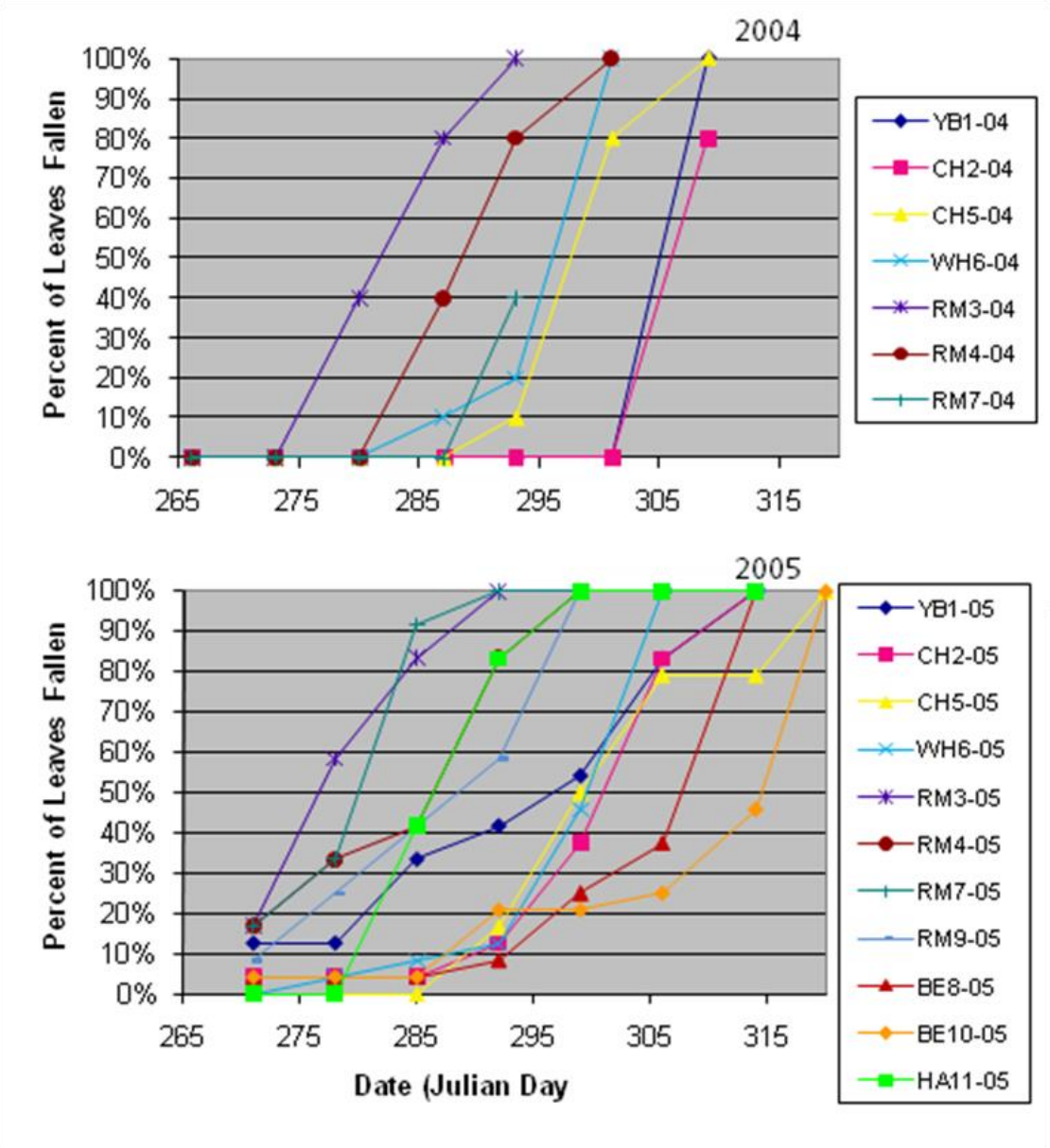
Leaf fall in one tree over four years of sampling. ARM Schoolyard data.



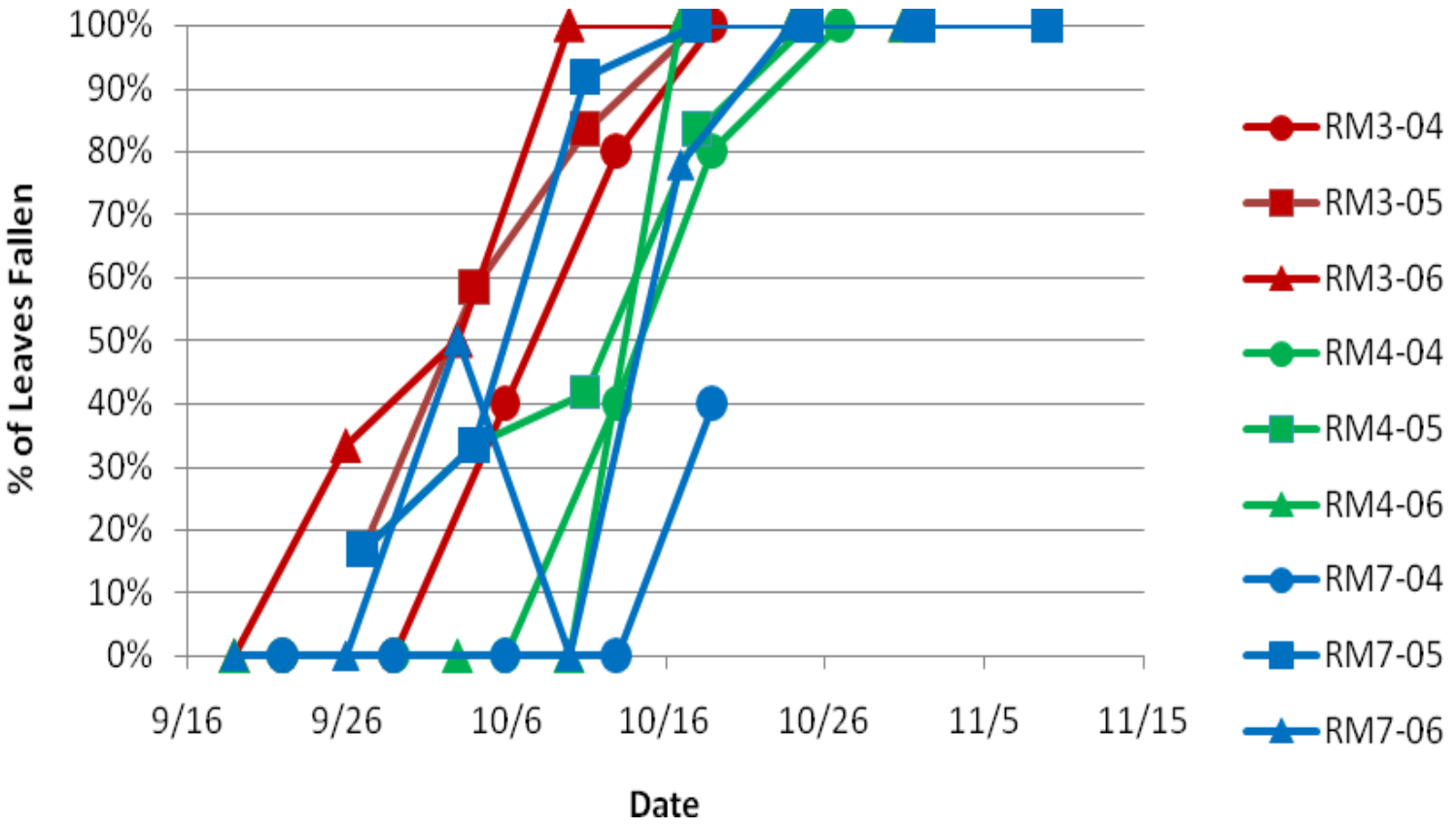




Leaf fall in Multiple Trees. ARM Schoolyard data.



Leaf fall in Multiple Trees. ARM Schoolyard Data.



Before Data Analysis:

Look at data

Evaluate for:

- errors
- missing information
- corrections that are necessary

Adjust accordingly

Extract additional information – e.g., length of growing season, percent of leaves fallen, etc.

Calculating Growing Season Length From Schoolyard Data

Growing Season Calculation:

1. Determine 50% bud burst and 50% leaf-fall dates for each tree, or Alternatively, you could calculate the average for each species, or average for all trees at a site, depending on your analysis goals.
2. Subtract budburst date from leaf-fall date; this gives the number of days in the growing season for the selected tree(s)
3. This approach could also be used to estimate average duration of flooding in some vernal pools, if data are available on both the increase in water depth in spring, and the decline in water levels as the hydrologic year progresses

Calculating Julian Date from Standard Date: use the Excel formula below

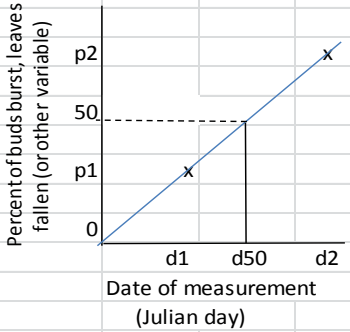
Date	Julian
4/8/1992	99
5/7/1999	127
6/4/1998	155
2/2/2002	33
5/5/1988	126
DATE	#VALUE!
DATE	#VALUE!
DATE	#VALUE!

Julian Date:
=K6-DATE(YEAR(K6),1,0)

NOTE: "K6" refers to the cell with the standard date

REPLACE "DATE" IN COLUMN A WITH AN ACTUAL DATE, AND THE JULIAN DAY WILL BE CALCULATED IN COLUMN B

Estimating date of 50% leaf fall, bud burst, pool filling or drying, or other event



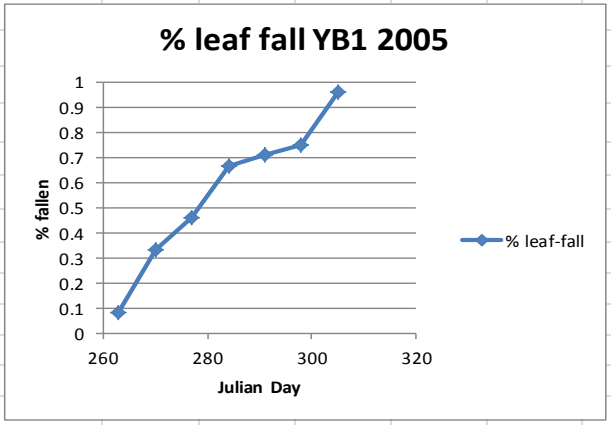
Use data measuring change in factor of interest -- water depth, growth, leaf fall, etc.
Look at the data, and choose two points bracketing the 50% level -- the formula below finds the 50% point between them
d1 and d2 are the julian days when measurements were made before and after the 50% level was reached
p1 and p2 are the percent of leaf-fall estimated for measurement dates d1 and d2, respectively
Plug the values for d1, d2, p1, and p2 into the following formula:

50% Leaf-fall or bud-burst Julian Date:
d1+[(d2-d1)(50-p1)/(p2-p1)]

NOTE: For measurements of water depth, growth, etc., plug in the comparable Julian days

EXAMPLE:

Spring	d1 = 95	d2 = 122	50% bud burst = 95 + ((122-95)(50-47)/(62-47)) = 100.4
	p1 = 47	p2 = 62	
Fall	d1 = 277	d2 = 284	50% leaf fall = 277 + ((284-277)(50-46)/(67-46)) = 278.3
	p1 = 46	p2 = 67	



If 50% bud-burst was at day 100 (April 10 in a non-leap year), and if 50% leaf-fall was day 278, then 278-100 = 178: the growing season was 178 days long for this particular tree or group of trees

INSERT YOUR SPRING AND FALL DATA:

	d1	p1	d2	p2	50%
Spring					#DIV/0!
Fall					#DIV/0!

Growing season length (number of days) **#DIV/0!**