Harvard Forest Schoolyard LTER

Looking at Data Workshop

Harvard Forest

9 Jan 2020

Emery R. Boose

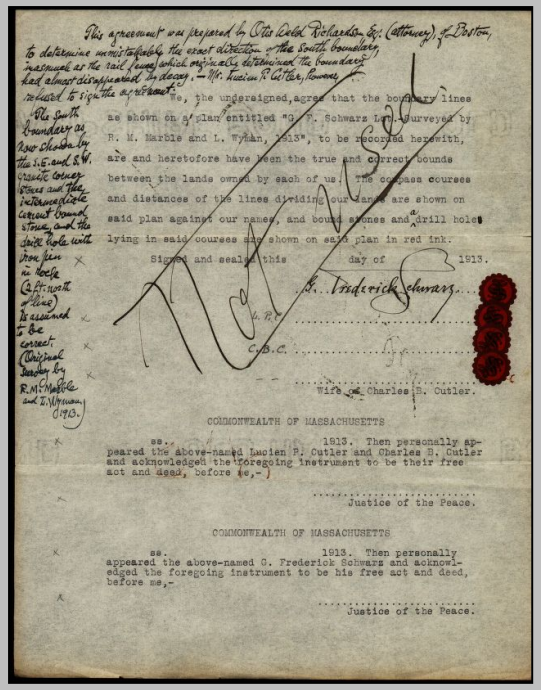
Photos contributed by program staff & teachers

Level 1 Session

- Scientific data
- Data entry
- Online graphing tool
- Graphing exercises

The New Yorker

Paper Records



This agreement was prepared by Otis Reed Richards, Esq. (attorney) of Boston, to determine more satisfactorily the exact direction of the South boundary, inasmuch as the rail fence which originally determined the boundary had almost disappeared by decay. — Mr. Lucien P. Cutler, however, refused to sign the agreement.

The South boundary as now checked by the S.E. and S.W. granite corner stones and the intermediate corner stone, and the iron pipe with iron pin in hole (Left north of line) is assumed to be correct. (Original bearings by R.M. Marble and L. Wyman, 1913.)

We, the undersigned, agree that the boundary lines as shown on a plan entitled "O. F. Schwarz Lot" Surveyed by R. M. Marble and L. Wyman, 1913", to be recorded herewith, are and heretofore have been the true and correct bounds between the lands owned by each of us. The compass courses and distances of the lines dividing our lands are shown on said plan against our names, and bound stones and drill holes lying in said courses are shown on said plan in red ink.

Signed and sealed this day of 1913.

O. Frederick Schwarz

L.P.C.

C.B.C.

Wife of Charles B. Cutler.

COMMONWEALTH OF MASSACHUSETTS

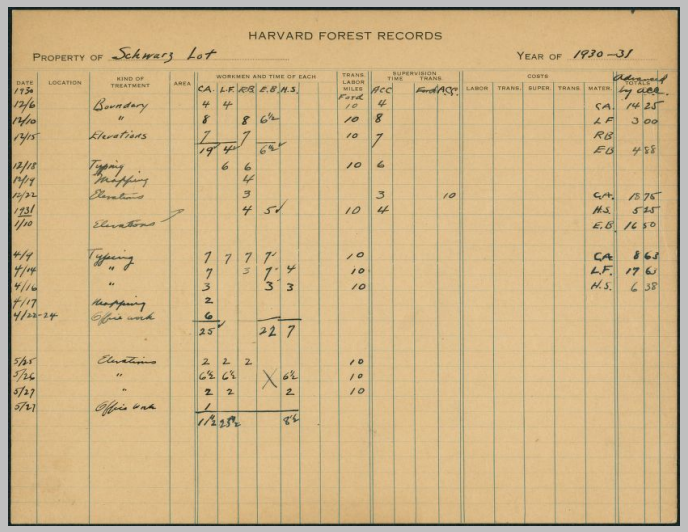
ss. 1913. Then personally appeared the above-named Lucien P. Cutler and Charles B. Cutler and acknowledged the foregoing instrument to be their free act and deed, before me,—

Justice of the Peace.

COMMONWEALTH OF MASSACHUSETTS

ss. 1913. Then personally appeared the above-named O. Frederick Schwarz and acknowledged the foregoing instrument to be his free act and deed, before me,—

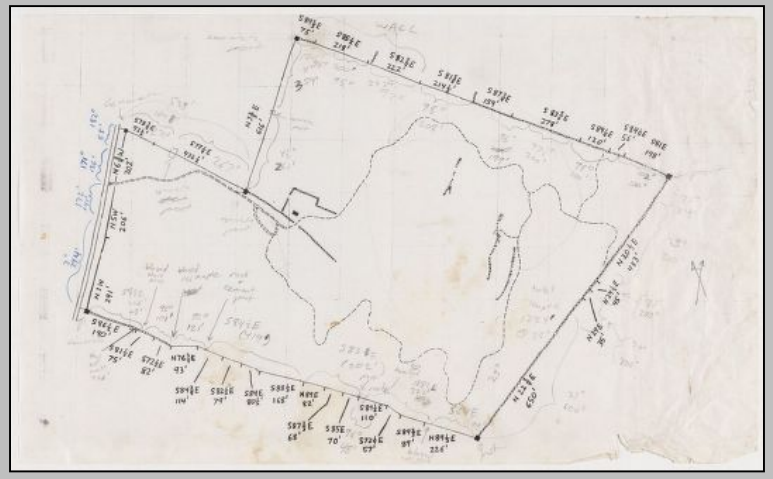
Justice of the Peace.

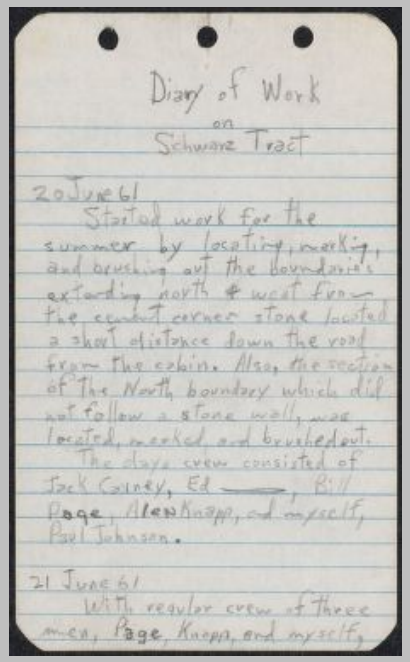


HARVARD FOREST RECORDS

PROPERTY OF Schwarz Lot YEAR OF 1930–31

DATE 1934	LOCATION	KIND OF TREATMENT	AREA	WORKMEN AND TIME OF EACH CA.	LF	RB	E.B.	M.S.	TRANS. LABOR MILES	SUPERVISION TIME	SUPERVISION TRANS.	COSTS LABOR	COSTS TRANS.	COSTS SUPER.	COSTS TRANS.	COSTS MATER.	Approved by Asst.
13/6		Boundary		4	4				Ford 10	4						CA. 14 25	
13/10		"		8		8	6½		10	8						LF 3 00	
13/15		Elevations		7		7			10	7						RB	
				19	4		6½									EB 4 58	
12/18		Tipping		6	6				10	6							
14/7		Mapping			4												
1/32		Elevations			3					3	10					CA. 12 75	
1/31					4		5½		10	4						HS. 5 25	
1/10		Elevations														EB 16 50	
4/4		Tipping		7	7	7	7		10							CA 8 68	
4/14		"		7		3	7	4	10							LF 17 61	
4/16		"		3			3	3	10							HS 6 38	
4/17		Mapping		2													
4/23-24		Office work		6													
				25			22	7									
5/25		Elevations		2	2	2			10								
5/26		"		6½	6½		X	6½	10								
5/27		"		2	2			2	10								
5/27		Office work		1													
				11½	23½			8½									





Diary of Work
on
Schwarz Tract

20 June 61
Started work for the summer by locating, marking, and brushing out the boundaries extending north & west from the comer corner stone located a short distance down the road from the cabin. Also, the section of the North boundary which did not follow a stone wall, was located, marked and brushed out. The days crew consisted of Jack Carey, Ed ——, Bill Page, Alex Knapp, and myself, Paul Johnsen.

21 June 61
With regular crew of three men, Page, Knapp, and myself,

Data Entered at Keyboard

Harvard Forest Data Archive HF003

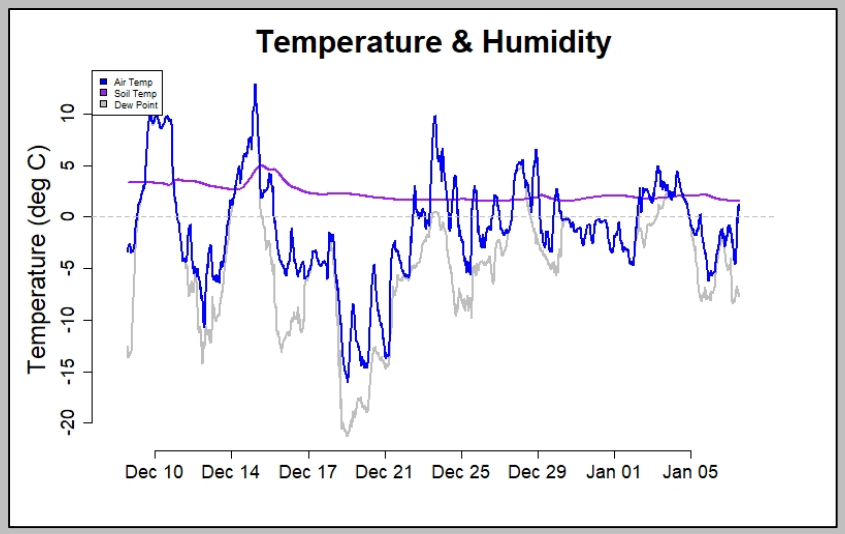
```
date,julian,tree.id,tag,circuit,fopn,fpst,lcolor,lfall,comments
2014-09-04,247,ACPE-01,PP022,12,NA,NA,2,0,NA
2014-09-04,247,ACPE-02,PP035,16,NA,NA,7,2,lots of fruit this year
2014-09-04,247,ACPE-03,PP040,19,NA,NA,3,0,NA
2014-09-04,247,ACPE-04,PP067,29,NA,NA,5,0,NA
2014-09-04,247,ACRU-01,PP008,4,NA,NA,3,0,NA
2014-09-04,247,ACRU-02,PP033,15,NA,NA,3,0,NA
2014-09-04,247,ACRU-03,PP063,28,NA,NA,0,0,NA
2014-09-04,247,ACRU-04,PP074,31,NA,NA,3,0,NA
2014-09-04,247,ACRU-05,PP106,49,NA,NA,12,1,NA
2014-09-04,247,ACSA-01,PP012,6,NA,NA,0,0,NA
```

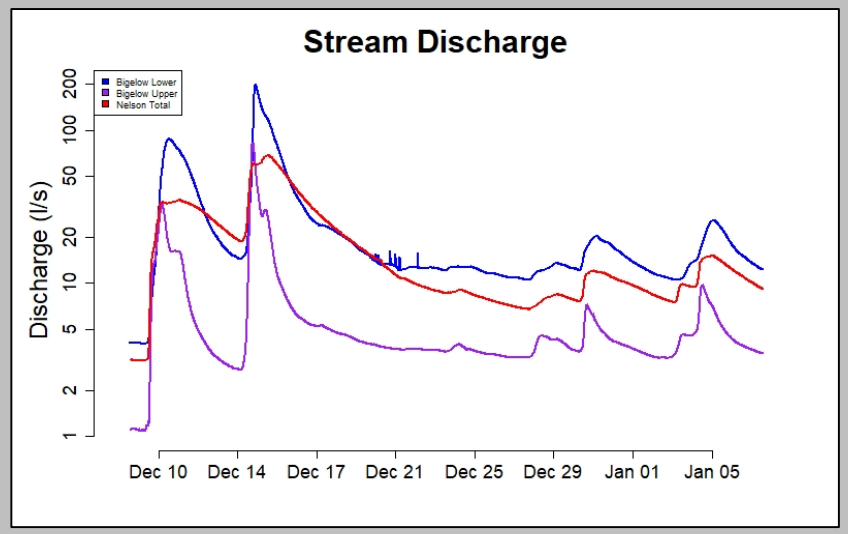
Born-Digital Data

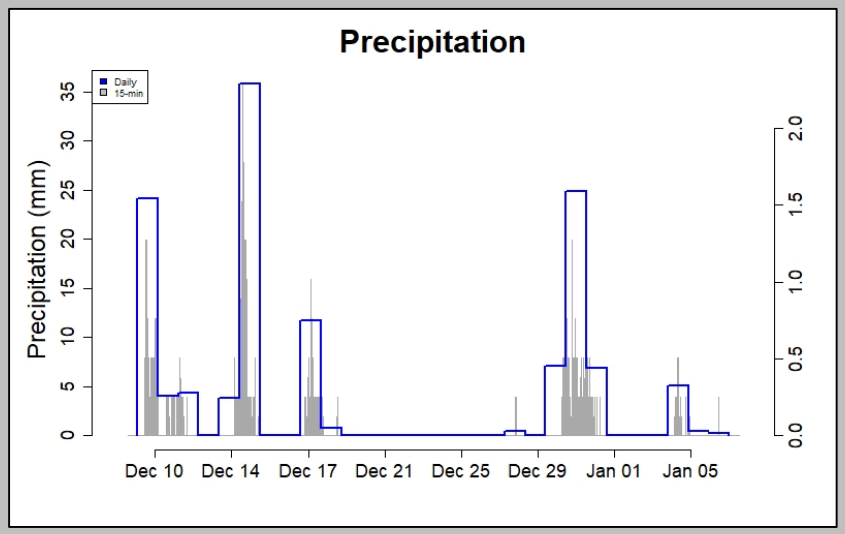
Harvard Forest Data Archive HF001

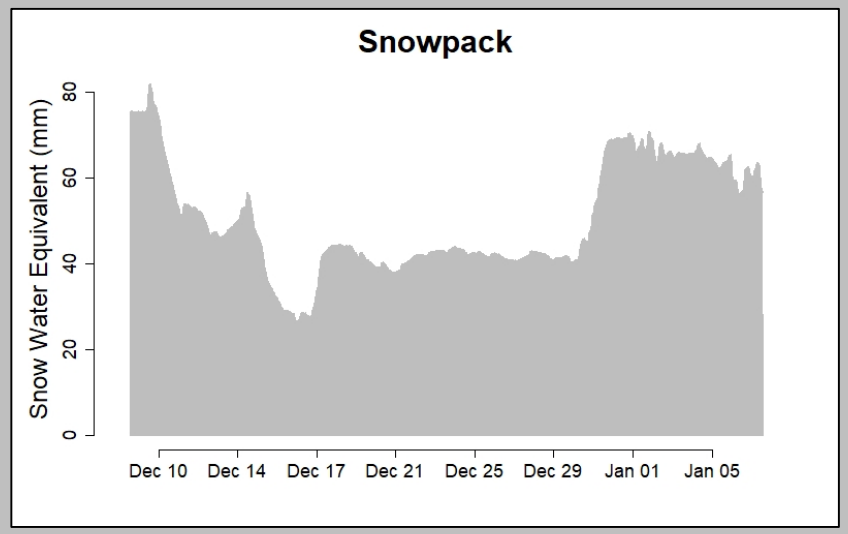
```
datetime,jd,airt,rh,dewp,prec,slrr,parr,netr,bar,wspd,wres,wdir,wdev,gspd,s10t
2015-11-01T00:15,305,6.2,77,2.5,0.0,0,0,-19,1016,1.4,1.3,214,24,4.1,10.4
2015-11-01T00:30,305,6.1,78,2.6,0.0,0,0,-14,1016,1.4,1.4,219,21,3.4,10.4
2015-11-01T00:45,305,6.2,79,2.7,0.0,0,0,-12,1016,1.4,1.3,225,28,4.8,10.4
2015-11-01T01:00,305,6.3,78,2.7,0.0,0,0,-12,1016,1.3,1.2,231,26,4.3,10.3
2015-11-01T01:15,305,6.4,78,2.9,0.0,0,0,-24,1016,1.1,1.1,238,22,3.8,10.3
2015-11-01T01:30,305,6.1,82,3.4,0.0,0,0,-24,1016,0.7,0.6,221,23,2.3,10.3
2015-11-01T01:45,305,5.9,86,3.7,0.0,0,0,-23,1016,0.9,0.9,195,24,2.7,10.3
2015-11-01T02:00,305,5.8,87,3.9,0.0,0,0,-23,1015,1.4,1.3,208,23,3.7,10.3
2015-11-01T02:15,305,5.8,89,4.1,0.0,0,0,-19,1015,1.2,1.0,207,26,3.5,10.3
```

Real-Time Data









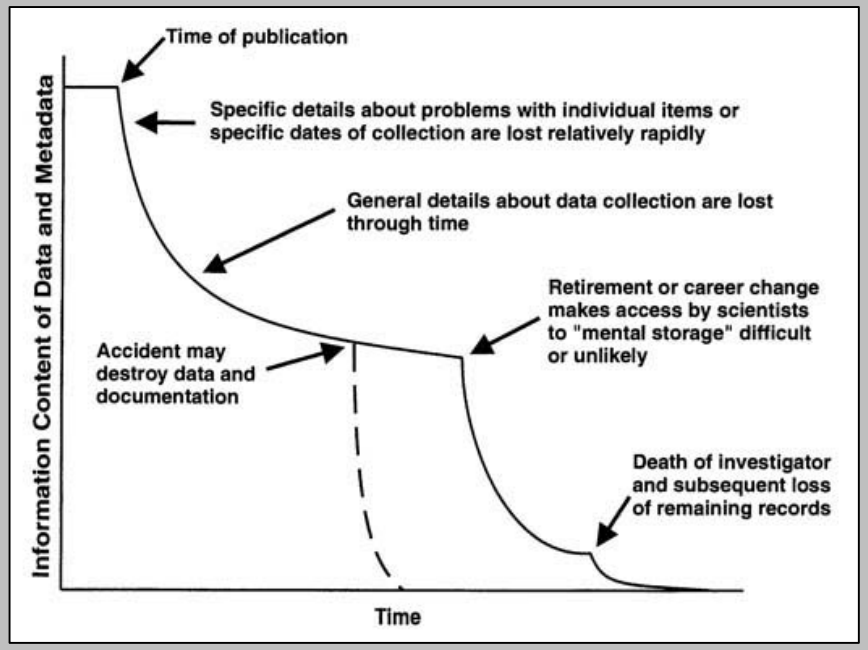
Harvard Forest Website: Real Time Data Graphs

Why Manage Data?

- Scientists build on the work of others
- Data must be accessible & understandable

The New Yorker

Data may disappear



Michener et al. 1997

Information content may disappear

Data & Metadata

Metadata provide the information needed to locate, access, and correctly interpret a dataset

METADATA

datetime = Date and time at end of sampling period (YYYY-MM-DDThh:mm)
jd = Julian day (DDD)
airt = Air temperature. Average of 1-second measurements. (celsius)
rh = Relative humidity. Average of 1-second measurements. (percent)
dewp = Dew point. Average of 1-second values calculated from air temperature and relative humidity. (celsius)
prec = Precipitation. Includes water equivalent of snow. Total value for 15-minute period. Measured in increments of 0.01 inch. (millimeter)

DATA

datetime,jd,airt,rh,dewp,prec
2005-01-01T00:15,1,5.1,84,2.5,0.0
2005-01-01T00:30,1,5.0,84,2.5,0.0
2005-01-01T00:45,1,4.9,85,2.6,0.0
2005-01-01T01:00,1,4.7,86,2.6,0.0

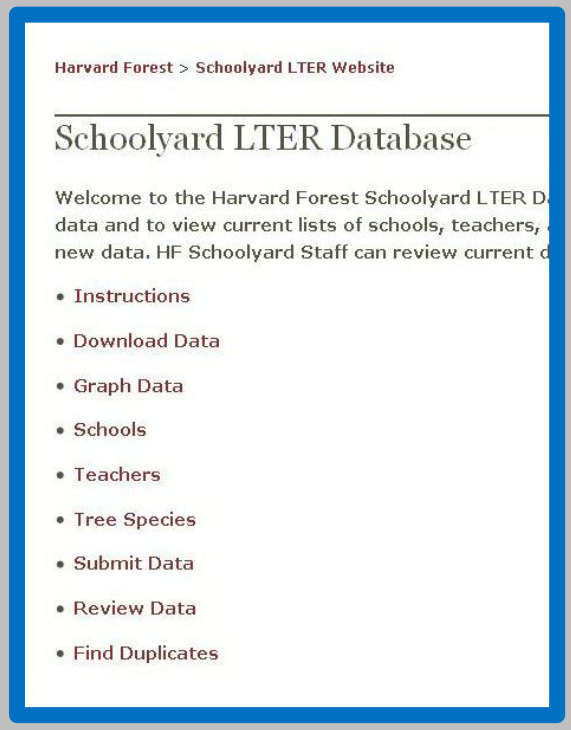
Schoolyard LTER Database

id	school_code	teacher_lastname	date	tree_id	species_code	leaves_total
1	AHE	Rosenthal	2010-09-14	1	SH	18
2	AHE	Rosenthal	2010-09-14	2	SA	12
3	AHE	Rosenthal	2010-09-14	3	RM	12
4	AHE	Rosenthal	2010-09-14	4	BC	12
5	AHE	Rosenthal	2010-09-14	5	GB	12
6	AHE	Rosenthal	2010-09-14	6	WB	18
7	AHE	Rosenthal	2010-09-14	7	WO	12
8	AHE	Rosenthal	2010-09-14	8	RO	12
9	AHE	Rosenthal	2010-09-14	9	BB	12
10	AHE	Rosenthal	2010-09-14	10	SA	18
11	AHE	Rosenthal	2010-09-14	11	WB	12
12	AHE	Rosenthal	2010-09-14	12	RM	12
13	AHE	Rosenthal	2010-09-21	1	SH	18
14	AHE	Rosenthal	2010-09-21	2	SA	12
15	AHE	Rosenthal	2010-09-21	3	RM	12
16	AHE	Rosenthal	2010-09-21	4	BC	12
17	AHE	Rosenthal	2010-09-21	5	GB	12
18	AHE	Rosenthal	2010-09-21	6	WB	18
19	AHE	Rosenthal	2010-09-21	7	WO	12
20	AHE	Rosenthal	2010-09-21	8	RO	12
21	AHE	Rosenthal	2010-09-21	9	BB	12
22	AHE	Rosenthal	2010-09-21	10	SA	18
23	AHE	Rosenthal	2010-09-21	11	WB	12
24	AHE	Rosenthal	2010-09-21	12	RM	12
25	AHE	Rosenthal	2010-09-29	1	SH	18
26	AHE	Rosenthal	2010-09-29	2	SA	12
27	AHE	Rosenthal	2010-09-29	3	RM	12
28	AHE	Rosenthal	2010-09-29	4	BC	12
29	AHE	Rosenthal	2010-09-29	5	GB	12
30	AHE	Rosenthal	2010-09-29	6	WB	18
31	AHE	Rosenthal	2010-09-29	7	WO	12
32	AHE	Rosenthal	2010-09-29	8	RO	12
33	AHE	Rosenthal	2010-09-29	9	BB	12
34	AHE	Rosenthal	2010-09-29	10	SA	18
35	AHE	Rosenthal	2010-09-29	11	WB	12
36	AHE	Rosenthal	2010-09-29	12	RM	12
37	AHE	Rosenthal	2010-10-05	1	SH	18

Programs

Data (PHP)

Graphs (R)



Back End
Database on HF Server
(MySQL)

Front End
Web page in your browser
(Firefox, etc)

Field Site Coordinates

Latitude = 42^0 31′ 55″ N
Longitude = 72^0 11′ 24″ W

1 degree = 60 minutes
1 minute = 60 seconds

Latitude = 42 + 31/60 + 55/3600
Longitude = 72 + 11/60 + 24/3600

Latitude = 42.53194 degrees
Longitude = -72.19000 degrees

Site Photo

Applewild School

Woodstock Middle School

Greater Lowell
Technical
High School

South Hadley
High School

Data Entry

RECOMMENDATIONS

- If you have more than one email address, pick one address to use as your login
- Check your data in the online form and again in Review Submissions
- Read the Instructions section

Fall Phenology / JRB-buds-001 / Bennett

Review Submissions

To add a new observation complete this form and press Submit. If a data value is missing, please leave the text box empty or select 'Missing Value' from the pull-down list.

NOTE Please enter data for each tree (not each branch). A worksheet is available to help you calculate tree values from branch values.

>>>>

Date (m/d/yyyy)	10/1/2018
Tree ID (number)	3
Species Code	SM (Sugar Maple)
Total Leaves	12
Fallen Leaves	4
Tree Color	2 (color 26-50%)
Delete This Record	◉ no ○ yes

Submit

Edit	Person ID	Site	Teacher	Date	Tree ID	Species Code	Total Leaves	Fallen Leaves	Tree Color
11298	6859	JRB-buds-001	Bennett	10/4/2018	31	RM	12	0	1
11304	6859	JRB-buds-001	Bennett	10/10/2018	31	RM	12	0	2
11321	6859	JRB-buds-001	Bennett	10/16/2018	31	RM	12	4	2
11405	6859	JRB-buds-001	Bennett	10/22/2018	31	RM	12	4	2
11430	6859	JRB-buds-001	Bennett	10/26/2018	31	RM	12	9	4
11436	6859	JRB-buds-001	Bennett	10/30/2018	31	RM	12	12	4
11295	6859	JRB-buds-001	Bennett	10/4/2018	32	BE	12	0	1
11301	6859	JRB-buds-001	Bennett	10/10/2018	32	BE	12	0	1
11314	6859	JRB-buds-001	Bennett	10/16/2018	32	BE	12	0	1
11402	6859	JRB-buds-001	Bennett	10/22/2018	32	BE	12	0	2
11427	6859	JRB-buds-001	Bennett	10/26/2018	32	BE	12	0	2
11433	6859	JRB-buds-001	Bennett	10/30/2018	32	BE	12	2	3
11297	6859	JRB-buds-001	Bennett	10/4/2018	33	WH	12	0	1
11303	6859	JRB-buds-001	Bennett	10/10/2018	33	WH	12	0	2
11319	6859	JRB-buds-001	Bennett	10/16/2018	33	WH	12	5	3
11404	6859	JRB-buds-001	Bennett	10/22/2018	33	WH	12	8	4

Missing Values

source: sendaiben.org

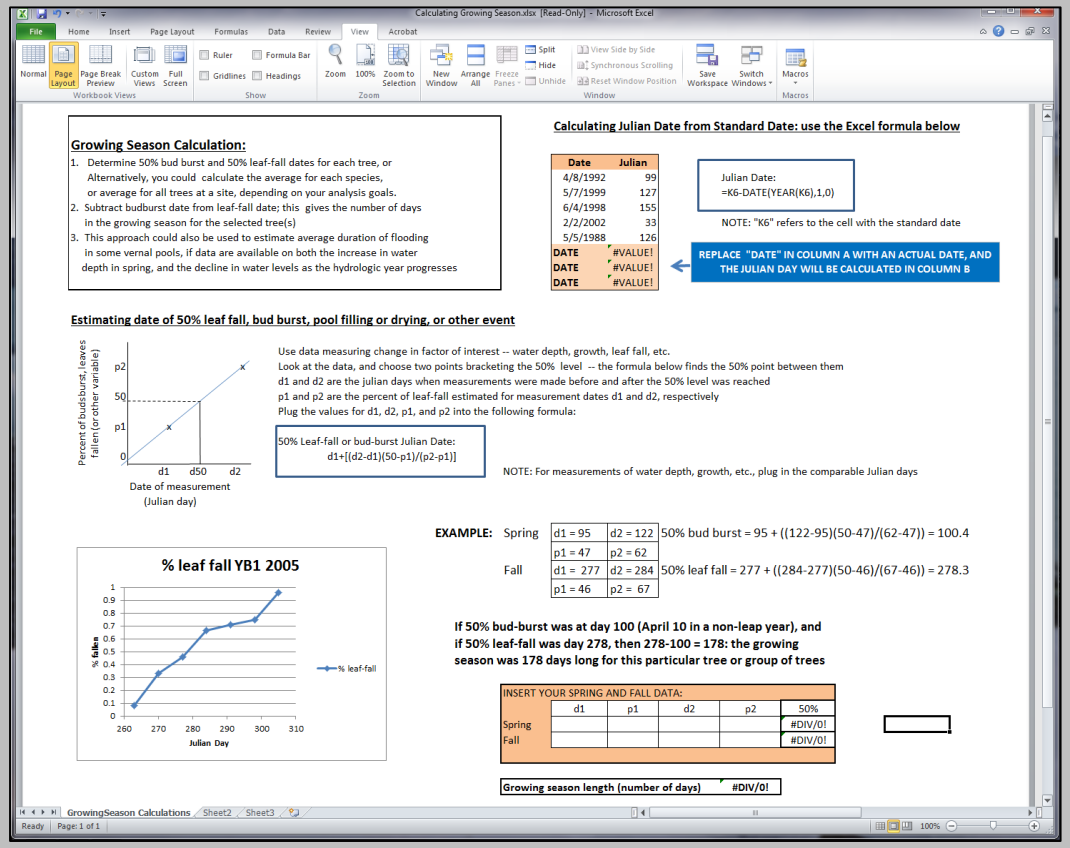
PROBLEMS

- Different software packages handle missing values differently
- Never use zero! Zero could be a measured value (0 degrees or 0 leaves fallen) or a code (0 = dead)

SCHOOLYARD DATABASE

- When entering data, leave text box empty or select “Missing Data” from pull-down list
- When data are downloaded, missing values are represented by NA

Calculating Growing Season



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

Percent of budsburst, leaves fallen (or other variable)
p2
50
p1
0
d1 d50 d2
Date of measurement (Julian day)

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

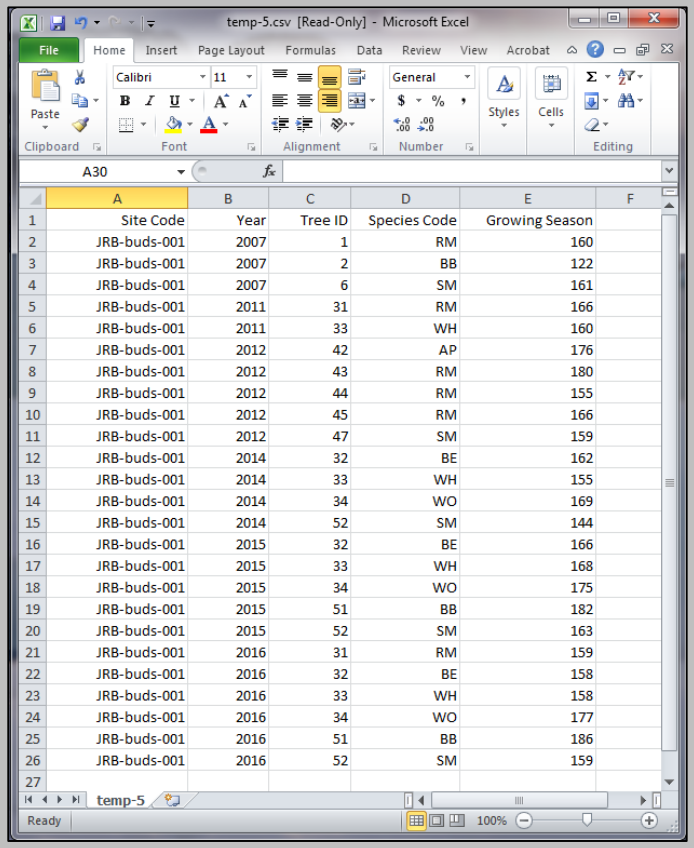
EXAMPLE:

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!



	A	B	C	D	E	F
1	Site Code	Year	Tree ID	Species Code	Growing Season	
2	JRB-buds-001	2007	1	RM	160	
3	JRB-buds-001	2007	2	BB	122	
4	JRB-buds-001	2007	6	SM	161	
5	JRB-buds-001	2011	31	RM	166	
6	JRB-buds-001	2011	33	WH	160	
7	JRB-buds-001	2012	42	AP	176	
8	JRB-buds-001	2012	43	RM	180	
9	JRB-buds-001	2012	44	RM	155	
10	JRB-buds-001	2012	45	RM	166	
11	JRB-buds-001	2012	47	SM	159	
12	JRB-buds-001	2014	32	BE	162	
13	JRB-buds-001	2014	33	WH	155	
14	JRB-buds-001	2014	34	WO	169	
15	JRB-buds-001	2014	52	SM	144	
16	JRB-buds-001	2015	32	BE	166	
17	JRB-buds-001	2015	33	WH	168	
18	JRB-buds-001	2015	34	WO	175	
19	JRB-buds-001	2015	51	BB	182	
20	JRB-buds-001	2015	52	SM	163	
21	JRB-buds-001	2016	31	RM	159	
22	JRB-buds-001	2016	32	BE	158	
23	JRB-buds-001	2016	33	WH	158	
24	JRB-buds-001	2016	34	WO	177	
25	JRB-buds-001	2016	51	BB	186	
26	JRB-buds-001	2016	52	SM	159	

Teacher Resources / Data Analysis

Colburn, E. 2014. Calculating Growing Season Active Worksheet

Schoolyard LTER Database / Download Data

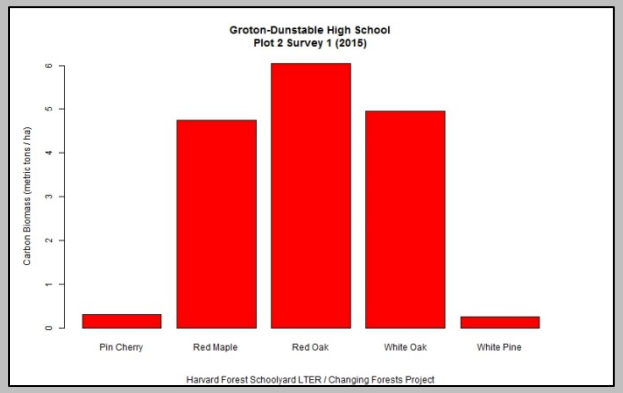
Length of growing season by tree

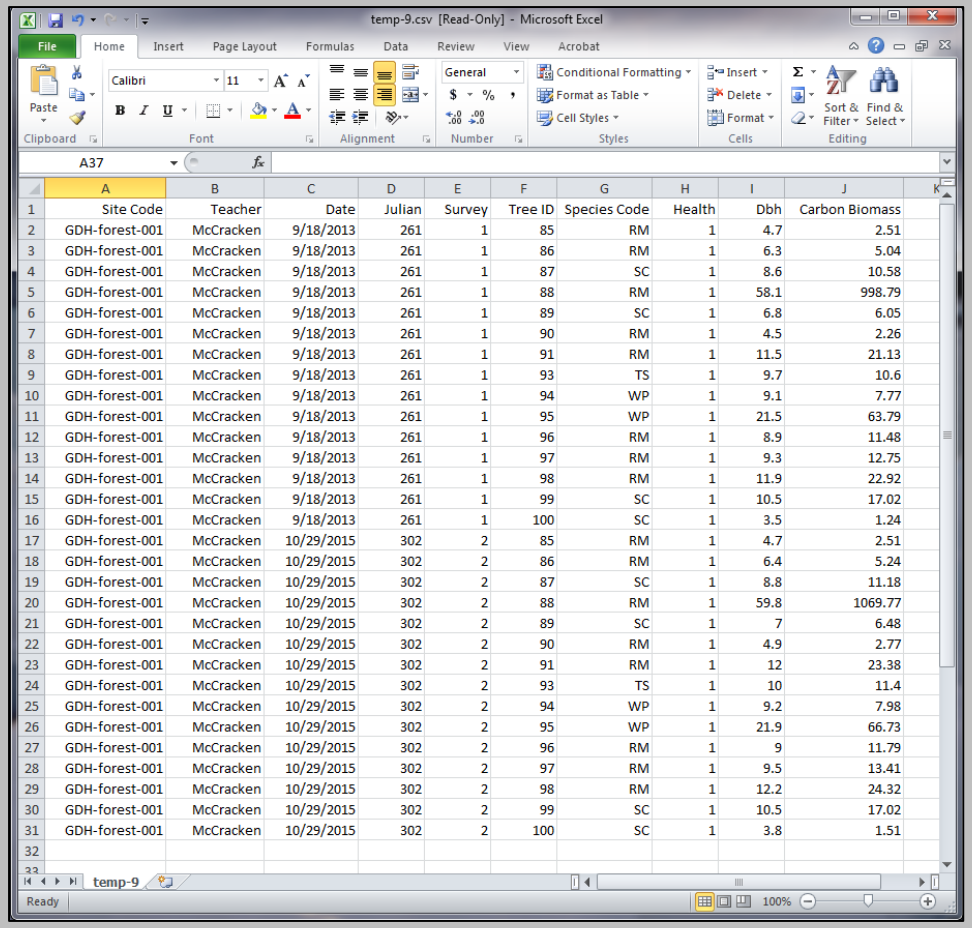
Calculating Carbon Biomass

Schoolyard LTER Database
Tree Biomass Equations
13-Nov-2013

Units: biomass = kilograms, dbh = centimeters
Biomass (metric tons) = biomass (kilograms)/1000
Carbon biomass = 0.5 * biomass
Default = red maple if biomass equation not available

Acer pensylvanicum (ST)	biomass = (exp(7.227+1.6478*log(dbh/2.54)))/1000
Acer rubrum (RM)	biomass = 0.1262*(dbh^2.3804)
Acer saccharum (SM)	biomass = 0.1008*(dbh^2.5735)
Betula alleghaniensis (YB)	biomass = 0.1684*(dbh^2.4150)
Betula lenta (BB)	biomass = 0.0629*(dbh^2.6606)
Betula papyrifera (WB)	biomass = 0.0612*(dbh^1.6287)
Betula populifolia (GB)	biomass = 0.1564*(dbh^2.3146)
Betula spp. (RB)	biomass = 0.0629*(dbh^2.6606)
Castanea dentate (CH)	biomass = 2.204*(exp(0.95595+2.4264*log(dbh/2.54)))
Fagus grandifolia (BE)	biomass = 0.1967*(dbh^2.3916)
Fraxinus Americana (WA)	biomass = (exp(7.1148+1.3707*log(dbh/2.54)))/1000
Nyssa sylvatica (BG)	biomass = (10^(1.1468+1.4806*log10(dbh^2)))/1000
Pinus resinosa (RP)	biomass = 0.1003*(dbh^2.3865)
Picea rubens (RS)	biomass = (10^(2.1735+2.1936*log10(dbh)))/1000
Picea spp. (BS, NS, WS)	biomass = (10^(2.1735+2.1936*log10(dbh)))/1000
Pinus strobus (WP)	biomass = 0.0696*(dbh^2.4490)
Populus grandidentata (LA)	biomass = 0.0785*(dbh^2.4981)
Populus tremuloides (TA)	biomass = 0.0637*(dbh^2.6087)
Populus spp. (CW)	biomass = 0.0785*(dbh^2.4981)
Prunus pensylvanica (PC)	biomass = 0.1556*(dbh^2.1948)
Prumus serotina (BC)	biomass = 0.0716*(dbh^2.6174)
Quercus alba (WO)	biomass = 0.0579*(dbh^2.6887)
Quercus rubrum (RO)	biomass = 0.1130*(dbh^2.4572)
Tsuga Canadensis (TS)	biomass = 0.0991*(dbh^2.3617)





	A	B	C	D	E	F	G	H	I	J
1	Site Code	Teacher	Date	Julian	Survey	Tree ID	Species Code	Health	Dbh	Carbon Biomass
2	GDH-forest-001	McCracken	9/18/2013	261	1	85	RM	1	4.7	2.51
3	GDH-forest-001	McCracken	9/18/2013	261	1	86	RM	1	6.3	5.04
4	GDH-forest-001	McCracken	9/18/2013	261	1	87	SC	1	8.6	10.58
5	GDH-forest-001	McCracken	9/18/2013	261	1	88	RM	1	58.1	998.79
6	GDH-forest-001	McCracken	9/18/2013	261	1	89	SC	1	6.8	6.05
7	GDH-forest-001	McCracken	9/18/2013	261	1	90	RM	1	4.5	2.26
8	GDH-forest-001	McCracken	9/18/2013	261	1	91	RM	1	11.5	21.13
9	GDH-forest-001	McCracken	9/18/2013	261	1	93	TS	1	9.7	10.6
10	GDH-forest-001	McCracken	9/18/2013	261	1	94	WP	1	9.1	7.77
11	GDH-forest-001	McCracken	9/18/2013	261	1	95	WP	1	21.5	63.79
12	GDH-forest-001	McCracken	9/18/2013	261	1	96	RM	1	8.9	11.48
13	GDH-forest-001	McCracken	9/18/2013	261	1	97	RM	1	9.3	12.75
14	GDH-forest-001	McCracken	9/18/2013	261	1	98	RM	1	11.9	22.92
15	GDH-forest-001	McCracken	9/18/2013	261	1	99	SC	1	10.5	17.02
16	GDH-forest-001	McCracken	9/18/2013	261	1	100	SC	1	3.5	1.24
17	GDH-forest-001	McCracken	10/29/2015	302	2	85	RM	1	4.7	2.51
18	GDH-forest-001	McCracken	10/29/2015	302	2	86	RM	1	6.4	5.24
19	GDH-forest-001	McCracken	10/29/2015	302	2	87	SC	1	8.8	11.18
20	GDH-forest-001	McCracken	10/29/2015	302	2	88	RM	1	59.8	1069.77
21	GDH-forest-001	McCracken	10/29/2015	302	2	89	SC	1	7	6.48
22	GDH-forest-001	McCracken	10/29/2015	302	2	90	RM	1	4.9	2.77
23	GDH-forest-001	McCracken	10/29/2015	302	2	91	RM	1	12	23.38
24	GDH-forest-001	McCracken	10/29/2015	302	2	93	TS	1	10	11.4
25	GDH-forest-001	McCracken	10/29/2015	302	2	94	WP	1	9.2	7.98
26	GDH-forest-001	McCracken	10/29/2015	302	2	95	WP	1	21.9	66.73
27	GDH-forest-001	McCracken	10/29/2015	302	2	96	RM	1	9	11.79
28	GDH-forest-001	McCracken	10/29/2015	302	2	97	RM	1	9.5	13.41
29	GDH-forest-001	McCracken	10/29/2015	302	2	98	RM	1	12.2	24.32
30	GDH-forest-001	McCracken	10/29/2015	302	2	99	SC	1	10.5	17.02
31	GDH-forest-001	McCracken	10/29/2015	302	2	100	SC	1	3.8	1.51
32										

Schoolyard LTER Database / Download Data

Carbon biomass by tree

Changing Forests / Resources / Tree Biomass Equations

Summary Data by Site

temp-10.csv [Read-Only] - Micr...

A46 | DFA-buds-001

	A	B	C	D
1	Site Code	Year	Growing Season	
2	AHE-buds-001	2011	166	
3	AHE-buds-001	2012	185	
4	AHE-buds-001	2013	170	
5	AHE-buds-001	2014	167	
6	AHE-buds-001	2015	172	
7	AHE-buds-001	2016	181	
8	AHS-buds-001	2011	202	
9	APS-buds-001	2007	175	
10	APS-buds-001	2011	184	
11	APS-buds-001	2012	185	
12	ARM-buds-001	2005	170	
13	ARM-buds-001	2006	164	
14	ARM-buds-001	2007	163	
15	ARM-buds-001	2008	163	
16	ARM-buds-001	2009	170	
17	AWM-buds-001	2014	160	
18	AWM-buds-001	2015	172	
19	BES-buds-001	2010	140	
20	BES-buds-001	2011	159	
21	BHS-buds-001	2009	166	
22	BHS-buds-001	2010	180	
23	BHS-buds-001	2011	169	
24	BHS-buds-001	2013	167	
25	BHS-buds-001	2014	154	
26	BHS-buds-001	2015	174	
27	BHS-buds-001	2016	175	
28	BTH-buds-001	2016	192	
29	CCE-buds-001	2009	160	
30	CCE-buds-001	2010	170	
31	CCE-buds-001	2011	162	
32	CCE-buds-001	2012	169	
33	CCE-buds-001	2013	157	
34	CCE-buds-001	2014	156	
35	CCH-buds-001	2010	172	
36	CCH-buds-001	2011	155	
37	CCH-buds-001	2012	172	

temp-10 | Ready

Schoolyard LTER Database / Download Data

Length of growing season by site

temp-11.csv [Read-Only] - Microsoft Excel

A45 | OMH-forest-002

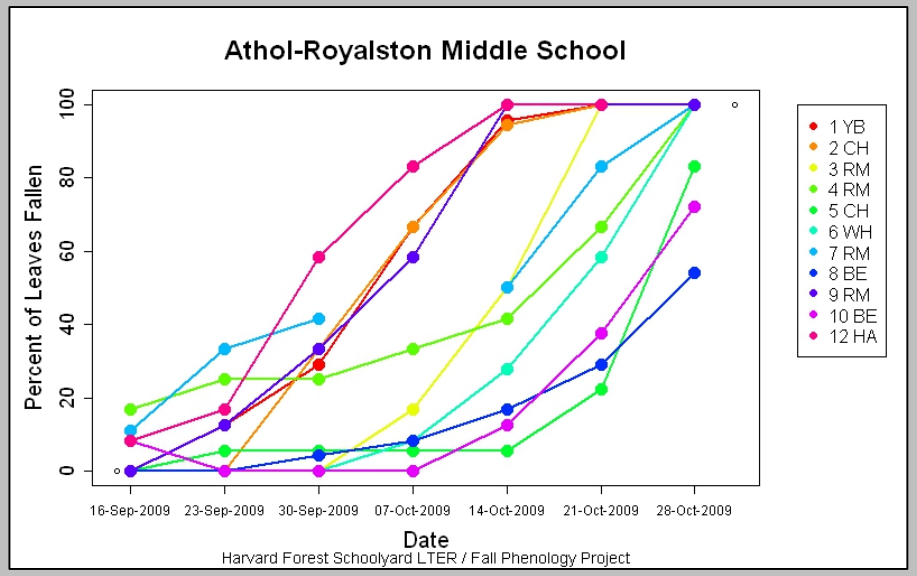
	A	B	C	D	E	F	G
1	Site Code	Survey	Year	Stand Density	Basal Area	Carbon Biomass	
2	APS-forest-001	1	2014	2600	79.18	241.64	
3	ATH-forest-001	1	2013	2400	116.62	409.75	
4	ATH-forest-002	1	2014	2000	169.32	423.33	
5	ATH-forest-003	1	2014	1300	33.82	89.75	
6	AWH-forest-001	1	2016	1000	70.59	212.23	
7	BCE-forest-001	1	2016	900	89.73	239.77	
8	BHS-forest-001	1	2015	2100	71.09	168.06	
9	BRH-forest-001	1	2013	1000	8.84	20.61	
10	DFA-forest-002	1	2014	900	31.06	74.69	
11	DFA-forest-002	2	2016	900	31.23	75.26	
12	EBM-forest-001	1	2014	2000	44.32	138.01	
13	EBM-forest-002	1	2014	4600	22.4	40.87	
14	EBM-forest-003	1	2014	1600	88.07	421.78	
15	EBM-forest-004	1	2014	600	58	150.5	
16	FPC-forest-001	1	2015	1400	89.58	402.59	
17	FPC-forest-002	1	2015	1000	34.27	120.11	
18	FPC-forest-003	1	2015	1000	64.09	238.41	
19	FPC-forest-004	1	2015	1500	64.03	212.92	
20	FPC-forest-009	1	2014	800	22.95	56.57	
21	FPC-forest-010	1	2014	1800	31.38	78.92	
22	FPC-forest-011	1	2014	1600	37.89	89.32	
23	FPC-forest-012	1	2014	1100	20.42	47.02	
24	GDH-forest-001	1	2013	1500	37.53	119.39	
25	GDH-forest-001	2	2015	1500	39.6	127.55	
26	GDH-forest-001	3	2017	1400	40.38	130.93	

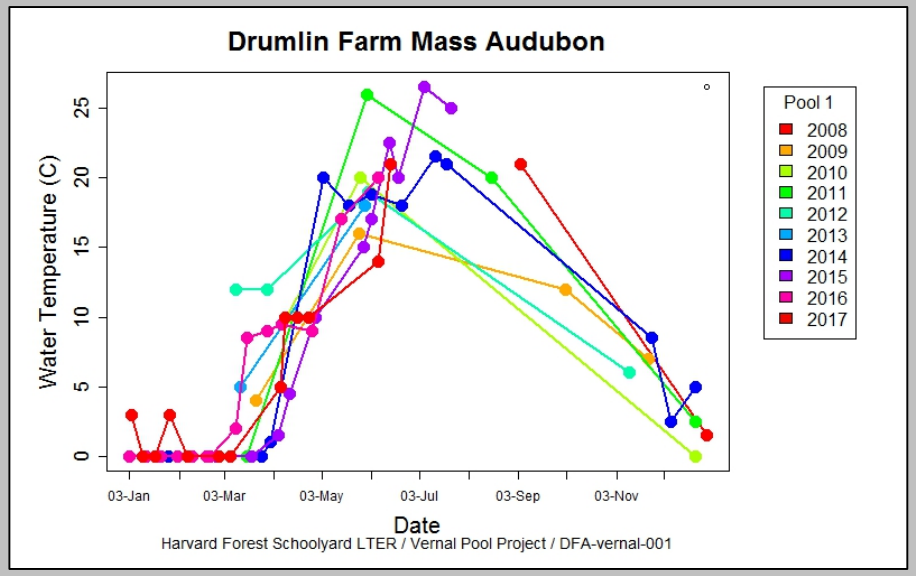
temp-11 | Ready

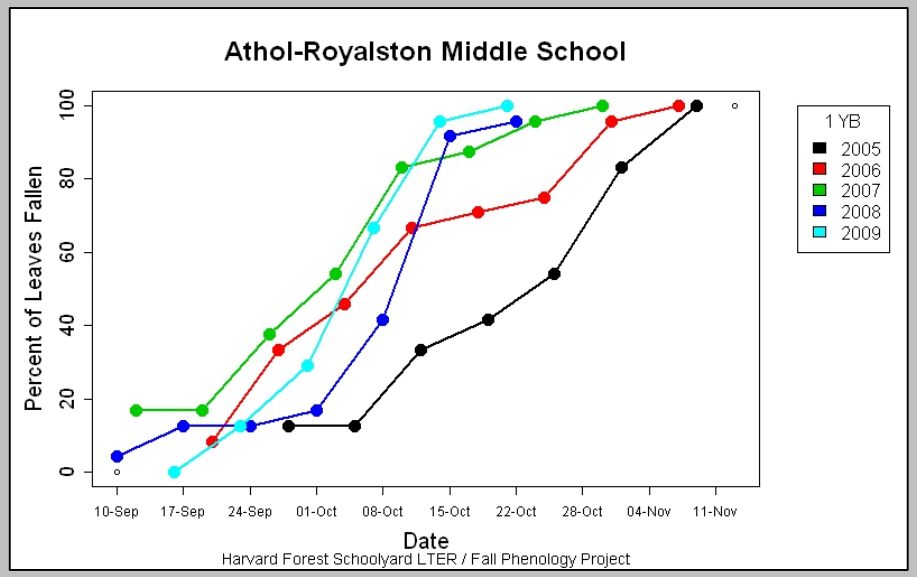
Schoolyard LTER Database / Download Data

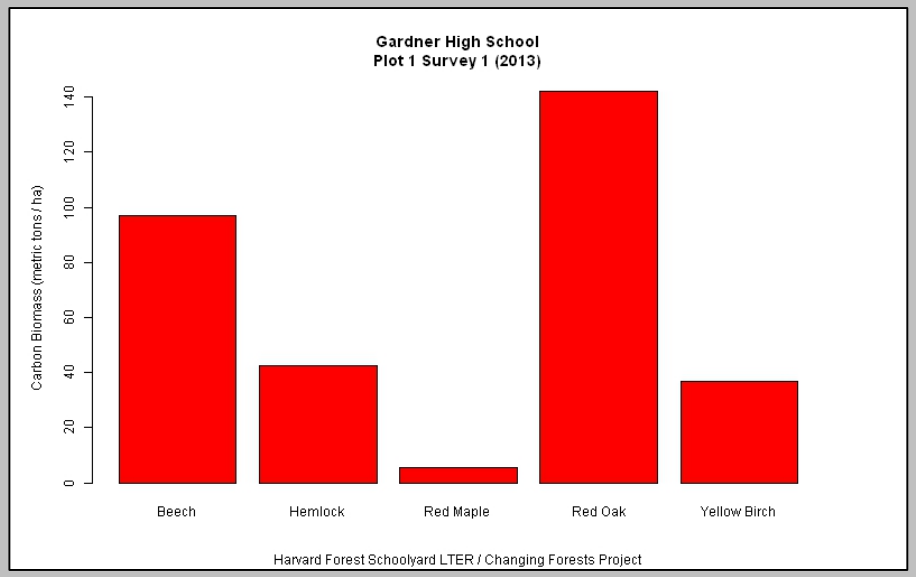
Carbon biomass by site

Detailed Data from a Single Site

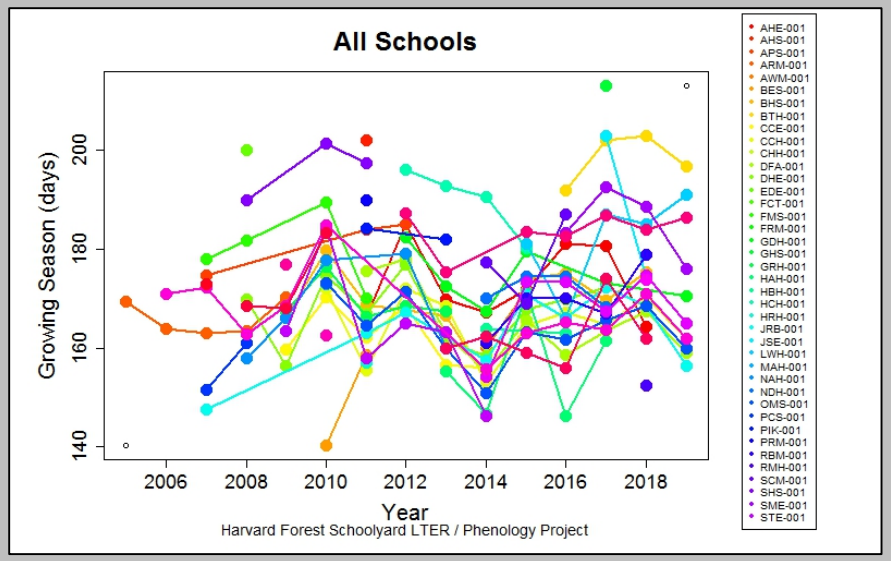


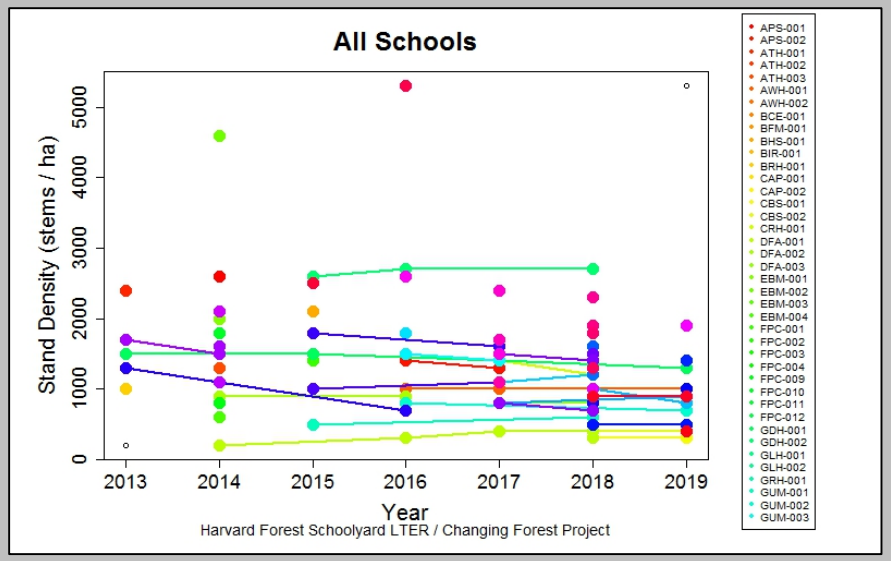


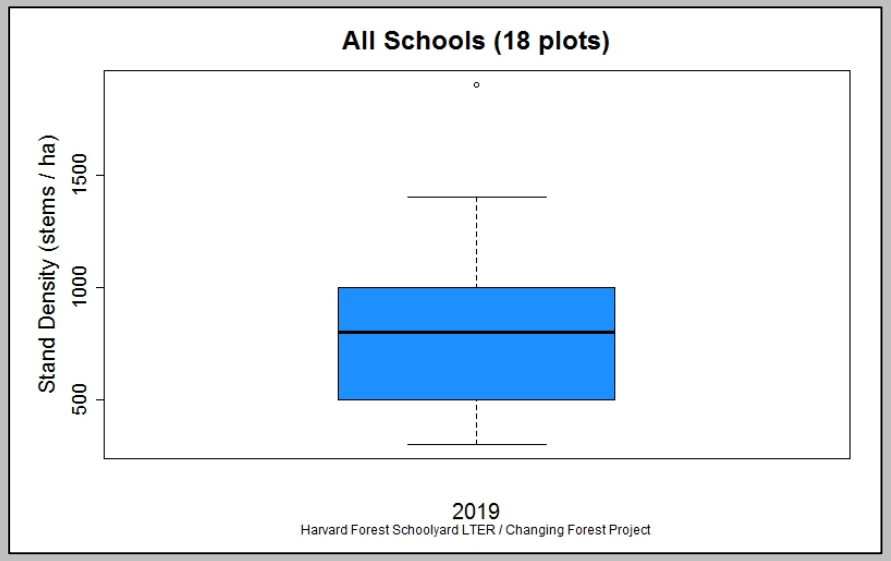




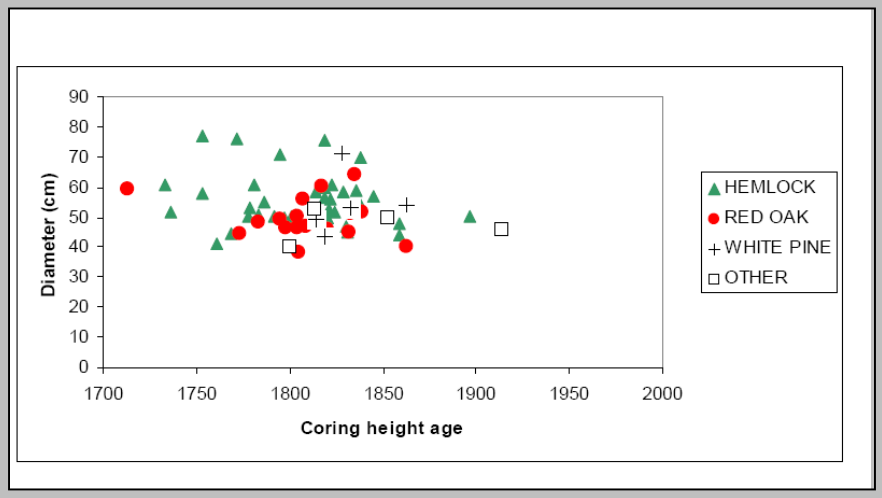
Summary Data from One or More Sites

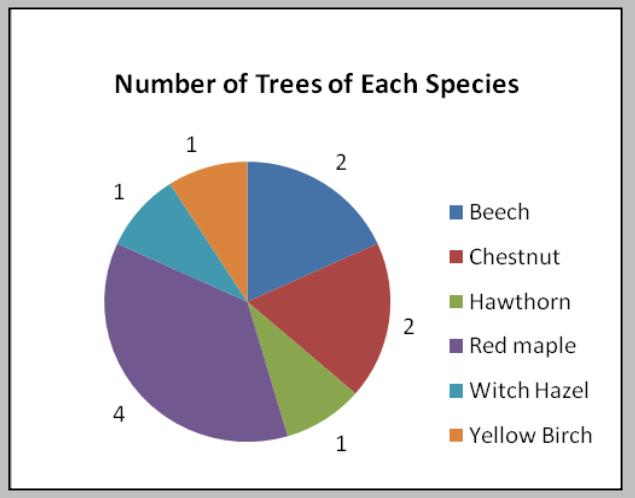


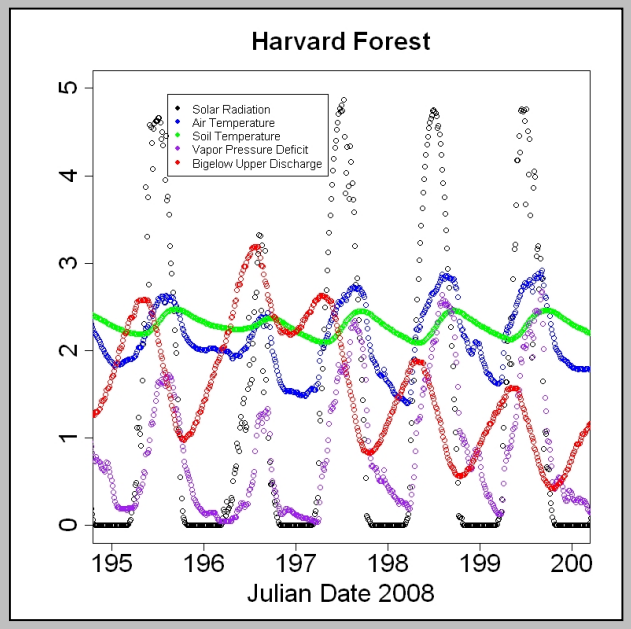


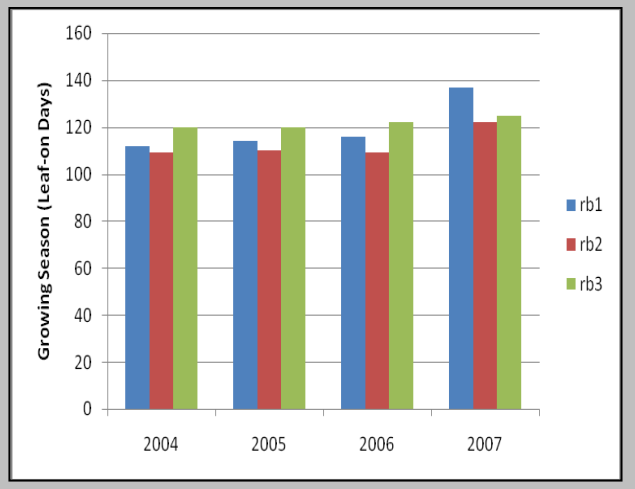


Data Visualization









Graphs from Colburn, Orwig & Boose

Level 1 Session

Activities

1. Data entry
2. Online graphing tool
3. Graphing exercises

Wireless Network

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