Introduction to Phenology Data

Graphing & Analyzing PhenoCam Data

Introduction

In this activity, students become familiar with the PhenoCam GCC (green chromatic coordinate) values from PhenoCam location Harvard Forest and use them to determine the date of bud burst for 2012. *Note: Students should have some experience using spreadsheets.*

Estimated Time:	**Grade Level:**	**Materials:** Access to computers and Excel spreadsheet with Harvard Forest GCC values for 2012
15-30 minutes	Grades 5-9	

Background Information

PhenoCam (phenocam.unh.edu) is a network of digital cameras that are used to record vegetation phenology, in terms of seasonal changes in the greenness of the canopy. Cameras record digital images hourly over the course of a year at all the PhenoCam locations. The images are computer analyzed for color and generate a numerical value of canopy greenness which is then a part of a timeseries graph. Scientists can then identify major phenophases such as budburst from these graphs. When estimating "bud burst" from the camera GCC data, it is usually the date when the GCC values has risen 10% of the way from winter minimum values to summertime maximum values.

Learning Objectives

Students will be able to:

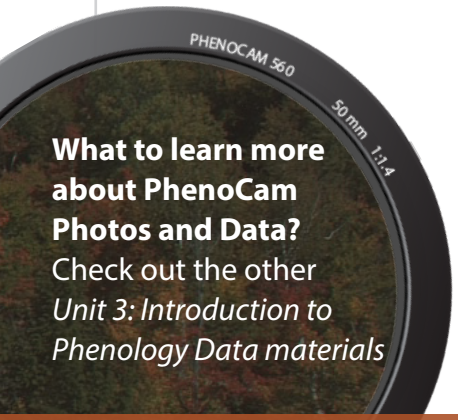
- Determine the date of budburst for 2012 using an excel spreadsheet and PhenoCam GCC values for the Harvard Forest site.
- Compare the target date from the GCC values to the images from that day.
- Answer open ended questions.

Activity Instructions

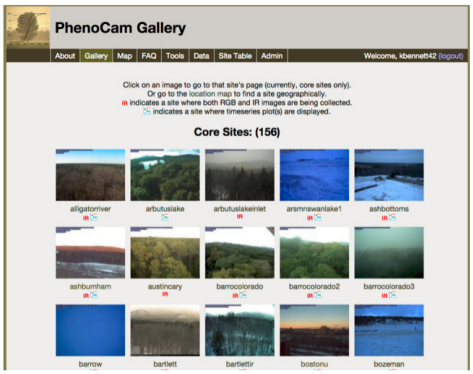
Setting the Stage

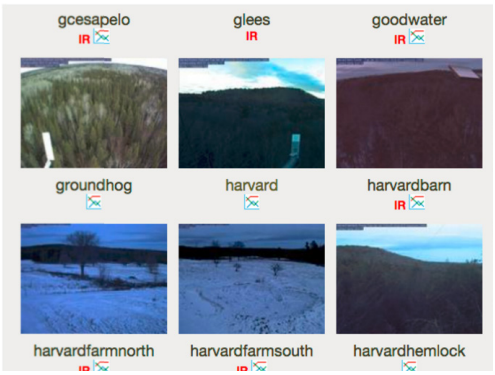
1) Explain to the students that the PhenoCam network generates large phenology datasets by computer analysis of each image for color and generating a numerical values of canopy greenness - green chromatic coordinates or GCC values.

Open the PhenoCam website. http://PhenoCam.sr.unh.edu/webcam/. **Next, open the Harvard PhenoCam site page.**



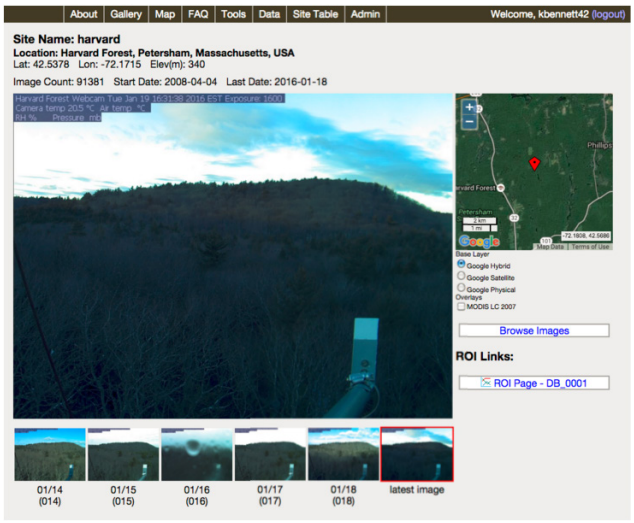
What to learn more about PhenoCam Photos and Data? Check out the other *Unit 3: Introduction to Phenology Data materials*

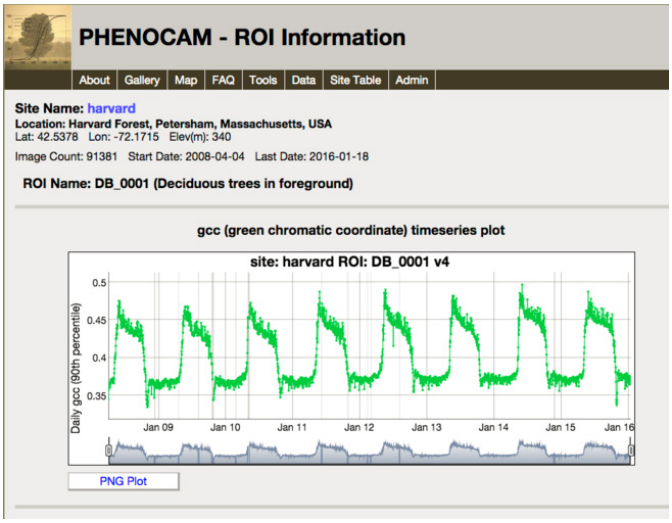




Setting the Stage

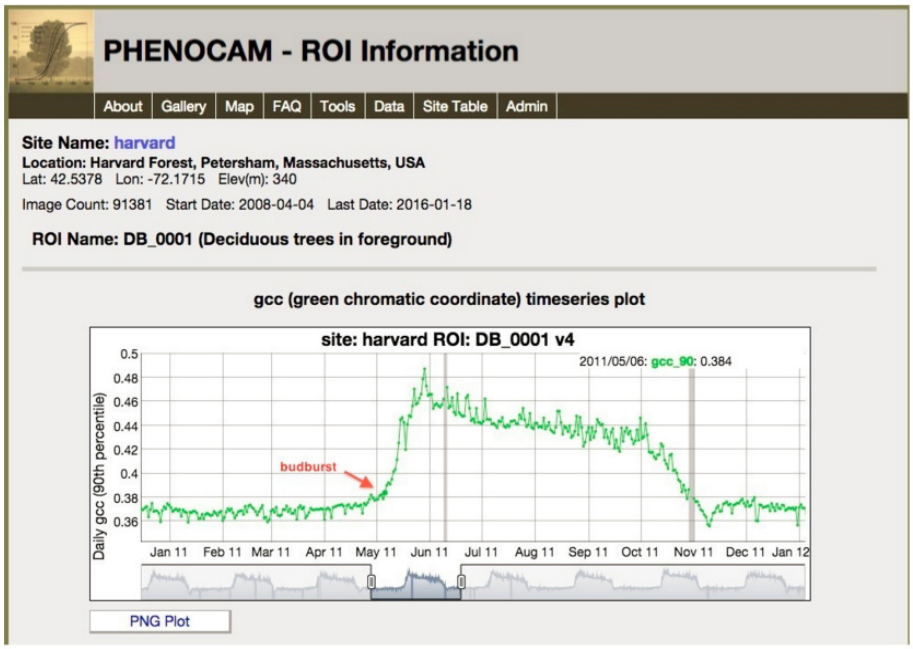
2. **Open the ROI timeseries graph.** Explain how the images are computer analyzed for color and a Green Chromatic Coordinate is generated. This is a basically a level of greenness. Point out the "shape" of data as it goes through the year.





Analyzing the Data

1. **Find BudBurst on the ROI timeseries graph.** The day of "budburst" is when GCC has risen 10% of the way from winter minimum values to summertime maximum values. Students will be using the GCC values to determine the day of budburst, then looking at the images from that day to see what it looks like and if they agree.



Analyzing the Data (cont.)

2. Open the spreadsheet that contains the mean GCC values for April and May for 2012.

2012 PhenoCam Harvard GCC

File Edit View Insert Format Data Tools Add-ons Help All changes saved in Drive

	A	B	C	D	E	F	G	H	I	J
1	date	year	day	GCC mean		date	year	day	GCC mean	
2	4/1/2012	2012	92	0.36871		5/16/2012	2012	137	0.45296	
3	4/2/2012	2012	93	0.36795		5/17/2012	2012	138	0.46051	
4	4/3/2012	2012	94	0.37407		5/18/2012	2012	139	0.46019	
5	4/4/2012	2012	95	0.37347		5/19/2012	2012	140	0.46219	
6	4/5/2012	2012	96	0.36974		5/20/2012	2012	141	0.46784	
7	4/6/2012	2012	97	0.37043		5/21/2012	2012	142	0.46637	

This side contains the GCC values for the first two weeks of April. Averaging the GCC values will give you the mean winter minimum.

This side contains the GCC values for the last two weeks of May. Averaging the GCC values will give you the mean summer maximum.

3. Have the students find the mean winter minimum and the mean summer maximum. Subtract the winter value from the summer value. Find 10% of the difference and add it to the winter value- this should be the GCC value of the day of budburst.

2012 PhenoCam Harvard GCC

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	A	B	C	D	E	F	G	H	I	J
4	4/3/2012	2012	94	0.37407		5/18/2012	2012	139	0.46019	
5	4/4/2012	2012	95	0.37347		5/19/2012	2012	140	0.46219	
6	4/5/2012	2012	96	0.36974		5/20/2012	2012	141	0.46784	
7	4/6/2012	2012	97	0.37043		5/21/2012	2012	142	0.46637	
8	4/7/2012	2012	98	0.37071		5/22/2012	2012	143	0.4717	
9	4/8/2012	2012	99	0.36926		5/23/2012	2012	144	0.46215	
10	4/9/2012	2012	100	0.36981		5/24/2012	2012	145	0.4596	
11	4/10/2012	2012	101	0.37147		5/25/2012	2012	146	0.46235	
12	4/11/2012	2012	102	0.36976		5/26/2012	2012	147	0.46123	
13	4/12/2012	2012	103	0.36894		5/27/2012	2012	148	0.45926	
14	4/13/2012	2012	104	0.37433		5/28/2012	2012	149	0.45943	
15	4/14/2012	2012	105	0.37722		5/29/2012	2012	150	0.46187	
16						5/30/2012	2012	151	0.4539	
17				0.3711335714	winter min					
18									0.4614366667	summer max
19										
20	4/20/2012	2012	111	0.37858		0.4614366667		0.3711335714		
21	4/21/2012	2012	112	0.37758		0.3711335714		0.009030309524	10%	
22	4/22/2012	2012	113	0.38282		0.09030309524	difference			
23	4/23/2012	2012	114	0.37761				0.380163881	sum- budburst	
24	4/24/2012	2012	115	0.37858						
25	4/25/2012	2012	116	0.38074						
26	4/26/2012	2012	117	0.37835						
27	4/27/2012	2012	118	0.38053	budburst					
28	4/28/2012	2012	119	0.38186						
29	4/29/2012	2012	120	0.38224						

Analyzing the Data (cont.)

4. When the students find the projected day of budburst, have them open the images for that day on the Phenocam website.

Does it look like this is the day of budburst?

Why or why not?