



Vegetation Phenology through Digital Photography

This module utilizes the learning progression developed by Digital Earth Watch under the PicturePost program. Picture Post introduces you to a new research tool that standardizes the collection digital images through a series of protocols that allows the data to be compared over time, or with that from other sites. In addition to its own investigative value, the Picture Post is a bridge to understanding the fundamental aspects of collecting images and analyzing them digitally.

Objectives:

- **Explore how scientists measure vegetation phenology.**
- **Practice with cutting edge tools for digital measurements of canopy characteristics**
- **Use freeware to upload and process photos taken in the field (PicturePost online database and Panorama Factory)**
- **Compare picturepost photos to MODIS imagery**

WHY MONITOR PLANT HEALTH?

One of the first warning systems for coal miners utilized canaries to warn miners of the presence of methane gas. A canary was placed in a coal mine. If it died, the miners knew that dangerous methane gas was present. The miners could get out of the mine safely.

Plants are nature's "green canaries." When the health of plant life in an area suffers, the health of other organisms in the area is soon to decline. By measuring the health of plants, we can draw conclusions about environmental conditions that affect all nearby organisms. If we see the plant health of an area is suffering, society can make lifestyle changes to prevent further damage.

WHAT IS A PICTUREPOST? There are many ways of gathering environmental data. Digital Earth Watch has developed an innovative way of obtaining that data through the use of PicturePosts. A PicturePost is a wooden or plastic post used to hold a camera in order to take photographs of an area in a 360° series.

The PicturePost photographs should be taken about once a week, and are used to monitor changes in the environment over time. One can observe changes in plant health over time, as well as view the drastic changes of spring "green-up" and "green-down." One can also observe changes in canopy cover, water levels of ponds and lakes, and air conditions.

Photographs are uploaded onto the PicturePost website, where they are shared with other participants and researchers. The PicturePost photograph database is online at <http://picturepost.smugmug.com/>.

“THE PICTUREPOST PROCESS”

As a PicturePost participant, you will be responsible for the five steps of the “PicturePost process.” These steps are obtaining the PicturePost, selecting a location, installing the PicturePost, taking photographs, and uploading the photograph to the Digital Earth Watch online database. These steps will be described in detail below.

Note that additional instructions and tutorial videos can be found at <http://picturepost.unh.edu/stuffYouCanDo.jsp>

OBTAINING YOUR PICTUREPOST

There are two ways to obtain a PicturePost. You can build your own or buy one. Building a PicturePost out of wood requires only about \$25 of materials. A wooden PicturePost can be placed anywhere, but is susceptible to warping and rotting. Those PicturePosts must be replaced often. The exact replacement time depends on the conditions of the area in which it is placed.

CHOOSING A LOCATION

Choosing a location for your PicturePost is an important step of the process. The type and quality of data will directly depend on your location choice. Your organization may have a specific goal or site already in mind, but we have provided some general guidelines for choosing a PicturePost location below.

- The PicturePost should be placed in a greenspace. This means that it should be surrounded by vegetation in order to make observation of plant life efficient and the data useful.
- It is beneficial to the PicturePost project to include as many environmental features within view of the PicturePost as possible. These features could be lakes, ponds, hills, rocks, and a variety of vegetation.
- It is a good idea to include at least one “landmark feature” within view of the PicturePost. This feature will serve as a reference point for comparing data from that location.
- Try to choose a location that can capture vegetation in each of the herbaceous (ground-level), shrub (mid-level) and canopy (tree-level) “layers” of the environment. You will be able to compare the different level of impact by environmental influences on these different layers. You will also see the stunning changes of these layers during spring green-up and autumn green-down.
- The PicturePost should also be accessible by the public, but located in area with low risk for vandalism.



INSTALLING YOUR PICTUREPOST

The instructions for installing a PicturePost that are described here refer to the installation of a plastic PicturePost. If you choose to build your own wooden PicturePost, instructions can be found online at: http://mvh.sr.unh.edu/mvhtools/build_picturepost.htm.

Instructions:

1. Dig a hole at least 3 feet deep and wide enough for the 4x4 PicturePost. (The PicturePost must be installed below frost depth. In the Boston area, that is about 3 feet. For the frost depth of your area, consult local builders.)
2. Use a level to keep the post level, while back filling the hole with dirt. Make sure to check the level in all directions and to stamp the dirt until it is firm and the post is stable.
3. Find **true north** for your area online at: <http://www.thecompassstore.com/decvar.html>. For the Boston area in early 2008, *magnetic north* is 15 degrees west of **true north**. See the picture at the right. Notice that the compass is held so that the white tip of the compass, which points north, points 15 degrees west of north.
4. Align the post cap so that the north directions points to **true north**. Double check alignments and drill four holes through the post head into the post. Secure with the drywall screws.
5. Using permanent marker or paint, label the post head with location information and attach basic instructions.
6. Now, PHOTOGRAPH AWAY!!!

TAKING PICTUREPOST PHOTOGRAPHS

Taking PicturePost photographs is as simple as using a tripod. We suggest using a digital camera, so that pictures can be uploaded to the PicturePost database. In order to simplify the naming process before uploading, you should take your photographs in a specific manner described below. These instructions are also available online at: http://mvh.sr.unh.edu/mvhtools/taking_photos.htm.

Instructions:

1. Record the date, time, and location of your photographs. We suggest taking a photograph of a watch and the PicturePost cap for this purpose.
2. Take 8 photographs of the landscape and 1 of the sky.
 - Make sure that the zoom lens is set to the widest angle.
 - Take the first photograph with the back of the camera against the **north** side of the octagon.
 - Take photographs in a **clockwise** manner (north, northeast, east, southeast, etc.)
 - Take a photograph with the camera on its back and the bottom edge of the camera aligned with the **north** side of the octagon to record sky or canopy conditions.

How often should you take photographs?

- During a most of the year, take photographs once a week.
- To study the seasonal plant cycles, take photographs at least once a day during spring “green up” and during autumn “green down.”
- Coordinate with a group of photographers during the busy weeks

***ACCEPTABLE PICTUREPOST PHOTOGRAPHS** Because the PicturePost database is a public website and is meant to serve as a database for environmental data, Digital Earth Watch has rules for uploading photographs. They are described below.*

All photographs that are uploaded to the PicturePost database must have been taken from a PicturePost.

Photographs that are in a public place can contain people if they are within view of the PicturePost, but it should not be the goal of the photographer to include those people. This means that photographs on the PicturePost website should be taken to include as much environmental data as possible.

Digital Earth Watch and SmugMug ask you that photographs posted on the site not be of an inappropriate nature. Please do not post images of nudity, drug use, other illegal activities, or anything of that nature.

We also ask you to not “spam” the PicturePost database with advertisements and announcements.

UPLOADING PHOTOGRAPHS

Downloading from your camera

Images can be downloaded from your camera to a computer in a variety of ways. Pictures can often be dragged and dropped to a new folder, copied to the computer using the software specific to the camera used or other photographic software such as Picassa or Photoshop.

Renaming your photographs

In your File Folder you can right click to rename the default camera name to new file name that contains key information. Please follow these rules. SSPPPCCYYMMDDHHmm.jpg

SS = State Abbreviation

PPP = 3-letter location name

CC – Direction Camera is pointing

- NN = North
- NE = Northeast
- EE = East
- SE = Southeast
- SS = South
- SW = Southwest
- WW = West
- NW = Northwest
- SKY = Camera pointing skyward

YY = Year

MM = Month

DD = Day of month

HH = Local hour (on the 24 hour clock)

mm = Minutes

Uploading to PicturePost

To upload or download photos to the **PicturePost** database, you must first register as a user. This is a simple process you can begin by navigating to:

<http://picturepost-dev.sr.unh.edu/registration.jsp?returnPage=/stuffYouCanDo.jsp>

You can find this link by visiting the **PicturePost Home** page, selecting “**Stuff You Can Do**” and “**Register As a User**”

[Home](#) | [Stuff You Can Do](#) | [Educators](#) | [Buy](#) | [Build](#) | [Help](#) | [My Page](#) | [Login](#)

If you have already registered with **Picture Post** and would like to update your registra

| | |
|--------------------------|--------------------------|
| Email: | <input type="text"/> |
| Password: | <input type="password"/> |
| Confirm Password: | <input type="password"/> |
| First Name: | <input type="text"/> |
| Last Name: | <input type="text"/> |
| Phone: | <input type="text"/> |
| Mobile Phone: | <input type="text"/> |

I agree to the [Terms Of Service](#).

Once you have received your activation email, you can login to the picture post website and select “**My Page**”, then “**Add a New Post here**”

You will be prompted for some basic information about your picture post, including a site name, description, latitude and longitude (in decimal degrees). This information can be determined in the interactive map provided on the new post web page.

[Home](#) | [Stuff You Can Do](#) | [Educators](#) | [Buy](#) | [Build](#) | [Help](#) | [My Page](#) |

Your favorite posts: Click on a link to see pictures from that post.
[Poker Hill Farm 1](#)

Update your registration? You can do so [here](#).

You currently own 1 post(s).

Or choose a post to manage from the list below:
[Poker Hill Farm 1](#)

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Install Date: year month day time zone

2011 July 25 Eastern Time

Location: Enter the latitude (-90.0 to 90.0) and longitude (-180.0 to 180.0) position of your post.
 latitude 44.4777835636653 longitude -73.1990075111389



Simply select the thumbtack and drag it to your approximate location. Continue to zoom in on the map (and switch to satellite view for my detailed photographs) until you have the thumbtack accurately positioned over your picture post.

Note that coordinates can also be collected using a hand held GPS, or online mapping software such as google earth. If your GPS coordinates are not in decimal degrees try an online converter such as: <http://transition.fcc.gov/mb/audio/bickel/DDDMSS-decimal.html>

You will also be required to navigate to the folder where you starting images are stored, and upload those as a reference. This will include a photo of the actual picturepost *post* itself. Simply browse to the folder where your renamed photos are stored and select them (ctrl can be held to select multiple pictures at once). Click upload and see the photos occupy the 8 locations on the page. You can easily drag and drop the photos to make sure they are in the correct direction spot (the northwest facing photo in the NW spot, etc.).

Once created and marked as a favorite, your new post will show up on your “My Page”

Home | Stuff You Can Do | Educators | Buy | Build | Help | My Page |

Your favorite posts: Click on a link to see pictures from that post.
[Poker Hill Farm 1](#)

Update your registration? You can do so [here](#).

You currently own 1 post(s).

Add a NEW Post [here](#).

Or choose a post to manage from the list below:
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Select your post to be brought to its “home” page.

Post: [Poker Hill Farm 1](#)

Upload: Click [here](#) to upload pictures for this post.

This post is in your favorites list, which you can

comments metadata save


Scroll
around the
panorama.


Scroll
through
time.

1 - 0 of 0

50 per page

| | | | | | | | | | |
|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|--------------------|----------------------|
| N | NE | E | SE | S | SW | W | NW | UP | Info |
|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|-------------------|--------------------|--------------------|----------------------|

No pictures are available for this post.

Now, whenever you have new photos to upload, you click the Upload **here** button to be prompted to browse to you photos, upload, and correctly arrange the photos just like you did with the original post.

This process can be repeated as often as you can get out collecting pictures. Each of your imagery dates will be stored here.

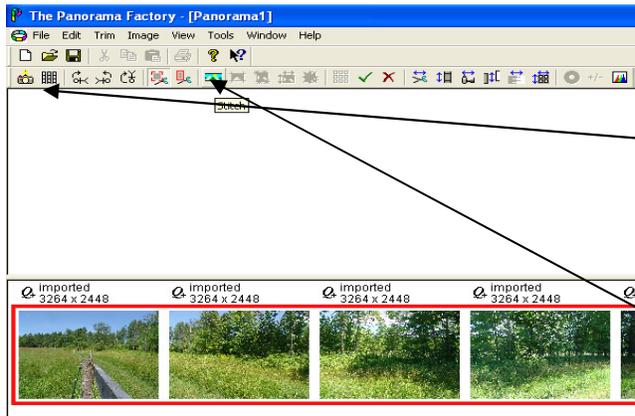
WHAT CAN I DO WITH MY PICTURES NOW?

After you upload your PicturePost photographs to the online database, what will you do with them next? In this section, we will give you a few fun suggestions of how you can enjoy your photographs outside of the PicturePost database.

CREATE A PANORAMA! The 360° series of photographs that you take at a PicturePost can be transformed into one panorama using free software. It will provide you with the entire 360° view from your PicturePost in one photograph. So place your PicturePost in an aesthetically pleasing area so that you can create beautiful panoramas of the area while you help the environment. Here are some websites with software to make panoramas:

The Panorama Factory: This software is an easy, yet powerful tool to mosaic your various photographs into one panoramic image.

- Go online to download: <http://www.foto-freeware.de/panoramafactory.php> You will need to click on the **>> Hier klicken und den Download starten <<** tab (or simply install



the files provided through the SWAC website.

- Upload your images into the software by clicking on the camera icon or under FILE > IMPORT. Make sure that you add the photographs into the program in an order that places the correct photographs beside each other.
- Select them all with the CTRL button
- Click on the Stitch Icon



CREATE A TIME LAPSE MOVIE! By making a time lapse movie out of your photographs, you can observe changes in plant health and growth. To make a movie, you will need to take several pictures from one view of the PicturePost or download them from the PicturePost database. We suggest using Windows Movie Maker or Apple's QuickTime Pro.

http://www.youtube.com/watch?v=skpTZf00Ntc&feature=player_embedded
<http://picturepost.unh.edu/moviepage.jsp>

LINKING PICTURE POST IMAGES TO MODIS DATA

How do Picture Post images compare to corresponding MODIS images, and what potential variables might affect the correlation between these two data sources?

MODIS (or Moderate Resolution Imaging Spectroradiometer) is an important Earth observing instrument, flown onboard NASA's Terra and Aqua satellites. MODIS views the entire Earth's surface every 1 to 2 days, acquiring data in 36 spectral bands throughout the visible and infrared regions of the electromagnetic spectrum. Data from MODIS are used in the study of global dynamics and processes occurring on the land, in the oceans, and in the atmosphere. We will make use of several key data products from MODIS;

vegetation indices, which allow us to study the seasonality of vegetation growth. Our “greenness” measure is a type of vegetation index quantifying the proportion of green color for our area of interest.

surface albedo (the proportion of incoming solar radiation reflected back to the atmosphere and to space) Think of this as “brightness” of the pixel over the Picture Post plot.

1. Open the Picture Post Animation (http://globecarboncycle.unh.edu/climate/ppost_new/picturepost6.html), linked under the Picture Post heading of the Climate Resource Directory page.
2. When you open the page, the animation will begin playing—watch it play for a few minutes to get a feel for how the graphed data relates to the two images as the progress through the seasons. Next, you can use the controls to change speed, freeze images, or move around throughout the date range.
3. Use the tool to explore the relationship between the MODIS albedo values for the PicturePost pixel (location) and the PicturePost image greenness values.
 - How does albedo relate to greenness?,
 - How might this tool be valuable in studying biomes, tree species distribution and their response to climate change?

OTHER INTERESTING PHENOLOGY/SATELLITE LINKS:

USGS remote sensing phenology website: http://phenology.cr.usgs.gov/get_data.php

Project Budburst <http://neoninc.org/budburst/>

My Nasa Data access to imagery and teaching tools around remote sensing imagery and earth observation <http://mynasadata.larc.nasa.gov/>