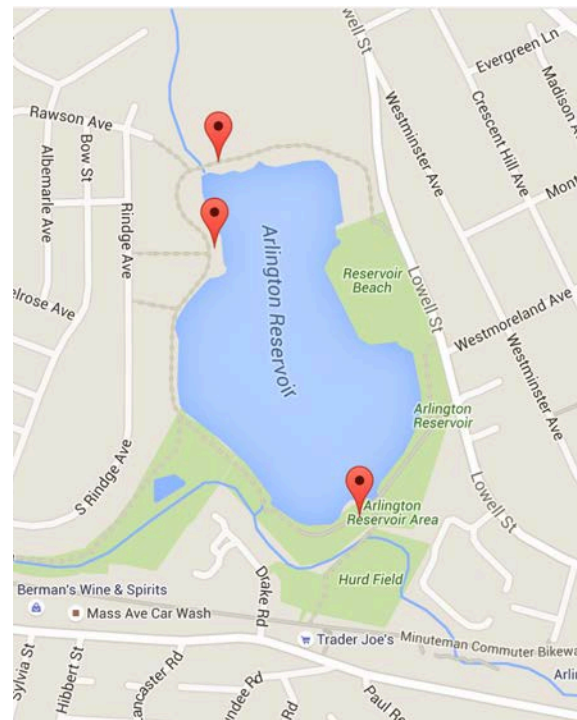


## Photographing Changes Around Arlington Reservoir

John Pickle

In late May 2016 four volunteers (David Markun, Michael Ratner, John Pickle, and David White) from the Arlington Reservoir Committee installed three Picture Posts, a citizen-science system designed to help monitor the surrounding environment for decades using digital photographs. Arlingtonians enjoying the paths around the Reservoir may use their smart phone cameras or digital cameras to take and upload photos to the free Picture Post website (<http://picturepost.unh.edu/index.jsp>) – it only takes a minute to take and upload the photos. Because the photos are organized chronologically by post on the website, it is easy to see and measure how the landscape has changed over the past few days, during the season, or from year to year.



David White, Michael Ratner, and David Markun, (from left to right) are three of the volunteers who installed the Picture Posts, and the location of the three posts around Arlington Reservoir.

### What is a Picture Post?

Picture Post is a NASA-funded project aimed at involving citizens in local environmental monitoring by 1) taking digital photographs at a designated Picture Post site in a consistent, sequential order, 2) uploading the digital photographs to the Picture Post website, 3) examining the digital photographs using the free image analysis tools on the Picture Post website, 4) continuing to take photos on a regular weekly basis, and 5)

sharing digital photographic records with local community organizations dedicated to environmental monitoring and use.



Examples of Picture Post caps. Key is to locate North for taking the first photo: use the flat surface to orient the camera so it is shooting northward. Then take the next seven in clockwise locations. The last photo is taken upward with the bottom of the camera facing northward.

A Picture Post is a 4"x4" post made of wood or recycled plastic with enough of the post buried in the ground so it extends below the frost line and stays secure throughout the year. Atop the post is a small octagonal-shaped platform or cap on which you can rest your camera to take a series of photographs. The post can stand alone, and is recommended to be about four feet high, modeled on what foresters call "diameter at breast height" or DBH. With most of today's digital cameras and smartphone cameras, the eight pictures easily cover the complete 360° around the post, and one picture straight up skyward would record cloud conditions or the forest canopy overhead. The key to performing accurate scientific Earth observation monitoring is to return on a regular basis, ideally once a week or once every two weeks, to record changes in the environmental scene for later analysis.

The Picture Post project is supported by a team of scientists and educators with the purpose of developing more citizen understanding of local and regional environments. The website is based at the University of New Hampshire (UNH) and is supervised by Annette Schloss, Ph.D., who has worked with visual repositories of NASA satellite data such as EOS-Webster.

## Picture Posts Started in Arlington!

During the winter of 2004/2005, John Pickle, who then worked at the Museum of Science in Boston, was thinking of ways to record the seasonal changes in Menotomy Rocks Park using a digital camera. At the time, he was in charge of a NASA-funded, seven-institution science education project to help people learn how to use plants to measure local environmental quality (Measuring Vegetation Health, which was later renamed Digital Earth Watch). He shared his interest with fellow Friends of Menotomy Rocks Park (FoMRP) board members, and the group of David Bean, Tom Gonsiorowski, Ellen Reed, Clarissa Rowe, and John came up with the concept and built the first Picture Posts. FoMRP members installed two posts around Hill's Pond during a weekend clean up of the park in April 2005, and several years later added two more in the hills of the park. Over the past 12 years, hundreds of posts have been installed around the United States, and one even in Australia!

## Using Picture Post Images

At the Picture Post website, along with the panoramic shots that photographers upload directly to the site, is satellite imagery of the same location where the photos were taken. Currently these images from the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument aboard NASA's Aqua and Terra satellites provide little more than atmospheric context for the picture takers. But part of the project's work is to create tools that will allow scientists and citizen scientists to use the Picture Post photographs to validate or "ground truth" the satellite imagery. A satellite views from above while the Picture Post images are taken horizontally, so scientists can determine what layer of a forest is being viewed: the canopy, shrubs, or herbaceous vegetation.

UNH Earth Systems Research Center (ESRC) research assistant professor Mary Martin and former UNH graduate student Haley Wicklein (now a research assistant in the ESRC Terrestrial Ecosystem Analysis Laboratory) have begun exploring this possibility by correlating the greenness index of trees in Picture Post photographs with MODIS albedo (reflectance) measurements. The greenness index is the ratio between the total *vegetated* area and the total *geographical* area covered. Low greenness index values indicate poor green cover that could be the result of climatic changes. Events that can cause low values include moisture shortages, extreme temperatures, and biotic interference. The correlation between the Picture Post photograph and the MODIS image indicates how accurate the satellite's readings are.

"Another thing you can do with Picture Post is monitoring phenology, which has become a huge topic of research interest," Schloss says. Phenology is the study of periodic plant and animal life cycle events and how these are influenced by seasonal and interannual

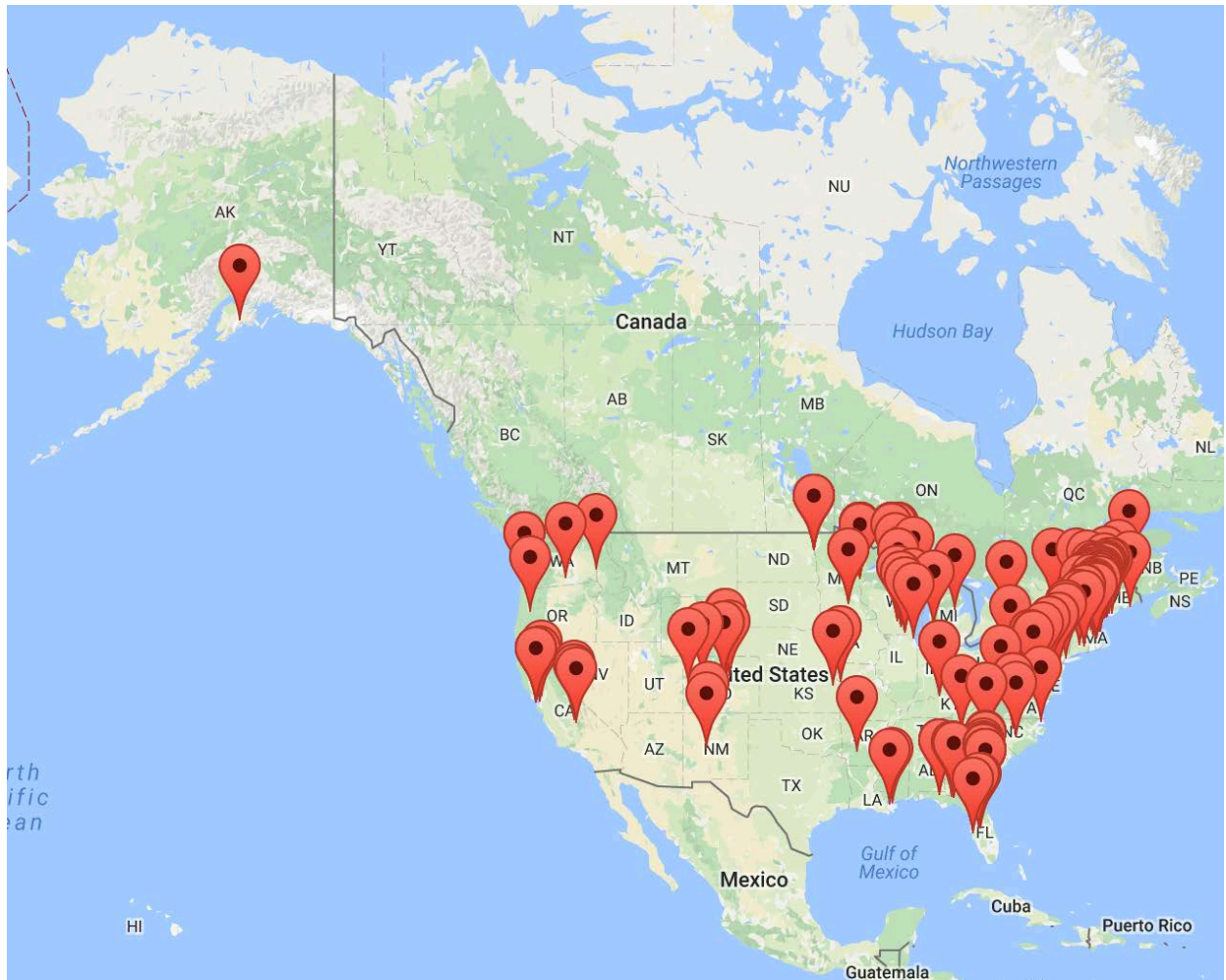
variations in climate. The National Ecological Observatory Network (NEON) is monitoring phenology via an effort called Project BudBurst and Schloss notes Picture Post has plugged into this large-scale citizen science effort that monitors the timing of leafing, flowering, and fruiting of plants – plant phenophases. Like Picture Post's standardized approach to documenting specific environments, Project BudBurst data are being collected in a consistent manner across the country so that scientists can use the data to learn more about the responsiveness of individual plant species to changes in climate locally, regionally, and nationally.

Notes Schloss, "With climate change, you can't really talk about detecting a signal until you have at least a 30-year record, so with projects like Picture Post and Project BudBurst you're not only adding a detailed time record but also adding to the *richness* of the data set. In other words, a satellite image, be it a 30 meter or 250 meter pixel, is integrated over a very large area so you're not going to detect any local differences. And obviously climate change affects me locally as much as it affects the big picture."

Some examples of projects possible using the photos from Arlington Reservoir:

- **Adopt a Leaf** - Record the opening of leaves or flowers in the spring: use dormant twigs to learn more about phenology.
- **Adopt a Tree Diameter (DBH)** - Measure the changing diameter of one or more trees – with most current cameras, one can measure the amount of new wood added to tree trunks on a daily basis.
- **Adopt a Canopy** - Capture the seasonal changes in percent leaf cover in a forest canopy.
- **Adopt a Climate Change Indicator** - Track the timing of seasonal changes in greenness in existing pictures.
- **Adopt a Season** – Record and measure the changing fall colors in deciduous trees.
- **Set up a Phenology Walk** - Set up a site to highlight seasonal changes, aka - phenology, in plants.

And this is just for one post: you can compare the results to different locations around the Reservoir, to those at Menotomy Rocks Park, other locations in New England or around the United States.



Map of current Picture Posts installed across the United States.