



Climate Science, Phenology, and Human Impact on the Land

by Sabrina Carlson

On November 2, 2015 28 members of Ms. Esparza's 6th grade science class headed onto the Arizona Trail Passage 32 (Elden Mountain) to sharpen their skills as citizen scientists to gather data on temperatures, elevation, and the life cycles of plants.

We started our hike from the access point Adjacent to Elden Pueblo Ruin. We hiked two miles into a diverse and healthy section of ponderosa pine forest with plenty of space between trees, grassland undergrowth, and some oak and cliffrose sprinkled through the landscape. Along the way we paused to inspect a few sections of forest that were considerably less healthy. Dense "dog hair" pines with too many pine needles in the understory to allow anything else to grow at all.

Once we arrived at our data collection location, the students split into groups and set to work collecting information as instructed by Ms. Esparza. They measured soil temperature and air temperature in sun and shade, elevation, time of day, date, and made an inventory of plant species they could see.

Next, they were given instructions on how to use a tree identification guide to figure out which trees would be Gambel oak; the species we were going to look at closely today. I was surprised by how many of the students, who have grown up in Flagstaff, didn't immediately know which trees were the oaks in question, but none of them did. It took at least 30 minutes for the first group to find an oak.



Checking the Air Temperature

Once the numerous oaks in the area were found, the groups set about completing their data sheets from the National Phenology Network's *Nature's Notebook*. They observed and recorded specific data on the seasonal state of their observed tree. Since it was autumn, no leaf or flower buds were to be seen. However, they students were able to make notations on the yellowing of the leaves, what percentage of the trees leaves had turned yellow, how many were on the ground, and if there were any beginning to brown.

After all of the data was collected, we discussed the value of this single data set. Can a scientist make a claim about seasonal changes based on one set of data? No! Could we even draw conclusions about the effects of climate change on the phenology of Gambel oaks from data taken in the same spot, on the same day, for 2-3 years. Not really. As we delved into the vast data point requirements for a climate and phenological scientist to draw conclusions, they began to see just how much evidence scientists need to begin to make assertions about the world around us. We pulled on this



Making Some Observations.

thread a bit more to emphasize the importance of the role of citizen scientists to collect and report data to organizations like The National Phenology Network. In fact, The Arizona Trail Association relies on trail condition data from trail users to keep us updated on trail conditions and safety concerns. As much as we wish we could be all over the trail all the time, we can't. We need helpful observers to help us too.

After lunch at our observation stop, we hiked back to Elden Pueblo where we spent some time observing the evidence of human habitation. Having talked in a more theoretical way about how humans could impact climate, it was interesting to have them observe very physical ways these ancient people had shifted the contents of the earth around. Places that once sloped downward that had been levels for home construction. The site of a kiva, a tremendous project of earthmoving and underground wall stabilization. Not to mention the check dams and terraces built along a drainage to capture rainfall and make crop growth possible.

It was a productive day of deep hands-on learning. We all walked away with a new appreciation for the work of modern scientists and ancient engineers alike.



The Clever Crew!

This outing was made possible by grants from

