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Weather History

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NEW PALTZ, N.Y. — It is probably a good thing that the Mohonk Mountain House, the 19th-century resort, was built on Shawangunk conglomerate, a concrete-hard quartz rock. Otherwise, the path to the [National Weather Service](#)'s cooperative station here surely would have turned to dust by now.

Every day for the last 112 years, people have trekked up the same gray outcropping to dutifully record temperatures and weather conditions. In the process, they have compiled a remarkable data collection that has become a climatological treasure chest.

The problems that often haunt other weather records — the station is moved, buildings are constructed nearby or observers record data inconsistently — have not arisen here because so much of this place has been frozen in time. The weather has been taken in exactly the same place, in precisely the same way, by just a handful of the same dedicated people since Grover Cleveland was president.

For much of that time, those same weather observers have also made detailed records about recurring natural events, like the appearance of the first spring peeper or the first witch hazel bush to bud in the fall. Together, these two sets of data, meticulously collected in the same area, are beginning to offer up intriguing indicators about [climate change](#) — not about what is causing it but rather how it affects the lives of animals, plants, insects and birds.

It all starts with the daily ritual of “doing the weather,” which is what people at Mohonk House call the process of recording temperatures. One day in late summer, it was the turn of a gentle 61-year-old botanist turned naturalist named Paul C. Huth. As he has done most days for the last 34 years, around 4 p.m. Mr. Huth scrambled up the conglomerate outcropping in the shadow of Mohonk House, a National Historic Landmark about 90 miles north of New York City that has retained its 19th-century sensibility. Signs along the resort's roads plead: “Slowly and Quietly Please.”

Mr. Huth opened the weather station, a louvered box about the size of a suitcase, and leaned in. He checked the high and low temperatures of the day on a pair of official Weather Service thermometers and then manually reset them. Besides the thermometers, the box contained a small flashlight, a can of lubricating oil and a plastic magnifying glass. Those thermometers can be hard to read in the rain.

If the procedure seems old-fashioned, that is just as it is intended. The temperatures that Mr. Huth recorded that day were the 41,152nd daily readings at this station, each taken exactly the same way. “Sometimes it feels like I've done most of them myself,” said Mr. Huth, who is one of only five people to have served as official weather observer at this station since the first reading was taken on Jan. 1, 1896.

That extremely limited number of observers greatly enhances the reliability, and therefore the value, of the

data. Other weather stations have operated longer, but few match Mohonk's consistency and reliability. "The quality of their observations is second to none on a number of counts," said Raymond G. O'Keefe, a meteorologist at the National Weather Service office in Albany. "They're very precise, they keep great records and they've done it for a very long time."

Mohonk's data stands apart from that of most other cooperative weather observers in other respects as well. The station has never been moved, and the resort, along with the area immediately surrounding the box, has hardly changed over time. Rain and snow are measured in the original brass rain gauge issued in 1896 by what was then known as the United States Weather Bureau. Mr. Huth also checks the temperature and pH of Mohonk Lake daily, and he measures the level of the lake according to its distance from the top of an iron bar that was bolted to the Shawangunk conglomerate in 1896.

The record shows that on this ridge in the Shawangunk Mountains, about 20 miles south of the better-known Catskills, the average annual temperature has risen 2.7 degrees in 112 years. Of the top 10 warmest years in that time, 7 have come since 1990. Both annual precipitation and annual snowfall have increased, and the growing season has lengthened by 10 days.

But what makes the data truly singular is how it parallels a vast collection of phenological observations taken at this same place, and by many of the same observers, since 1925.

Phenology is the science of natural occurrences, yearly events like the first snow, the first blooming of hepatica and the arrival of the first whippoorwill. Keeping diaries of such occurrences was a hobby of counts and lords in Europe, and there are records in Kyoto, Japan, of the flowering of cherry blossom trees dating back 900 years. Among the most notable American phenological records were those kept by [Thomas Jefferson](#) at Monticello and [Henry David Thoreau](#) at Walden Pond.

Today, phenology is recognized as an important, even critical, approach to understanding climate change. The National Phenology Network, with financing from the [National Science Foundation](#) and other agencies, has started an field campaign, called Project BudBurst (www.budburst.org), in which volunteers record the way 500 native plants are responding to climate change.

The phenology records at Mohonk House are, in many ways, a model for such observations. They were compiled, in large measure, by Mr. Huth and the naturalist he succeeded, Daniel Smiley Jr. Mr. Smiley, who died in 1989, was a beloved descendant of the two Quaker brothers who founded Mohonk House in 1869. He dedicated much of his life to keeping lists of everything he saw and heard on the mountain, collecting whatever was of interest to him and labeling it carefully for future use.

Mr. Smiley kept his phenology records as meticulously as he "did the weather" for more than 50 years, for which he earned the National Weather Service's highest award, named for Thomas Jefferson.

He walked the extensive grounds of the resort making notes about every bird call he heard, every animal he saw, every budding flower and flowering tree. Back in his office, he transcribed those notes onto 3-by-5 cards (many early ones were written on the reverse side of the hotel's old menu cards). Over time, he amassed more than 14,500 cards with notations like this one, from March 28, 1929, filed under "partridge": "Near Duck Hawk ledge on Sky Top saw one 'treading' another, with great commotion down in a brush pile in a crevice,

while a third looked on. Too dark for a picture.”

In 1978, the Smiley family carved out 6,500 of its acres around the hotel to form the Mohonk Preserve, the largest nonprofit nature preserve in New York State. In 1980, the preserve created a research center that was named for Mr. Smiley after he died in 1989. Mr. Smiley was an old-school amateur naturalist, but his observations have proved to be solid scientific evidence. For instance, when the hotel’s chlorination system started acting up in 1931, he began taking water temperature and acidity readings. He was surprised to find that the water was unusually acidic, a pH of around 4.5, but he did not know why and just filed away his notes. Jump ahead 40 years to the early 1970s, when acid rain became a concern. Mr. Smiley dug up his old notes and sent them to the [Environmental Defense Fund](#), which used the data as a baseline for extended studies of acid rain.

Similarly, in the 1950s Mr. Smiley found on his walks that the use of DDT to control gypsy moths was killing all kinds of insects, and that the peregrine falcon had nearly disappeared from the Shawangunks. He ordered all spraying stopped on Mohonk land. Of course, DDT spraying was later banned.

Last year, Benjamin I. Cook, a climate modeler and post-doctoral fellow at the [NASA](#) Goddard Institute for Space Studies, and his father, Edward R. Cook, a tree-ring specialist at the Lamont-Doherty Earth Observatory who met Mr. Smiley in 1971 when he was a military policeman at [West Point](#), published a study in *The International Journal of Climatology*. They analyzed Mohonk House data to determine how some overwintering birds, insects, animals and 19 species of plants had changed their habits in accord with changes in temperature.

The results showed how sensitive species can be to climate change, even though the climate data itself is mixed. Benjamin Cook said hepatica, bloodroot and red berried elder tended to show the strongest trends toward earlier flowering. And despite a general warming trend, there was no significant increase in the length of the frost-free season. Nonetheless, there were significantly more days without frost.

“This is more than just a normal January thaw,” Mr. Cook said. The increase in warmer days in winter sends false signals to plants and animals whose seasonal changes can be set off by the temporary warmth.

Intrigued by that initial dip into Mr. Smiley’s data, Mr. Cook next intends to look at migrating birds. Mr. Smiley observed that by the early 1980s many migrating species were arriving about a week earlier than they did in the 1920s, and many American robins had stopped migrating altogether.

As a climate modeler, Mr. Cook said he was used to having to correct for inconsistencies in weather records and biases in phenological observations. But he said the Mohonk records were so consistently reliable that there was little need for corrections.

“It was a kind of perfect storm of the Smiley family, with this strong ethos about the land and land preservation, and Dan Smiley himself, with that same ethos but a scientific mind,” Mr. Cook said. “We just happened to be in the right place at the right time. We were all just incredibly lucky.”

