

## **Climate change brings many surprises**

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This winter in Pittsford was again warm. Very few days had minimum temperatures below -10F. Periods of cold and snowy weather alternated with thaws that melted the snow.

In winter, cold air temperatures freeze the water in the first foot or two of soil. The deep soil temperature stays near 45F, much warmer than the air in winter. When snow cover insulates the ground from the frigid air above, the upward flow of heat from the deep soil can start melting the frozen soil from below. This happened more than once last winter.

I keep track of how long my garden soil is frozen by taking a shovel to my rye cover crop. To my surprise, I was digging again this year on March 11, the same date as last year when the winter was exceptionally warm. This year the unbroken period of frozen soil lasted a remarkably short 55 days, a new record. By March 24, I had turned over all my cover crop and was ready for spring — but until this past week, it was still too cold to plant!

March was generally cold in both North America and northern Eurasia because of a strong high pressure over Greenland, where it was unusually warm. This pushed the jet stream further south over North America, leaving us on the cold northern side. Models suggest that reduced Arctic ice cover contributes to this pattern. But oceans, ice and atmosphere are all linked together, and the climate is fast changing and showing new patterns.

Scientists are always a few years behind the curve in figuring out what is going on. We have been trying to understand why the strong global warming in the last 30 years of the 20<sup>th</sup> century appears to have slowed in the past decade.

Several recent volcanic eruptions have put aerosols into the stratosphere that scatter sunlight back into space, and this cools the earth a little. In the last decade rapid industrialization in China has spewed increasing clouds of pollution into the air, and this also stops some of the sun's warmth from reaching the ground. Unfortunately a new satellite designed to measure these aerosols failed on launch in 2011.

Meanwhile the deep oceans seem to be warming faster than before, but again we have little data. The sun has been a little weaker, and we have almost no idea what is happening inside it. The reduced ultraviolet light from the sun affects the upper atmosphere.

You may at this point think that we are getting in over our heads, and indeed we are. The earth system is extremely complex and mysterious. There is so much to learn — and so little time. But of course this approach is much too limited.

Society and many scientists are living in a dream world, thinking that if we could only understand what is happening to the Earth, we could fix it, or at least adapt to it — or perhaps even change our ways! We humans get fearful when we face something beyond our understanding or outside our control. It is not surprising that some find denial easier than facing an uncertain future.

Some things are very difficult to accept, such as the reality that even as we are responsible for climate change, we are not in control. We cannot manage the Earth — we can only manage ourselves and minimize our impacts on the Earth. We are so many people, and our industrial impact and our unmanaged waste streams are now so large that the Earth's atmosphere and oceans cannot absorb them.

We have the skills and resources to re-engineer our society, so why be stuck in the wasteful ways of the past? The sooner we realize this, the better — and the easier the transition will be for us all.

Spring calls us to take heart and plant new seeds of hope. My spinach that wintered over under glass is ready, and perhaps I can plant my peas this week.