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Nature in the Neighborhood

This edition of the Swampscott Conservancy's Nature in the Neighborhood, is written by Stephen Young, a professor in the Geography and Sustainability Department at Salem State University.

*If you want to hear more from Dr. Young on the impacts of Climate Change, the Conservancy in conjunction with the Unitarian Universalist Church of Greater Lynn will be hosting a presentation by him on **Wednesday, October 12 at 7:00 pm** in person at the church, located at 100 Forest Ave., Swampscott, and also broadcast live on Facebook from the church page at <https://www.facebook.com/UUCGL>*

You can also read his most recent publication in the journal Climate showing that New England is warming faster than the global average: <https://www.mdpi.com/2225-1154/9/12/176>.

“Why droughts and floods will intensify for decades” by Prof. Stephen Young

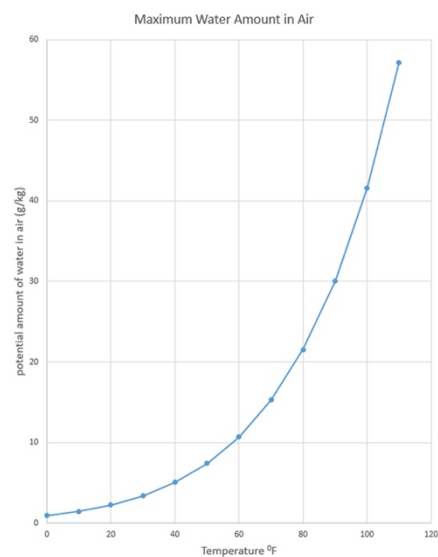
Last July I saw mushrooms sprouting everywhere, even in the sand dunes. July 2021 was one of the wettest Julys on record for eastern Massachusetts. This summer I have hardly seen a mushroom, mostly brown lawns and the smell of forest fires in Lynn Woods due to one of the driest summers on record. This swing between extreme precipitation and drought is an aspect of our new climate — driven by a warming world.

In addition to the drought in New England, the world is witnessing some of the most severe droughts in history. From the mega-drought in the U.S. Southwest, causing Lake Mead and Lake Powell to shrink, to drought across Europe, spawning unprecedented fires, threatening river transport and exposing dozens of sunken World War II vehicles. Dry weather in southwestern China has crippled multiple hydroelectric plants, forcing cities to impose rolling blackouts, close industrial plants, and critical agricultural production is now threatened.

Along with droughts, our world is witnessing floods at an extraordinary scale. This summer, Death Valley received almost a year's worth of rain in three hours; eastern Kentucky was hit with a 1,000-year flood where 37 people died, and Pakistan's severe floods have killed over 1,000 people. Some places have experienced weather whiplash, going from drought to floods such as Dallas, Texas, which went from a top-tier "exceptional" drought to a 1,000-year flood.

These extreme floods and droughts may seem like a fluke, but they were predictable and can be explained by basic physics. As the atmosphere heats up, evaporation intensifies as moisture is drawn out of the soil and the warmer atmosphere has more room to store the evaporated water. This can lead to intensive, long-lasting droughts. Because warmer air can hold much more water, when storms do occur, they can produce greater rainfall, thus 1,000-year floods are becoming more frequent.

The accompanying graph shows how much water air can hold as the air heats up. Not only can warmer air hold more water, as it warms it can hold much more water. For example, air at 50 degrees Fahrenheit can hold more than eight times more moisture than at 0 degrees Fahrenheit, and at 100 degrees Fahrenheit it can hold more than 45 times as much than at 0 degrees Fahrenheit. Each dot on the graph equals 10-year intervals and you can see how each interval gets further apart with increasing water-holding capacity as the air gets warmer.



We have left a stable climate which our civilization developed in, a climate that fluctuated but would return to long-term temperature and precipitation averages. Our new, transitional climate will not return to long-term averages and will continue to warm and as it heats up the atmosphere will be able to hold more moisture and droughts and floods

will intensify. We are just beginning to witness the punishing impacts of climate change-induced droughts and floods, which will intensify for decades. It probably won't be long before we start to see 5,000-year floods. Most recent NOAA atmospheric data show that amounts of CO₂ and methane (greenhouse gasses) continue to rise and methane emissions are accelerating. Humanity has yet to start to slow down greenhouse gas emissions, resigning us to decades of warming.

To survive in the new climate there are two things that we need to do:

1. Prepare for and adapt to intensified floods and droughts in addition to other climate change-induced impacts such as sea-level rise, invasive pests, and extended heat waves. We need to immediately incorporate resiliency into our policies and actions.
2. Transform our economy and behaviors, which were successful strategies in a stable climate, but are now detrimental in the new changing climate. This means changing our energy systems, agriculture, transportation and more. It's crazy that we know fossil fuels are the main reason we're in this predicament and yet fossil fuel companies right now are making record profits, still being subsidized and those profits are not being used to address the damage done by the burning of those fuels. Basic atmospheric physics shows us that if we don't transition as soon as possible, we will live in a world with horrific droughts and floods.