Why hay fever may get worse in a warming climate

October 31 2022, by Rewi Newnham

Credit: Unsplash/CC0 Public Domain

Spring—for many, a time of lifting spirits after those long winter months of short days and cold nights. But for about a third of our population who suffer from hay fever, asthma, or both, spring and early summer can be nightmare months, plagued by allergic reactions to various pollens in the air.

Seasoned hay fever sufferers are used to anticipating exactly when their symptoms will be prevalent—albeit with the occasional surprise in anomalous years. Yet for many, that predictability, which has helped them to plan treatment and avoidance strategies, is now starting to unravel. Climate variability increasingly seems to be messing around with the pollen seasons.

But nature is full of surprises. Can we be sure about the impact of climate change on pollen seasons to the point where we can predict how they might change in the future, in much the same way as we are currently projecting sea-level rise and other consequences of climate change?

In considering this question, I'm reminded of the long, tortuous saga that eventually led to widespread acceptance that climate change today is mostly a direct consequence of human activity. These days, it is clear that we are largely to blame, but this so-called question of "climate change attribution" was debated for decades.

Widespread acceptance eventually materialized only after a number of steps were navigated. First, there had to be a proven conceptual link between observed warming temperatures and the accused perpetrator that could be demonstrated in terms of biophysical processes, and in particular the radiative forcing effect of atmospheric greenhouse gases (AGHGs).

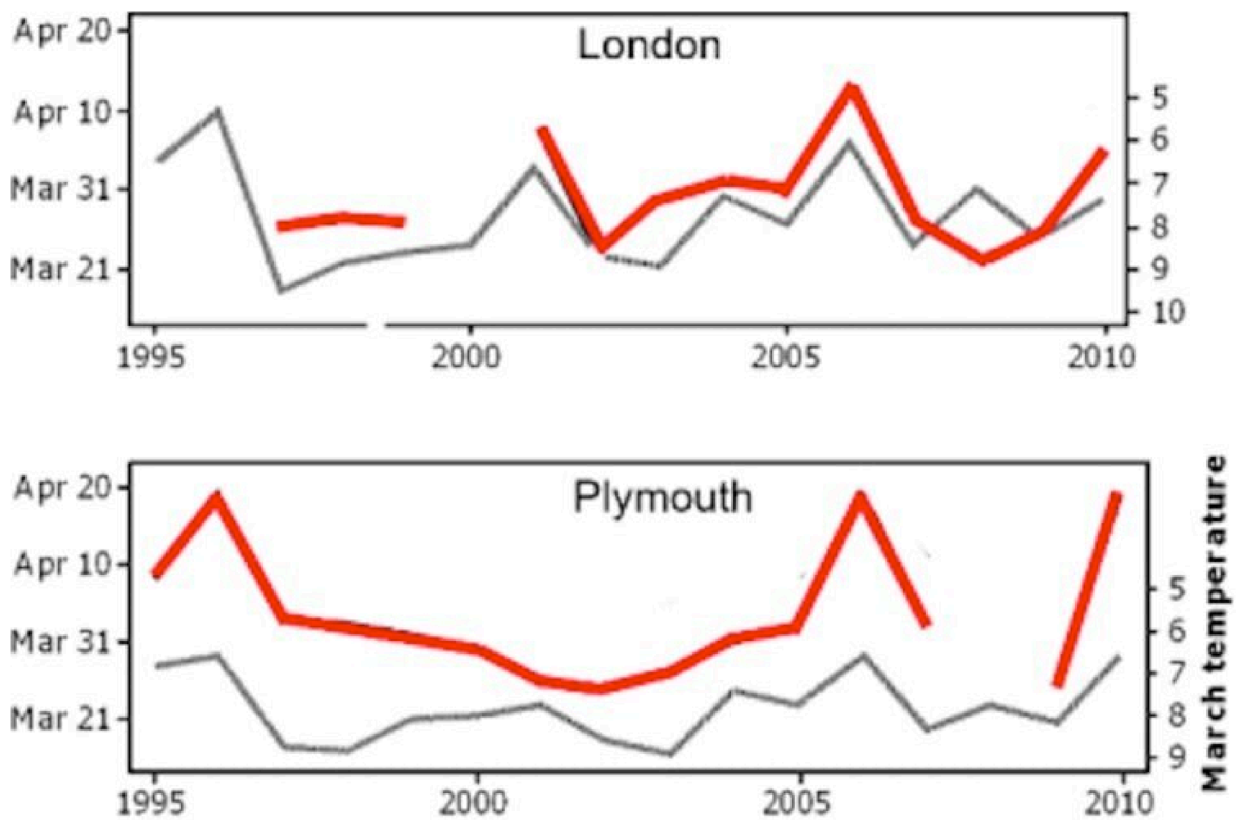
Second, models that constrained and quantified those processes were developed and applied in both forwards (predictions) and backwards (hindcast) modes to generate simulations of temperature change over time. The hindcast simulations are important because we have both direct (observational) and indirect (proxy) records of past climate and AGHGs that can be used to test and improve the model simulations.

Third, the tested models are run with and without the anthropogenic AGHGs to see which version best explains the actual climate pattern that was observed. As a result of these three steps, for some years now climate scientists have known the answer to the question of climate change attribution: we are to blame.

But a fourth step was necessary before widespread acceptance in the community was finally achieved and that final step is being played out right now in the form of extreme events that are forcing us all to face up to the tragic reality of climate change on the ground.

So how does this relate to the question I posed earlier: how, exactly, is climate change altering the timing or severity of allergy-causing pollen seasons? Well, the honest answer is we don't really know, largely because we have yet to complete all four of those steps along the pathway of attribution.

We can be pretty sure about step one on the basis of biological processes and observations. Pollen production and release are governed primarily by two environmental factors: day length, which is not impacted by climate change, and temperature, which is.



Credit: Newnham, R.M., Sparks, T.H., Skjøth, C.A. et al, Pollen season and climate: Is the timing of birch pollen release in the UK approaching its limit? (2012)

Most plants begin pollen production once certain species-specific temperature thresholds are reached. For example, the figure above shows how the date of onset of the birch pollen season (red lines) coincides consistently with the average temperatures for the month of March (gray lines) at three centers in the U.K., with the season commencing earlier in warmer years and later in cooler years.

Many allergy sufferers will tell you they are already at step four where they are experiencing first hand a change in timing of their seasonal symptoms and, in particular, an earlier onset with warmer springs.

However, in New Zealand at least, we are a long way off completing steps two and three, accurately constraining and quantifying the relationship between temperature (and other climate factors) and pollen seasons for key allergenic species.

The problem is lack of data observations. The most recent comprehensive monitoring of airborne pollen here took place in the summer of 1988/89, more than 30 years ago. We know how climate has changed since then, but we simply don't know how the timing and severity of allergenic pollen seasons has been impacted.

We must also consider changes in land use, vegetation communities, population and lifestyle, all of which can affect the pollen levels in the atmosphere or the allergic response across our communities.

There are other factors at play as well. Warmer temperatures encourage the spread of invasive plants, some of which like grasses, plantains and ragweed are known allergy triggers. And the increased atmospheric concentrations of carbon dioxide are boosting the pollen production of some key allergic species.

So, if we put all these factors together, we can be sure that pollen seasons are changing and likely getting worse, but we don't really know by how much. And for allergy sufferers, the devil lurks menacingly in the detail.

Provided by Victoria University of Wellington

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