**Headline:** How Climate Change Is Boosting Pollen Production and Worsening Our Allergies

**Teaser:** Higher carbon dioxide levels and warmer temperatures are causing plants to increase their pollen production.

By Lucy Goodchild van Hilten

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**[Article Body:]**

When the season turns to spring, flowers begin to bloom, trees turn green, and the sun shines longer. But if you’re like almost [one-third](https://www.cdc.gov/nchs/products/databriefs/db460.htm) of adults in the U.S., you might be experiencing watery eyes, a tickly throat, and a runny nose. [With spring comes pollen](https://acaai.org/allergies/allergic-conditions/seasonal-allergies/), which makes breathing air more difficult.

But it’s [getting worse](https://www.allergicliving.com/2023/06/06/why-climate-change-is-making-pollen-allergies-worse-than-ever/): With climate change shifting weather patterns and causing an early, more extended pollen high, we could all be sneezing more than usual. According to Dr. Kathleen May, president of the American College of Allergy, Asthma, and Immunology, exposure to pollen [repeatedly](https://www.allergicliving.com/2023/06/06/why-climate-change-is-making-pollen-allergies-worse-than-ever/) for extended periods may cause symptoms in people not previously prone to allergies.

“If you live with seasonal allergies and feel like the pollen seasons feel longer and longer every year, you may be right,” [wrote](https://attheu.utah.edu/facultystaff/pollen-seasons/) Paul Gabrielsen, a science writer at the University of Utah, in 2021. “[P]ollen seasons start 20 days earlier, are 10 days longer, and feature [21 percent more pollen than in 1990](https://www.pnas.org/doi/10.1073/pnas.2013284118)—meaning more days of itchy, sneezy, drippy misery.” These facts came to light as part of research conducted between 1998 and 2018 across the United States and Canada. The research also found that climate change alone contributed to an increase of about 8 percent in the amount of pollen production.

In fact, according to a 2022 [study](https://www.nature.com/articles/s41467-022-28764-0) published in the journal Nature, a change in temperature leads to an increase in annual pollen emissions by 16 to 40 percent. In the U.S., the continued release of carbon dioxide from various polluting sources will eventually lead to a [200 percent increase](https://fortune.com/well/2023/04/12/brace-yourselves-allergy-sufferers-pollen-season-is-getting-longer-and-more-intense-with-climate-change-heres-what-you-can-expect-in-the-future/) in pollen by the end of the 21st century. Allergy specialist Dr. Kari Nadeau, chair of the department of environmental health at the Harvard School of Public Health, blames global warming. “There are these extreme, chaotic conditions that climate change is associated with,” Nadeau [told](https://www.boston25news.com/news/local/global-warming-causing-earlier-more-intense-allergy-seasons/UHDYTWAZVRFGBJ2D23T6FIGZ7E/) Boston 25 News in March 2023. “And that warming is affecting our pollen seasons.”

Nadeau [pointed out](https://www.boston25news.com/news/local/global-warming-causing-earlier-more-intense-allergy-seasons/UHDYTWAZVRFGBJ2D23T6FIGZ7E/) that climate change leads to trees “getting the wrong message,” causing them to release pollen earlier than they normally would. “So my patients, for example, otherwise would have started allergy season in March, now they’re having allergy season start January-February.”

**Pollen: Pervasive Problem**

One of the most common pollen allergies is [hay fever](https://www.aaaai.org/Conditions-Treatments/Allergies/Hay-Fever-Rhinitis), which isn’t new. It was first described in 1819, when physician John Bostock presented a novel case to the Medical and Chirurgical Society, calling it a “[[c]ase of a periodical affection of the eyes and chest](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3110966/).” It was the first recorded description of what he later called “catarrhus aestivus or summer catarrh,” which is now known as hay fever.

Hay fever has become increasingly common: According to the [Asthma and Allergy Foundation of America](https://aafa.org/allergies/allergy-facts/#:~:text), approximately 81 million people in the United States were diagnosed with hay fever in 2021—about one-quarter of adults and one-fifth of children. The percentage of people with hay fever varies around the world: a [2022 study of 193,912 adults in 17 countries](https://erj.ersjournals.com/content/60/3/2102865) revealed a prevalence of 14.4 percent on average, ranging from 2.8 percent in Ibadan, Nigeria, to 45.7 percent in Bangkok, Thailand.

It’s the pollen that’s to blame for these symptoms. When plants reproduce, they have to get their sex cells together. Pollen carries the male sex cells so it has to be transferred to the female plant. Many plants use insects, like bees, to transfer their pollen to other plants, and others rely on wind. The wind-pollinated plants produce tiny, light pollen that can be carried on a breeze—fantastic for their reproduction, disastrous for our respiration.

**Immune Response**

When we inhale pollen grains, they can kickstart an immune response in which our body is trying to attack them. Our [immune system can overreact](https://www.webmd.com/allergies/understanding-hay-fever-basics) to the harmless pollen: The sneezing, the watery eyes, and the histamines that make your nose itchy are designed to kill or eject the pollen. If you’re prone to [allergic rhinitis](https://www.nhsinform.scot/illnesses-and-conditions/ears-nose-and-throat/allergic-rhinitis/), the more pollen you’re exposed to, the worse your symptoms.

Not every person suffering from hay fever is, however, allergic to every kind of pollen. It tends to be seasonal: In the spring, tree pollens from [birch](https://allergyasthmanetwork.org/news/birch-pollen-allergy/), [oak](https://www.uaex.uada.edu/yard-garden/resource-library/plant-week/oak-pollen.aspx), and [mountain cedar](https://today.tamu.edu/2020/12/31/what-is-cedar-fever/) cause the most problems, while grass and weeds like [mugwort](https://cipwg.uconn.edu/wp-content/uploads/sites/244/2016/10/Mugwort-Poster-10-10-16-36x48Landscaperevised.pdf) and [nettle](https://tinyurl.com/bdct7mrk) lead to allergies in the summer, with weeds like [ragweed](https://harvardforest.fas.harvard.edu/photos/ragweed-pollen-study) (the [leading cause](https://tpwd.texas.gov/publications/nonpwdpubs/young_naturalist/plants/airborne_pollen/) of hay fever nationwide) and [fungus spores](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4397360/) causing symptoms in autumn.

These allergies have worsened over time thanks to climate change, which is [causing](https://www.hsph.harvard.edu/news/hsph-in-the-news/allergies-are-getting-worse-with-climate-change/) an increase in pollen release, likely due to the [flowers growing larger and producing more pollen](https://yaleclimateconnections.org/2023/04/in-every-breath-we-take-how-climate-change-impacts-pollen-allergies/). With [colder countries](https://www.hsph.harvard.edu/news/hsph-in-the-news/allergies-are-getting-worse-with-climate-change/) experiencing warmer weather due to global warming, “pollen-producing plants are now able to [even] grow there,” according to Nadeau.

In 2015, the [World Allergy Organization](https://www.worldallergy.org/), composed of more than 100 allergy and immunology societies from around the world, [released a statement](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4499913/) warning that climate change will have an impact on when, how long, and how bad the pollen season will be, “as well as the allergenicity of the pollen.”

“The strong link between warmer weather and pollen seasons provides a crystal-clear example of how climate change is already affecting… [people’s] health across the U.S.,” [said](https://www.nifa.usda.gov/about-nifa/impacts/yes-allergy-seasons-are-getting-worse-blame-climate-change) William Anderegg, a biologist at the University of Utah, about research conducted by him and his team that was [published](https://www.pnas.org/doi/10.1073/pnas.2013284118) in the Proceedings of the National Academy of Sciences in 2021.

“A number of smaller-scale studies—usually in greenhouse settings on small plants—had indicated strong links between temperature and pollen,” [noted](https://www.nifa.usda.gov/about-nifa/impacts/yes-allergy-seasons-are-getting-worse-blame-climate-change) Anderegg. “This study reveals that connection at continental scales and explicitly links pollen trends to human-caused climate change.”

**Warmer Weather Means More Pollen**

A 2015 [study](https://www.ncbi.nlm.nih.gov/pubmed/25266307/) published in PubMed showed that in the decade between 2001 and 2010 in the U.S., pollen season started on average three days earlier than it did in the 1990s.

What’s more, the amount of airborne pollen increased by more than 40 percent. “These changes are likely due to recent climate change and particularly the enhanced warming and precipitation at higher latitudes in the contiguous United States,” [concluded](https://pubmed.ncbi.nlm.nih.gov/25266307/) the researchers.

Global warming is also increasing the number of people [suffering](https://www.newscientist.com/article/2267062-climate-change-is-making-us-hay-fever-season-longer-and-more-intense/) from hay fever, with extending warm periods, in turn, increasing the time for pollination, according to an [article in the New Scientist](https://www.newscientist.com/article/2267062-climate-change-is-making-us-hay-fever-season-longer-and-more-intense/): “Warmer temperatures signal to plants that it is time to reproduce, leading to pollen seasons that typically start in the spring.”

**Pollen Problem Fueled by Carbon Dioxide**

While warmer temperatures have led to earlier and [longer pollen seasons and more pollen](https://www.nifa.usda.gov/about-nifa/impacts/yes-allergy-seasons-are-getting-worse-blame-climate-change), rising carbon dioxide levels are also helping plants produce more pollen. Plants feed on carbon dioxide, so when there’s an [abundance](https://www.nature.com/articles/s41467-022-28764-0#:~:text=Increasing%20atmospheric%20CO2%20may,to%20climate%20or%20CO2.) of it, they can produce more pollen. Couple that with warmer temperatures, and you’ve got the ideal conditions for plant growth and reproduction, which means more allergens for us.

Take the invasive and highly allergenic plant ragweed, for example. Referring to [research published](https://www.publish.csiro.au/fp/FP05039) in 2005, a 2020 [article](https://onlinelibrary.wiley.com/doi/full/10.1111/all.14476#all14476-bib-0010) in the European journal Allergy stated that “recent and projected increases in CO2 could directly increase the allergenicity of ragweed pollen and consequently the prevalence and/or severity of seasonal allergic disease.” The researchers [concluded](https://www.publish.csiro.au/FP/PP00032) that “continuing increase in atmospheric CO2 could directly influence public health by stimulating the growth and pollen production of allergy-inducing species such as ragweed.”

Another 2002 [study](https://www.annallergy.org/article/S1081-1206%2810%2962009-1/pdf), which looked at the effects of CO2 on ragweed pollen production, stated that the doubling of CO2 in environmentally controlled greenhouses resulted in ragweed pollen emissions increasing by 61 percent.

Lewis Ziska, assistant professor at the Columbia Mailman School of Public Health—who was previously a research plant physiologist with the U.S. Department of Agriculture (USDA)—[said](https://ehp.niehs.nih.gov/doi/10.1289/ehp.124-A70) that the intensity of an allergic reaction depends on how much pollen is released, the duration of the exposure, and how allergenic the pollen is. In ragweed, these three factors work strongly together. “What’s unique about ragweed is that it produces so much pollen—roughly a billion grains per plant,” Ziska said, according to a 2016 [article](https://ehp.niehs.nih.gov/doi/10.1289/ehp.124-A70) written by Charles W. Schmidt for the journal Environmental Health Perspectives.

**No Escape to the City**

One might be tempted to think that hay fever would be less of a problem in the city, away from all the trees and weeds, but the opposite appears to be true. Similar results were observed outside the lab in downtown Baltimore, where Ziska and his team planted ragweed in 2002. The area was [3.5 degrees Fahrenheit](https://ehp.niehs.nih.gov/doi/10.1289/ehp.124-A70) warmer and had 30 percent more carbon dioxide than the countryside. The ragweed “thrived, growing bigger, and puffing out larger plumes of pollen than its country counterpart,” [reported](https://www.theverge.com/2017/4/10/15203522/allergies-hay-fever-seasonal-spring-pollen-global-warming-climate-change) Rachel Becker in the Verge.

In fact, more vehicles and resulting CO2 emissions, urbanization, and several other factors are [causing](https://onlinelibrary.wiley.com/doi/full/10.1111/all.14476#all14476-bib-0010) “[a] greater presentation of respiratory allergy caused by pollen in patients living in urban areas compared with those living in rural areas.”

Ragweed may thrive in our cities, but there’s a more significant—and taller—problem: The trees planted to provide shade and beauty are making our allergies worse.

“Many people believe that the more trees you have in a city’s green infrastructure, the more they act as a biofilter,” said [Amena Warner](https://www.allergyuk.org/about-us/meet-the-team/), head of clinical services at [Allergy UK](https://www.allergyuk.org/), during an interview. “But are they the right kind of trees? In urban areas, particularly in London, there’s a lean toward planting birch trees, which are highly allergenic. When they’re in cities, people can’t escape the pollen easily, and it’s virtually indestructible unless it’s wet.”

That means the pollen that collects on your clothes, the bottom of your shoes, and in your hair during your afternoon stroll could plague you until it rains or is washed away. That, said Warner, extends the time you’re in contact with pollen, even out of pollen season. “The UK has some of the highest prevalence rates of allergic conditions in the world,” [according](https://www.allergyuk.org/about-allergy/statistics-and-figures/) to Allergy UK, with more than 20 percent of its population suffering from one or more allergic disorders.

“It’s important that the right tree is planted in the right place,” said Warner. “We want to raise awareness of why planting allergenic birch trees in urban areas can increase hay fever and other respiratory conditions.”

So, if we know the pollen from birch trees (and lots of others) is causing allergic reactions, why are they still dominating our city streets? “Mainly because they seem to be fashionable,” said Warner. “They have this lovely silvery bark, and they’re long and graceful with a beautiful sweeping canopy that gently sways in the wind. And they don’t drop fruit—in a city, you want trees with a low cleanup cost.”

**Keeping Hay Fever at Bay**

There are alternatives: Not all tree pollen is allergenic. In 2010, a [report](https://www.aafa.org/media/Extreme-Allergies-Global-Warming-Report-2010.pdf) by the National Wildlife Federation called on states, communities, and homeowners to “undertake smart community planning and landscaping, with attention to allergenic plants and urban heat island effects, to limit the amount of pollen and other allergens that become airborne.”

One way to reduce the impact of hay fever in cities would be to use the [Ogren Plant Allergy Scale](https://tinyurl.com/2hvf2hb5) (OPALS), which rates trees in terms of how allergenic they are. So when choosing your tree, whether you plan to plant it in your garden or on the street, opt for something that won’t make people sneeze.

As the climate continues to change and we see an increase in hay fever, we’ll also notice a more significant [impact on public health](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4829390/), not least because “[[a]sthma is found in up to 38 percent of people with allergic rhinitis](https://www.nature.com/articles/s41598-022-10448-w).” While urban planning may be out of our hands, there are some things we can do to reduce the pollen problem.

David Mizejewski, a naturalist at the National Wildlife Federation and a longtime allergy sufferer, gave [some advice](https://www.aafa.org/media/Extreme-Allergies-Global-Warming-Report-2010.pdf) on things to keep in mind while venturing outside during allergy season:

* Get an allergy test—that way, you can decide when’s best to go outside
* Ask your doctor about allergens and what medication to take
* Check daily pollen counts and go out when they’re low
* Wash your clothes and yourself to remove trapped pollen, and use nasal sprays
* Choose non-allergenic plants for your garden
* Plant female trees and shrubs (it’s the male plants that produce pollen)

It’s important to remember that people with allergic rhinitis can develop asthma, which can be serious. So, if your symptoms start to affect your breathing, it’s best to consult a doctor.

According to a [review in eBioMedicine](https://www.thelancet.com/pdfs/journals/ebiom/PIIS2352-3964%2823%2900043-9.pdf), “Allergic respiratory diseases are already serious public health challenges in many countries and regions.” Continuing to ignore climate change will not only result in irreversible damage to the planet, but it will also significantly impact public health systems by increasing the prevalence and intensity of allergies around the world.