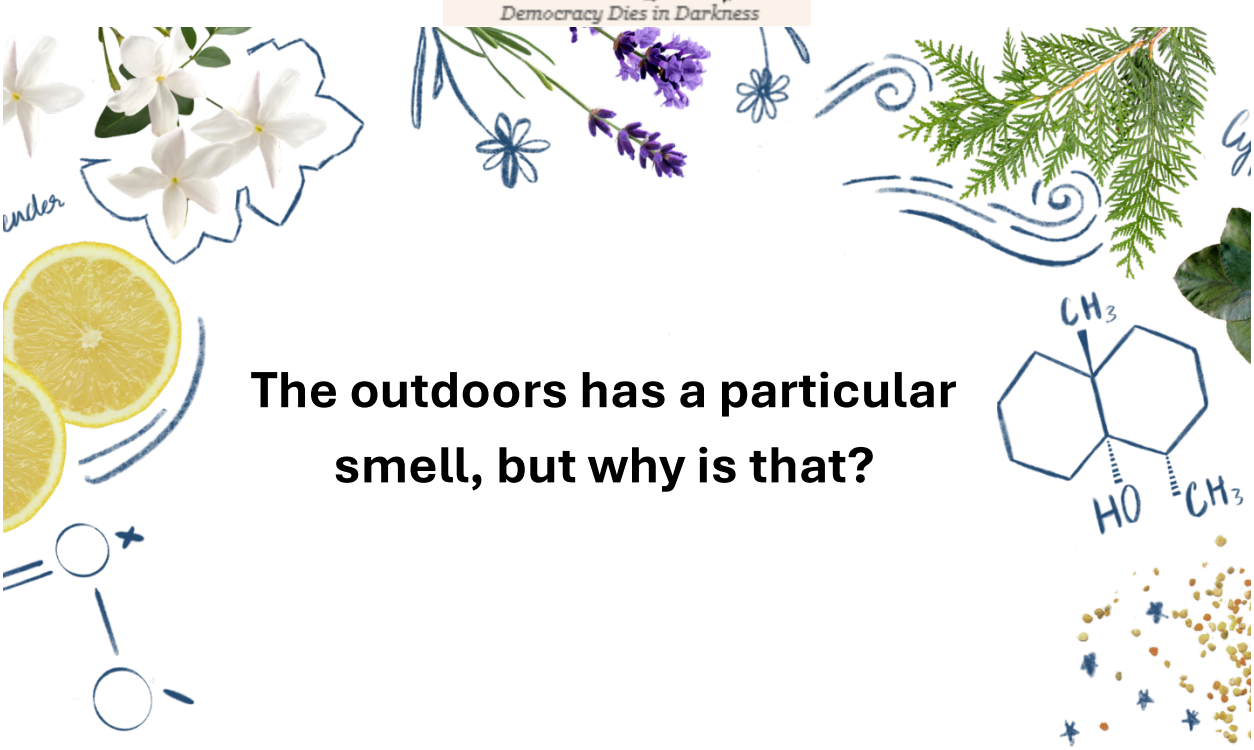
The Washington Post
Democracy Dies in Darkness



The outdoors has a particular smell, but why is that?

A scientific explanation for the always present but ambiguous scent that follows us indoors.

By Emma Kumer and Shikha Subramaniam

May 3, 2025

Spring has sprung — and in many parts of the world, you can *smell it*. The air might smell sweeter, with notes of budding florals and pollen. But there are complex parts of the scent, too, more metallic notes of fresh air and breeze. You might even find that the smell lingers on your clothes, hair and pets after you go inside.

Outside smell changes depending on the season and location. People might describe it as fresh, earthy or even sharp. It seems stronger in the winter, and stronger still on hair or fur. Some people think it smells fresh and lovely, while others find it irritating and unclean.

But what *is* the "smell of the outside," really?

We asked this question at a party filled with journalists, and received more questions than answers. What does it mean for the outdoors to have a smell, on a molecular level? Why are only some people able to detect it? Does the smell differ based on location, weather, or temperature? Do parents have a heightened awareness of it? And why don't people seem to agree?

We immediately turned to some experts in the field to find out. And when you subtract the localized smells from trees and flowers in your region, there actually is a universal “smell of the outside,” no matter where you are, and no matter what season.

What is outside smell?

When you’re smelling the air while outside, you’re taking in a complicated bouquet of molecules floating through the atmosphere. But when the smell follows you inside on your clothes and hair, it’s made up largely of two compounds.

The first is ozone — which is sharper and often described as “cold.”

“That metallic smell that you’re smelling is actually an ozone smell,” said Karla Ziegelmann-Fjeld, Research and Development Scientist who specializes in microbiology.

You might remember this part from science class: According to the Environmental Protection Agency, ozone is composed of three oxygen atoms, making it highly reactive. This makes it easy for ozone to stick into the porous surfaces of your clothes and hair.

The second scent is geosmin, a natural compound with a richer, earthy smell. If you like the smell of rain, also known as *petrichor*, geosmin is the main compound responsible for this smell.

You might struggle to imagine this smell if you aren't familiar with it. But this fragrance is something the human nose is extremely attuned to.

"Humans can smell geosmin better than sharks can smell blood in the water," said Bree Elliott, co-founder of Fantôme, a perfume house that specializes in atmospheric scents. Anthropologists believe humans developed this elevated perception to help our ancestors literally sniff out water, Elliott said, by identifying it underground or predicting rainfall.

At Fantôme, Elliott's team replicates the unique blend of aromas that make up the outdoors with a few tricks.

"We kind of mimic this by using mint in certain products," Elliott said. "Mint tricks us into thinking that we are experiencing the cold. The menthol activates the same receptor on our nerve endings."

To evoke warmth, a perfumist might use cinnemaldehyde, the compound that gives cinnamon its odor and flavor, which activates heat receptors in the same way. And for a more “city-like” smell, they might try to evoke buzzing neon, exposed metal, or motor oil.

How is the smell sticking to you?

On the molecular level, smells take the form of odor molecules detected by our noses’ olfactory sensory neurons. That means that the smell of the outdoors is genuine traces from the world around us — particles of dirt, air, plant matter and bacteria — that linger on us.

Smell molecules often get tangled or attached on your skin, clothes and hair. “Natural fibers are going to hold on to things a little bit better,” said Ziegelmann-Fjeld.

Rachel Herz is an expert on the psychological science of smell. She explains that often, outside smell is most noticeable when you enter the warm indoors from the cold outdoors. There's a reason for this. When you walk back in, the drop in temperature creates more volatility in the smell compounds, making them more perceptible.

"It's not just the pure outdoor environment that you're smelling, whether it be geosmin or ozone," she said. "It is also in combination with the body odor of the individual and also the clothing that they're wearing." This combines with city smoke, pollen and other notes of the environment to create "a new volatile bouquet."

You might not be able to detect the smell on yourself. If you have already been outside, that particular scent will not stand out to you as much as it would to someone waiting for you inside.

"The sense of smell is basically a change detection system," said Herz. "It's always noticing what's different or novel in the environment as a signal for information from the point of view."

What makes it more intense?

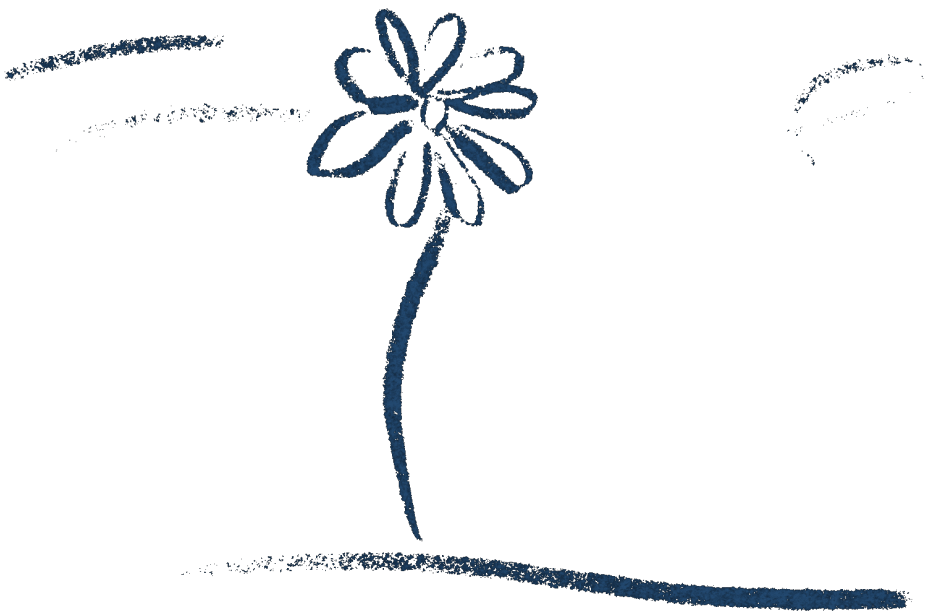
Some people find the sharp “outside smell” of ozone to be stronger in the winter.

Elliott explained that this might be due to the fact that there are fewer particles in the air. In the spring or summer, plant oils, pollen, solar particles — and yes, geosmin — make up a larger percentage of the atmosphere. When those are gone, it’s easier to pick up on that metallic ozone scent.

“Winter is so conducive to smelling,” Elliott said. “That is as close as we can get to a vacuum in nature. And it makes everything smell so crisp and pure.”

Geosmin may be found in larger quantities in the summer, but not explicitly due to the heat.

According to Ziegelmann-Fjeld, this scent depends more on when it last rained. In the days following rainfall or humidity, the soil is moist. This creates ideal conditions to activate dormant forms of bacteria, called spores. The more spores in the atmosphere, the stronger the scent becomes.



Why doesn’t everybody like it?

Our perception of smell is heavily affected by our associations with it, real or imagined. The same scent can have very different meanings for two different people.

“For example, how do you view lemon?” Elliott asks. “Does it evoke the warm weather citrus smell of blossoms or is it the cleaning products that you might associate with your childhood home that was used to mop the floors? And lavender is similar to this. Do you consider it soothing or medicinal?”

Of course, to those who have formed a career in smell, there might not be any bad smells — just different ones.

In one of Herz’s most-cited studies, she provided test subjects with a container with the scent of isovaleric and butyric acid. She told them it would provide the scent of parmesan cheese; many of the reviewers described the smell as good and familiar. A week later, she repeated the study, this time mentioning they would smell vomit. The reviewers strongly disliked it this time around, finding it disgusting and horrible. The twist? Both smells were the same.

“I basically showed the equivalent of an olfactory illusion,” she explained, “where people had totally different hedonic responses to a scent as a function of the label,” reminding us that perception can change completely as a function of context.

Even if you like the smell of the outdoors, you might notice that your skin chemistry can emphasize certain notes that are stronger or weaker on someone else.

“When I’m developing a scent, I have everybody around me wear it, you know, to see … what notes are pulled,” Elliott says. “For example, I find that my skin amplifies spice notes and dampens floral notes, no matter what fragrance it is.”

Why can some people smell it more easily?

In anecdotal research, it was clear that the pool of people who could easily discern “outside smell” included a lot of parents. But there’s not necessarily a reason to believe the ability to sense it is something that comes with age, or with parenthood.

Herz suggests pregnant women, and parents in general, perceive their sense of smell to be stronger, and find many smells especially intense. This can be attributed to a general hyper vigilance. According to the NIH, smell sensitivity tests reveal a negligible difference in olfactory ability before, after or during pregnancy.

The human nose can detect at least 1 trillion odors. But being able to name them all is a notoriously difficult skill. The prestigious Givaudan Perfumery School in Paris asks students to memorize 500 fragrance components within their first year; career perfumers like Elliott might be able to possess and memorize thousands.

When it comes to the average person, though, we don't have a convenient way to test for olfactory ability.

People might not have thought too much about it before the covid-19 pandemic, but losing the sense of smell ranked as one of the virus' most recognizable symptoms. While eyesight and hearing tests are fairly common, there isn't a counterpart test for smell.

Herz and other scientists are advocating for that to change. A loss of smell can be a sign of many more illnesses, Herz said, including dementia.

"I'm a huge advocate for the medical community taking on board the annual smell test as part of your physical," she said.

"It is a fantastic bellwether for your physical health and all kinds of other aspects of cognitive health in general."

To assess our own relative sense of smell, we ordered a couple scratch-and-sniff tests online and asked several colleagues to name the samples. Most people completed the test with 75 to 85 percent accuracy, but there was such a wide range in results that it proved that just because you can differentiate between scents doesn't mean you can always identify them. Luckily, that's something that you can improve on your own.

It's not as hard as you might think. Herz suggests something called "smell training." She recommends setting aside a few minutes each day to gather things with strong or unique smells — maybe a fresh fruit from the kitchen, a cream from the bathroom and a nearby candle. "Don't just smell passively," she suggests, "but sniff with intention. Train your brain to link the source of that scent with the experience of it."

About this story

Reported and illustrated by Emma Kumer and Shikha Subramaniam. Photographs from iStock. Editing by Paulina Firozi, Joe Moore and Juliet Eilperin. Additional editing by Dominique Hildebrand. Copy editing by Dorine Bethea.

https://www.washingtonpost.com/climate-environment/interactive/2025/outdoors-has-particular-smell-why-is-that/