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Scientists want to know how the smells of nature benefit our health

[James Urton](#)

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Tropical forest canopy in Caxiuanã, Brazil. *Jake Bryant*

Spending time in nature is good for us. Studies have shown that contact with nature can lift our well-being by [affecting emotions, influencing thoughts, reducing stress and improving physical health](#). Even brief exposure to nature can help. One well-known study found that hospital patients recovered faster [if their room included a window view of a natural setting](#).

Knowing more about nature's effects on our bodies could not only help our well-being, but could also improve how we care for land, preserve ecosystems and design cities, homes and parks. Yet studies on the benefits of contact with nature have typically focused primarily on how seeing nature affects us. There has been less focus on what the nose knows. That is something a group of researchers wants to change.

“We are immersed in a world of odorants, and we have a sophisticated olfactory system that processes them, with resulting impacts on our emotions and behavior,” said Gregory Bratman, a University of Washington assistant professor of environmental and forest sciences. “But compared to research on the benefits of seeing nature, we don’t know nearly as much about how the impacts of nature’s scents and olfactory cues affect us.”

In a paper published May 15 in Science Advances, Bratman and colleagues from around the world outline ways to expand research into how odors and scents from natural settings impact our health and well-being. The interdisciplinary group of experts in olfaction, psychology, ecology, public health, atmospheric science and other fields are based at institutions in the U.S., the U.K., Taiwan, Germany, Poland and Cyprus.

At its core, the human sense of smell, or olfaction, is a complex chemical detection system in constant operation. The nose is packed with hundreds of olfactory receptors, which are sophisticated chemical sensors. Together, they can detect more than one trillion scents, and that information gets delivered directly to the nervous system for our minds to interpret — consciously or otherwise.

The natural world releases a steady stream of chemical compounds to keep our olfactory system busy. Plants in particular exude volatile organic compounds, or VOCs, that can persist in the air for hours or days. VOCs perform many functions for plants, such as repelling herbivores or attracting pollinators. Some researchers have studied the impact of exposures to plant VOCs on people.

“We know bits and pieces of the overall picture,” said Bratman. “But there is so much more to learn. We are proposing a framework, informed by important research from many others, on how to investigate the intimate links between olfaction, nature and human well-being.”



A subalpine meadow on Mount Rainier in the summer. *Elli Theobald*

Nature's smell-mediated impacts likely come through different routes, according to the authors. Some chemical compounds, including a subset of those from the invisible realm of plant VOCs, may be acting on us without our conscious knowledge. In these cases, olfactory receptors in the nose could be initiating a "subthreshold" response to molecules that people are largely unaware of. Bratman and his co-authors are calling for vastly expanded research on when, where and how these undetected biochemical processes related to natural VOCs may affect us.

Other olfactory cues are picked up consciously, but scientists still don't fully understand all their impacts on our health and well-being. Some scents, for example, may have "universal" interpretations to humans — something that nearly always smells pleasant, like a sweet-smelling flower. Other scents are closely tied to specific memories, or have associations and interpretations that vary by culture and personal experience, as research by co-author [Asifa Majid](#) of the University of Oxford has shown.

"Understanding how olfaction mediates our relationships with the natural world and the benefits we receive from it are multi-disciplinary undertakings," said Bratman. "It involves insights from olfactory function research, Indigenous knowledge, Western psychology, anthropology, atmospheric chemistry, forest ecology, [Shinrin-yoku](#) — or 'forest bathing' — neuroscience, and more."

Investigation into the potential links between our sense of smell and positive experiences with nature includes research by co-author [Cecilia Bembibre](#) at University College London, which shows that the cultural significance of smells, including those from nature, can be passed down in communities to each new generation. Co-author [Jieling Xiao](#) at Birmingham City University has delved into the associations people have with scents in built environments and urban gardens.

Other co-authors have shown that nature leaves its signature in the very air we breathe. Forests, for example, release a complex chemical milieu into the air. Research by co-author [Jonathan Williams](#) at the Max Planck Institute for Chemistry and the Cyprus Institute shows how natural VOCs can react and mix in the atmosphere, with repercussions for olfactory environments.

The authors are also calling for more studies to investigate how human activity alters nature's olfactory footprint — both by pollution, which can modify or destroy odorants in the air, and by reducing habitats that release beneficial scents.

“Human activity is modifying the environment so quickly in some cases that we’re learning about these benefits while we’re simultaneously making them more difficult for people to access,” said Bratman. “As research illuminates more of these links, our hope is that we can make more informed decisions about our impacts on the natural world and the volatile organic compounds that come from it. As we say in the paper, we live within the chemical contexts that nature creates. Understanding this more can contribute to human well-being and advance efforts to protect the natural world.”

Other UW co-authors on the paper are [Peter Kahn](#), professor of psychology; [Connor Lashus](#), a graduate student in the School of Environmental and Forest Sciences; and [Anne Riederer](#), a clinical associate professor of environmental and occupational health sciences. Additional co-authors are [Gretchen Daily](#) of Stanford University; [Richard Doty](#) at the University of Pennsylvania; Thomas Hummel of the Dresden University of Technology; [Lucia Jacobs](#) of the University of California, Berkeley; John Miller of Wildwood | Mahonia; Anna Oleszkiewicz of the University of Wrocław; [Hector Olvera-Alvarez](#) of Oregon Health and Sciences University; [Valentina Parma](#) of the Monell Chemical Senses Center; [Nancy Long Sieber](#) and [John Spengler](#) of Harvard University; and Chia-Pin Yu of National Taiwan University.

For more information, contact Bratman at bratman@uw.edu.