

Everyone says trees are good for us. This scientist wants to prove it.

Nearly 8,000 trees and shrubs in southern Louisville and health data from about 500 residents fill out the urban science experiment



By [Bishop Sand](#)

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Aruni Bhatnagar in Washington on Oct. 16, 2023. Bhatnagar is the lead researcher on a multimillion-dollar initiative focused on finding the link between trees and human health. (Michael A. McCoy for The Washington Post)

Aruni Bhatnagar looked up.

“This tree right here, it’s got a lot of good leaves so you can stick a lot of air pollutants in it,” Bhatnagar, a cardiology researcher, said as he gestured toward a magnolia tree on the U.S. Capitol grounds.

Bhatnagar, silver haired and wearing a black turtleneck, was in D.C. for the World Forum on Urban Forests to speak about his \$15 million [Green Heart Louisville](#) project — an initiative aimed at showing a causal connection between greenness and human health, and a potential model for U.S. cities looking to measure the effects of their tree planting.

In 2018, Bhatnagar, a University of Louisville medical school professor, decided that he wanted to “do something” about air pollution in Louisville, which has repeatedly earned [failing grades](#) for air quality from the American Lung Association. His contribution, he decided, would be to find the connection between trees and better heart health using the gold standard for evidence: clinical trials.

“The idea is to learn to examine everything, no matter how obvious they may seem,” he says.

Bhatnagar is well aware of the massive forest of urban tree research available, but much of it involves observational health studies, in which scientists measure potential correlations between urban trees and residents’ health.

“What I thought was we really don’t know if trees are beneficial for health,” Bhatnagar said.

To get beyond that, he proposed the Green Heart Louisville initiative, which launched in 2018. Over time, contractors and volunteers have planted nearly 8,000 trees and shrubs in a cluster of lower-to-middle-income neighborhoods in southern Louisville and measured health data from nearly 500 residents.

Today, the project involves more than 50 researchers, 4 universities, 4 nonprofits groups, 5 state and local government agencies, and the U.S. Forest Service. It began as a collaboration between Bhatnagar; Louisville philanthropist Christina Lee Brown; former Louisville mayor Greg Fischer; and Ted Smith, Louisville’s then-chief innovation officer. Roughly \$9 million from the Nature Conservancy got things moving. The National Institute of Environmental Health Sciences provided another \$3 million, and local donors contributed \$3 million as well.

The work is focused in neighborhoods that — like many poor urban areas — have fewer trees compared with more affluent parts of the city. The neighborhoods are mixed racially and ethnically: 54 percent White, 29 percent Black and 11 percent Hispanic. A highway runs right through the areas — providing an unhealthy baseline of air pollution.

Bhatnagar collects an almost-obscene amount of data that includes blood panels, urine, hair samples, wastewater runoff, air pollution samples, soil and leaf samples, bat sounds, LiDar scans, temperature and humidity measurements, crime data, psychological surveys and sleep surveys. It is all being parsed, and relationships are starting to emerge, he said.

Among the tantalizing hypotheses Green Heart is testing: whether trees filter air pollution that can stiffen human arteries. Another is whether trees reduce stress and improve sleep by buffering noise. Some trees seem to be better at filtration than others — evergreens, for instance, filter air throughout the year and those with needles absorb harmful pollutants more efficiently than broad-leafed trees.

Another hypothesis is that trees release a suite of chemicals into the air that reduce blood pressure and stress. Bhatnagar has seen these chemicals’ metabolites show up in urine samples at higher concentrations where people have more exposure to trees and other greenery.

Cities around the country are set to receive funding from the Inflation Reduction Act this year to plant trees, and already many local governments spend millions every year on planting and maintaining trees. Cities often maintain detailed records of size and health of every tree for every block, and LiDar scans from aircraft paint a more complete model of the urban tree canopy. Medical professors also study green spaces and trees’ effects on aging. And psychologists have observed that stress levels and depressive states are less in greener areas of the city.

But Bhatnagar’s research will add new, concrete health data. “There’s this idea that we should just plant some trees and things will be better,” Bhatnagar said, “but who, what, where, and how? These are the questions.”

“We can’t just go, ‘Oh, look, this is greener place and people are happier’ because most places that are greener are richer, etc.,” he said, noting that other factors could play a role in overall health.

In a 2018 literature review, Forest Service research social scientist Michelle Kondo found that — before Green Heart — there had been few randomized controlled trials looking into the effects of greening interventions on human health or safety.

Bhatnagar’s study — planting mature trees throughout a neighborhood and measuring many variables — is the first of its kind, said Kondo, who collaborates with Green Heart in her job. “Almost all of the studies being done four years ago were what you call observational and cross-sectional,” she added.

Bhatnagar’s study is famous in urban forestry circles, said Kathleen Woolf, a research social scientist at the University of Washington, who has also reviewed the urban tree and health literature.

Green Heart “is very important because it is that very intentional, systematic introduction of an intervention on a neighborhood scale, in a community that has been identified to have numerous health challenges. And so it’s in a sense, following the random controlled trial model,” Woolf said.

In conversation, Bhatnagar likes to reference the Bradford Hill criteria of causation which states, among other things, that a cause must precede an effect in time and there must a dose-response relationship.

Bhatnagar wanted this deeper level of causal understanding. He wanted clinical trial experimental data, in which “doses” of trees were introduced to a population with a nearby control group and extensive measurements over time.

Establishing cause would not be easy. Bhatnagar needed expensive, mature trees — \$1,000 each — to have a measurable effect, willing participants, a small army of scientists gathering data and another legion of researchers to analyze it.

Scientists, he said, can pursue research in isolation, but they can also actively engage with colleagues in wide-ranging fields, share a vision with community leaders and philanthropists, speak at conferences around the world, write articles for the World Economic Forum, host a podcast and read Virginia Woolf — which, coincidentally describes Bhatnagar.

“We need to be in the world ... able to synthesize ideas, to be able to create some larger vision and not to be put in your place,” he said.

So far, Bhatnagar has published a few studies about the immediate effects of introducing trees. His team has found higher air pollution near fast food restaurants, and better sleep and sense of well-being near green spaces — all interesting, but the most meaningful results are the changes over time. And Bhatnagar is finally able to see some long-term, longitudinal effects of the trees on health.

Even as he cautioned against expectations influencing Green Heart's results, he said he expects to find positive effects on the health of the people in the target clusters compared with the control clusters.

"We think we have a strong signal that there is some health benefits in a longitudinal way," Bhatnagar said, noting that he has yet to have his results peer reviewed.

Cecil Konijnendijk has spent 30 years in urban forestry. As co-director of a think tank called the Nature Based Solutions Institute, he advises governments where to plant trees. And he's firmly behind studies like Green Heart.

"That will really help us of course, not only arguing for the need for trees, but also really how to make interventions for specific outcomes and benefits," Konijnendijk said. "We can be more targeted toward specific communities of people, targeted toward certain types of green."

Bhatnagar is hopeful that other scientists will take note of his study and pursue similar experiments. If that happens, more scientists can be actively involved in policies and recommendations to create healthier urban neighborhoods, he said.

"Right now, we have no idea that what sort of what a healthy neighborhood looks like," Bhatnagar said. "This is one step in that direction."