

High levels of lead contaminate many backyards in Brooklyn neighborhood

October 10 2017, by Sarah Fecht



Columbia researchers are searching for lead in the soil in Greenpoint, Brooklyn.
Credit: Sarah Fecht

When we met Philip, he was chiseling black paint off the iron railing in front of his brownstone. He led us through his beautiful home and into the backyard. "Nothing will grow in this back corner," he explained. "It seems like there's definitely something wrong with that... We've dug up a lot of trash back here, so God only knows what else is in the soil."

Philip is one of dozens of Brooklynites who have volunteered to have their soil tested for lead by Franziska Landes, a graduate student in Columbia's Department of Earth and Environmental Sciences. Since this spring, Landes and her team have analyzed 264 [soil samples](#) from 52 private backyards. They're still collecting data, but the preliminary results are disturbing: some 92 percent of Greenpoint backyards have at least one sample that exceeds the lead level that the EPA designates as safe for residential soil. Some yards contain seven or eight times more lead than they should—higher than the levels found in some polluted Peruvian mining communities Landes has studied.

Whether connected to contaminated soil or not, children in Greenpoint are about four times more likely to have lead poisoning than their peers in other New York City neighborhoods. Five percent of Greenpoint children have [lead levels](#) exceeding five micrograms per deciliter of blood, the level at which CDC recommends taking action.

"You like to know what you're living with," said Stephanie, another Greenpoint resident who was getting her soil tested that day. To protect their privacy (and potentially the values of their and their neighbors' homes), Stephanie and Philip preferred not to use their last names.

Digging for an Explanation

Landes and her assistant, Sabina Gilioli, worked efficiently, spreading out over Philip's yard to pick out which areas to sample, and setting up vials on his patio table. In five spots (including the far left corner, bare

except for a dead magnolia tree), they scooped up dirt with metal spoons and, using a kitchen strainer to sift out larger clumps, funneled it into the vials. Each container was carefully labeled; back in the lab, they would find out how much of the toxic metal each one harbored inside.

Lead isn't good for anyone, but it poses the most serious threats to children under the age of six. As a neurotoxin, it disrupts growth in young brains, increasing a child's risk of developing a low I.Q., Attention Deficit Hyperactivity Disorder, and behavioral problems.

Many of the participants in Landes' study are concerned parents, found through a local activist group called Neighbors Allied for Good Growth. "A lot of times the parents tell us 'my children have tested high with lead, and that's why we found this program,'" said Gilioli.

"That's why we wanted to focus on this area," explained Landes. "Maybe we could figure out what's playing a role in this."



Grad student Franziska Landes (right) and her assistant Sabina Gilioli collect soil samples on a sidewalk in Greenpoint, Brooklyn. Credit: Sarah Fecht

Until now, no one has done a systematic mapping of the lead levels in Greenpoint's soil. Brooklyn College will test soil samples that anyone in the U.S. can mail in, but their data aren't always evenly distributed. With a more complete map, Landes hopes to take a look at the distribution of lead on a smaller scale and learn about the relationship between backyard and public levels; for example, are backyard soils more contaminated with lead even in areas where the public soil is not?

"Backyards are often not tested for lead in soils, but they could be

harboring high levels of contamination that kids could be exposed to," said Landes. "Are we missing a potentially large exposure because we're not looking in the right places?"

Her map is crowded with red, green, and yellow pins from the samples they've collected, many with the help of Barnard environmental scientist Brian Mailloux and his students. But there doesn't seem to be any particular pattern to colors on the map. "There's not one clear hotspot," Landes said. "One of the challenging things about working in an urban area is there are so many potential sources of contamination."

Lead paint, used until the 1970s, could have easily found its way into peoples' backyards during remodeling and routine maintenance—like scraping paint off of your front railing, as Philip was doing when we met him (although he was working over concrete and said he swept up afterwards). Before leaded gasoline was officially phased out in the 1990s, fine lead particles from vehicle exhaust rained down on high traffic areas and neighborhoods near throughways. Waste incineration sent lead particles on a similar path. In addition, Greenpoint has an industrial history, including being home to the lead smelters of the Non-Ferrous Processing Corporation.

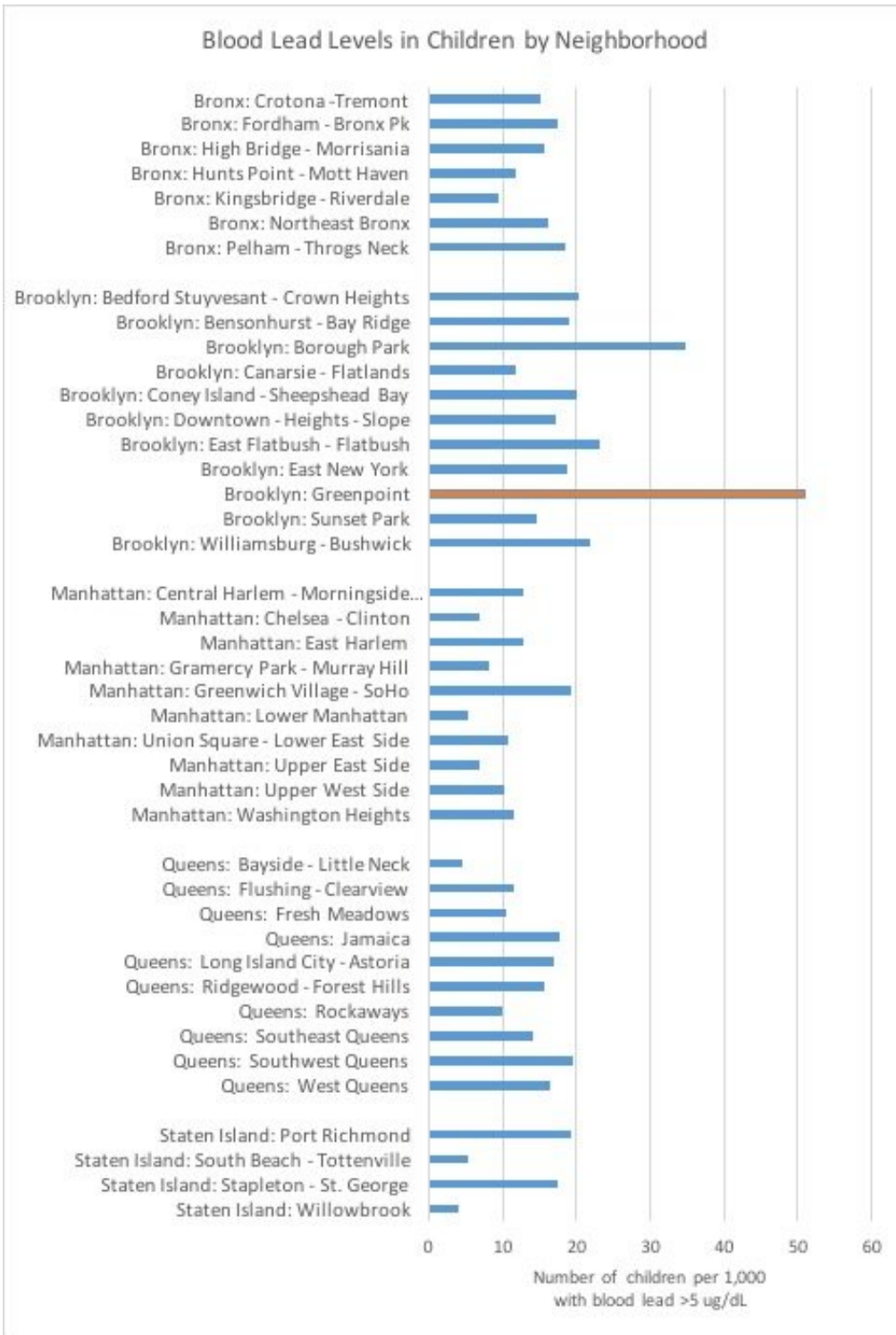
"Soils are recording this history, because lead doesn't go away," Landes said. Once it's deposited, lead tends to stick around, not moving much except when it's kicked up as dust. Vegetables growing in lead-contaminated soil may take up small amounts of the metal, and sometimes lead-contaminated dust gets tracked into the home. But its main route into the human body is through direct ingestion. "Kids are really the concern there," said Landes. "They like to play in the dirt and then stick their toys in their mouth or suck their thumbs, and they're not always washing their hands in between."

A Private Problem

After collecting the little vials of soil, Landes and Sabina bring them back to the lab to see what's inside. There, they place a bit of plastic wrap over each vial's opening, and set it upside down inside a metal box that closes like a backyard grill.

From below, an x-ray fluorescence spectrometer gun fires x-rays up into the sample. The rays excite electrons in the soil, making some jump to an outer shell of the atoms they reside in. In response, another electron from the outer shell drops into its place in the inner shell, releasing a specific amount of energy that reveals the identity of its atom. By measuring these electron emissions per second, the system figures out how much lead and other metals are in the soil. It spits results onto a computer screen within 60 seconds.

The Environmental Protection Agency sets 400 parts per million as an acceptable level of lead in bare residential soil. The limit is meant for guidance—it's not enforceable—and there may be risk at levels as low as 100 ppm. So far, Landes and her team have found that some 84 percent of Greenpoint of the backyard samples exceed the EPA standard, and 35 percent have lead levels over 1200 ppm, the EPA's standard for industrial soils. Of the 52 yards sampled, 33 (that's 62 percent) had at least one sample that exceeded the industrial standard, and a few have gone as high as 3,000 ppm. "Even as an adult I wouldn't want to be hanging out in those yards," said Landes.



Greenpoint children are more likely than their peers in other NYC neighborhoods to have elevated levels of lead in their blood. This chart shows the number of children per 1,000 expected to have blood lead levels exceeding five micrograms per deciliter, the level at which the CDC recommends taking action.

Credit: NYC Dept of Health, 2015

By contrast, of the 463 samples that the team has collected from public parks and sidewalks, only about 14 percent exceed the lead levels. Landes isn't sure why the lead contamination is so much higher in private yards, but it may have something to do with their close proximity to decaying paints in the home as well as debris from remodeling. Plus, they're just older soils carrying the legacy of leaded gasoline, waste incineration, and industrial byproducts; public spaces are more likely to have new soil and mulch hauled in from elsewhere for landscaping.

The work underlines a pattern that researchers at Brooklyn College uncovered in 2015, said Landes' thesis advisor, Alexander van Geen from Columbia's Lamont-Doherty Earth Observatory. Those researchers also found high lead levels to be much more common in private yards. "Franziska's work over the summer really made the contrast between soil in public and private spaces even starker," said van Geen.

And while the data suggest that the lead levels in the soil could be connected to the higher lead levels in the blood of Greenpoint children, the team hasn't proved that yet. After they finish collecting samples in Greenpoint, they'll need to replicate the study in an area where childhood [blood lead levels](#) are particularly low. "If soil lead is low there, too, it will add to the argument that soil contributes in North Brooklyn," said van Geen. "If it isn't, then we're still missing a big piece of the puzzle."

Taking it to the Streets (and Mines)

One thing that Landes has learned while making her maps is that it's hard to predict where the lead will be. "You have to test it to find out where the contamination is, and that's one of the reasons I'm developing a field

test."

Before she was digging around and raising eyebrows on the sidewalks of Greenpoint, Landes worked in Peru, helping mining communities look for lead in their soil. Those rural communities didn't have access to expensive analysis equipment, so Landes designed a relatively simple test that works anywhere.

With Landes' help, participants mix the soil from their yards with a glycine and hydrochloric acid solution, shake it, filter it, and add a color-changing substance called sodium rhodizonate. At the end, a clear or bright yellow solution indicates low levels of lead. Dark yellow means medium amounts of lead, and brown to black indicates high risk.

"I had feared the levels of lead would be high, but I didn't anticipate them being that high."

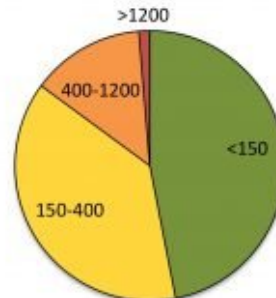
In Peru, "mothers used the field kit to find areas of contamination that we had missed," said Landes. In fact, the most difficult thing for them was using a smartphone touchscreen for an app that records the sample's location and soil properties.

Lead (Pb) levels in soils as measured by XRF

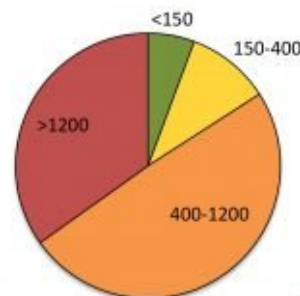
Updated: 9/28/17



Public samples n= 455



Private samples n= 264



Data collected as part of the Columbia/ Barnard Soil Lead Study 2017. Please contact lead_study@ldeo.columbia.edu or fcl2115@columbia.edu with questions.

Landes-Oliver Earth Observatory
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The study's results as of September 28 show that most Greenpoint backyard samples contain lead levels higher than the EPA's recommended 400 ppm.
Credit: Franziska Landes

Unlike the x-ray fluorescence gun, which tells the total amount of lead in a soil sample, the field test, because it simulates stomach acid and the movements of digestion, gives a better idea of how much the human body may absorb from a sample. Landes is working on increasing the test's sensitivity, to try to increase its precision with lower levels of lead. She aims to make it easier to use and distribute: "I hope it doesn't just stay in the lab."

Backyard Remedies

Philip's soil results came back in the red zone; with the exception of a potted plant, his yard is contaminated with lead levels ranging from 736 to 1196 ppm. Naturally, he's upset. "I had feared the levels of lead would be high," he said, "but I didn't anticipate them being that high." He and his wife just bought their house last year, so for them as well as many others in the neighborhood, moving is not really an option.

Fortunately, there are actions they can take to protect their health, and they all boil down to minimizing contact with the contaminated soil.

Rather than digging up the entire backyard to replace the soil, which could potentially put more lead into the air and into your home, guidance from Cornell University and the New York State Department of Health recommends containing the contamination. Planting grass will help to keep the soil in place, and a patio, mulch, or gravel could cover it. Another option is to blanket the ground with landscaping fabric and add six inches of clean soil on top.

Parents should keep an eye on their kids when they're playing in the backyard to make sure they keep their hands out of their mouths, and consider building a sandbox for them to play in instead.

Backyard gardeners can use raised beds with clean soil. Although plants don't typically take up much lead—it tends to get stuck in the roots—you should wash all vegetables in case lead-contaminated soil has blown onto them, and peel root vegetables. And try not to track dirt into your home. Philip said he and his wife will be sure to take their shoes off before entering their house after doing yard work.

Landes thinks it's unlikely that the state or city government will step in to help with the remediation. "So much of the Northeast is contaminated, I

don't see the government coming in and fixing everything." However, she said, it helps to raise awareness and to know where kids should and should not be playing.

"Lead in the [soil](#) should probably be a concern for anyone who lives in New York," she said. "You should get it tested before letting kids play in it, or before you plant a garden."

Provided by Columbia University

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