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Environmental Health Science in Action: Field Sampling with Community Partners

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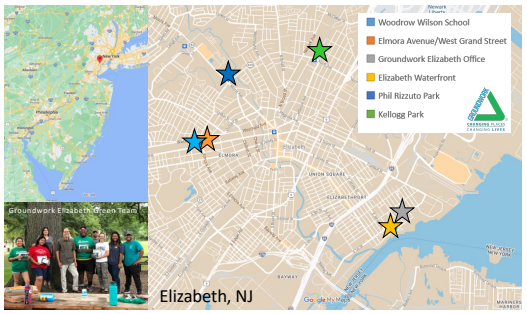
Abstract

Working with communities to address their environmental concerns is central to translating basic toxicology research to humans and improving public health. In Summer 2022, the Summer Undergraduate Research Fellowship (SURF) Program at Rutgers University partnered with Groundwork Elizabeth in Elizabeth, NJ to learn about community sustainability and environmental justice efforts, as well as the potential for contamination of the local environment with toxic heavy metals. This collaboration was part of a 10-week research program that included didactic sessions on the developmental neurotoxicity of lead and assessment of persistent heavy metals in the environment. Twenty-one undergraduate students, including three youth leaders from Groundwork Elizabeth, and five graduate students were divided into five teams. Following interactive lessons on environmental sustainability, including microfarms, and proper technique in field sampling, the teams were tasked with field sampling at six sites across Elizabeth, NJ to collect soil, street dust, and water. Results from the field sampling indicated that soil and dust at most locations had heavy metal levels below EPA standard guidelines. Mean heavy metal levels for 34 soil and dust samples were 128 ppm lead (Pb; range: 5- 1541 ppm), 13 ppm chromium (Cr; range: 3-39 ppm), 7.7 ppm arsenic (As; range: 3.7-16.3 ppm), and 0.4 ppm cadmium (Cd; range: 0.2-1.7 ppm). Of the six collection site locations, only one dust sample exceeded the EPA standard for lead in residential areas (400 ppm; EPA). Overall, road dust samples had higher Pb levels than adjacent soil samples, indicating potentially different sources of contamination. In addition, 3 water samples collected along the Elizabeth Waterfront revealed elevated arsenic levels (30-39 ppb, n=3) above the NJ drinking water standard (5 ppb; NJDEP). These results highlight the importance of environmental monitoring for potential heavy metal exposure. Students completed pre- and post-activity surveys that allowed self-assessment of knowledge using a 5-point Likert scale (0-4). The greatest knowledge gains were related to steps involved in sampling (pre-test mean 1.5; post-test mean 3.3, p<0.05) and sources of lead and other pollutants in the environment (pre-test mean 1.8; post-test mean 3.0, p<0.05). Participants rated the sampling field trip as 4.7 out of 5 stars. Taken together, a partnership with an environmental community action group provides a unique training experience for toxicology students by incorporating team science and exposure science, and demonstrates the importance of environmental justice efforts. Supported by R25ES020721, P30ES005022, T32ES007148, UL1TR003017, and the SOT and ASPET SURF Intern Programs.

Building Community Partnership to Address Environmental Health Concerns

Through this experience, students were able to:

- Engage with community organizers to learn about the city.
- Work with community partners to assess environmental sources of heavy metal exposure and select sampling sites.
- Receive hands-on training in environmental field sampling.
- Understand the distribution and sources of heavy metals in an industrialized city.
- Connect field-to-laboratory research in environmental health.



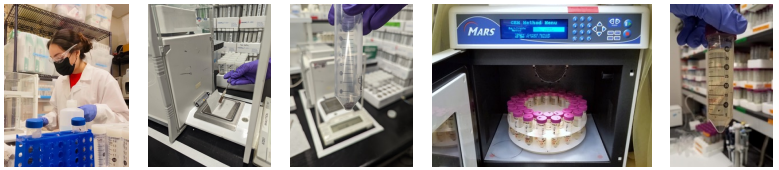
Study sites in Elizabeth, NJ and community leaders from Groundwork Elizabeth. The mission of Groundwork Elizabeth is to work with the community to improve the quality of their environment in order to build healthy, sustainable, and equitable communities.

Field Sampling with Community Partners

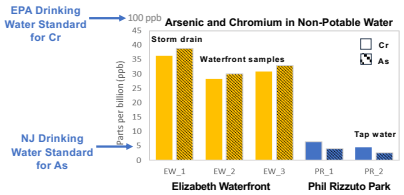
Participants meet with community organizers. Student interns learning about Groundwork Elizabeth, the city of Elizabeth, touring the city micro-farm, and participating in on-site field sampling training. This partnership provided a unique opportunity to connect field-to-laboratory research that impacts human health.

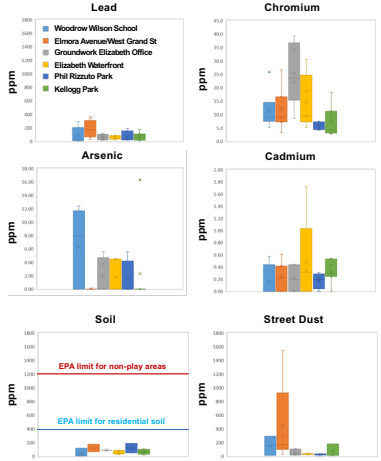
Working together to assess heavy metals in the environment. Student interns collecting street dust, soil, and water samples in the field under the guidance of community youth leaders.

Field-to-Laboratory Connection



Preparing Environmental Field Samples for Heavy Metal Analysis. Student interns extracted heavy metals from samples by reacting them with nitric acid in a microwave digestion system. The samples were then analyzed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS).





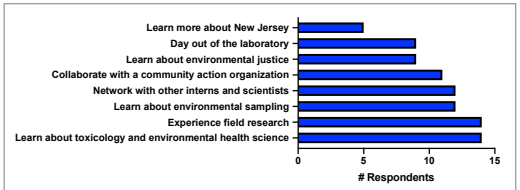
Results from Field Sampling.

(Above) Non-potable water samples collected along the Elizabeth Waterfront revealed elevated arsenic levels above the NJDEP drinking water standard. This water source is not used for drinking, but may pose a risk for consumption of fish.

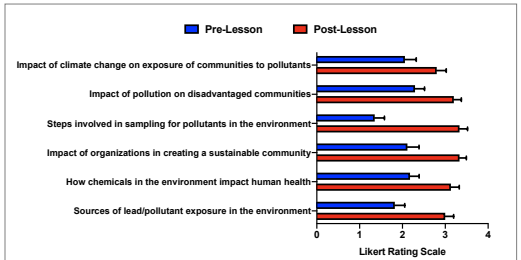
(Top Right) Distribution and mean heavy metal levels for soil and street dust samples at each location. Only one street dust sample exceeded the EPA standard for lead in residential areas (400 ppm; EPA).

(Bottom Right) Overall, street dust samples had higher Pb levels than adjacent soil samples, indicating potentially different sources of contamination.

Student Feedback on Experience



Participants were Asked Why They Chose to Participate in The Field Sampling Activity. Responses indicated a broad range of perceived benefits, ranging from gaining knowledge to networking and collaboration.



Pre- and Post-Activity Survey by 21 Rutgers SURF Interns. Self assessment of knowledge gains were rated on a Likert scale of 1 (lowest) to 5 (highest). The greatest knowledge gains were related to steps involved in sampling and sources of lead and other pollutants in the environment. Significant knowledge gains were recorded in all aspects of the field sampling with community partners experience.

Main Takeaway

A partnership with an environmental community action group provides a unique training experience for toxicology students by incorporating team science and exposure science, and demonstrates the importance of collaboration in environmental justice efforts.

Acknowledgments

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https://surf.rutgers.edu

GROUNDWORK CHANGING PLACES CHANGING LIVES

NIH National Institute of Environmental Health Sciences