Environmental Research Methods Service-Learning Project

Abstract

The city of Springfield, Ohio, like many cities around the country has a wide-spread issue with high concentrations of lead in the soil, leading to significant health risks. Thus, the Environmental Research Methods course at Wittenberg University was structured around the main theme of running a service-learning project to simultaneously learn scientific methods and provide the citizens of Springfield with knowledge about the lead problem they are living with each and every day in an attempt to address the project. In order to successfully accomplish this goal, the course started with canvassing Springfield residents to raise awareness of the issue by inviting them to Promise Fest, a community event at which we set up a booth providing soil testing and information on lead in the soil and water of Springfield. After that event, we continued our work by taking to the streets of Springfield and informing people at their homes, while taking samples for testing purposes. By doing so we were able to reach a much wider audience and provide information to many. Many residents were provided with information on the soil levels in their lead, raising the general awareness of the issue within the community. In addition, the wealth of data collected allowed us to analyze trends to not only determine the severity of lead contamination in Springfield but also to tie trends in increased lead with historic HOLC zones that carry with them discrimination. The project was able to lead us to the potential next step of providing families with short term solutions to reduce exposure hazard until a long term solution can be planned and executed by the city of Springfield.

Introduction

As part of the Environmental Research Methods class at Wittenberg University, we conducted a community service-learning based project in which we attempted to raise awareness of the lead issue prevalent in Springfield, Ohio, while also collecting soil lead level data in order to understand the breadth of the issue. The course was structured mainly around events which aimed to simultaneously teach methods commonly applied in the environmental sciences and also have a positive impact on the community. The methods covered include canvassing and community engagement, asking a lead research question framed in the legacy associated with housing policy, soil lead sampling (both the taking of samples and the analysis of them), and data analysis (both numerically/graphically and spatially utilizing GIS applications).

The project was successfully informative mainly in the area of gaining experience with the aforementioned scientific methods and tools, and was valuable in obtaining data about the Springfield community. The community involvement/education aspect of the project, while important, ended up being unsuccessful for the most part and requires reevaluation in future iterations of this project in order to be successful, with aspects of other community outreach programs being considered and implemented to the best of our ability within the class's project. Overall, the lessons learned from the project, both those intended in the scientific methods and those learned for the future in the aspect of community involvement are both valuable in our future applications of related ideas in environmental science. This paper aims to discuss the methods of this project, its impact on the community, and the lessons learned from its execution.

Methods

Initially, we focused specifically on community engagement through participation in a local Springfield event known as PromiseFest. Prior to the event, our class split into groups and went canvassing in the area around where the event was held. We passed out informational flyers and Ziploc bags, with the intent that residents of the homes we visited would collect their own soil samples for testing in order to raise community interest and awareness of the lead issues prevalent in Springfield. Then, during the event, the intent was to have local residents bring in their collected soil samples for testing to inform them of the lead levels in their yard, the samples being taken one near the street, one in the mid-yard, and one at the dripline. We set up a booth at the event at which we had several informative pamphlets as well as a NITON Portable XRF Analyzer for use in determining the lead content of the soil samples. Unfortunately, we only had one person arrive at our booth with samples from their home, so our ability to test Springfield's soil lead levels was incredibly limited. However, some people, especially smaller children, did visit the booth and took samples of the soil near the event, allowing us to teach them about Springfield's lead problem.

After this event, we continued our efforts to raise awareness of Springfield's lead issue, this time in the context of environmental injustice. We did so by researching lead concentrations associated with historical redlining practices that are associated with high vacancy rates and deteriorating housing stock. We collected soil samples from the yards of willing participants, ensuring that we targeted houses in each of the four types of HOLC zone divisions.

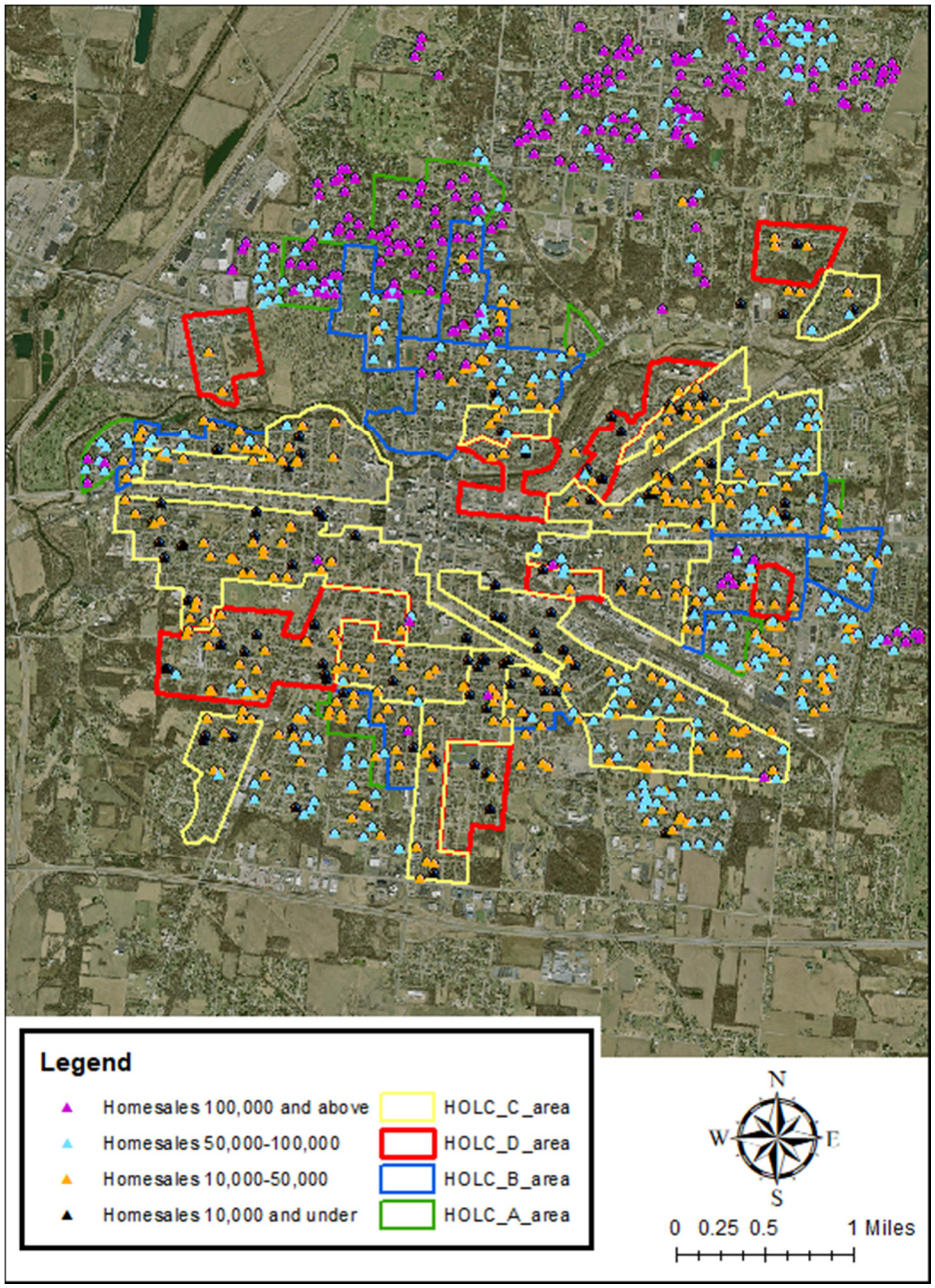

Fig. 1 A map of Springfield with HOLC Zones outlined and locations of homesales marked with colored symbols denoting the price at which the home was sold.

These were areas marked out by grades given by the Home Owners Loan Corporation to determine loan availability, and were ranked from “A” at the high end of the scale to “D” or redlined at the bottom. The criteria for ranking were mainly based on the racial demographic of the area, as realistically the zones were used as a tool for

Redlining and discrimination (“Mapping Inequality”). A map outlining the historic HOLC zones compared to the current day homesale values is provided above for sampling area reference and to show the continued geographic and economic inequalities. Thus, we aimed to highlight injustices related to the lead levels in the soil in higher ranked areas as compared to lower ranked areas, as it is well known that the echoes of past discrimination are still very much felt today.

We went door to door in these areas, acquiring samples from willing homeowners in much the same way as the first event: one near the road, one in the mid-yard, and one near the drip-line. We collected contact information from those who wanted to provide it so that we could communicate with them their lead levels after testing. In addition, we took some samples from abandoned properties. Once all of these samples were collected, they were brought back to the lab and analyzed for lead content much like the samples at the Promise Fest event. Although there was still some difficulty engaging the community and finding interested participants, this event was much more successful in raising community awareness, as we had multiple participants interested in us returning the data collected from their property and provided information to those who were interested in it. This method of community engagement was significantly more successful, as shown by the fact that we concluded with substantial amounts of data and a handful of residents who were interested in the issues we discussed enough to provide contact information so that we could update them on the lead concentration in their yards. It has previously been shown that visiting community residents in their homes has a positive impact on combating issues such as child health and maltreatment, as personalized care is more helpful to the resident and it is more

convenient at the same time (Avellar, 2013). Thus, it is unsurprising that the same sort of concept, of talking to community members in their homes and testing their personal property for lead was more successful in raising awareness of the issue.

Results & Discussion

Due to the lack of participants at our booth at PromiseFest, we collected very little data at the event. Thus, there is an insufficient amount of information on lead collected at the event and thus there is nothing worth presenting in this article. However, we did learn some valuable information about community engagement. Simply alerting the public of the event did little to spark their information in the lead soil issue, as shown by the lack of participation. Thus, it was clear that it was important to provide more direct engagement and information to spark a discussion amongst the people of Springfield about the lead in their yards.

Median / Average Lead ppm	Near Street	Mid-Yard	Dripline
A	56.55 / 60.68	40.85 / 39.47	71.2 / 107.52
B	72.9 / 96.14	112.5 / 142.43	938.1 / 1108.383
C	90.60 / 98.00	110.40 / 160.40	198.5 / 266.68
D	78.8 / 134.7	98.3 / 141.7	287.00 / 429.8

Table1. A table showing median and average lead levels (ppm) in soil sampled from homes in each type of HOLC zone. 3 samples were taken at each home: one near the street, one at the mid-yard, and one at the dripline.

Fortunately, our second attempt at data collection was much more successful. Above is a table showing the median and averages of each of the sample types (street, mid-yard, and dripline) from each HOLC zone. Generally, the data shows a trend of increasing lead levels moving from near the street to close to the house, except for the

exception of the A zone mid-yard values. This lines up with what we expected to find, as hazardous lead levels are typically sourced from lead-based paints used in and outside of homes, as well as carried in water that runs through lead-based pipes, both of which are problems prevalent in Springfield due to housing age (Binns *et. al,* 2007 ; CDC, 2019). Logically, it follows that more lead would deposit from these at the dripline (near the house) than farther away near the street.

In addition, other than the incredibly high levels in the B zone dripline, the lead levels show a trend of increasing down the ladder of HOLC zone rankings, highlighting more of the injustices tied to the segmentation of the land by the HOLC so many years ago. The abnormally high levels of lead found in the B zone dripline may be due to error, and was not normalized to a lower level because of a slightly smaller amount of data collected in B zones compared to the other zones. The homes within the B and D zones show concerningly high lead ppms, as the EPA standard for lead concentration in soils is 400ppm for “play-areas,” where it is likely that children are present frequently. However, even this number is a bare-minimum for health and ideally soil contains less than 50 ppm of lead, which few of the homes exhibit except for those in the A zones at mid-yard (Environmental Health, 2017). This highlights the concerning state of soil lead in Springfield, along with the frankly disgusting environmental inequalities that persist to this day. Ideally, this data can be used to raise awareness of this issue and drive change to improve the health of people across the city, regardless of economic status or geographic location of their home.

Conclusion

There are two main concepts that are vital to take away from this service-learning project for improvement in the future. The first is the obvious fact that something must be done about the lead issue in Springfield, Ohio. It is incredibly important to raise awareness about the issue, but that must be matched with solutions to the problem so that we can end it entirely.

A seemingly simple solution to the issue of Springfield's lead concentration comes to mind almost immediately: surely to get rid of the lead contamination, it is as simple as removing the contaminants. If you were to clean old houses of lead paint and repaint them and replace lead pipes with copper or some other material so that lead no longer leaches into water and from there into the soil, it would certainly address the issue of lead permeating the land of Springfield. However, unfortunately, this is not a cost-effective solution and it would be incredibly economically and logistically difficult for the city of Springfield to achieve. Therefore, while it is the ideal solution, it will certainly take a very large amount of time before something like that can be implemented. Until then, a short-term solution to reducing lead exposure risk must be developed.

Luckily, we have already performed two of the three most important steps to reducing this risk: Raising awareness of the issue within the community and testing soils to determine their lead content. Now, we must act upon our findings and inspire others in the community to do the same. In order to do so, we should follow the example of others who have done such projects before us, like the project tested in the Dorchester neighborhood of Boston, Massachusetts. After proceeding through the first two steps much like we did in our own project, the runners of the Dorchester Lead-Safe Yard

Project went on to act on the concerning lead concentrations they found by tailoring their solutions to the amount of lead. For particularly high lead amounts (above 5000 ppm), they constructed physical barriers out of landscaping cloth or plastic to cover the soil and covering it with a material such as gravel in order to physically prevent interaction with the hazardous soil (Hynes *et al.,* 2001). However, as we did not detect any lead levels that drastic, we should take a page from the book of their solutions to lower levels of lead contamination, such as guiding families in those homes to ensure that gardening does not take place in high risk areas, and to protect high use areas constructing pathways over typically traveled areas and by framing areas of heavy use for purposes such as leisure or children's play areas (Hynes *et al.,* 2001). By providing such solutions to families living on property with dangerous lead levels (such as those we measured in the 400-1000 range) we can provide short term relief until long term solutions can be planned and implemented. If the city of Springfield was to devote resources to providing solutions for lead exposure risk to those in the areas that are generally poor due to injustice holding over from the time of HOLC zoning who potentially do not have the time or resources to perform the potentially expensive landscaping procedures necessary to make their yards safe, it would go a long way towards lifting the menace of lead in Springfield as well as banishing some of the ghosts of HOLC's injustices. By doing so, we can provide relief until a long term solution can be achieved.

Acknowledgements

Thank you to Dr. Fortner, Dr. Cunningham, the Springfield Promise Neighborhood Association & all of my peers in the Environmental Research Methods course at Wittenberg University for making this project possible.

Works Cited

Avellar, S. A., & Supplee, L. H. (2013). Effectiveness of Home Visiting in Improving Child Health and Reducing Child Maltreatment. *Pediatrics*, *132*(Supplement). doi: 10.1542/peds.2013-1021g

Binns, H. J., Campbell, C. J., & Brown, M. J. (2007). Interpreting and Managing Blood Lead Levels of Less Than 10 g/dL in Children and Reducing Childhood Exposure to Lead: Recommendations of the Centers for Disease Control and Prevention Advisory Committee on Childhood Lead Poisoning Prevention. *Pediatrics*, *120*(5). doi: 10.1542/peds.2005-1770

CDC - Lead - Home Page. (2019, July 30). Retrieved from https://www.cdc.gov/nceh/lead/default.htm.

Environmental Health and Medicine Education. (2017, June 12). Retrieved December 3, 2019, from https://www.atsdr.cdc.gov/csem/csem.asp?csem=34&po=8.

Hynes, H. P., Maxfield, R., Carroll, P., & Hillger, R. (2001). Dorchester lead-safe yard project: a pilot program to demonstrate low-cost, on-site techniques to reduce exposure to lead-contaminated soil. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, *78*(1), 199–212. doi: 10.1093/jurban/78.1.199

“Mapping Inequality.” *Digital Scholarship Lab*, dsl.richmond.edu/panorama/redlining/#loc=5/39.1/-94.58&text=intro.