

Study of Lead Contamination Surrounding Houses of Knowledge

Environmental Research Methods

Professor Fortner

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Introduction:

Lead pollution is an issue that many people across the United States know all too well. Whenever the issue of lead pollution is brought up, the conversation is immediately steered towards disasters such as what occurred in Flint Michigan relatively recently in the history of our nation. Fewer people realize the impact that lead can have in ways that are not related to lead being used in water pipes. Lead can enter the soil profile at housing knockdown sites when older housing with lead paint is destroyed. These areas are of particular interest because cleared lots are often looked at as places to create community spaces such as parks or gardens where people bring their children and spend a lot of time (Lead Regulations).

Lead poses particular risks to children, as lead is an extremely potent neurotoxin, which can produce devastating effects upon children who find themselves exposed to it. These effects are terrible for children's development with their brain and motor functions, and they can lead to lifelong neurological defects, or in some extreme cases even result in death. Soil lead is not as acute as the lead that may be found in a contaminated tap, yet with the prolonged exposure of children at sites with high levels of lead exposure there is still a great risk for contamination (ATSDR). Therefore, it is important to examine any possible causes of lead being present near these locations. Many locations that contain issues with soil lead or other issues of environmental justice are often victims of redlining or community disinvestment (Schell, Christopher J., et al.).

Another aspect of soil that is important for general soil health is the soil organic carbon (SOC) level. Soil organic carbon levels are crucial to the physical structure of soil, with the higher levels leading to a soil that is much more resistant to negative environmental influence. Good quality soil will handle water much better than a soil that is deficient in soil organic carbon, and these soils with high SOC are able to carry more oxygen. The issue of key

importance tied to SOC is the fact that better soils will be resistant to the issues of erosion and the excess loss of nutrients (Sickman, J. O., et al.).

Redlining and community disinvestment are closely related to issues of class and race in American cities. Some communities and areas are not worth maintaining as they hold little value to politicians or the upper class of that area. This leads to an excessive amount of derelict structures across that redlined district and many of those buildings are either slated for demolitions or are left to slowly fall apart, both can lead to soil lead contamination along with a host of other issues such as a lack of soil organic carbon as the soils are often disturbed in urban areas due to urbanization (Lead Regulations). It is due to these factors that many minority and lower class districts are disproportionately affected by lead contamination.

There is great importance in raising awareness surrounding these dangers that are being faced by the residents of these areas. The residents of redlined areas have far fewer options when it comes to social services and environmental amenities which are brought about by landscape heterogeneity which is generally found outside of redlined districts in the areas of higher income. This leads to an intensification of the issues that plague people living in redlined districts as not only are they being affected by problems inherent in the system, but they must also deal with health issues brought about by the same system that also provides their districts with fewer places to turn to when those health complications brought about via environmental justice issues (Schell, Christopher J., et al.).

It is important to call attention to these issues through community awareness and studies surrounding the concentration and impact of issues like soil lead contamination and soil carbon in relation to urbanization. Discovering areas that are suitable to be covered with vegetation or community gardens is a great way to begin the fight back against environmental injustice issues.

Pairing this study with the Houses of Knowledge of the Conscious Connect is a great way to know how the area of Springfield is doing regarding issues of environmental justice. Not only can this information be used to improve conditions out in these affected neighborhoods, but it can be used to affect the outcome of future decisions made regarding redlining and community disinvestment.

Methods:

The main objective of this sampling was to collect soil around 10 centimeters deep surrounding Houses of Knowledge (HoK). Using the Conscious Connect website we gathered the precise locations of all HoK within the City of Springfield. The class divided into groups and each group was assigned a certain number of the HoK that are present in Springfield. Each group then went to the sites with a trowel and sampling bags. Each HoK was sampled at 5 different sites at the discretion of the groups. The soil was gathered at a depth of 10cm to best capture any amount of lead that may have been present. The samples were marked and tagged based on their coordinates of latitude and longitude.

All samples were brought back to the lab and sat out to dry over the course of a day. Once the soils were dry, a sub sample of 3 out of 5 were selected to be tested for their levels of soil organic carbon. These 3 were selected from the samples that were taken in areas that would be best suited to install a small garden or grow some flowers surrounding the HoK. The dried samples were put into tins which had been weighed and labeled. Both the soil and tin were weighed together so the weight of the tin could be subtracted from that total to get the exact weight of the soil. After all samples were weighed, they were put into an oven and burnt to gather the organic content levels. After the samples were burned a similar process to the pre burn process occurred where the burned soil was weighed with the tin then the weight of the tin was

subtracted. This allowed for the group to see the difference that the burning process created, which in turn allows for the soil organic carbon data to be calculated. All this data was then entered into a spreadsheet which was used to calculate the soil organic carbon levels.

Finally, the soils were taken aside after soil organic carbon testing and examined for lead concentration with the use of an XRF analyzer, and that data was also entered into the same spreadsheet. With all the data gathered, the groups then applied their coordinates of latitude and longitude to GIS with the intent of creating concentration maps showing soil organic carbon and lead concentrations across the surveyed areas of Springfield surrounding the HoK. The data taken was examined under the EPA regulations for safe concentrations of lead bearing soil.

Results:

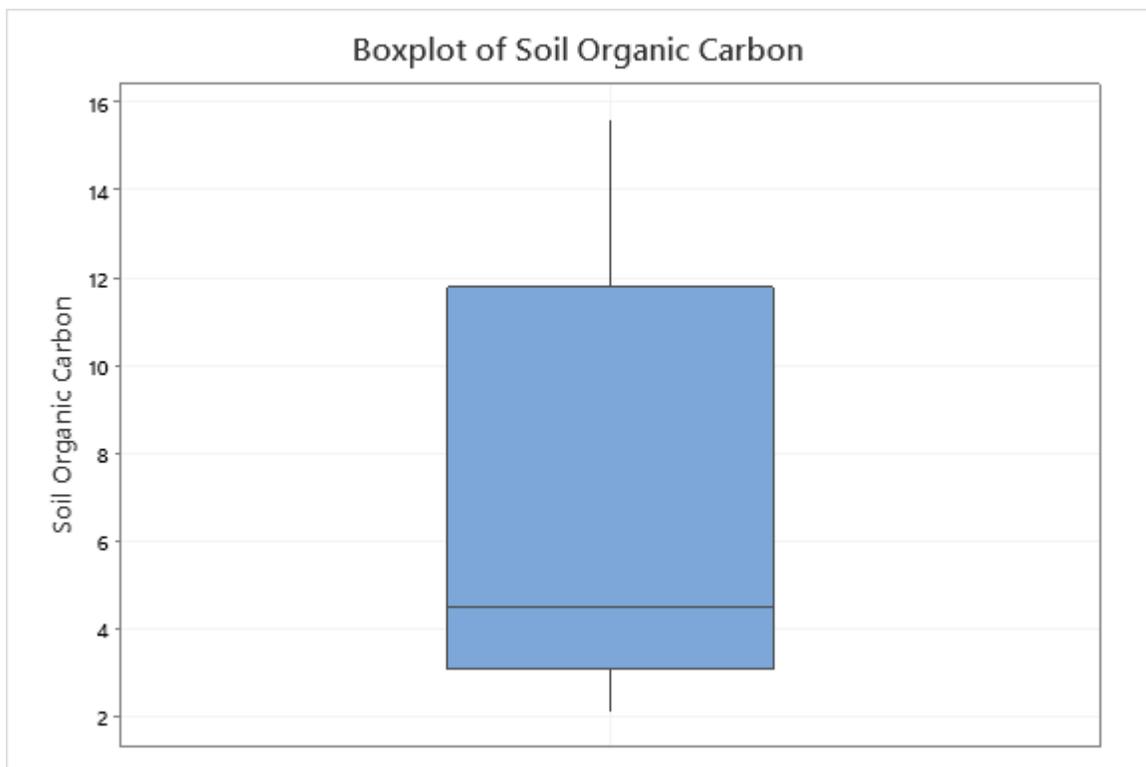


Figure 1.) Soil Organic Carbon by percent

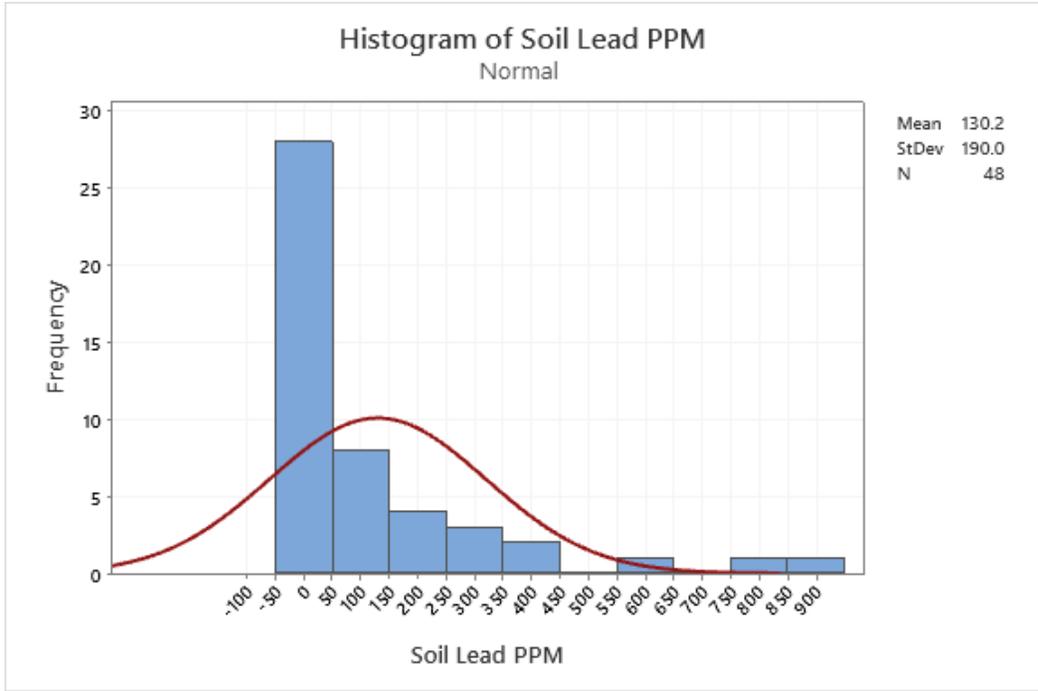


Figure 2.) Frequency distribution of Soil Lead by Parts Per Million

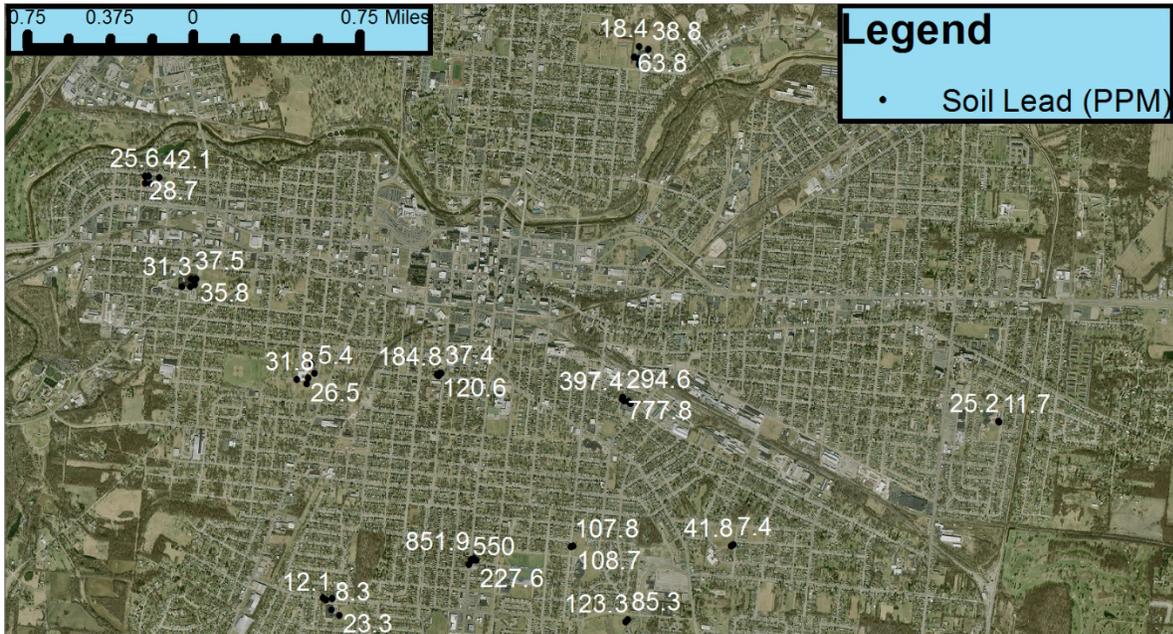


Figure 3.) GIS mapping of sites sampled for lead concentration

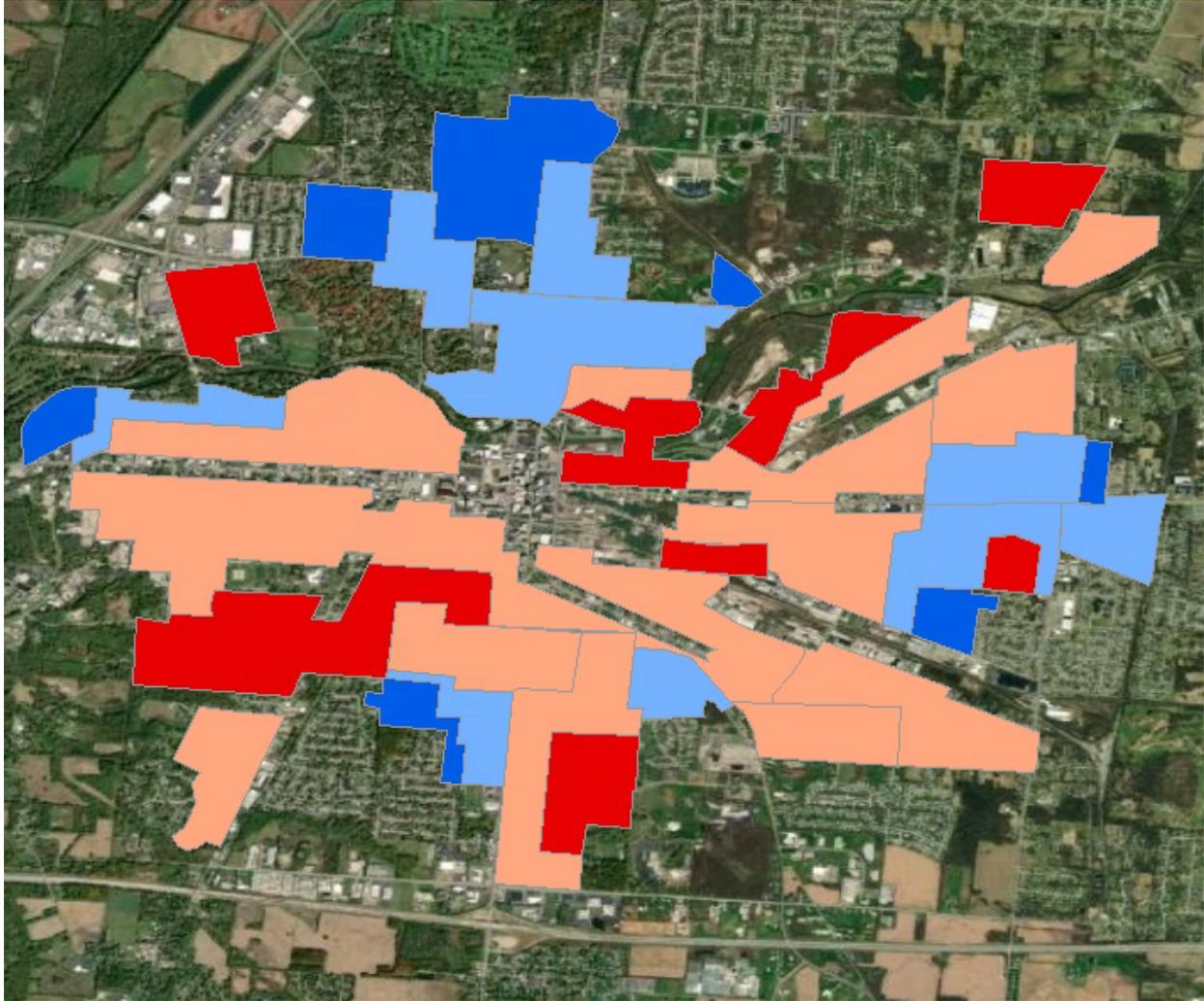


Figure 4.) Redlining map of Springfield

Overall, the soil organic carbon levels were well within the 3-6% levels that are satisfactory with what is considered “healthy” soil. However, our sampling may reflect relative concentrations because the lower range samples were light in color. Soil lead concentration is generally relatively low, yet there are several outliers that are congruent with the redlining map, which raise some worrying issues and questions.

Discussion:

This data paints an interesting story regarding the relation of soil lead concentrations to the redlining that is present within the city of Springfield. Most of the soil samples that were brought back had soil lead concentrations that do not come anywhere close to breaching the 400 ppm limit put forth by the EPA for play areas for children, and none of the samples were over the 1200 ppm limit for lead in non-play areas. However, there are plenty of samples that come close to the play area limit, and there are even a decent number that breach that regulation. The majority of these 400 ppm plus sites are in areas that have seen significant levels of redlining.

Another fact to consider is that most of the HoK (Houses of Knowledge) are positioned directly next to elementary schools. This means that children in these high risk, redlined areas could be experiencing a disproportionate amount of soil lead exposure due to the proximity of these sites to areas of high traffic with children from the school.

The extent to which urbanization has affected the organic carbon levels of the soil appears to be quite low. All soil organic samples were taken from the same locations as the lead samples, and virtually none of the soil organic samples taken around the HoK were found to be severely deficient in organic carbon. This is a good sign if gardens are to be considered for planting at these locations, as soil organic carbon is a very important statistic regarding the ability for a certain soil to support plant life.

There is a clear relation seen between the redlining map and the map of soil lead concentration. This data is like other studies which have considered soil lead concentrations in areas that see significant effects of redlining. Redlining is a pervasive generational issue that causes entire swathes of a community to be trapped in a terrible situation with very little help

from the city that redlined their districts in the first place. The only way out is to raise awareness surrounding this issue that has arisen in a myriad of cities across the United States. Along with raising awareness there needs to be a push for change at the decision-making level and people must be held accountable for the actions they make which create issues like redlining which plagues cities for decades.

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