Lead in Soil Final Project

Environmental Science-250

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Introduction:

In today's world there are several injustices people face, especially minority groups and lower-income households. More specifically, environmental injustice is a large problem in America that effects thousands of people, that most of the time the communities effected have little to no understanding/education on what is affecting them. One major environmental inequality minorities and lower-income communities face is lead pollution in the soil that surrounds them.

In a lot of cases, areas with a high lead concentration in soils are places where an older house has been knocked down and its hazardous materials contaminates the soil in that area. This is especially important to understand because in many times older buildings are knocked down and that space is used for playgrounds, gardens, inner-city schools, and areas where kids will be playing, and people could be getting their food from. According to the Environmental Protection Agency (EPA) below 200 ppm (parts per million) is safe for gardening, 400 ppm is the limit for safe gardening, and anything below 1200 ppm is safe for play areas where kids can play in the bare soil. Children under the age of six are most at risk for lead poisoning because they tend to put their hands or objects contaminated into their mouth, which in return can interfere with their development at a young age ("At Risk Populations – Children"). It has been shown that children living below the poverty line and of certain minorities are disproportionately affected by lead. The effects on children exposed to lead include neurological and physical effects such as, reading problems, speech problems, hearing loss, slowed development physically and mentally, resulting in a lower IQ, stunted growth, and a decreased ability to pay attention ("Health Effects of Lead Exposure"). The lower-income neighborhoods and minority communities are disproportionately affected by lead which is a result of redlining and community divestment.

Redlining and community divestment are closely entangled to causing lead pollution in communities below the poverty line and minority communities because they are viewed as not worth investing in so older buildings are either left to fall apart or demoed. Community divestment is a problem when it comes to these redlined districts/communities in cities because the money necessary for maintaining safe communities, or in many cases necessary for restoring the community, is cut or taken away.

Urbanization and its effect on organic carbon in soil is another issue that continues around the country. When the process urbanization occurs the organic carbon in the soil is reduced, leaving urban soils with significantly less soil organic carbon. A lack of soil organic carbon leads to soils that are unsustainable for safe gardening areas. Soil organic carbon also plays a leading role in the atmospheric carbon cycle. Overall, the urbanization drastically changes the soils in that area, and it is imperative these communities become aware of this so we can continue to help communities in need of clean and safe living environment.

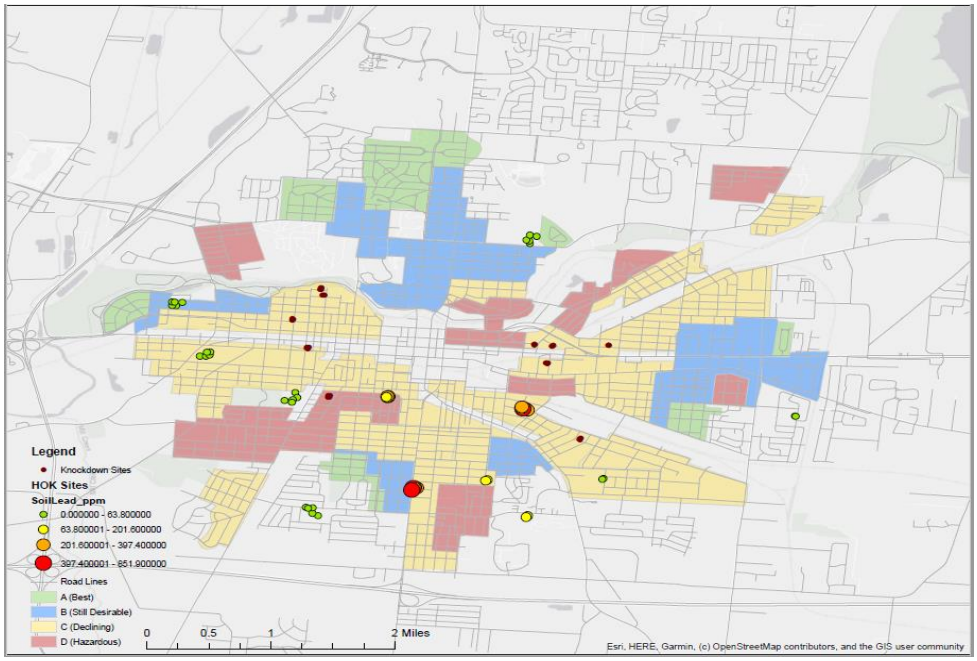

Figure 1: Redlining Map of Springfield, Ohio with Lead Concentration Levels at the Sites Researched.

This study aimed to protect the children and environment of Springfield, Ohio in redlined communities and areas where kids and people spend their time outside. The goals of this study

specifically were to improve the community's health, while educating them, and then to present then information found that regards health to community decision makers. To achieve this goal there was a strict set of methods utilized by our researchers.

Methods:

With the community's health the main priority in this study, soils samples were all taken from Houses of Knowledge (HoK) provided to us by the non-profit organization Conscious Connect. The HoKs were located near elementary schools, community gardens, and vacant lots from house knockdowns. These areas pose the greatest risk of lead contamination to children and other people. To collect all the data needed for the study our class split the research sites (HoK) up between groups to conserve time and resources. Each group collected five samples from each site assigned to them. At each location five samples were tested for lead concentration and three were tested for soil organic carbon (SOC). To collect and analyze the samples we needed the materials used were notebooks, pens, Ziploc bags, trowels, XRF tools, metal tins, and a scale. When obtaining the samples, the trowels were used to dig ten centimeters down taking that soil and putting it in Ziploc bags to safely transport it back to the lab. The pen and notebook were used for writing down the coordinates of where the samples were taken from.

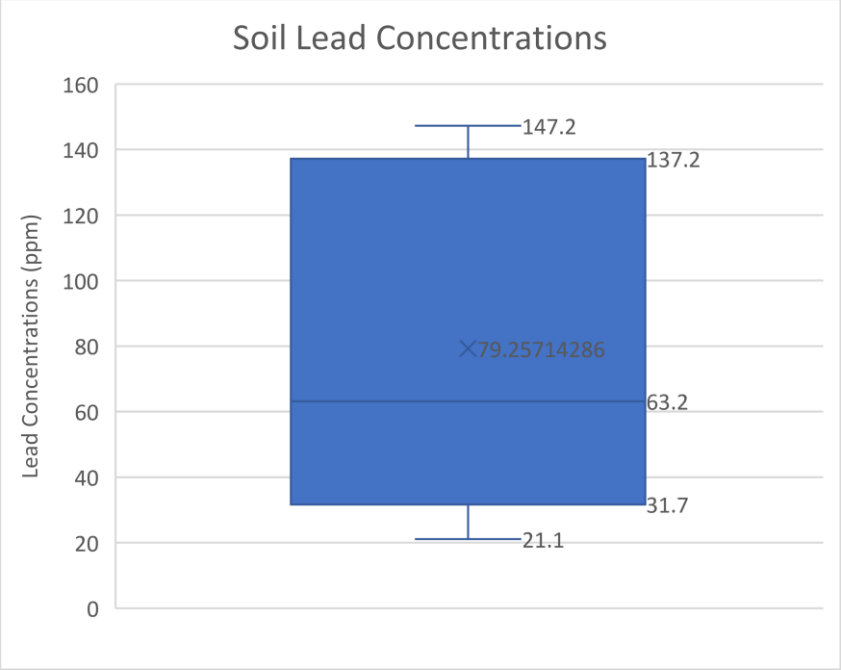

Figure 2: Soil Lead Concentrations from Sites.

Once the soil samples got back to the lab they had to sit until the soil dried out. After the soil dried out the metal tins were utilized to hold the dirt while it was weighed out for the soil organic carbon calculations [(Dry-Burned)/Dry *0.45*100]. Once the soil had dried out and the SOC calculations were made we moved on to testing the lead concentrations (ppm) from the sites. Using an XRF (X-Ray Fluorescence) analyzer the lead concentrations were then collected. It is important to keep in mind the XRF analyzer does not perfectly analyze the soil and each concentration is accompanied with error bars to make the lead concentration as accurate as possible. After completing the measurements for soil organic carbon and lead concentration we then could move forward analyzing our results from the study.

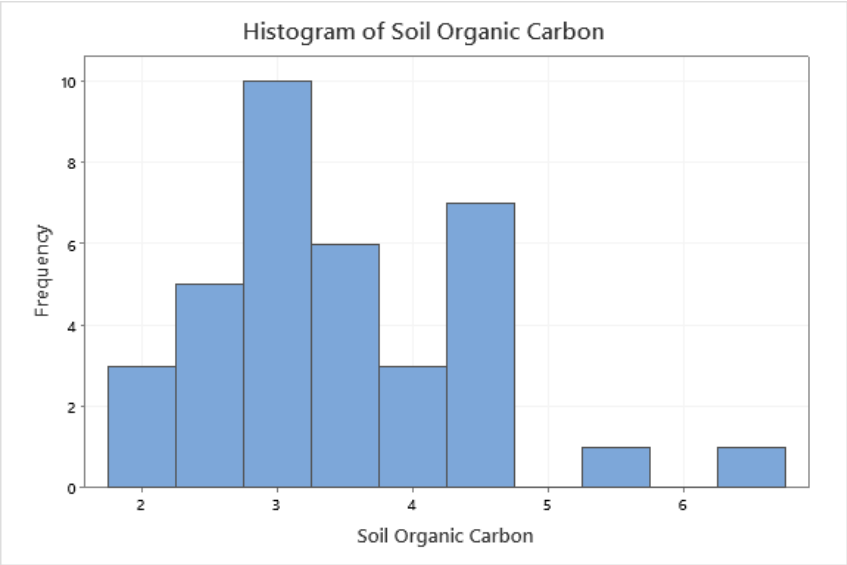

Figure 3: Frequency of Soil Organic Carbon (grams).

Analyses:

Following the completion of gathering and logging the data for the soil lead concentration and soil organic carbon, the results were then analyzed. Using ArcGis, a mapping software, lead concentration levels of our testing sites were then put onto a redlining map of Springfield. I then used that same data collected from our sites to produce a box and whiskers plot that visually shows the median, and upper and lower quartiles. After producing the figures the analyzation process was over and it was time to discuss our findings.

Discussion:

After further pondering the results and figures it was it was found that most locations were below the EPA standards for safe lead levels. However, rather than the redlined neighborhoods having the highest lead concentration in the soil (we originally thought would happen) the neighborhoods that showed the highest lead concentration levels were the "C" graded or "declining" neighborhoods. Although the lead concentrations were safe enough for children to play in the bare soil, they were still too high in some areas to practice safe gardening. In the interests of our partners at Conscious Connect and community decision makers I would suggest to future classes to look at how these lead and soil organic carbon levels have changed from year to year. This would give us a greater insight on whether the soil is becoming more polluted or becoming healthier. With that in mind it would allow for community decision makers to have a better understanding where they should be spending their time, money, and resources. If the levels are steadily declining from year to year, then they could redirect their focus on areas of Springfield that need more help, or areas where levels are increasing. Overall, this research project was a success because information was gained from areas in need of help and it will be given to community decision makers to decide what to do next to keeping our community and future generations safe.

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