Soil Contamination and the Implications of Growing Food in Urban Gardens

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Urban gardens provide multiple ecosystem services for people and the environment. They produce nutritious food, reintroduce natural scenery into metropolitan areas, and are an efficient way to support the local economy. Further, they provide socioeconomic benefits for low-income communities, including education opportunities, access to healthier foods, and a common area for gathering. Nonetheless, there are risks associated with developing such a site within a major city. In particular, studies show that there are major health risks associated with consuming foods grown in soils that have been contaminated with industrial or agriculture compounds. Studies on plant uptake of metropolitan contaminants show that uptake is highest among leafy greens and root vegetables. The extent of pollution of soils is proportionate to the distance from various sources, such as industrial sites and busy roadways.

Questions:

1. What's causing patterns of contamination in urban gardens?
2. How sustainable are urban gardens when considering biophysical templates and ecosystem health?
3. What causes contamination variability in urban centers?
4. How do time and distance effect contamination levels of urban gardens?

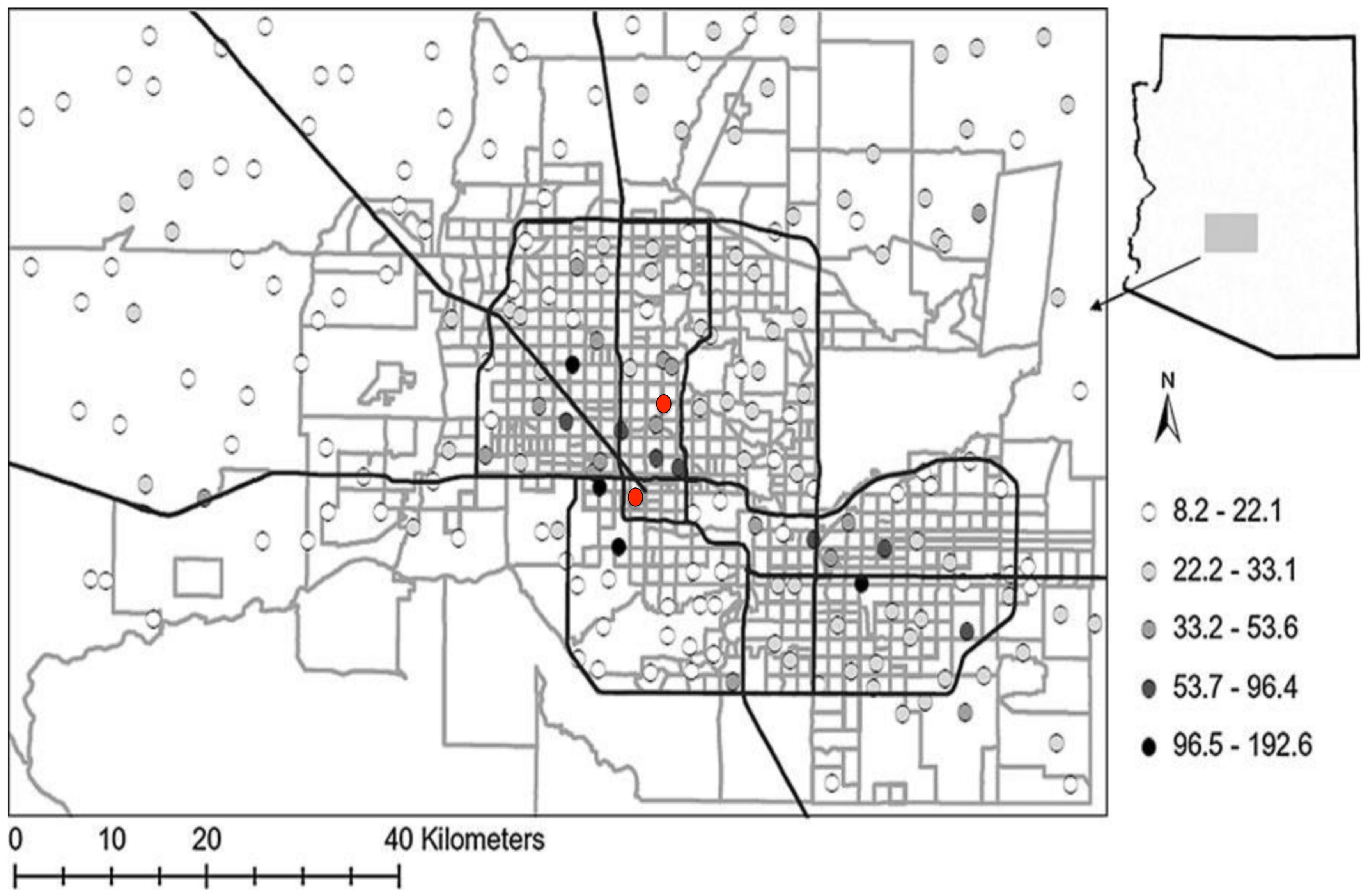

Figure 1 This map displays the spatial lead distribution in soils in Phoenix (X Zhuo. ''Distributions of Toxic Elements in Urban Desert Soils''). The distribution for cadmium is similar. Sites 1 (North Phoenix) and 2 (South Phoenix are plotted in red.

Methods:

Phase 1:

1. Two gardens will be sampled for Pb and Cd contamination.
2. Soil cores will be collected from 4 transects increasing in distance from the house. Random samples will also be collected from the yard to map the general geography of contamination in each plot.
3. One leaf plant will be collected from each of the 4 transects.

Phase 2: A risk-based analysis will determine if the specific plots are safe to produce edible food. Results from Phase 1 will yield an understanding of contamination patterns in metropolitan areas, which can be utilized to mitigate pollution problems in other urban areas.

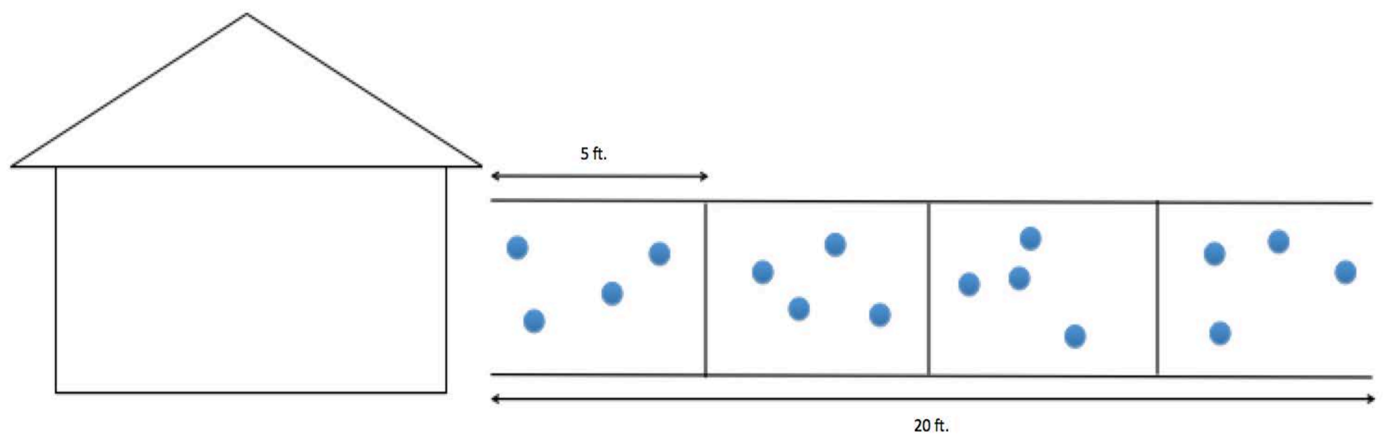

Figure 2 Soil cores will be taken from transects increasing in distance from structures.

Hypotheses

- The sustainability of urban gardens in Phoenix is contingent upon the balance between the biophysical template and social barriers in a plot's surrounding area.
- Contamination in a garden is a result of time, urban geography, solubility of metals in plants being grown, and soil type.
- Soil type impacts the solubility of heavy metals into crops.
- Distance from contamination sources is a driving factor of contamination of soils.
- Contamination is related to distance to past urban centers where concentrations of heavy metals have been found to be highest.
- Soil contamination is related to distance to sources of contamination —lead paint, fuel emissions, and industrial waste.

Expected outcomes:

- It is likely that the location of the urban gardens will have a major impact on the contamination levels due to factors, such as community affluence, historical usage, and plot maturity.
- Site 1 (North Phoenix) will likely contain fewer contaminants in both the soil and crops and will not exceed the Reasonable Maximum Exposure guidelines or safety standards set by the EPA.
- Site 2 (South Phoenix) is presumed to be highly contaminated, making it unsafe for growing edible crops.

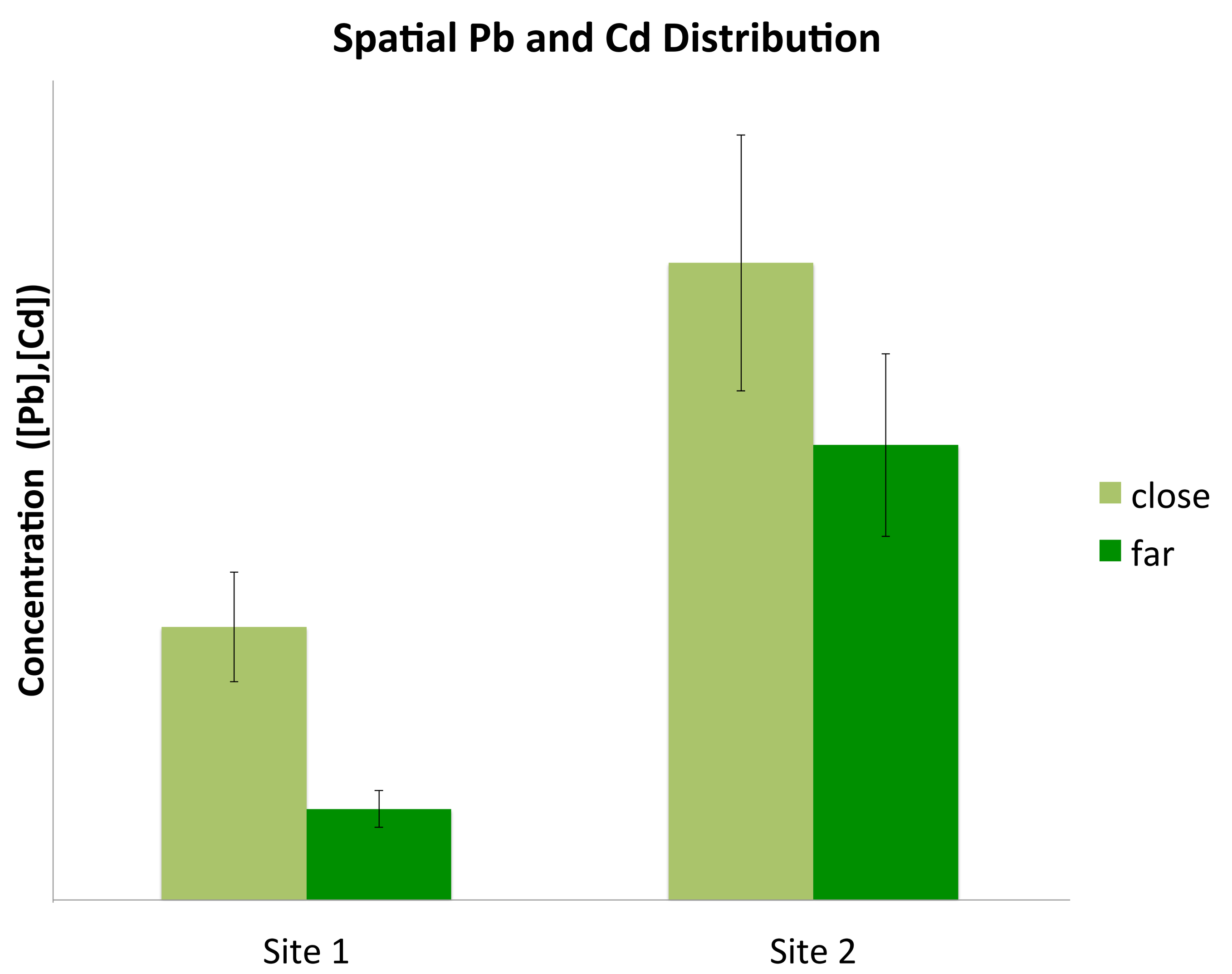

Figure 3 Studies show that plots within urban centers will be more polluted than outlying plots and increased disturbances raise contamination levels.

Soil image from http://grist.org/article/2009-08-13-debate-soil-organics-nutrition/