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Introduction

Across the country, communities are adopting the use of urban agriculture and community gardens for neighborhood revitalization. Sites ranging from former auto-manufacturing sites, industrial complexes, and whole neighborhoods, down to small individual lots, including commercial and residential areas, are being considered as potential sites for growing food.

The benefits of urban agriculture/community gardening vary from health and environmental to economic and social. Gardening in urban areas:

- Increases surrounding property values, beautifies vacant properties, increases a sense of community, and provides recreational and cultural uses.
- Increases infiltration of rainwater, reducing stormwater overflows and flooding, decreases erosion and topsoil removal, improves air quality, and reduces waste by the reuse of food and garden wastes as organic material and compost.
- Increases physical activity and educates new gardeners on the many facets of food production from food security to nutrition and preparation of fresh foods.

Kids who garden are more likely to try and like vegetables and eat more of them, and the combination of the social connection of gardening with the increased access to fruit and vegetables creates a new norm in children who continue to make healthier choices.

Implementation Process

The Jefferson County Cooperative Extension Service (JCCES) has developed a general guideline for implementing plans for developing a site for a community garden or a residential garden. Having the community involved early on is a critical first step.

Once a site has been selected a series of decisions need to be made based on:

1. Property History

The previous use of the property and those surrounding it will be the major deciding factor on how cautious you should be before gardening. The more historical information learned about a site’s previous uses, the more informed decisions can be made during garden development.

No two vacant parcels are alike. However, we can infer possible types of contamination based on the previous use of the property. For example, residential areas may have unsafe concentrations of lead where the presence of older homes or structures indicates lead-based paint was present. A fruit orchard may have high levels of lead and arsenic from lead arsenate insecticide. Manufacturing sites will have a different host of contaminates where the option to garden would be to just “walk away”.

Below is a general list of sources of contamination and specific contaminant.

Land Use	**Contaminant**
Agriculture, green space	Nitrate, pesticides/herbicides
Car wash, parking lots, road and maintenance depot, vehicle services	Metals, PAHs, petroleum products, sodium, solvents, surfactants
Dry cleaning	Solvents
Existing commercial or industrial building structures	Asbestos, petroleum products, lead paint, PCB caulks, solvents
Junkyards	Metals, petroleum products, solvents, sulfate
Machine shops and metal works	Metals, petroleum products, solvents, surfactants
Residential areas, buildings with lead-based paint, where coal, oil, gas or garbage was burned	Metals, including lead, PAHs, petroleum products creosote
Stormwater drains and retention basins	Metals, pathogens, pesticides/herbicides, petroleum products, sodium, solvents
Underground and aboveground storage tanks	Pesticides/herbicides, petroleum products, solvents
Wood preserving	Metals, petroleum products, phenols, solvents, sulfate
Chemical manufacture, clandestine dumping, hazardous material storage and transfer, industrial lagoons and pits, railroad tracks and yards, research labs	Fluoride, metals, nitrate, pathogens, petroleum products, phenols, radioactivity, sodium, solvents, sulfate

(EPA, 2011)

2. Soil testing

Two types of soil quality sampling are recommended for every site: (a) soil as a growing medium, and (b) soil contaminant concentrations for safety. Because each parcel of land is unique, each sampling approach should be considered individually. However, given that not all previous uses are created equal, we can make some assumptions about the relative risk of the previous use, and this will guide our sampling strategy. Low risk previous uses like residential areas, green space, traffic corridors and parking areas generally have a narrow band of likely contamination that allows for a basic sampling strategy.

Sampling Methodology

How do you decide where to sample and how deep to go? Sampling methodologies vary slightly depending on what you are sampling for or the type of crop you are planning to grow because some plant root systems are deeper and more extensive than others. Sampling to determine surface exposure is usually done at 1-2 inches, while root zone sampling is 4-6 inches. The physical quality of the soil can usually be determined during the sampling process. If the surface material (rocks, brick or other debris) is such that a soil probe will not penetrate the top 1 inch, consider raised beds.

Sampling for soil quality should include a composite sample that represents the preferred growing area. This type of sampling and analysis is simple to perform and relatively inexpensive to do. Sampling for pH, organic matter, nutrients (nitrogen, phosphorus, potassium), determines what types of improvements should be made or amendments added so that plants can thrive in your garden. Don't forget to call ahead of time to have utilities marked before digging anywhere on your site. Find your local "Call before you dig" service at *http://www.call811.com*.

The Jefferson County Cooperative Extension Service can perform general soil testing to determine the soil pH and fertility which is done at the University of Kentucky. If heavy metals are considered, the University of Massachusetts (UMASS) is used. The Cooperative Extension Service does not test for metals or other contaminants using EPA testing criteria. The approach is to give a general idea of levels of metals of concern (primarily lead) and then decide whether to abandon the site, plant directly into the soil using specific guidelines in place to minimize direct contact and plant uptake, or simply use raised beds. This approach allows the project to continue to move forward without the cost of sampling slowing the process.

Dangers of Soil Contamination: The Need for Soil Testing

Soil contamination can be problematic on several levels. Risks from soil contamination include plants absorbing contaminants through the soil; groundwater becoming contaminated as it interacts with and flows beneath the soil; and bioaccumulation, occurring when livestock or humans ingest contaminants from vegetation growing in compromised soil.

While each of these issues is important, the primary concern for most urban gardeners relating to soil contamination is human health. Significant health risks resulting from exposure to a wide range of soil contaminants have been observed and documented. Some examples of these contaminants include heavy metals, pesticides, and polychlorinated biphenyls (PCBs), which are a general class of organic compounds and persistent environmental pollutants.

When investigating the risks associated with soil contamination, as well as identifying appropriate remediation strategies, it is critical to determine the level, or concentration, to which contaminants are present in soil. The particular level of any given contaminant is usually expressed in mass-per-unit/mass-of-soil (e.g. mg/kg), ppm (parts per million), or ppb (parts per billion). The contamination level can be identified through soil testing. Soil testing should be the first step in ensuring the health and safety of the people involved in any urban gardening venture.

UMASS Soil Lead Information

Lead Level	Estimated Total Lead Level
Low	Less than 299 ppm
Medium	300-900 ppm
High	1,000-2,000 ppm
Very High	Greater than 2,000 ppm

If estimated total lead levels are above 300 ppm, young children and pregnant women should avoid contact with the soil. Estimated total lead levels above 2,000 ppm are considered a concern for all users and may represent a hazardous waste situation.

Good Gardening Practices to Reduce Lead Exposure

1. Locate gardens away from old painted structures and heavily travelled roads.
2. Give planting preferences to fruiting crops (tomatoes, squash, peas, sunflowers, corn, etc.).
3. Incorporate organic materials such as high quality compost, humus, and peat moss.
4. Lime soil as recommended by soil test (a soil pH of 6.5 to 7.0 will minimize lead availability).
5. Wash hands immediately after gardening and prior to eating
6. Discard outer leaves before eating leafy vegetables. Peel root crops. Wash all produce thoroughly.
7. Protect garden from airborne particulates using a fence or hedge (fine dust has the highest lead concentration).
8. Keep dust in the garden to a minimum by maintaining a well-mulched, vegetated, and/or moist soil surface.

Recommendations

- Low - Follow the good gardening practices listed above.
- Medium - In addition to following good gardening practices:
  - Restrict access of children to these soils by maintaining dense cover.
  - Do not grow leafy green vegetables or root crops in this soil; instead, grow them in raised beds built with non-contaminated soil and organic amendments.
- High - In addition to following good gardening practices:
  - Do not grow food crops in this soil and do not allow children access to it.
  - Keep soil covered and take steps described above to reduce lead availability.
  - Grow food crops in containers filled with growing media or clean topsoil; or, create lined, raised beds filled with non-contaminated soil and organic amendments.
- Very High
  - Contact your local Health Department, Cooperative Extension, or the Department of Environmental Protection office for advice on lead abatement measures that should be taken.

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CENTER FOR ENVIRONMENTAL POLICY & MANAGEMENT

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