Harmony Park: A Decision Case on Gardening on a Brownfield Site
Ashley Marie Raes Harms, DeAnn Ricks Presley,* Ganga M. Hettiarachchi, Chammi Attanayake, Sabine Martin, and Steven J. Thien

ABSTRACT In March of 2009, Mr. John Holloway and his neighbors in the Harmony Park district of Kansas City, MO, were excited to begin gardening on a vacant city lot in their neighborhood. The neighborhood, like many in urban areas, had once been residential interspersed with small establishments including restaurants, shops, and businesses such as auto body shops and gas stations. The under-utilized lot had once had multiple abandoned houses on it that had been torn down about two decades earlier, but since then the lot had been empty, overgrown with weeds, and a neighborhood eyesore. Mr. Holloway, a leader in his community, hoped that a community garden would not only improve the aesthetics of his neighborhood, but also provide a local, inexpensive source of fresh fruits and vegetables for his neighborhood, which is located in a food desert. When concerns arose about soil contaminants on the site, Mr. Holloway grew panicked that a community garden on a brownfield site would do more harm than good in his neighborhood. This case focuses on Mr. Holloway’s decision of whether to continue gardening on the brownfield site in Harmony Park. The decision requires that students evaluate environmental, agronomic, human health, social, and economic issues related to the problem Mr. Holloway faces. Objectives of this case are for students to analyze and discuss data and concepts related to gardening on brownfield sites, urban soil contamination, urban food deserts, and human health.

In 2010, 83.7% of the United States population was living in urban areas, and that percentage is projected to increase in the future (U.S. Census Bureau, 2011); however, this population growth is not uniform throughout the various neighborhoods in cities. Many urban neighborhoods with higher poverty rates (30% or greater) have experienced a rapid decline in population since the 1980s. Nearly 15% of urban land in U.S. cities, or approximately 1,800 hectares per city, is vacant or abandoned (Pagano and Bowman, 2000). As urban populations transitioned to suburbs, inner-city businesses, houses, and parking lots were abandoned or razed, leaving open, vacant lots. Publicly and privately owned vacant lands and brownfields in many U.S. cities are quickly being converted to urban gardens and farms by individuals, families, neighborhoods, schools, nonprofit organizations, and many other groups or organizations. According to the Small Business Liability Relief and Brownfields Revitalization Act (U.S. Government Printing Office, 2002), brownfields are defined as “real property of which the expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.”

The United States has an estimated 450,000 to 1 million brownfields, many of which are often considered potential gardening sites due to their proximity to residential areas. This problem case is based on an actual situation faced by a neighborhood group that established a community garden on a brownfield site. Recommendation for best management practices (BMP) based on soil analyses for both agronomic and environmental parameters must be made to reduce any potential risk from gardening in the contaminated soil.

20 February 2008

John Holloway grew up in Harmony Park, and he built his life and career in this area of Kansas City. He saw firsthand that more and more of the neighborhood’s houses were left empty, unkempt, and eventually boarded up or razed. Mr. Holloway knew that he had to do something to remedy this and improve his neighborhood, his lifelong home. He was concerned that if nothing was done, his neighborhood would become nothing but endless vacant, unused lots and unsafe structures. Mr. Holloway envisioned a more prosperous and vibrant future for his neighborhood and fellow neighbors.

Abbreviations: BMP, best management practice; DDE, dichlorodiphenyldichloroethane; DDT, dichlorodiphenyltrichloroethane; FDA, Food and Drug Administration; GPS, global positioning system; ICP-OES, inductively coupled plasma optical emission spectrometer; USDA-NRCS, United States Department of Agriculture Natural Resources Conservation Service; USEPA, United States Environmental Protection Agency; XRF, x-ray fluorescence spectrophotometer.
Neighborhood History

A great deal of Kansas City’s African-American history took place in the area of the city that included Harmony Park, and many of the city’s notable African-American leaders once resided here. In the last 50 years, the neighborhood experienced a population decline from 11,700 to 2,500. In 2008, nearly 38 hectares or approximately 25% of the land area in the Harmony Park neighborhood was vacant lots. After the decline in population, many historic buildings and residences fell into disrepair, and vacant lots turned into weedy sites or were used for illegal trash dumping. The sights of boarded-up homes and businesses and the demolition of condemned structures were not uncommon. A decline in the number of businesses throughout the Harmony Park neighborhood also forces current residents to travel farther from home for basic needs such as groceries, fresh produce, medicines, and clothing.

A Neighborhood in a Food Desert

Low-income, minority neighborhoods in many cities throughout the United States are often disproportionately located in food deserts (Chung and Myers, 1999; Powell et al., 2007; Zenk et al., 2005). A food desert, as defined by Cummins and Macintyre (2002) is a “poor urban area, where residents cannot buy affordable, healthy foods.” The lack of access to healthy, fresh, affordable foods threatens the well-being of millions of Americans who live within food deserts, including the residents of Harmony Park.

Low-income urban residents face many obstacles to eating a healthy diet; one is a shortage of places to shop. Poorer neighborhoods throughout the United States have nearly 30% fewer supermarkets than the highest-income neighborhoods, so access to food is more often limited to smaller convenience stores (Chung and Myers, 1999; Giang et al., 2008; Morland et al., 2002a; Weinberg, 1995). Poor minority neighborhoods are even less likely to have access to a supermarket than poor white neighborhoods (Morland et al., 2002b; Powell et al., 2007; Zenk et al., 2005). The smaller convenience stores in these food deserts often offer a lower selection of higher priced, lower quality food items (Chung and Myers, 1999; Hendrickson et al., 2006; Zenk et al., 2005). Access to food is further limited for many low-income residents due to a lack of reliable transportation and the greater distance from home to store (Walker et al., 2010). The Harmony Park neighborhood does not have a local grocery store or supermarket, and gas station convenience stores are the only locations in the neighborhood where residents can purchase food items. Jackson County, MO, where Harmony Park is located, saw a 10 to 24.9% decrease in grocery stores from 2007 to 2008 (USDA-ERS, 2011).

The lack of affordable, healthy, and fresh foods decreases the ability of Harmony Park residents to maintain a healthy diet. Research has found that low-income populations, especially minorities, consume fewer fruits and vegetables than currently recommended by the Food and Drug Administration (FDA) (Kratt et al., 2000; Resnicow et al., 2001). A healthful, balanced diet contributes to a healthy body and decreased instance of diet-related health issues (Ness and Powles, 1997; Van Duyn and Pivonka, 2000). Food desert neighborhoods are disproportionately affected by adverse diet-related health problems such as type 2 diabetes, cancer, obesity, heart disease, and premature death (Deaton and Lubotsky, 2003; Hendrickson et al., 2006).

Mr. Holloway and other community members were aware of these economic, social, and health problems in their neighborhood and set out to make changes for themselves, their friends, and neighbors. Efforts began in 2008 to revitalize this historic neighborhood. The Harmony Park Neighborhood Improvement Association formed and worked in conjunction with the University of Missouri-Kansas City and governmental groups to implement historic preservation plans for many buildings in the neighborhood and to transform many vacant lots into usable green spaces. The Harmony Park Neighborhood Improvement Association wrote an action plan, and its first recommendation was to “enhance self-sufficiency and economic growth through the development of urban agriculture on vacant lots.”

THE CASE

In early 2009, Mr. Holloway and his neighbors gathered to discuss what should be done with a vacant lot on Michigan Avenue. Mr. Holloway, president of the Harmony Park Neighborhood Improvement Association for 15 years and resident of the neighborhood, led the neighborhood gathering. As a prominent figure and friend to those in the neighborhood, Mr. Holloway is passionate about uplifting Harmony Park and reintroducing the neighborhood to the rest of the Kansas City metropolitan area as the historically and culturally rich community that it once was. His efforts already can be seen on many of the residential streets in Harmony Park. Houses that once were boarded up and abandoned are now hopeful reminders of the resilience of this neighborhood, standing strong with fresh paint and new windows, roofs, and residents. Although abundant strides have been made to revitalize the community, several vacant lots on each residential block are empty, weedy dumping grounds and remain eyesores. Mr. Holloway wanted to do something about the 38 hectares of unused, vacant lots throughout Harmony Park.

The Michigan Avenue Vacant Lot

An example is one of three vacant lots located on Michigan Avenue (Fig. 1). The 42 m by 37 m lot was situated within a residential area of the Harmony Park...
neighborhood. To the north and south edges of the lot were two uninhabited, boarded-up houses (Fig. 2). The lot had a westerly ascending slope of 2 to 9% to an elementary school yard that was once the site of an auto body shop. The east edge was bordered by Michigan Avenue, across which was a row of inhabited houses. Four houses once stood on the site, but they fell into disrepair and were razed and cleared away in the 1990s. Remnants of these former houses, such as broken glass, bricks, paint chips, wood, and cement remained in the soil. The site's soils were subjected to many anthropogenic impacts and were mapped by the U.S. Department of Agriculture–Natural Resource Conservation Service (USDA-NRCS) as an Urban land-Harvester complex, a soil formed in less than 40 inches of disturbed material over a truncated loess (Soil Survey Staff, 2001).

Mr. Holloway and neighbors wanted to craft something on the lot to improve the neighborhood. The group discussed many potential uses for the lot, including a park, a playground, a flower garden, and an orchard. In March 2009, Mr. Holloway and his fellow neighbors finally settled on the decision to establish a community garden. They envisioned a community gardening space with numerous plots to grow vegetables, fruits, herbs, and flowers. Each 28 square-meter plot was to be assigned to an individual or family in the neighborhood, and gardeners could keep what they grew and give away extra to neighbors. The garden would provide a local source of fresh produce for Harmony Park community residents that they wouldn't have to venture far from home to get and that would improve the diets of these low-income individuals and families. Mr. Holloway thought a garden would be aesthetically pleasing as well, and a relaxing place for recreation and socializing.

By April 2009, the vacant lot on Michigan Avenue was cleared of weeds and loose debris and the soil was tilled in preparation for establishing a garden that spring and summer (Fig. 3). Even before the plots were delineated, all available plot spaces were claimed by Harmony Park residents. Elderly women, young men, and families with children were all excited to enjoy the recreation of gardening and to eat the fresh produce from their plots. The neighborhood was eager to move forward with plans for the community garden, and many gardeners began to plant early spring crops such as Swiss chard, lettuces, and spinach in anticipation of their first growing season on their new garden plots.

The Problem

One morning as Mr. Holloway was reading the paper and drinking his morning cup of coffee, he came across a newspaper article on President Obama’s new garden (Burros, 2009). The article read, “When the Obamas decided to turn some of the South Lawn at the White House into a kitchen garden, they did what many smart urban gardeners do: they had the soil tested for its nutrients and potential contaminants, like lead.” Mr. Holloway felt alarmed; he had not thought to have the soils tested for potential contaminants. He wondered what types of contaminants could possibly be in a soil in his neighborhood. “Surely we have nothing to worry about,” he thought. Mr. Holloway visited the garden that evening to pick his newest batch of ripe tomatoes and okra and saw the grandchildren of his elderly neighbor, Norma, playing in the soil of her garden plot as she weeded and watered her crops. He began to worry, thinking, “If our soil is contaminated, then are Norma’s grandchildren at risk from playing in the soil?” And what about the tomatoes and okra he had planned to bring home to family for dinner—could they be contaminated, too? Although a garden was a beautiful addition to their neighborhood, Mr. Holloway did not want to put any of his friends or family at risk. He decided to add his new harvest of fresh veggies to the compost pile instead of taking them home for dinner. He needed more information before he could feel safe eating anything grown on the site.

The next day, Mr. Holloway called the extension service at the nearby land-grant university to request help with his problem. Mr. Holloway knew he needed to determine whether it was safe to garden on and eat food from the community garden lot; he especially wanted help figuring out how to better manage the urban soils to keep everyone healthy. What good is a beautiful community garden in a food desert if it could be hurting everyone he loves? The garden was supposed to improve his neighborhood’s health and vitality, not threaten it.
Soil and Plant Tissue Sampling and Testing

Soil scientists from a nearby university came to help Mr. Holloway assess the soil quality, potential presence of contaminants, and any potential human health risks of the Michigan Avenue community garden site. Screening of the site for trace elements (specifically lead [Pb], cadmium [Cd], and arsenic [As]) was done using a field portable x-ray fluorescence spectrophotometer (XRF) analyzer (Thermo Scientific, Billerica, MA) (Fig. 4 and 5). Measurements were taken every 3 m across the site in a rough grid pattern. The XRF measurements were georeferenced using a global positioning systems (GPS) unit. Total soil lead concentration maps were created using this spatial data to determine areas of high or low total soil lead concentrations (Fig. 6). Eight soil samples were collected from the site for confirmation analysis of the total soil lead concentration by laboratory digestion using method 3051A (USEPA, 2007) followed by analysis using an inductively coupled plasma optical emission spectrometer (ICP-OES) (Table 1). Soil samples were collected from areas where compost had been added to garden plots where compost had not been added. Soils were digested as described before and the total soil lead concentration was also measured for these samples using the same ICP-OES method (Table 2).

The soil scientists told Mr. Holloway that the common sources of trace elements in urban environments included the past use of leaded paint and gasoline, historical pesticide use, and industrial and commercial activities. The potential sources of contamination of urban areas like the Michigan Avenue lot are shown in Table 3. Additional soil samples were collected to analyze for chlordane (C1–C3, Fig. 6), dichlorodiphenyltrichloroethane (DDT), and dichlorodiphenyldichloroethylene (DDE) (C4–C9, Fig. 6). Chlordane, a pesticide and common persistent urban organic contaminant, was used to treat house foundations for termites and is commonly found in soils around house foundations or where previous structures stood. Because houses border the lot and rubble from formerly razed houses was found on the site, the soil scientists told Mr. Holloway that additional soil tests would need to be conducted to determine if chlordane was present in the soil. The soil scientist also explained that DDT was a commonly used insecticide before it was banned in the United States.

Table 1. Total soil lead concentrations of the Michigan Avenue vacant lot in the spring of 2009.

<table>
<thead>
<tr>
<th>Soil sample</th>
<th>Total lead mg/kg</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>288</td>
</tr>
<tr>
<td>2</td>
<td>254</td>
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<tr>
<td>3</td>
<td>335</td>
</tr>
<tr>
<td>4</td>
<td>173</td>
</tr>
<tr>
<td>5</td>
<td>252</td>
</tr>
<tr>
<td>6</td>
<td>141</td>
</tr>
<tr>
<td>7</td>
<td>183</td>
</tr>
<tr>
<td>8</td>
<td>185</td>
</tr>
<tr>
<td>Average</td>
<td>226</td>
</tr>
</tbody>
</table>

Table 2. Average total soil lead concentrations of the Michigan vacant lot before and after the addition of compost in the spring of 2009.

<table>
<thead>
<tr>
<th>Before or after adding compost</th>
<th>Average total soil lead mg/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before adding compost</td>
<td>245 ± 21</td>
</tr>
<tr>
<td>After adding compost</td>
<td>145 ± 20</td>
</tr>
</tbody>
</table>
in 1972, and it is found in soils where pesticide spray was common, so tests would be done to determine its presence. DDE is an intermediate product of DDT degradation in the soils and can be found in the soils where DDT was applied. Chlordane, DDT, and DDE in the soil samples were extracted using the EPA 3540C, the Soxhlet extraction method, and were analyzed using gas chromatography following EPA 8081A method. The concentration of chlordane was below the minimum detection limits of the laboratory method (i.e., 0.05 mg/kg). Concentrations of DDT and DDE were low: the range of DDT concentration was 0.04 to 1.3 mg/kg, and maximum DDE concentration found was 0.04 mg/kg. Testing concluded that these pesticides were not a great concern at this site.

Background on Brownfields and Urban Soils

Natural and urban-derived soils vary considerably. Urban soils are often highly disturbed and/or contaminated due to human activities (Bullock and Gregory, 1991; Craul, 1999; Reimann and De Caritat, 2000). Urban soils are often more physically, chemically, and biologically heterogeneous than naturally derived soils, posing unique management issues. Previous land use and human activities on and around an urban site (e.g., industries, automobile emissions, leaded paint, mining, and use of man-made products) can lead to increased accumulation of trace elements and organic compounds or soil contamination (Boyd et al., 1999; Mielke et al., 1999; Mielke and Reagan, 1998; Nriagu, 1979, 1996). Lead, cadmium, and arsenic are the

<table>
<thead>
<tr>
<th>General source</th>
<th>Examples of previous site uses</th>
<th>Specific contaminants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint (before 1978)</td>
<td>old residential buildings; mining; leather tanning; landfill operations; aircraft component manufacturing</td>
<td>lead</td>
</tr>
<tr>
<td>High-traffic areas or near roadways</td>
<td>next to trafficked roadways or highways; near roadways built before leaded fuel was phased out</td>
<td>lead, zinc, polycyclic aromatic hydrocarbons (PAHs)</td>
</tr>
<tr>
<td>Treated lumber</td>
<td>lumber treatment facilities; structures built with treated lumber</td>
<td>arsenic, chromium, copper, cresote</td>
</tr>
<tr>
<td>Burning wastes</td>
<td>landfill operations</td>
<td>PAHs, dioxins</td>
</tr>
<tr>
<td>Contaminated manure</td>
<td>copper, zinc salts added to animal feed</td>
<td>copper, zinc</td>
</tr>
<tr>
<td>Coal ash</td>
<td>coal-fired power plants; landfills; homes with coal furnaces</td>
<td>arsenic, selenium, cadmium, sulfur</td>
</tr>
<tr>
<td>Biosolids</td>
<td>wastewater treatment plants; agriculture</td>
<td>cadmium, copper, zinc, lead, persistent bioaccumulative toxins (PBTs)</td>
</tr>
<tr>
<td>Petroleum spills</td>
<td>gas stations; residential/commercial/industrial uses (anywhere an aboveground or underground storage tank is or has been located)</td>
<td>PAHs, benzene, toluene, xylene, ethyl benzene</td>
</tr>
<tr>
<td>Pesticides</td>
<td>widespread pesticide use, such as in orchards; pesticide formulation, packaging, and shipping</td>
<td>lead, arsenic, mercury, dichlorodiphenyltrichloroethane (DDT), chlordane, and other chlorinated pesticides</td>
</tr>
<tr>
<td>Commercial or industrial site use</td>
<td></td>
<td>PAHs, petroleum products, solvents, lead, and other heavy metals (such as cadmium, arsenic, chromium, lead, mercury, and zinc)</td>
</tr>
<tr>
<td>Dry cleaners</td>
<td></td>
<td>stoddard solvent and tetrachloroethene</td>
</tr>
<tr>
<td>Metal finishing operations</td>
<td></td>
<td>metals and cyanides</td>
</tr>
</tbody>
</table>
most common contaminants in urban environments. Trace elements occur in small quantities and are found naturally in many soils; however, urban soils often contain elevated concentrations of non-naturally occurring trace elements and compounds due to human activities (Finster et al., 2004). Soils are a sink for many trace element contaminants, and most of these urban soil contaminants are persistent, immobile, and non-biodegradable (Boyd et al., 1999; Finster et al., 2004; Mielke et al., 1999; Mielke and Reagan, 1998; Watt et al., 1993).

Contaminated urban soils require unique management techniques due to their heterogeneity and potential contamination to reduce exposure pathways and any human health risks. Past and forgotten sources of contamination, razing of aboveground materials, and mixing of urban soils can lead to sites with variably distributed contamination, making understanding and minimizing human health risks difficult.

Urban soils are an important pathway for human exposure to trace elements and organic contaminants (Boyd et al., 1999; Gallacher et al., 1984; Mielke et al., 1999; Mielke and Reagan, 1998; Watt et al., 1993). This is troublesome because common urban soil contaminants (e.g., lead and arsenic) are toxic to humans, especially children (Boyd et al., 1999; Finster et al., 2004; Hettiarachchi and Pierzynski, 2004; Mielke et al., 1999; Mielke and Reagan, 1998). Gallacher et al. (1984) found that residents living in areas with highly lead-contaminated soils had higher blood lead levels than residents of areas with minimally contaminated or uncontaminated soils. Humans may be exposed to soil contaminants through three main pathways: ingestion, inhalation, and dermal exposure (Boyd et al., 1999; Mielke et al., 1999; Mielke and Reagan, 1998).

The two main exposure pathways affecting urban dwellers, especially gardeners and farmers, are ingestion of soil dust and ingestion of food grown in contaminated soil (Cambra et al., 1999; Hawley, 1985; Hettiarachchi and Pierzynski, 2004). Direct ingestion of soil dust may be from putting soil or dirty fingers in mouths, which is a typical occurrence for young children when playing outdoors, or from soil dust that adheres to produce, hands, and clothing. Root crops grown directly in the soil and crops that grow close to the soil, such as spinach, often have soil dust adhered to the tissue when harvested (Finster et al., 2004). Ingestion of food grown in contaminated soil also may pose a risk to human health if the bioavailability of the contaminant is high and if translocation of the contaminant from soil to the edible portion of the plant has occurred (Finster et al., 2004; Purves and Mackenzie, 1970). The bioavailability of an individual contaminant affects the plant uptake and translocation of the contaminant from soil into the roots, from the roots to shoots, and shoots to fructifying bodies. Hettiarachchi and Pierzynski (2004) defined bioavailability as the proportion of a soil contaminant that is available for absorption into an organism. Some researchers have attempted to develop rules of thumb for managing soils based on the measured contaminant concentration (Table 4). Individuals in direct contact with urban soil should be aware of these issues so they can minimize the environmental and human health risks associated with soil contamination.

### THE DECISION FOR STUDENTS

Mr. Holloway is frightened to make a decision about promoting community gardening on the Michigan Avenue site. He wants to improve his neighborhood with this beautiful garden, to give his neighbors the opportunity for recreation and socializing while gardening, and to provide everyone with fresh, healthy, and local produce. But what if their health is at risk from lead contamination, if not other chemicals or metals? He is alarmed, but he doesn’t want to also alarm his friends. “We’ve put so much effort into this garden, and it has already become a bright spot in Harmony Park. What should I do?”

**Case Objectives**

Upon completion of this case, students should be able to:

1. Discuss issues related to brownfields, food deserts, urban soil quality and contamination, and growing food on mildly contaminated soils.
2. Discuss the common urban soil quality and contamination issues related to historical and current human impacts on urban lands.
3. Discuss how food deserts affect urban dwellers’ ability to access healthy, fresh foods.
4. Discuss the three pathways and the potential human health risks associated with exposure to contaminated soil.
5. Uncover relevant scientific information and evaluate its validity.
6. Analyze site-specific data on the contaminants tested and the potential risks associated with growing food crops on brownfields.
7. Formulate a BMP recommendation for gardening on a brownfield given that the gardeners have already begun growing on the site.
Additional Reading for Teachers and Students

- USEPA. Lead website. http://www2.epa.gov/lead/

TEACHING NOTES

Case Uses

This case could be used effectively by high school or undergraduate students interested in urban soil quality, soil contamination, urban soil sampling, food deserts, and urban agriculture. The case could help students investigate the complex environmental, human health, social, and economic issues of urban agriculture on brownfields. Students with varied academic and personal backgrounds could make use of this case to practice the following skills: uncover and assess validity of scientific information; interpret research data; analyze social, economic, environmental, and human health issues associated with a complex real-world problem; and formulate a BMP protocol to mitigate human health risk for urban growers and consumers. Instructors should emphasize that additional information from scientific literature and reference guides will be necessary to make a sound decision.

Students could be given the case several class periods before the scheduled discussion in class, as well as additional reading materials, and should be encouraged to research case topics independently. Instructors should separate teaching resources before making the case and list of resources available to students. Students should arrive to the discussion period prepared to discuss the case problem and topics with their peers and instructor.

Questions to Stimulate Discussion and to Examine the Issues of the Case

Review the evidence of contamination on the site as well as the social, economic, human health, and environmental issues of this case and answer the following questions:

1. What is the dilemma that Mr. Holloway faces? Should he and his fellow neighbors continue to garden on and eat produce grown on the brownfield site? Is it a good idea to convert the vacant city lots in this neighborhood into community garden spaces to grow fresh foods for neighborhood consumption?

2. Does Mr. Holloway have a legitimate reason to worry about the health of his neighbors, friends, and family who are gardening on the site? Who will Mr. Holloway’s decision affect?

3. Should Mr. Holloway tell the gardeners on the site about the contamination?

4. What are the benefits of locating the community garden on a brownfields site?

5. What are the disadvantages of locating the community garden on a brownfields site?

6. How are soils tested? Is it like the television show “CSI: Crime Scene Investigation,” where you put a soil sample into an analytical machine and get a readout of all possible contaminants? Are there any university or private soil testing labs in your state? How much does it cost to test one soil for lead? Do the benefits of growing fresh produce for the neighborhood outweigh the disadvantages associated with the urban soils of the lot?

7. Based on the evidence, what BMPs would you recommend that Mr. Holloway and the other gardeners implement on the site? What, if anything, could be done on the site to ensure the health of growers and consumers?

Answers to Questions, and Ideas for Classroom Management

1. Mr. Holloway is a community leader.

2. The total soil lead concentrations are mildly elevated (Table 1, 2, and 4), indicating the past human impacts have raised lead concentration above the natural soil levels. Mr. Holloway and the other gardeners should be aware that the soils they are growing in contain elevated levels of lead; however, these concentrations should not provoke panic for these gardeners. The main risk from lead is through eating or inhaling soil. Lead is not a plant nutrient, so uptake into plant tissues is not a concern.

3. Mr. Holloway is a leader in the community, and many people are looking to him for guidance on whether or not they should continue to garden at the site. His family, neighbors, and any other consumers of produce from the site will be affected by his decision to continue or to stop gardening on the Michigan Avenue lot. If they continue gardening without taking the proper precautionary measures, they may be endangering themselves; however, the soil total lead concentrations are not elevated enough to warrant the immediate termination of gardening on the site. Precautionary measures would include the following. First, collecting and submitting soil samples to a laboratory would help them to assess the overall risk of gardening on the site. Second, if the soil is only mildly contaminated and is thus still safe for gardening, then the gardeners should avoid inhaling dust while working. One solution is to cover walkways with fabric or mulch to keep the dust down. If they are doing an operation that is particularly dusty, such as tillage, they should consider wearing a dust mask. Gardeners should also avoid the transfer of soil into their mouths, for example, to wash their hands and produce with soap and water before eating. Consumers should be told to wash produce thoroughly, peel root crops, and discard the outer leaves of leafy crops.

4. Mr. Holloway, as a leader in his neighborhood, has a responsibility to his neighbors and to the consumers of the produce from the garden to notify all who are involved of the mildly elevated concentrations of lead in the soil. Ask
5. The Harmony Park neighborhood is located in a food desert in which access to affordable, fresh, healthy foods is limited. The residents of Harmony Park could benefit from a local, free supply of healthy fruits and vegetables. Improved diets may help improve the health of these community members. Also, residents benefit from socializing at this community gathering spot, enjoying a beautiful piece of nature and green space in the middle of the city, and recreation and exercise while engaging in gardening activities. This brownfield site was an underutilized and convenient location in the neighborhood.

6. The urban soils on the site are highly heterogeneous, making management of the site more difficult. The total soil lead concentrations are elevated, whereas the levels of both DDT and chlordane were below the detectable limits in the soils of this brownfield site. These issues can make management decisions complex and difficult for gardeners to make. Expensive soil tests and potentially expensive risk mitigation techniques may be too expensive for a community gardening group to shoulder. Outside technical assistance is often required to determine the safety of and the BMP of a specific brownfield site.

7. Students should contact and/or identify local soil testing laboratories and inquire about the availability, cost of testing, and turnaround time for total soil lead and for chlordane and DDT. (This question is posed so that students have an appreciation for the costs associated with testing for contaminants and why community gardens will likely not be able to afford extensive soil testing.) This question was designed to make students think about the potential positive and negative aspects of the proposed community garden. Many answers are possible. Students should identify that the addition of compost to soils on the site decreased the total soil lead concentration. How did it do this (dilution of the concentration and reduction of the bioavailability)? Gardeners could add compost to the entire site to reduce the total soil lead concentration in the surface soil. At the actual site, Mr. Holloway and the gardeners added compost to the entire Michigan Avenue community garden and incorporated it into the top 6 inches of soil. Mulch was also added to all walkways to reduce the amount of exposed soil and to minimize soil dust in the garden. Depending on the size of the community garden, the cost of bringing compost and/or mulch could be quite high. How would that be paid for? Raised beds created using imported topsoil would be another option, along with covered walkways. Gardeners should be advised to wear gloves while gardening or to wash hands after working in the soil. Children should be prohibited from putting soil in their mouths, and babies and toddlers must be closely monitored if they are going to be present in the garden. A fence would be a good measure to keep children and pets from passing through this mildly contaminated site. All produce should be thoroughly washed with soapy water to remove adhered soil particles prior to eating. Furthermore, urban soils are usually inherently poor and need to be improved by adding compost, testing for soil nutrients, and adding nutrients if needed. Adding compost will lead to increased productivity for food production. One important note is that commercial composting facilities are not permitted on contaminated sites. Therefore, the amount of contaminants present in the compost itself is usually very low. Composting garden materials upon the contaminated soils at the community garden should be avoided, as composting is often done directly on the soil surface, and this would lead to enrichment of the compost in lead. On-site composting should be confined to low-lead parts of the property, if possible.

REFERENCES


