Abstract
The importance of soil health receives little to no attention in urban communities, especially in poor neighborhoods lacking access to fresh nutritious food. Yet, high quality soil yields high-quality foods, and improving degraded or contaminated soils in vacant lots or existing community gardens, can transform food deserts into food oases. To this purpose, we created a manual for an educational permaculture garden suitable for community-shared or individually-owned spaces. The manual achieves the following aims: (1) provides the foundational knowledge, generally lacking in urban communities, on soil health; (2) features gardening techniques grounded in permaculture principles for restoration and sustainable management of soil health; (3) develops a framework for community engagement, education, outreach, and self-reliance; and (4) enhances ecological awareness in urban landscapes. Interviews with local professionals and reviews of the literature informed the manual’s guidelines for garden design and educational activities. An existing community garden in Lower Price Hill served as the case study due to its lead-contaminated soils and underutilized space for community benefit. Using the manual, we created an example of a garden design and suggested educational approaches specific to the site. The educational permaculture garden manual lays the groundwork for best practices for soil health in urban areas and community education and builds in the next steps for engagement, expansion, and maintenance.

Introduction
The global trend of urbanization and industrialization has led to a depletion of healthy urban soils, which in turn has had a negative effect on human populations and urban ecologies (Amundson et al., 2015). Soil health has been both directly and indirectly linked to surrounding human health (Li et al., 2018), and therefore producing, remediating, and protecting healthy soil will be necessary in developing (or redeveloping) sustainable urban areas.

In addition to producing food, urban gardens and green spaces also have the potential to reduce soil erosion, groundwater contamination, and air pollution as well as to increase urban biodiversity by attracting and housing healthy soil biota, insects, reptiles, birds and other animals (Brown et al., 2000). Studies have also suggested that the presence of urban garden projects reduce stress levels in nearby individuals and can be linked to decreased crime rates (Brown et al., 2000).

Society’s adoption of agroecological methods and principles, such as permaculture, have the potential to substantially reduce energy, pesticide use, and water consumption, while also restoring soil health, sequestering carbon, increasing biodiversity and providing food.

Permaculture is an agroecological design philosophy that seeks to create and manage landscapes in a way that replicates natural ecosystems. It is founded on three ethical points: Care of Earth, Care of People, and Share of Surplus or Fair Share. Permaculture includes a variety of holistic techniques that seek to grow food in ecologically and socially responsible ways.

Results
- Manual to create a community permaculture garden
- Educational signage
- Garden design using techniques described in the manual
- Soil health, permaculture, and the natural world

Conclusion
By creating this manual and educational materials we hope to educate the public about soil health, permaculture, and the natural world.

Future work
- Implementation of physical garden using manual
- Increase community involvement
- Expansion of educational material
- Survey design efficacy in community
- Adaptation of design, expand phase II and III of manual
- Potential use of garden design and manual by Community Matters at the Sassafras Garden

Discussion
- Soil health is linked to human health
- Lessening the gap between humans and nature
- Creating food security in urban areas
- Educating communities on sustainable gardening
- Biodiversity integration

Methods

<table>
<thead>
<tr>
<th>Literature Review</th>
<th>Interviews with local experts</th>
<th>Site Selection</th>
<th>Manual Creation</th>
<th>Design of Garden</th>
<th>Creation of Educational Materials</th>
</tr>
</thead>
</table>

Acknowledgements
We would like to thank Dr. Susanna Tong, Dr. Teri Jacobs, and the EVST program for their help in creating this project. We would also like to extend our gratitude to the local experts from the Civic Garden Center, the Cincinnati Permaculture Institute, Community Matters, and other local permaculture experts for sharing their knowledge with us.

References