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Barriers and opportunities to sustainable urban agriculture: the case of Louisville, Kentucky.

Sait Sarr
University of Louisville

BARRIERS AND OPPORTUNITIES TO SUSTAINABLE URBAN AGRICULTURE: THE CASE OF LOUISVILLE, KENTUCKY

By

Sait Sarr
BSc., Kentucky State University, 2015
MBA, Kentucky State University, 2017
MSc., Kentucky State University, 2018

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A Dissertation Approved on

May 20, 2022

By the following Dissertation Committee:

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Dr. Matthew Ruther (Dissertation Director)

_____

Dr. Tamara Sluss

_____

Dr. Patrick C. Exmeyer

_____

Ariana R. Levinson, J.D.

DEDICATION

This thesis is dedicated to my wife, Oumie Ceesay, and my three children, Ndumbeh,

Mariama, and Naffiesatou Sarr.

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ABSTRACT

BARRIERS AND OPPORTUNITIES TO SUSTAINABLE URBAN AGRICULTURE: THE CASE OF LOUISVILLE, KENTUCKY

Sait Sarr

May 20, 2022

As the urban populations continue to increase, food insecurity will continue to affect urban residents as well, depriving them of access to abundant and nutritious food. This has captured the attention of many policymakers, urban planners, nonprofits, grassroots movements, and other stakeholders. As a result, there is growing interest in developing new sustainable strategies and policy measures that improve food security through the promotion of sustainable urban agriculture. More than 100,000 Louisville residents, of which 20% are from West Louisville, do not have access to adequate and nutritious foods, and are at a higher risk of developing health issues. West Louisville, with the highest population of the city's most marginalized residents, is the home to almost 10,000 households receiving federal food assistance (SNAP benefits), and about one-third of these households lack mobility to have access to fresh, healthy, local food. Relatively, little research has documented the barriers to sustainable urban agriculture in Louisville, Kentucky. Specifically, the aim of this study is, "to examine the barriers (social, economic, cultural, and political or policy barriers) to sustainable agriculture in Louisville, and how these barriers can be addressed in a more holistic approach with the

full and active participation of all stakeholders." This study identified gaps in achieving a more sustainable form of agriculture in Louisville and proposed potential policy recommendations. With a mixed-methods approach, inclusive of a survey of forty-two urban farmers (growers) and twenty-six Louisville consumers, semi-structured interviews were conducted with twelve key stakeholders (policymakers, planners, and representatives of non-profits) with knowledge and experience about urban agriculture in Louisville, KY. Background information and data about the activities and potentials of urban agriculture in Louisville were also collected and analyzed. This study identified that the two most frequently mentioned barriers were limited access to land (76%) and lack of financial resources or funding (76%). Other barriers were restricted market access (45%), insufficient government or community support (43%), zoning policies (38%), water access and affordability (36%), lack of farming skills/knowledge (30%), and pests and diseases (27%). Addressing these barriers requires significant policy and program initiatives, including, but not limited to: increased access to land and tenure through favorable urban policies (e.g., zoning); increased funding, or provision of more resources; better access to markets by connecting producers to consumers, and the presence of more markets with extended hours and days of operation (especially in West Louisville); more support for urban agriculture from the Louisville community and Louisville Metro government; more education, training, and extension outreach; innovative ideas and solutions; and lastly, creating new models for collaboration among stakeholders to collectively identify and find common solutions (co-production).

Keywords: Barriers; Collective action; Food desert; Funding; Land access; Louisville; Sustainable; Urban agriculture.

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1. INTRODUCTION

As urban populations continue to increase (United Nations, 2019), food insecurity will continue to affect urban residents, depriving them of access to abundant and nutritious foods (Mougeot, 2006; Bisaga et al., 2019). This has captured the attention of policymakers, urban planners, nonprofits, grassroots movements, and other stakeholders (Mougeot, 2006; Oberholtzer et al., 2014). As a result, there is growing interest in developing new sustainable strategies and policy measures that improve urban food security through the promotion and expansion of sustainable urban agriculture (Mougeot, 2006; De Bon et al., 2010; Ackerman et al., 2014).

In this study, urban agriculture, which is practiced by over 750 million people worldwide (FAO, 2017) is defined as the practice of cultivating, processing, and distributing food within and around a city (Smit et al., 1996; Bailkey and Nasr, 2000; Mougeot, 2006; Vagneron, 2007; Randolph, 2012), in this case, the city of Louisville KY. Approximately, 25% of the world's food is grown in urban areas, and the percentage is expected to increase as urbanization and food insecurity continue to affect cities worldwide (FAO, 2017; Houessou et al., 2020). In Louisville, like many other cities in the United States, there is growing interest in urban agriculture that if properly implemented and sustained, could satisfy hunger for local food while supporting local economic development, generating social support or community networks, improving the

health and dietary needs of Louisville residents, and enhancing the Louisville urban environment (Moskowitz, 2013; Peterson, 2013; Hashim, 2015).

Currently, Louisville residents' demand for local food exceeds the supply, and they spend over USD100 million annually on locally grown food, and this number has been increasing (Low et al., 2015; Louisville Grows, 2020). In addition, the annual total produce from the urban farms alone (operated by the Jefferson County Extension Service, which oversees over forty acres of the county's land) was valued around $2 million (Peterson, 2013). The potentials of urban agriculture in Louisville's urban core are not fully met or tapped. To boost or support the production, access, and equitable distribution of local and healthy foods in Louisville, the Jefferson County Cooperative Extension Service, and other grassroots organizations like Louisville Grows, Community Earth Gardens, and Sustainable Agriculture of Louisville (SAL) have been providing resources, training, and education to Louisville growers and consumers (Louisville Grows, 2020; Louisville Metro Government, 2020; SAL, 2021). For example, in 2018, Louisville Metro Council appropriated over USD45,000 to neighborhoods lacking access to healthy foods to boost the presence of farmers' markets, grocery stores, and programs to support urban gardens in West Louisville (Louisville Metro Government, 2020). In addition, and in the same year (2018), the city incorporated sustainability into the Land Development Code in its new plan (Plan 2040), which could boost the potential and sustainability of agriculture in Louisville (Louisville Metro Government, 2020).

From a sustainability perspective, urban agriculture, which contributes to urban sustainability goals brings insights to some of the world's Sustainable Development Goals (SDGs), which have been adopted by many nations to eradicate hunger and

poverty, and protect the planet for its sustainable use (UNDP, 2020). These SDGs encompass the three pillars of sustainability: social, economic, and environmental (Ali et al., 2006; Ackerman et al., 2014; Houessou et al., 2020; UNDP, 2020). Urban agriculture specifically addresses SDG-2 (zero hunger), SDG-3 (good health and well-being), SDG-8 (work and economic growth), and SDG-11 (sustainable cities and communities) (Bisaga et al., 2019).

Promoting sustainable urban agriculture can provide several short and long-term benefits for creating sustainable, resilient cities (Perez et al., 2007; FAO, 2008; EPA, 2015). Urban agriculture provides jobs, food, and employment to the urban poor (UNDP, 1996; Veenhuizeen, 2006; Nord et al., 2007; Veenhuizeen and Danso, 2007; De Bon et al., 2010), creates a green public space (Lattuca et al., 2005; De Bon et al., 2010), and fosters social cohesion, and community empowerment and development (Mees and Stone, 2012; Ackerman et al., 2014; EPA, 2015). Urban agriculture, which creates a green city environment by reducing energy use and urban heat island effects, can be used as a climate change mitigation and adaptation strategy (Rowe, 2001; Ali et al., 2006; Whittinghill and Rowe, 2012; Ackerman et al., 2014).

For urban agriculture to be sustainable, it should comprise an integrated food production systems and practices that address human food needs while enhancing environmental quality. It should also include a comprehensive understanding and adoption of sustainable agricultural practices, e.g., reduced chemical fertilizer and pesticide use (De Bon et al., 2010; Mishra, 2018). Sustainable urban agriculture requires investments, access to resources and markets, training, co-operation, and the full support

and active participation of key actors/stakeholders, including urban farmers, experts, and political and community leaders (Raja et al., 2008; Lovell, 2010; Hull et al., 2020).

Despite its many benefits, many factors or barriers influence the adoption of sustainable agriculture, including the level of education, training, and the production techniques or practices of urban growers, the availability of growing space, competition for land uses, urban policies (e.g., unfavorable zoning policies for urban agriculture), lack of collaboration or networking among key actors/stakeholders, lack of funding, inadequate resources, markets, tools, and data (Knowler and Bradshaw, 2007; FAO, 2008; Lovell, 2010; Castillo et al., 2013; Ackerman et al., 2014; Sarr et al., 2015). Few recent studies have specifically documented some of the barriers or challenges to urban agriculture in Louisville, KY (Zhong et al., 2016; Mishra et al., 2018; Sarr and Whittinghill, 2021). Despite several years of efforts undertaken by research institutions, grassroots organizations, and relevant government agencies like the Natural Resources Conservation Service (NRCS) and Jefferson County Cooperative Extension Service to promote sustainable urban agriculture, challenges remain that require the attention and commitment of all stakeholders, including city planners and urban growers (Pothukuchi and Kaufman, 2000; NRCS, 2003, 2005, 2014; Lovell, 2010).

1.1 Objectives

Specifically, the aim of this paper is to examine the barriers (social, economic, cultural, and political or policy barriers) to sustainable agriculture in Louisville, and how these barriers can be addressed in a more holistic approach with the full and active participation of all stakeholders. In addition, this study identified gaps in achieving a

more sustainable form of agriculture in Louisville and highlighted potential policy recommendations. The broad objectives of this study were:

1) To examine the key barriers (social, economic, cultural, and political or policy barriers) that influence the adoption and sustainability of agriculture in Louisville.
2) To make policy recommendations to achieving a more sustainable form of agriculture in Louisville, with the active and full participation of all stakeholders.

1.2 Urban agriculture in Louisville, KY

Recently, urban agriculture in Louisville has been practiced mainly in the form of community gardens, residential and school backyards, and private farms within the city. With over thirty community gardens across the city, some of which are managed by the Jefferson County Cooperative Extension Service (JCCES), Louisville residents are still hungry for more local food (Louisville Grows, 2020). However, this requires more growing space, investments in infrastructure, and local support. We have seen the rise of grassroots and urban farming movements across Louisville helping to coordinate efforts and programs to promote urban agriculture. For example, Louisville Grows, a non-profit organization founded in 2009, and Sustainable Agriculture of Louisville (SAL), have been providing technical and financial assistance to some communities in Louisville with the aim of building a more just and resilient city through urban agriculture (Louisville Grows, 2020; SAL, 2020). In 2016 alone, Louisville Grows assisted four neighborhoods in Louisville (Portland, Shawnee, Beechmont, Parkland) to establish and maintain a community garden (Louisville Grows, 2020). These community gardens, while

eliminating vacant lots in Louisville, provide income and fresh and local produce to these low-income neighborhoods, protect the urban environment, and serve as an urban green space for neighbors to interact and spend time together (Hashim, 2015; Louisville Grows, 2020).

1.3 Hypotheses

The following hypotheses were developed:

1) First, this study will test whether limited access to land, part of which is created by unfavorable zoning policies, is a barrier to the sustainability of urban agriculture in Louisville. From the literature, limited land access and lack of tenure on land for farming has been one of the greatest challenges to sustainable urban agriculture, and those with the greatest need (i.e., minorities and the marginalized groups) to farm in the city are the ones mostly affected (Lovell, 2010; Ackerman et al. 2014; Bisaga et al., 2019). Poor planning or unfavorable zoning policies has been linked to barriers relating to limited land access for urban agriculture (Oberholtzer et al., 2014), and hence the need to explore whether same challenges occur in Louisville like many other cities in the United States (Castillo et al. 2013; Ackerman et al., 2014; Oberholtzer et al., 2014).
2) Second, the study will examine whether limited funding is a barrier to the sustainability of urban agriculture in Louisville. Lack of funding or financial resources, besides limited land access, has been documented to be one the major obstacles to urban agriculture (Kaufman and Bailkey, 2000; Lovell, 2010; Pollard et al., 2018). The prohibitive cost of water, seeds, equipment, storage facilities, capital to buy or rent land, and converting vacant parcels into urban gardens can

be a daunting challenge to urban farmers. As a result, there is the need to examine the extent to which access to funding or financial resources influence the sustainability of urban agriculture in Louisville.

3) Third, limited access to markets, whereby urban farmers and local consumers do not have full access to farmers markets and other marketing outlets to facilitate trade due to limited transportation or other limiting factors (e.g., short season markets), have been documented as a constraint for the sustainability of urban agriculture (De Bon et al., 2010; Lovell, 2010; Nchanji, 2017; Houessou et al., 2020). In addition, the low presence of farmers markets and grocery stores in low-income, food desert neighborhoods like West Louisville, have been a challenge for many urban residents to access fresh, healthy, local food (Bregendahl and Flora, 2006; Hashim, 2015; Houessou et al., 2020). As a result, further investigation is warranted to determine whether limited market access is a barrier to sustainable urban agriculture.

4) Fourth, lack of community or government support is a challenge for the adoption and sustainability of urban agriculture in Louisville. With this hypothesis, study participants were asked how they perceive the community and political support for the expansion of urban agriculture in Louisville. Urban agriculture in some cities in the United States and beyond has been influenced by the lack of support and enforcement of urban development plans for urban farming by certain communities or policymakers (Kaufman and Bailkey, 2000; Orsini et al., 2013; Artmann and Sartison, 2018; Bisaga et al., 2019). Louisville Metro government policies and stance around urban agriculture, as mentioned by

some proponents of the urban agriculture movement in Louisville, has not been very clear. Hence, this study will examine whether the support from the city is strong or weak for the expansion of urban agriculture in Louisville.

5) Fifth, unsustainable farming or production practices (e.g., application of chemical fertilizers and pesticides) adopted by Louisville farmers have a negative effect on the sustainability of urban agriculture. The effect and sustainability of urban agriculture for the benefit of city dwellers depends on several factors, including the adoption of sustainable farming practices or systems (Orsini et al., 2013; Mishra et al., 2018). If not properly implemented, urban agriculture can adversely affect local water sources and urban soils as they may become polluted with excessive chemical fertilizers, pesticides, and accumulated animal wastes (Buechler et al., 2006; Graefe et al., 2008; Wortman and Lovell, 2013). Sustainable farming practices, such as organic farming, crop rotation, and soil testing for contaminants, has potential social, economic, and environmental benefits in urban settings (Rabinovitch and Schmetzer, 1997; Buechler et al., 2006; Kornegay et al., 2010). As a result, examining the farming practices or production techniques adopted by Louisville farmers is warranted for the sustainability of urban agriculture in Louisville.

6) Sixth, lack of collaboration/networking and partnerships among stakeholders have stalled many urban development projects in some cities, including urban agriculture-related projects (NRCS, 2005; MacRae et al., 2011; Diekmann et al., 2017). Hence, this study will examine whether the same barrier apply to the development and sustainability of urban agriculture in Louisville. Successful

collaboration and creating partnerships within the urban agriculture community and beyond could facilitate the transfer of information and resources, build trust among stakeholders, and create innovative ideas and solutions.

1.4 Significance of the Study

Food insecurity is common in low-income black neighborhoods across the United States (Hashim, 2015; Loosemore, 2019). As a result, sustainable urban agriculture, if promoted and developed with a community-led approach, has been one of the viable options proposed to combat health and economic crisis faced by these highly food insecure neighborhoods or food apartheid (FAO, 2008; Lovell, 2010; Zezza and Tasciotti, 2010; Hashim, 2015; Bisaga et al., 2019). But for urban agriculture to be effective in combatting food insecurity and other poverty-related and health issues faced by low-income neighborhoods, it must be sustainable (i.e., its barriers must be addressed so it can serve our present needs and that of the future generation with social, economic, and environmental benefits).

This study is expected to be beneficial in multiple ways. First, this study can be used for background information for other studies in the field, especially in public policy, and in the discussions of building resilient, sustainable cities. Second, recommendations and lessons from this study will be pertinent to other urban communities and municipalities throughout Kentucky and across the United States, mostly benefitting urban growers and low-income urban consumers in food-insecure communities like West Louisville. Third, the study is expected to provide insights and directions for advocates, policymakers, city planners, and cooperative extension agents to collectively design better policies and plans, and develop transformative solutions to expand the adoption of

resilient and sustainable urban agriculture systems in Louisville (Lawson, 2005; De Bon et al., 2010; Lovell, 2010; Bisaga et al., 2019). Fourth, the study highlighted how the sustainability of urban agriculture in Louisville is influenced by significant zoning laws and other government policies and incentives, and the need to call for greater community-based and local government support for urban agriculture in Louisville. Finally, this study has revealed some of the current and past efforts, gains, deficiencies, and future outcomes in the co-production of addressing the barriers to sustainable agriculture in Louisville.

2. LITERATURE REVIEW

This section, which aims to describe a critical overview of some of the available scholarly literature on urban agriculture, is divided into two parts: i) the history, definition, benefits, or potentials of urban agriculture in respect to alleviating urban poverty, enhancing food security, improving the health of urban residents, and the environmental sustainability of our cities, including Louisville; ii) how socio-economic, cultural, and other factors and urban policies influence the adoption and sustainability of urban agriculture.

2.1 The meaning and benefits of urban agriculture

Urban agriculture has been given different meanings based on localities, production activities or types (such as vegetables and fruits production), and for purposes of production for consumption and marketing (Smit et al., 1996; UNDP, 1996; Mougeot, 2006; Vagneron, 2007; Ackerman et al., 2014). For the purpose of this study, urban agriculture is defined as the practice of cultivating, processing, and distributing food within and around a city (Smit et al., 1996; Mougeot, 2006; Veenhuizen, 2006; Vagneron, 2007). Urban agriculture may include activities in the urban and peri-urban settlements where residents use land and other resources (water, solid wastes, etc.) to produce food for their own benefits or for sale to other residents in close proximity (Mougeot, 2006). It can also incorporate various forms, including community gardens, residential backyard and school gardens, private farms, urban forests, horticulture, rooftop gardens, apiaries, and aquaculture (Escobedo et al., 2008; Lovell, 2010; De

Zeeuw et al., 2011; Greswal and Greswal, 2012; Ackerman et al., 2014). Urban farms can be designed in alternate forms and at varying scales depending on the objectives and available resources (Lovell, 2010; Anderson et al., 2019).

Community gardens/farms, which are prominent in United States' cities, target civic participation and provide food and income for the urban poor, cultural ecosystem services, and other socio-economic and health benefits (Lawson, 2005; Mougeot, 2006; Escobedo et al., 2008; FAO, 2008; Lovell and Taylor, 2013). Residential and school yards have also been used for urban farming and are gaining momentum in the United States (Lovell, 2010). This is especially important when the main objective for their use is for direct household or individual consumption, for sharing or donating produce with others in the community, and to have access to fresh, healthy food (Lovell, 2010). Private farms within city boundaries produce high-value crops and other farming products, reducing the struggle for urban residents to access abundant, healthy, and nutritious foods (Bachmann, 2009; Lovell, 2010). Residential gardens are relatively smaller than private urban farms, although they enhance urban green space.

For many years, urban agriculture has been practiced via multi-story combinations of trees, shrubs, and herbaceous plants (agroforestry systems), increasing biodiversity, and providing food and other goods like timber (Kumar and Nair, 2004; Lovell, 2010). Agroforestry systems are especially common in developing and low-income nations (Lovell, 2010). Green roofs are also becoming common in some cities in the United States, including Chicago, where new opportunities exist for flat rooftops to serve as platforms of growing media supporting urban agriculture (Lovell, 2010).

However, one of the major problems associated with rooftops or green roofs is that crops are susceptible to winds, droughts, and excessive temperatures (Lovell, 2010).

Historically, urban agriculture has been a key component of many contemporary cities, addressing needs of city residents, especially in sub-Sahara Africa, Latin America, and parts of Asia (Mougeot, 2006; Lovell, 2010). In these areas, the role of urban agriculture is often improving the livelihoods of the urban poor, addressing food shortages, providing employment and income, and empowering women (Madaleno, 2000; Lovell, 2010). A typical example is Havana, Cuba, where urban agriculture addressed food shortages after the collapse of the Soviet Union and the resulting loss of food imports between the two nations (Murphy, 2004). The emergence of urban agriculture in many nations (including the United States), has been linked to the rapid urbanization of the world, and rising economic and food security issues in cities (De Bon et al., 2010; Lovell, 2010).

In the United States, urban agriculture dates back more than a century with the establishment of community gardens on vacant and abandoned lots in United States' cities as a source of food provision (Lawson, 2005). During the Great Depression of the 1930's and after World War II, the support for victory gardens gained momentum with the support of local and federal agencies to address the need for food and employment on urban farms (Lawson, 2005). In the 1970's, urban farms in the United States were geared towards renewal of urban spaces, providing food and recreation, and enhancing social ties (Lawson, 2005; Lovell, 2010).

Today, urban agriculture in the United States, where over 200 million citizens live in urban areas (United Nations, 2015, 2019), focuses on addressing food insecurity in

some neighborhoods where the lack of access to healthy and nutritious foods by the urban poor is obvious (e.g., West Louisville KY), alleviating urban poverty, and improving environmental sustainability through waste recycling, reduced energy usage, etc. (Redwood, 2009; Ackerman et al., 2014).

As urban population growth continues, there is the need to re-evaluate how urban spaces are developed and how its occupants are fed (UNDP, 1996; Veehuizeen, 2006; Graefe et al., 2008; De Bon et al., 2010; Ackerman et al., 2014). The recent lockdown of cities across the world due to the emergence coronavirus (SARS COVID-19) has led to the increasing awareness of the vital importance of urban agriculture to respond to crisis as the pandemic threatened global food supply (FAO, 2020; Pulighe and Lupia, 2020). COVID-19 brought short-term effects on the availability and abundance of food supply across cities, especially densely populated cities that depend on food supply from external sources to feed its citizens. Urban agriculture can enhance urban food security, which is influenced by both the amount and quality of food produced and available to urban consumers (Mougeot, 2006; Nord et al., 2007; FAO, 2008; Graefe et al., 2008; De Bon et al., 2010). For example, in cities like Detroit and Oregon, urban agriculture provides between 20% and 50% or more of the fruits and vegetables intake needs of their residents (Colasanti and Hamm, 2010).

In addition to providing healthy and adequate food supply to the urban poor, urban agriculture also provides employment and income for the urban poor (Figure 1) (Nugent, 2000; Ali et al., 2006; Vagneron, 2007; World Bank, 2007; Baudoin and Drescher, 2008; Ackerman et al., 2014). Urban poverty and food insecurity go hand in hand, and many low-income neighborhoods in the United States (e.g., West Louisville

KY) and beyond are faced with food insecurity challenges (Mougeot, 2006; De Bon et al., 2010; Moskowitz, 2013; Hashim, 2015). Rising food prices, coupled with low-income consumers in urban areas, have forced many urban households to turn to cheap and less nutritious foods such as chips and hamburgers (Baker, 2008; FAO, 2008; Butterfield, 2009; Moskowitz, 2013). Urban agriculture can supplement household diets and income through the production and sale of vegetables, dairy products, etc. (Nugent, 2000; Ali et al., 2006; Vagneron, 2007; Graefe et al., 2008; Ackerman et al., 2014). Many cities, especially in developing nations, are faced with rising unemployment, and urban agriculture could play a role in job creation (Mougeot, 2006; World Bank, 2007; De Bon et al., 2010; Zeeza and Tasciotti, 2010). It expands the urban economy (economic development) by creating employment for many urban residents and boosting businesses (Nugent, 2000; Brown and Carter, 2003; De Bon et al., 2010; Ackerman et al., 2014). The potential of urban agriculture in alleviating urban poverty is well documented in many areas, especially in the developing world (Novo, 2002; Midmore et al., 2003; World Bank, 2007; Veenhuizen and Danso, 2007). For example, in 2008, urban agriculture, through summer vegetables sales, contributed over USD 5million towards the household incomes of the residents of Philadelphia, PA (Vitiello and Nairn, 2009).

Urban agriculture, depending on the objectives of its use among cities, not only enhances food and economic security, but can also create a green city environment by reducing energy use, urban heat island effects, and recycling and re-use of urban wastes and waste from storm water (Akbari, 2002; Ali et al., 2006; Veenhuizen, 2006; Whittinghill and Rowe, 2012; Ackerman et al., 2014). By limiting the ecological footprint of cities, its environmental benefits almost outweigh the production inputs or

functions (Coffey and Coad, 2010; Lovell, 2010; Wortman and Lovell, 2013). With rising air and water pollution, urban demand for water, waste management, and climate-related issues (climate change) continue to pose major environmental challenges or threats to cities worldwide (IPCC, 2007). Urban agriculture can play a key role in improving the urban environment and help cities to adapt to climate change by improving the urban micro-climate (Smit et al., 1996; FAO, 2008; Lovell, 2010; UN-Habitat, 2009; De Bon et al., 2010; Ackerman et al., 2014). Because of lower transportation distances for food grown locally within cities, energy use is limited, which could decrease greenhouse gas emissions (Lovell, 2010; Ackerman et al., 2014; Lee et al., 2015). In addition, the presence of different crop species can reduce suspended dust and air pollution by various compounds (e.g., NO_2) in the urban environment (Mougeot, 2006; Prain, 2010; Orsini et al., 2013). Urban agriculture also minimizes storm water runoff through water storage and increased infiltration, and its increasing importance is getting the attention of policymakers and planners in cities such as Portland, OR (Rowe, 2011).

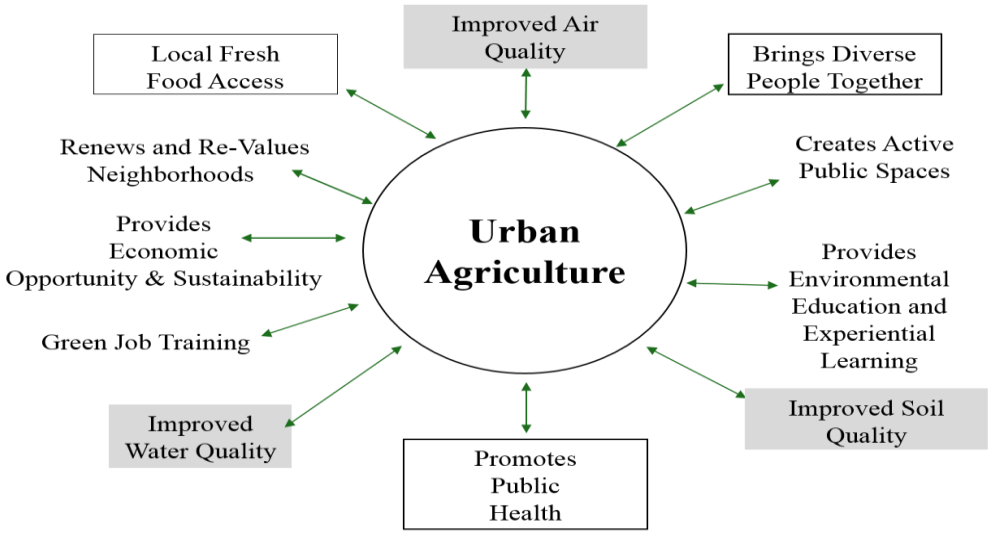

Figure 1. Depiction of the many benefits of Urban Agriculture (Source: Adapted from Diekmann et al., 2017)

Composting urban wastes for urban agriculture has been documented and lowers the cost of public waste management in many cities around the world (Orsini et al., 2013; Ackerman et al., 2014). For example, in some cities such as Nairobi (Kenya) and New Delhi (India), urban wastes have been used for livestock feed, and composts from urban wastes are used to control plant diseases and as a fertilizer source (Cofie et al., 2006; WHO, 2006; Prain, 2010; Orsini et al., 2013). By integrating a wide range of crops and animal species, urban agriculture helps to protect and maintain biodiversity of cities, and increases ecosystem resilience (McPherson, 1992; Pretty et al., 2005; Mougeot, 2006).

Other benefits of urban agriculture include improved health and overall well-being (UNDP, 1996, Mougeot, 2006; Nord et al., 2007), recreational opportunities and agro-tourism (Nugent, 2000; Jiang et al., 2005 ; Lovell, 2010), creating a public good, i.e., landscape for all users (Lattuca et al., 2005; De Bon et al., 2010), strengthened community ties (Nugent, 2000; Mees and Stone, 2012; Moskowitz, 2013), community revitalization and increased access to land (Brown and Carter, 2003; Lovell, 2010; Ackerman et al., 2014), educational opportunities and raised awareness (De Bon et al., 2010; Ackerman et al., 2014), youth and women empowerment (Madaleno, 2000; Lawson, 2005), decreased crimes, beautified neighborhoods, and increased property values (Price, 2003; Moskowitz, 2013).

2.2 Barriers to sustainable urban agriculture

To be considered sustainable, urban agriculture must be multifunctional, offering social, economic, and environmental benefits (Ali et al., 2006; Ackerman et al., 2014; Huang et al., 2015; Artmann and Sartison, 2018). The effect and sustainability of urban agriculture for the benefit of city dwellers depends on several factors, including the

adoption practices or systems (Orsini et al., 2013; Mishra et al., 2018), land and water availability (Kaufman and Bailkey, 2000; Ellis and Sumberg, 2008; Redwood, 2009; Ackerman et al. 2014), favorable urban policies (Kaufman and Bailkey, 2000; Orsini et al., 2013; Artmann and Sartison, 2018), community support (Deelstra et al., 2001; Adelman and Barton, 2002), collaboration among stakeholders (Kaufman and Bailkey, 2000; Bisaga et al., 2019), and access to markets, tools, and other resources (Kaufman and Bailkey, 2000; Lovell, 2010; Pollard et al., 2018; Houesso et al., 2020).

2.2.1 Environmental factors and factors associated with farming practices

Despite its benefits, there are environmental and urban health risks associated with urban agriculture (Rabinovitch and Schmetzer, 1997; Mougeot, 2006; De Bon et al., 2010; De Zeeuw, 2011; Bisaga et al., 2019). If not properly implemented, urban agriculture can adversely affect local water sources and urban soils as they may become polluted with excessive chemical fertilizers, pesticides, and accumulated animal wastes (Rabinovitch and Schmetzer, 1997; Buechler et al., 2006; Wortman and Lovell, 2013). Urban agriculture can pose a serious threat to urban public health because of disease transmission (e.g., bird flu) to humans from plant and animal production (De Bon et al., 2010; De Zeeuw et al., 2011). Food safety can also become a concern as some crops may accumulate heavy metals in their edible parts (Leake et al., 2009; Lovell, 2010; Orsini et al., 2013;). On the other hand, the use of solid and liquid urban wastes in urban farming has associated health risks for urban growers and consumers (Cofie et al., 2006; De Bon et al., 2010). For example, the presence of pathogenic organisms or contamination (e.g., Salmonella) in urban solid wastes and fecal coliforms (e.g., *Escherichia coli*) in urban wastewater have serious health implications (Cofie et al., 2006; De Bon et al., 2010; Topè

et al., 2014; Houessou et al., 2020). Measures to curb or eliminate the effects of such risks associated with urban agriculture could include practicing organic farming, frequent or regular tests for contaminants and heavy metals of urban soils used for farming, and the treatment and proper management of wastewaters and organic wastes used for irrigation and fertilization by urban producers (Smit et al. 1996; WHO, 2006; De Bon et al., 2010; Drechsel et al., 2010).

Natural constraints like climate change, and the presence of pests could be challenges for urban agriculture (Rabinovitch and Schmetzer, 1997; De Bon et al., 2010; Nchanji, 2017; Houessou et al., 2020). Climate-related factors such as rising temperatures and excessive rain in major cities worldwide have enhanced plant and animal diseases, damaged crops, reduced soil quality, and hence reduced urban farm productivity (IPCC, 2007; De Bon et al., 2010; Tubby and Webber, 2010; Rosenzweig et al., 2011; Artmann and Sartison, 2018). Climate change plays a key role in changing the patterns of disturbance from certain native pests and pathogens through physiological changes in the host crop and increases the population and survival of certain non-native species (Tubby and Webber, 2010). In addition, the use of pesticides in some cities is not available, or is prohibited by city authorities due to the health risks associated with it (Houessou et al., 2020). As a result, there is the need to enhance the natural control of pests and diseases through more research, training, education, and extension services (De Bon et al., 2010; Houessou et al., 2020). Cities should also incorporate urban agriculture in their resilience and adaptation plans to reduce the negative impacts of climate-related factors on urban farm productivity (Okvat and Zauta, 2011; Artmann and Sartison, 2018; Clarke et al., 2018).

Adopting sustainable agricultural practices through better training programs and other forms of technical and financial support is critical to ensure urban food and water security, and cushion the urban environment from extreme impacts of climate change (Lal, 2004; Delgado et al., 2007; Perez et al., 2007; Coffey and Mumma, 2014; FAO, 2017). These strategies include: cover cropping, mulching, composting, crop diversification, limited or no use of chemical fertilizers and pesticides, integrated pest, weed, and water management (Buechler et al., 2006; Veenhuizen, 2006; Clarke et al., 2018; Bisaga et al., 2019), fallow management (Schillinger, 2001), controlled animal grazing with fencing (Franzluebbers et al., 2012), the use of local or native crops (Mougeot, 2006; Danne et al., 2010), conservation or minimum tillage (Holland, 2004; Kornegay et al., 2010), alley cropping (Garrett et al., 2009; Wolz and DeLucia, 2018), windbreaks and shelterbelts (Kornegay et al., 2010), and urban reforestation (Mougeot, 2006; Danne et al., 2010; Hall et al., 2012; Colinas et al., 2019).

Integrated pest, weed, and water management, as a sustainable practice aimed at controlling weeds and decreasing the level of pesticide and water use and contamination, has potential social, economic, and environmental benefits in urban settings (Rabinovitch and Schmetzer, 1997; Buechler et al., 2006; Kornegay et al., 2010). Urban agriculture, which could consume considerable water, poses serious risks to water resources due to increased pesticide levels in groundwater pollution. Using wastewater for irrigation could increase the presence of toxic chemicals in soils, microbial loads (e.g., *Escherichia coli*) on plants, and other harmful residues with time (Bisaga et al., 2019). Some urban growers have begun to use organic fertilizers, and continuous training and educating growers on fertility management increase the potential impacts of urban farming on urban livelihoods

(Clarke et al., 2018). Pests, weeds, and water management techniques and applications, including the use of efficient irrigation systems, cultural and biological practices like organic pest control, and the use of aquatic vegetation to reduce nutrients in urban wastewater, can sustain urban farming (Buechler et al., 2006; Bisaga et al., 2019).

The use of the fallow period for soil and water conservation is a sustainable management practice that has been widely given more attention and embraced by many urban farmers in the United States because of its many benefits (Schillinger, 2001; Kornegay et al., 2010). It is an important management tool for soil health by improving soil structure, reducing soil erosion, and enhancing soil biomass, soil nitrogen level, and soil organic matter content (Schillinger, 2001; Kornegay et al., 2010). It also facilitates pest and disease management by breaking pest and disease cycles and suppressing weed growth, and increases crop yield and income for urban growers (Kornegay et al., 2010).

Controlled or managed grazing of animals, which requires field rotations and letting fields recover before a successive round of grazing, is very sustainable with multiple benefits (Gillespie et al., 2007; Franzluebbers et al., 2012). Ecologically sound grazing management reduces fertilizer and pesticide use, provides ecosystem services, and is economically sustainable for the urban farmer (Franzluebbers et al., 2012). However, the practice could require additional land base, and educational and training assistance resources to be effective and sustainable in urban farming.

The use of local or native crops or animals in urban farming has multiple benefits, including the provision of ecosystem services, increasing biodiversity, increasing crop pollination, and controlling of pest species and diseases. It is economically viable for the urban farmer as they can save money by not using pesticides and chemical fertilizers

(Mougeot, 2006; Danne et al., 2010; Kornegay et al., 2010). Native crops can enhance the occurrence of beneficial insects or animals that helps in controlling pests, but this requires a careful consideration and management considering that they could also increase local pests (Kornegay et al., 2010).

Conservation tillage (or minimum tillage), a sustainable management practice aimed at minimizing the frequency or intensity of tillage operations, is adopted by many urban farmers in the United States and other parts of the world (Holland, 2004). It has also been used as a method to prepare for planting, and to minimize soil compaction and soil disturbance by reducing tillage passes by more than half compared to conventional methods (Kornegay et al., 2010). Conservation tillage has multiple benefits, including preventing soil erosion, retaining soil moisture, reducing the risk of runoff and pollution of surface waters, raising carbon sequestration, improving nutrient cycling, and helping reduce plant pests, diseases, and production costs (Holland, 2004; Busari et al., 2015).

Alley cropping, sometimes called intercropping, is a sustainable farming practice in which trees or shrubs are grown simultaneously with arable crops, and has several benefits (Kang et al., 1993; Garrett et al., 2009; Kornegay et al., 2010; Wolz et al., 2018). Alley cropping improves crop performance and yield by improving soil fauna activities, suppressing weeds, adding nutrients and organic matter to the soil, lowering soil temperature, and reducing evaporation, water runoff, soil erosion, and chemical fertilizer use because the pruning from the trees could be used as green manure (Kang et al., 1993; Garrett et al., 2009; Kornegay et al., 2010; Wolz et al., 2018). Windbreaks and shelter belts, usually comprising of one or more planted rows of trees and shrubs, provide protection to crops and soils by acting as barriers from harsh weather conditions (e.g.,

intense winds) (Kornegay et al., 2010). Other additional benefits of windbreaks in urban farms include the provision of shade to crops, habitat for livestock or wildlife, and could serve as a source of wood or timber supply (Kornegay et al., 2010).

Urban reforestation and stewardship, which is the reestablishment of forest in urban space or farmland (or the planting of trees at a larger scale in the urban environment), and its conservation and development, is a sustainable practice with multiple social, economic, and environmental benefits (Hall et al., 2012; Colinas et al., 2019). These benefits include urban beautification (aesthetic or recreation) (Price, 2003), moderating the urban climate to an extent by providing shade (Rahman et al., 2015), improving air and water quality, reducing the urban heat island effect and helping cities adapt to climate change (Akbari, 2002; Wang and Akbarib, 2016; Nowak et al., 2018), containing storm water runoff (Berland et al., 2017), and providing ecosystem services (e.g., aquatic ecosystem), food, jobs, and income for urban residents (Escobedo et al., 2008; Hall et al., 2012; Nowak et al., 2016; Colinas et al., 2019).
with efforts in promoting urban reforestation are centered around its competition for money and urban space with other development efforts or projects.

Vertical farming, which requires skills and more resources, is an innovative urban farming system involving crop growth in a controlled environment, and is gaining momentum in cities worldwide due to its many benefits (de Zeeuw, 2011). AeroFarms, which is the largest indoor vertical farm in the United States, is in Newark, NJ, and produces more than one million pounds of vegetables annually with the use of LED lights (Birkby, 2016). Cities like Mexico City, in Mexico, and New Delhi, in India, are also operating commercial vertical farms, producing tons of fruits and vegetables on daily

basis (Anda and Shear, 2017; Singh and Das, 2018). Vertical farming reduces farm input and transportation costs (cost-effective) with the most efficient use of limited urban space, improves air quality, enhances crop growth and protection, uses less amount of water compared to outdoor farming (because it recycles wastewater), and is more favorable to practice in dry regions or cities with arid climates (Hemenway, 2015; Benke and Tomkins, 2017). However, there are also number of problems associated with vertical farming. First, initial costs could be higher, especially when one is trying to acquire land; second, production volumes could be limited with less diversity in terms of the number and type of crops grown compared to conventional farming, and; third, it requires more training and a skilled workforce (Benke and Tomkins, 2017).

Permaculture, which entails the integration of crop production, ecology, architecture, and community design is another innovative production technique aimed at creating sustainable production systems that are self-reliant (Kornegay et al., 2010; Hemenway, 2015). In such a system, which entails a more holistic approach to farming, crops are grown in organically enriched beddings in every available urban space, including balconies. Such systems lead to efficiency in terms of resource use (e.g., using rainwater and wastewater), and preserve and contain food products for alternate uses (Hemenway, 2015).

2.2.2 Socio-economic factors that influence the sustainability of urban agriculture

Limited land access and lack of tenure on land has been one of the greatest challenges to sustainable urban agriculture, and those with the greatest need (i.e., minorities and marginalized groups) to farm in the city are the ones mostly affected (Lovell, 2010; Ackerman et al. 2014; Bisaga et al., 2019). A common concern is the lack

of tenure, and private developers, public agencies, and other interest groups are usually in control of suitable spaces for urban agriculture (De Bon et al., 2010; Bisaga et al., 2019). For example, in Harare, the largest city in Zimbabwe, many of the urban growers do not have land rights and are primarily renters (Toriro, 2009). Lack of government support makes it worse because they could be removed from their land at any given time (Toriro, 2009). However, some cities, such as Havana, in Cuba, have reserved vast areas specifically for urban farming (Novo, 2002). In the United States, many cities have many vacant lots, and efforts have been made to use them for urban farming (Balmer et al., 2005; Ackerman et al., 2014; Diekmann et al., 2017). However, some of these lots have been contaminated, or are Superfund sites needing some form of soil remediation before use for growing crops (Kaufman and Bailkey, 2000; Hagey et al., 2012).

Lack of financial resources or support is another major obstacle to urban agriculture (Kaufman and Bailkey, 2000; Lovell, 2010; Pollard et al., 2018; Bisaga et al., 2019). The cost of seeds, equipment, water, storage facilities, capital to buy or rent land, and converting vacant parcels into urban gardens can be a daunting challenge to urban farmers, or to those interested in engaging in the practice (Kaufman and Bailkey, 2000; Gregory et al., 2016; Pollard et al., 2018; Bisaga et al., 2019). The lack of consistent funding is absolutely a major barrier to the continued advancement of urban agriculture as the operations associated with the practice could be difficult to initiate and maintain once established (Kaufman and Bailkey, 2000; Lovell, 2010; Bisaga et al., 2019). Individuals or groups that engage in urban agriculture in many instances have limited income, and depend on partnerships and outside donors for funding (Kaufman and Bailkey, 2000; Bisaga et al., 2019). However, public funding from agencies like the

United States Department of Agriculture (USDA) and other sources in the form of grants and donations are contributing to the success of urban agriculture in some cities in the United States (Kaufman and Bailkey, 2000; Castillo et al., 2013). Measures to improve urban growers access to financial resources/capital, including the revision of loan conditions with lower interest rates, creating micro-credit schemes, and providing incentives can go a long way in boosting the potentials of urban agriculture, and hence sustain urban livelihoods (Kaufman and Bailkey, 2000; Bisaga et al., 2019).

Lack of technical support and knowledge/skills are other obstacles in the practice of urban agriculture and could influence urban farm productivity (Kaufman and Bailkey, 2000; Orsini et al., 2013; Mishra et al., 2018; Pollard et al., 2018; Bisaga et al., 2019). A critical need of urban farming practices is skilled and experienced urban growers, especially in the case of low-income neighborhoods like Louisville's West End (Kaufman and Bailkey, 2000; Pollard et al., 2018). Past research has suggested a strong correlation between experience and farm productivity (Kaufman and Bailkey, 2000; Pollard et al., 2018; Bisaga et al., 2019). In addition, better performance ideally comes with experience, skills, and knowledge, but this is not the case in urban farming where most growers have little experience (Bisaga et al., 2019). Critical issues associated with the lack of knowledge or skills are on the methods of production techniques, including growing crops on vertical farms, chemical application, pest management, alternate cropping systems to use, soil and water conservation techniques, proper harvest and storage of products, marketing, and record keeping (Lovell, 2010; Aubry et al., 2012; Orsini et al., 2013). These issues are becoming more complex to manage because of the multidimensional nature of urban agriculture, including its ecological, social, and cultural

dimensions (Lovell, 2010). As a result, there is the urgent need for continuous technical support, and to recruit and retain more experienced urban growers worldwide.

Restricted market access is another constraint for the sustainability of urban agriculture (De Bon et al., 2010; Lovell, 2010; Nchanji, 2017; Houessou et al., 2020). Market participation could be a challenge for some urban growers who do not have access to closer markets, and transportation costs become an issue making their produce uninteresting or difficult to sell (Mougeot, 2006; Houessou et al., 2020). In addition, lack of reliable local customers or contracts, low prices, and market competition with less bargaining power are challenges (Houessou et al., 2020). Innovative marketing initiatives and approaches, such as price or market regulation, promotion of local consumption, clever marketing, and boost in farmers markets to sell urban produce, auger well for the future of urban agriculture (Lovell, 2010; Bisaga et al., 2019; Houessou et al., 2020). There is also the need to develop efficient and reliable transportation network systems so urban residents can have better access to local food (Lovell, 2010). In the United States, there has been a considerable increase in the number of farmers markets in cities nationwide, including Louisville KY (Brown and Miller, 2008; Mendes et al., 2008; Randolph, 2012). Establishing community-supported urban farms/gardens can also be beneficial not only in bringing urban growers and local consumers together, but enables stakeholders to buy a share of the produce in advance, motivating urban producers to be fully engaged in their farm production (Bregendahl and Flora, 2006).

Lack of access to clean and reliable water, and water costs, which is a major input in urban agriculture, is a major challenge for urban growers (Halloran and Magid, 2013; Ackerman et al., 2014; Bisaga et al., 2019; Houessou et al., 2020). In addition, urban

growers who have access to irrigation facilities are also more likely to adopt sustainable farming practices (e.g., soil management) than their counterparts who do not (Carlisle, 2016). The use of wastewater for irrigation purposes, which have been used as a response to the shortage or lack of access to water, can improve water use efficiency, but requires investments in treatment. However, untreated wastewater can carry water-borne diseases and can lead to environmental contamination of urban soils and microbial loads on plants (Rabinovitch and Schmetzer, 1997; Ali et al., 2006; Veenhuizen, 2006; Lee-Smith, 2010; Nchanji, 2017). As a result, investment in developing a network of water channels and drains, technologies, research for the treatment of urban sewage water for urban agriculture, and educating and training urban growers on safe water use and management are all necessary.

2.2.3 Urban policies associated with urban agriculture

Urban agriculture is also influenced by government control and regulation, mainly at the local level (Kaufman and Bailkey, 2000; Orsini et al., 2013; Artmann and Sartison, 2018; Bisaga et al., 2019). As public interest in urban farming continues to gain momentum, coupled with the social, economic, and environmental benefits associated with it, local governments have adopted, or are considering policies and regulations that favor urban farming (De Bon et al., 2010; Randolph, 2012; Orsini et al., 2013; Ackerman et al., 2014; Cretella and Buenger, 2016). For example, the city of Louisville has been continuously revising its policy guidance, plans, and zoning ordinances that could favor urban agriculture (Moskowitz, 2013; Louisville Metro Government, 2020). Government impediments are mainly around issues of policy, practicality, and funding, and conflicts could arise among the different objectives of different government agencies or interest

groups over the use of a vacant land for an urban farming project (Kaufman and Bailkey, 2000; Nchanji, 2017). In some cities, an application to use a vacant land for urban agriculture could be accepted by one agency and rejected by another agency in the same locality (Kaufman and Bailkey, 2000; Nchanji, 2017). At the political spectrum, the general lack of support and enforcement of urban development plans for urban agriculture by political leaders/policymakers or city authorities could be an obstacle (Halloran and Magid, 2013; Houessou et al., 2020). At times, local government policies act as blocking, and not facilitating mechanisms, and public battles could arise to secure or save public spaces for farming (Kaufman and Bailkey, 2000; Nchanji, 2017; Artmann and Sartison, 2018). At the federal level, lack of financial support from federal agencies like the USDA (United States Department of Agriculture) for urban agriculture projects could be an obstacle (Kaufman and Bailkey, 2000; Castillo et al., 2013). This could be in the form of budget cuts or decreased investment in programs that could boost urban agriculture. In general, the successful implementation of many innovative and sustainable urban agriculture projects in cities worldwide requires strong political support so risks could be minimized, and supportive regulations could be established by local authorities (Okvat and Zauta, 2011; Clarke et al., 2018). Policymakers can stimulate dissemination of sustainable farming practices to urban growers by providing technical and financial support, adopting policies that minimizes the use of pesticides, and promoting practices that are more sustainable (Barrs, 1997; De Bon et al., 2010; Bisaga et al., 2019). This can be achieved through the combined efforts of a municipal working group, including stakeholders from the urban farming community, city authorities, and other agencies or non-profit organizations.

2.2.4 Other barriers associated with urban agriculture

Other challenges associated with urban agriculture include potential vandalism, inadequate time, inequality issues, little economic payback relative to the costs involved (low economic return), the lack of interest or negative attitude or perceptions towards urban agriculture by policymakers, or a certain community or a community development organization (e.g., farming is principally viewed as a rural activity, and not does not belong to the city) (Kaufman and Bailkey, 2000; Mishra et al., 2018). In addition to the above challenges, it is worth note that the success of urban agriculture also depends on other factors such as age, educational level, income, farm size or characteristics, urban farmers' participation in government administered cost-share easement programs, community outreach programs to cover or offset some of their initial or operating costs, and the ability of farmers to cope and manage with the constraints associated with the practice of urban agriculture (Propoky et al., 2008; Sarr et al., 2015; Mishra et al., 2018; Pollard et al., 2018; Bisaga et al., 2019). For example, younger and more educated urban growers are more likely to adopt new sustainable practices than their older and less educated counterparts, who are not familiar with it (Kabii and Horwitz, 2006; Knowler and Bradshaw, 2007; Baumgart-Getz et al., 2012).

2.3 Gaps in the Literature

Even though there is an extensive literature on urban agriculture, relatively little research has documented the barriers to sustainable urban agriculture in United States' cities, including Louisville (Castillo et al., 2013; Mishra et al., 2018). Castillo et al. (2013) identified seven perceived barriers to urban agriculture in the greater Chicago metropolitan area, including limited access to land and water, limited funding, lack of

farmer training and certification, and regulatory barriers related to zoning. Specifically for Louisville, most research on urban agriculture, which are either ethnographic or case studies, has not extensively examined the barriers associated with sustainable agriculture, including unfavorable zoning policies, limited land access for farming, and financial constraints (Montgomery, 2016; Goldstein, 2019; Whittinghill and Sarr, 2021).

What is unique about this study, besides highlighting the barriers to urban agriculture in Louisville and making potential policy recommendations, is the focus on interviewing and engaging a wide range of important key stakeholders, especially the local residents, executives of nonprofits that support the urban agriculture community, city planners, and Louisville Metro councilmembers (policymakers). Our previous study (Whittinghill and Sarr, 2021) focused only on West Louisville and the challenges faced by the farmers in this locality based on the farming practices they adopted. The current study focuses on all of Louisville, the most populated city in Kentucky with over 600,000 residents. Examining the barriers to sustainable urban agriculture in a metropolitan area requires looking broadly across the urban context rather than a single locality or neighborhood.

Castillo et al. (2013), in identifying regulatory and other barriers that influence the sustainability of urban agriculture in the Chicago metropolitan area, limited their study to only interviewing urban planners and farmers. In the current study, Louisville residents/consumers, representatives from nonprofits, and elected officials and other key stakeholders were involved. In addition, this study specifically identified additional perceived barriers (e.g., restricted market access and cultural barriers) that were not discovered in Castillo et al.'s (2013) work, although they suggested the need for more

research and potential solutions pertaining to improving producers and consumers access to markets, which the current study has identified.

Most studies on stakeholder experience with challenges relating to sustainable agriculture have focused on rural counties or regions (Mishra et al., 2018). The current study has extended the existing literature to the urban context, including the Louisville. Like our previous study (Whittinghill and Sarr, 2021), Zhong et al. (2016) and Mishra et al. (2018), using survey sampling techniques focused only on Kentucky farmers, examined the sustainable farming/production practices adopted by Kentucky farmers, both in rural and urban settings. In contrast, and in comparison to other studies mentioned above, the current study specifically focused on the barriers relating to sustainable agriculture in Louisville's urban core, making it more generalizable, comparable, and applicable to other cities. It is also easier for policymakers, planners, extension personnel, and other stakeholders to tailor and adopt plans and solutions related to urban agriculture from this study than those that cover all agricultural districts, including ones that do not fall into the urban context or category (rural areas).

Cohen and Reynolds (2015) examined the barriers stakeholders are facing in the urban agriculture community in five boroughs of New York City accessing, matching, and distributing resources effectively and equitably to ensure and promote a more sustainable local food system. Cohen and Reynolds (2015), unlike this study, not only excluded representatives of other key stakeholders of the urban agriculture community in New York (private backyard gardens and other urban farms) in its study, but focused only on the characteristics of urban agriculture in New York and issues around policies and performance evaluation of urban agriculture programs and activities. By comparison,

the current study examined not only the characteristics of urban agriculture in Louisville, but explicitly identified and discussed other resource needs (e.g., water access and affordability) of urban agriculture with potential policy recommendations, including the formation of a food policy council. However, both studies have called for similar strategies to promote a more sustainable local food system, including the need for more technical assistance, funding, and collaboration/networking among stakeholders.

The full features and potential of urban agriculture has been hindered by the lack of good quality and reliable data or information (Redwood, 2009; De Bon et al., 2010; Zezza and Tasciotti, 2010; Orsini et al., 2013; Clarke et al., 2018). For Louisville, there is lack of information or data about the perceptions of the behavior and attitudes of Louisville farmers, communities, and policymakers towards the practice (Montgomery, 2016; Mishra et al., 2018; Goldstein, 2019). Research has scarcely addressed this issue with limited amount of quantitative work, especially in developing countries (Zezza and Tasciotti, 2010; Orsini et al., 2013). In addition, research opportunities in urban agriculture requires alternative methodological approaches given the multidimensional and interdisciplinary nature of the field (Lovell, 2010). Most of the literature on urban agriculture is found in technical bulletins and project reports, and on case-by-case basis. As a result, many of the practical aspects of urban agriculture remain understudied (Kaufman and Bailkey, 2000; Goldstein et al., 2011; Pollard et al., 2018).

3. MATERIALS AND METHODS

3.1 Research Area

The study was conducted in Louisville, Kentucky (Figure 2). Louisville is the most populated city in Kentucky with over 780,000 residents in the combined city/county Louisville Metro government (US Census Bureau, 2020), and Jefferson County's land area of approximately 397 square miles. It is located next to the Ohio River and ranks among the top cities in the United States for low-income, high food insecurity neighborhoods (CFA, 2007; Biesel and Sims, 2013). Merging its government with that of Jefferson County, Louisville Metro government is run by a mayor with a city legislature comprising of 26 Metro councilmembers, each representing their districts. The Louisville Metro Office of Planning and Design Services (PDS) is the agency responsible for administering zoning and other land use policies and programs as they relate to urban agriculture. Recently, urban agriculture in Louisville has been practiced mainly in the form of community gardens, residential and school backyards, and private farms within the city. With over thirty community gardens and private farms across the city, some of which are managed by the Jefferson County Cooperative Extension Service (JCCES), Louisville Metro government and nonprofits, such as Community Earth Gardens, continue to provide financial resources and technical assistance to the farming community.

In some of the predominantly African American neighborhoods in West Louisville, with a long history of discrimination like many other poor black

neighborhoods in the United States (Wright, 1985; Hashim, 2015; Poe, 2017), food insecurity is a challenge due to poverty and restricted access to healthy fresh foods. Besides the other problems of poverty (e.g., housing insecurity and lack of economic investment), these neighborhoods are disproportionately faced with severe health problems like obesity, which has drawn the attention of many local and state agencies (e.g., Louisville Metro government), nonprofits (e.g., Louisville Grows), and other advocates of the food justice movements (Bostock et al., 2013; Hashim, 2015). Many residents live more than a mile away from a grocery store or supermarket (Figure 3), and with few grocery stores, there is a high concentration of fast-food restaurant chains in these neighborhoods.

The disparity in Louisville has been growing for so many years with West Louisville having been hardest hit by food insecurity compared to the East End (Poe, 2017; Loosemore, 2019). West Louisville, with a population of over 50,000 of the city's most marginalized residents, is the home to almost 10,000 households receiving federal food assistance (SNAP benefits), about one-third of these households lack mobility to have access to fresh, healthy, local food, and have an average yearly individual income of about $15,000 (Loosemore, 2019). More than 100,000 Louisville residents, of which 20% are from West Louisville, do not have access to adequate and nutritious foods, and are at a higher risk of developing health issues (CFA, 2007; Hashim, 2015; Kentucky State Data Center, 2017; Louisville Metro Government, 2017). In addition, many grocery stores have disappeared in parts of Louisville over the years, especially in West Louisville (Hashim, 2015; Loosemore, 2019).

In some neighborhoods, such as Rubbertown in West Louisville, there is a high concentration of industrial activities and brownfields, making Louisville ranked among the most polluted cities in the United States. There have been reported violations of chemical leaks and spills from chemical industries in the past (ATSDR, 2006; Bullard, 2013; Bruggers, 2015; Gilderbloom et al., 2019). As a result, soils and waters in these neighborhoods may not be appropriate for urban farming due to the potential for excess toxic pollutants (Igalavithana et al., 2015, 2017). Currently, Louisville has over six hundred vacant lots and properties, and most of these lots are in West Louisville (Louisville Metro Government, 2022). Some of these have been used before for dumping waste, organized crime, or other improper activities (Moskowitz, 2013; Hashim, 2015).

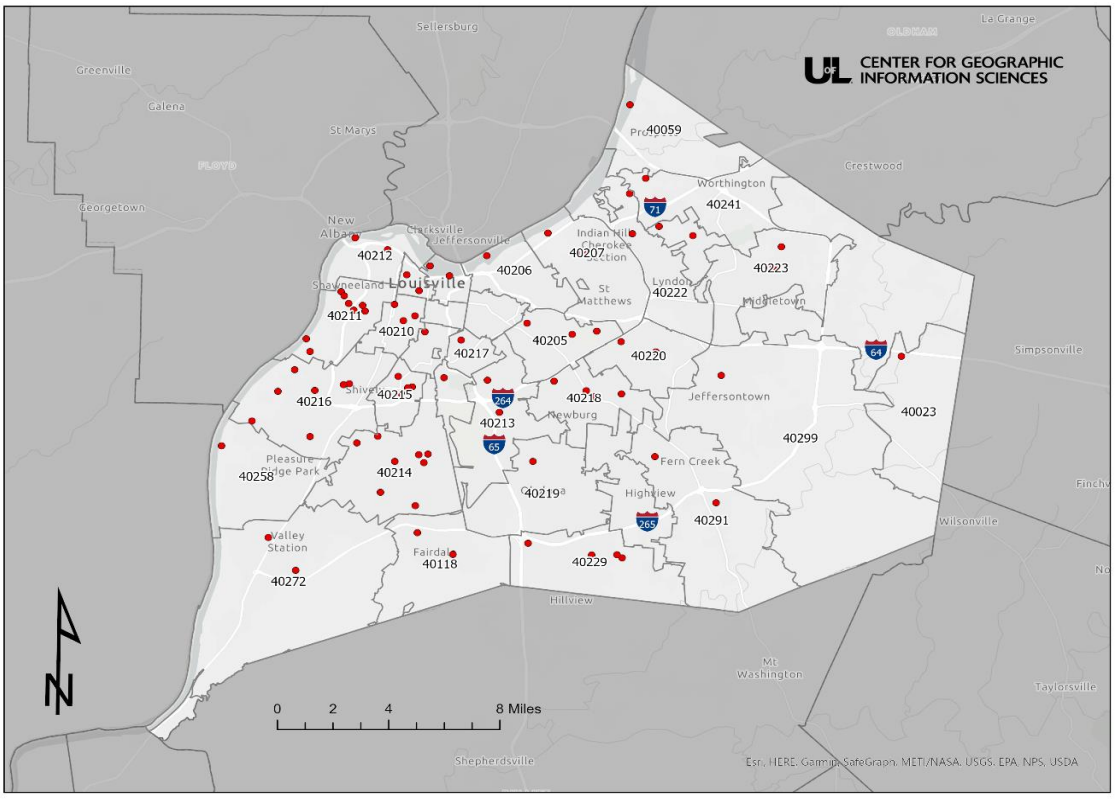

Figure 2. Map of Louisville, KY, with the red dots indicating the geographical distribution of study participants. (Source: University of Louisville Center for Geographic Information Sciences)

Parts of Louisville, especially West Louisville, have been abandoned by good quality food vendors, and have few grocery stores (Hashim, 2015). Urban agriculture could be an alternative source of products for community-owned grocery stores in some neighborhoods and for concerned Louisville residents who wish to revitalize their communities through stewardship of local food production (Moskowitz, 2013; Hashim, 2015). Overall, Louisville residents are already benefitting from urban agriculture (Loosemore, 2019), and there is a high demand for growing space with many residents put on waiting lists for plot allocation, indicating that the public supports the practice.

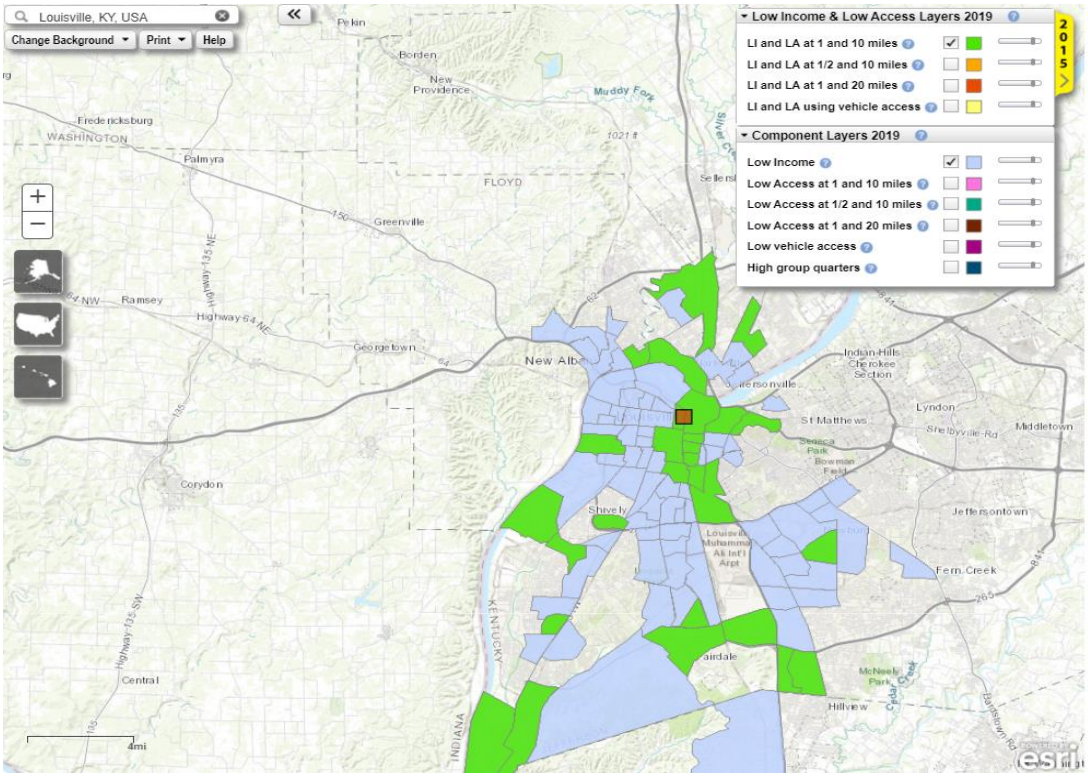

Figure 3. Low-income food desert neighborhoods in West Louisville. Green Zone indicates census tracts that are both Low-income (LI) and Low access (LA), with Louisville residents living more than 1 to 10 miles from a supermarket, grocery store, farmers market, or other sources of healthy, affordable food. The Blue Zone indicates other low-income neighborhoods in Louisville. (Source: Economic Research Service, United States Department of Agriculture).

3.2 Data collection and analyses

This study synthesized multiple sources of quantitative and qualitative data to develop a rich description of the activities, opportunities, and challenges to sustainable urban agriculture in Louisville and to make policy recommendations. Data was collected about the demography of the stakeholders, including Louisville residents. Government and non-government databases and websites were accessed to collect background documents for the study, including government reports, news articles, and previous scientific and scholarly articles and case studies that have not yet been synthesized. These sources helped to develop a basic background description of the study. Surveys (Appendix A) and interviews (Appendix B) with key stakeholders familiar with the activities of urban agriculture in Louisville were conducted, including experts from Jefferson County Cooperative Extension Service, which oversees over ten urban gardens in different sites across Louisville.

Data were screened and corrected by the author for errors prior to starting the analyses. This includes going over survey responses for accurate entries, accounting or compensating for missing data or information, and matching field notes with some of the corresponding pictures taken during site visits. Simple statistical analyses were performed using Microsoft Excel for total frequencies (percent), averages, and comparison of the gender composition of the study participants to that of Louisville as a whole.

3.3 Interviews and participants

A mixed-methods approach was used, inclusive of a survey of forty-two urban growers, twenty-six Louisville consumers/residents, and semi-structured interviews of

twelve other key stakeholders (policymakers, planners, and representatives of nonprofits and grassroots organizations) with knowledge and experience about urban agriculture in Louisville was conducted. A purposive sampling strategy was first used to select the majority of study participants through attendance at community farms and farmers markets events, and grocery stores. Then, using snowball sampling technique, few other potential participants were later identified and contacted (through site visits, phone calls, and emails) with the recommendations and assistance from other study participants, including personnel from the Jefferson County Extension Service and nonprofits, such as the executive director of Sustainable Agriculture of Louisville. Almost every zip code in Louisville were represented by one or more study participants, and this sampling approach is assumed to represent the range of variation expected in the urban agriculture community of Louisville (Patton, 2005). For a list of the positions and the respective organizations of the targeted stakeholders interviewed, see Table 1. Efforts were also made to interview personnel from Louisville Metro Government Office of Advanced Planning and Sustainability and Louisville Metro Councilmembers from Districts other than those in West Louisville, but to no avail. Field notes were taken during the study period. IRB approval for the study was obtained from the Human Subjects Protection Program Office at the University of Louisville on September 13, 2021 (IRB No. 21.0701).

Participation in the study was voluntary and all participants were informed of how their responses would be used before they agreed to take part. The interviews were conducted in-person or online (thru zoom video conferencing) and lasted about 45 to 60 mins. I first administered consent to participants and a brief description of the study

before the start of each interview. Questions targeted the history, goals, achievements, motivations, production practices or techniques (e.g., water sources or irrigation methods), initial and current challenges to urban agriculture in Louisville (e.g., farm operating expenses, land access), failures, disagreements, trust, public engagement, and the political will and ongoing activities to address the barriers to sustainable agriculture. For a complete list of the survey questionnaires and interview questions, please refer to Appendices A and B, respectively. Interview questions also targeted design principles for co-production, for example, Jefferson County Cooperative Extension agents were asked about shared decision making, types and levels of authority, funding, and responsibility. The interview questions helped to provide additional information about some of the demographic features of the stakeholders and their knowledge, information, functions, beliefs, values, and preferences about policy initiatives and outcomes with regard to the adoption and the impediments to sustainable agriculture in Louisville KY (Rubin & Rubin, 2012).

Responses from interviews were transcribed (otter.ai app/software) so they could be coded using a combination of different coding methods/techniques (electic coding) (Saldaña, 2021). A holistic coding method, which entails the use of a single code (e.g., using the code "BARRIER" to a small passage or large unit of data) (Saldaña, 2021), was used simultaneously. For example, when study participants were asked whether they benefitted from urban agriculture, some did not simply say "YES" or "NO," but their responses, which could be a few words to many, were holistically coded "YES" or "NO" based on my understanding of the overall contents of the responses and the possible categories they belong to (Saldaña, 2021). With the hypothesis coding, where codes can

be created from a theory or prediction about what is expected in the data before they are gathered or analyzed, simple or complex statistical analyses can be used, including simple frequency (Saldaña, 2021). For example, it is hypothesized that the responses from a question about barriers to urban agriculture in Louisville will generate one or more of the nine answers from study participants (See Appendix A). A frequency analysis was conducted to determine the most frequently mentioned barriers to sustainable urban agriculture by stakeholders (e.g., limited access to land, lack of funding, partnership, or community or political support).

Table 1. List of positions and organizations of interview subjects.

Participant's occupation	**Participant's organization**
Louisville Metro Council Members for Districts 1, 5, 21	Louisville Metro Government
Planning Technician	Louisville Metro Government Planning Department
Extension Agent for Horticulture Education	Jefferson County Cooperative Extension Service
Soil Technician	Jefferson County Soil and Water Conservation District
Executive Director	Sustainable Agriculture of Louisville (SAL)
Executive Director	Louisville Grows 501(c)(3) nonprofit
Executive Director	Feed The City of Louisville 501(c)(3) nonprofit
Program Manager	The Food Literacy Project
Staff & Board Member	Louisville Community Grocery
Assistant Director	Common Earth Gardens

Responses from planners and other stakeholders, amongst others, shed more highlights on the barriers related to unsustainable farming practices, initial and operating costs, financing or access to resources, and regulatory barriers like zoning or land use. I also triangulated the data sources (surveys, interviews, and field notes) to ensure a better representation from the study participants' different viewpoints, and hence, increase reliability (Patton, 2005; Bennett and Elman, 2006). Interacting with some of these study participants helped build a stronger and trusted relationship, to better understand their keys tasks and roles, and to reveal lapses that were missed during the initial study design process (Rubin & Rubin, 2012).

4. RESULTS AND DISCUSSION

4.1 Demographics

During the data collection period (October to December 2021), 100 individuals 18 or older, were contacted and 80 agreed to participate. The demography is in Table 2. Based on their postal zip codes, 59% were from West Louisville. Most of the study participants were white females in their late 30s and 50s with a college degree, and most were employed full time with 51% reporting an annual income above 45,000 USD. Overall, study participants differed from the population of Louisville as a whole in few ways (Table 2). Similar to our previous study (Whittinghill and Sarr, 2021), study participants were older, with more Black/African Americans, and had a higher education level and annual household income than the average Louisville resident (Table 2). Education plays a key role in the success of urban agriculture by promoting the adoption of sustainable production or management practices among urban farmers (Kaufman and Bailkey, 2000; Pollard et al., 2018; Bisaga et al., 2019). Past research suggests a strong correlation between higher education/ knowledge and better farming performance or urban farm productivity (Orsini et al., 2013; Pollard et al., 2018).

For the forty-two farmers surveyed, the average gardening experience was 12.5 years, with a range of few months to 65 years. Most of these farmers mentioned some sort of success in urban agriculture, and one urban farmer was quick to say, “I built a successful business over the years with record sales.” Another farmer said, “my family is able to save money, thanks to the farm and selling our crops allowed us to pay our bills.”

Table 2. The demography of study participants (n = 80), and the population of Louisville (n = 615,067) (US Census Bureau, 2020).

	Study Participants (%)	The Population of Louisville (%)
Gender		
Male	43.7	48.5
Female	56.3	51.5
Age		
18–25	6.2	6.6
26–35	16.2	15.0
36–45	25.0	12.5
46–55	13.8	12.5
56–65	25.0	13.4
> 65	13.8	21.8
Race		
White	65	64.5
Black /African American	26.2	23.6
Asian	2.5	2.7
Multiple race	2.5	2.6
Hispanic	1.2	6.1
Education		
Master's degree	23.8	12.0
Bachelor's degree	37.5	17.9
Some college	10.0	22.9
High school degree	21.2	28.6
Annual Income (USD)		
<15,000	6.9	12.4
15,000–24,999	9.7	10.3
25,000–34,999	11.1	10.2
35,000–44,999	20.8	13.9
>45,000	51.4	48.4

The overwhelming majority of the study participants acknowledged the importance of having access to fresh, healthy, local food, and documented the benefits and the most common reasons for engaging in urban agriculture. These included personal consumption (fresh local food), income, and other non-commercial reasons like hobby/leisure, educational opportunities, cultural reasons (e.g., parents were farmers), social cohesion, community empowerment, information access, and promotion of local

produce (Figure 4). One study participant simply stated, “The community gardens are more of a social construct.” The majority mentioned the health benefits associated with urban agriculture.

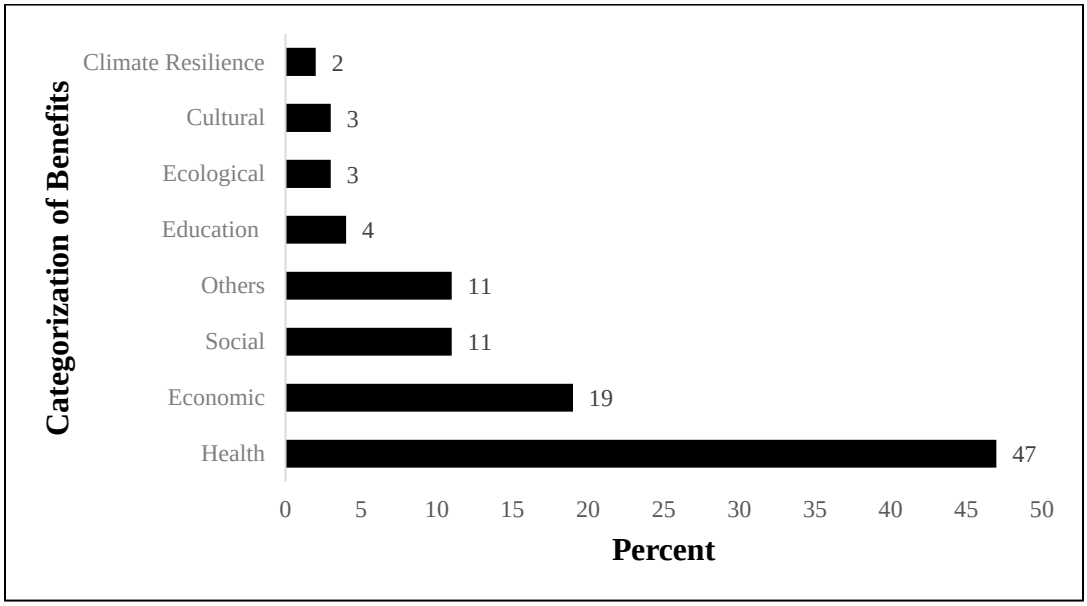

Figure 4. Study participants’ responses to the question, “Have you, or other residents, benefitted from urban agriculture?” These values are not mutually exclusive. (n=66)

4.2 Characteristics of the farms/gardens

Depending on the objectives and the available resources, urban farms/gardens can have different settings (Lovell, 2010; Biesel and Sims, 2013; Whittinghill and Sarr, 2021). For the purpose of this study, an urban farm was considered as any area in Louisville where food is grown and raised, including community gardens, backyard gardens, and private farms. During the study period, various farms/gardens were visited, including 7th Street Community Garden (Figures 5, 6), Lots of Food Garden in the Portland Neighborhood (Figure 7), the Incubator Farm in West Louisville operated by Common Earth Gardens, Naked Greens Farm (Figures 8, 9, 10), Sunny Acres Farm, Field Day Family Farm (Figure11), Black Acres Farm, and Preston Greenhouse & Garden. The

7th Street Community Garden alone has over three hundred growers and, on average, gardeners report saving over $250/year on food and groceries (personal communication). It is managed by the Jefferson County Extension Service, and the garden demonstrates diversity with growers including refugees from Kenya (Africa) and Myanmar (Asia).

The median farm size was 4 acres, and the largest farm, in East Louisville, was 30 acres. In West Louisville, the largest farm or garden size was only 2.2 acres, and this could indicate that land availability for farming is more accessible in the East end than the West Louisville. Thirty-three percent of farmers indicated that their farms/gardens are on lease contracts, and some are at risk of losing their contracts. Most farmers are experienced with an average gardening experience of 12.5 years. Crops grown include vegetables (spinach, broccoli, tomatoes, etc.), fruits (e.g., apples), leafy greens (lettuce, cabbage, etc.), and herbs (basil, thymes, etc.). Few farms reported raising goats, sheep, birds, rabbits, and bee keeping.

Figure 5. Jefferson County Soil and Water Conservation District supplying cover crop seeds to farmers at the 7th Street Community Garden. November 2021. (Photo by Sait Sarr)

Figure 6. Plots at the 7th Street Community Garden, Louisville, Kentucky. October 2021. (Photo by Sait Sarr)

Figure 7. Rainwater harvesting (1200 gallons in both tanks) at Lots of Food Garden, in the Portland Neighborhood, West Louisville. November 2021. (Photo by Sait Sarr)

Figure 8. Mixed cropping under a drip irrigation system, Naked Greens Farm, East Louisville. November 2021. (Photo by Sait Sarr)

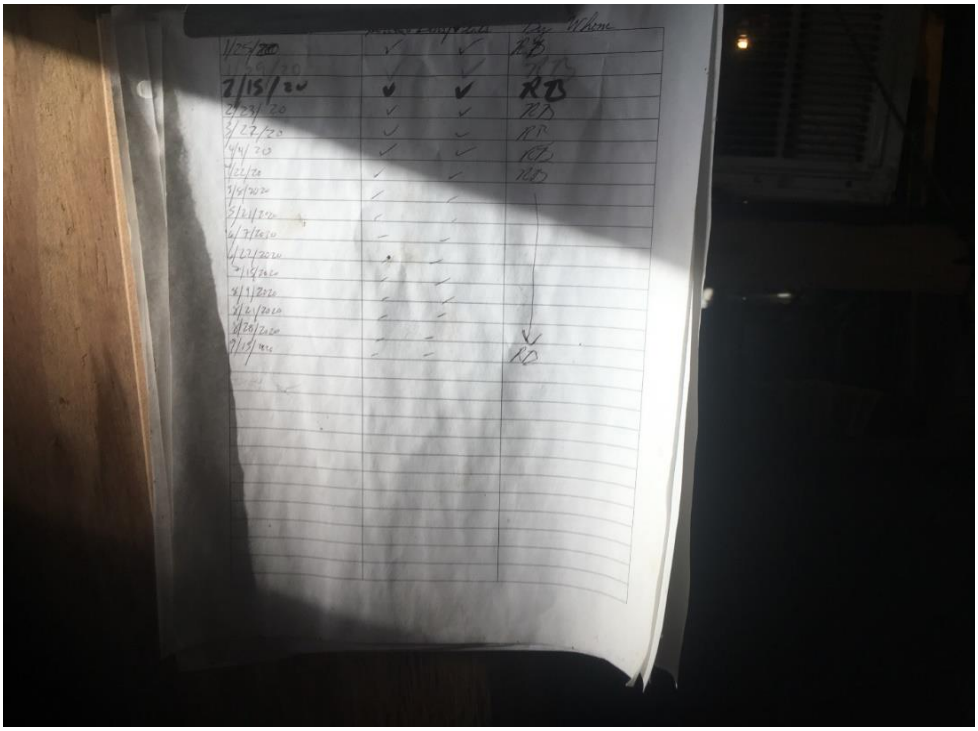

Figure 9. Farm record keeping, Naked Greens Farm, East Louisville. November 2021. (Photo by Sait Sarr)

Figure 10. Greenhouse tunnel, Naked Greens Farm, East Louisville. November 2021. (Photo by Sait Sarr)

Figure 11. Cover cropping (soil management), Field Day Family Farm, East Louisville. November 2021. (Photo by Sait Sarr)

4.3 Tools and resources used by Louisville farmers

During the study period, I visited some gardens/farms, and took notes and pictures, including some of the farm implements or tools used by Louisville farmers. The lists include rakes, spades, rain barrels, sheds (Figure 13), irrigation facilities (hose, watering cans), and other hand tools (Figures 9, 10). The use of heavy equipment like tractors are observed only on the private farms visited, including Field Day Family Farms, in East Louisville. This could be attributed to the fact that most community gardens plots and other farming plots visited were operating on a smaller scale, comparatively. Access to tools for farming could enhance the sustainability of urban agriculture (NRCS, 2003; Oberholtzer et al., 2014), and are among the major expenses incurred by urban farmers across the United States (NRCS, 2003; Oberholtzer et al., 2014). However, stakeholders such as JCCES and Community Earth Gardens are helping to provide tools and other resources to some of the Louisville farmers.

Figure 12. Farm shed at Field Day Family Farm, East Louisville. November 2021. (Photo by Sait Sarr)

When Louisville farmers were asked about the resources they used to make decisions about their farms, the majority (62%) depend on other local farmers for advice or other forms of assistance, 52% depend on extension services, such as the Jefferson County Cooperative Extension Service (JCCES), for technical advice, and 15% depend on other resources (Table 3). Local and federal agencies, such the Jefferson County Soil and Water Conservation District, Farm Service Agency (FSA), and the Natural Resources Conservation Service (NRCS) have been mentioned by Louisville farmers surveyed as resources providing technical and financial assistance, training, and other tools with the aim of building a more just and resilient city through urban agriculture.

Access to resources to make farm decisions, such as extension services, could promote sustainable urban agriculture (NRCS, 2003; Oberholtzer et al., 2014; Bisaga et al., 2019). Research publications or urban agriculture data from the web, nonprofit agencies, local, and federal agencies such as the United States Department of Agriculture, can sometimes provide resources to urban farmers in addressing some of the barriers faced, especially with regards to lack of access to resources and information (NRCS, 2003, 2005; Oberholtzer et al., 2014). These resources are contributing to the success of urban agriculture in the United States (NRCS, 2005; Oberholtzer et al., 2014; Whittinghill and Sarr, 2021). For example, in Louisville, JCCES has been an instrumental resource in promoting the success of community gardens. The agency runs over ten gardens in the city, providing technical assistance, educational materials, tools workshops, training, seeds, etc. However, some of the farmers surveyed were not aware of some of the resources or agencies to contact in seeking assistance with some of their farming operations.

Table 3. Resources used by Louisville farmers to make decisions about their farming activities (n = 42). These values are not mutually exclusive of each other.

Resources	Responses (%)
Other Local Farmers	62%
Extension Services	55%
Internet & Media	37%
Local & Federal agencies	15%
Others	15%

4.4 Barriers and opportunities to urban agriculture in Louisville

Figure 13 details the perceived barriers to urban agriculture noted by the study participants. The major barriers are addressed in detail below.

4.4.1 Limited access to land and lack of tenure on land

Along with limited funding or lack of financial resources, having access to land and lack of tenure on land was mentioned as the biggest challenge to urban agriculture by study participants (76%; Figure 13). I hypothesized that limited land access for farming was a barrier to sustainable agriculture in Louisville, and this was supported by most of the study participants. Most farmers surveyed (29 of the 42) simply stated that land access was the biggest challenge. One farmer said, “Land access is a huge barrier, and we about to lose the farm in Iroquois owned by the Louisville Metro Housing Authority. We would really like to have a really permanent place for us to grow.” Thirty-three percent of

these farmers indicated that their farms/gardens are on lease contracts, and some are at risk of losing their contracts. These results were corroborated by interviews with other stakeholders. For example, the city planner stated,

> "I would say probably, definitely like access to land and access to capital. Those are probably the main things for me, you know, people, that's the big disconnect. Like there's a lot of people who would be interested in growing food, but land can be expensive and hard to get. And then once you have land, you got to have some capital to set up."

Land tenure and the prohibitive cost to buy and prepare a lot for farming are a common concern for some of these farmers, and many critics of the urban food movement suggest that denial of ownership and dispossession of land is a major barrier preventing many black, low-income neighborhoods from engaging in farming (Redwood, 2009; Hodgson, 2012; Bisaga et al., 2019).

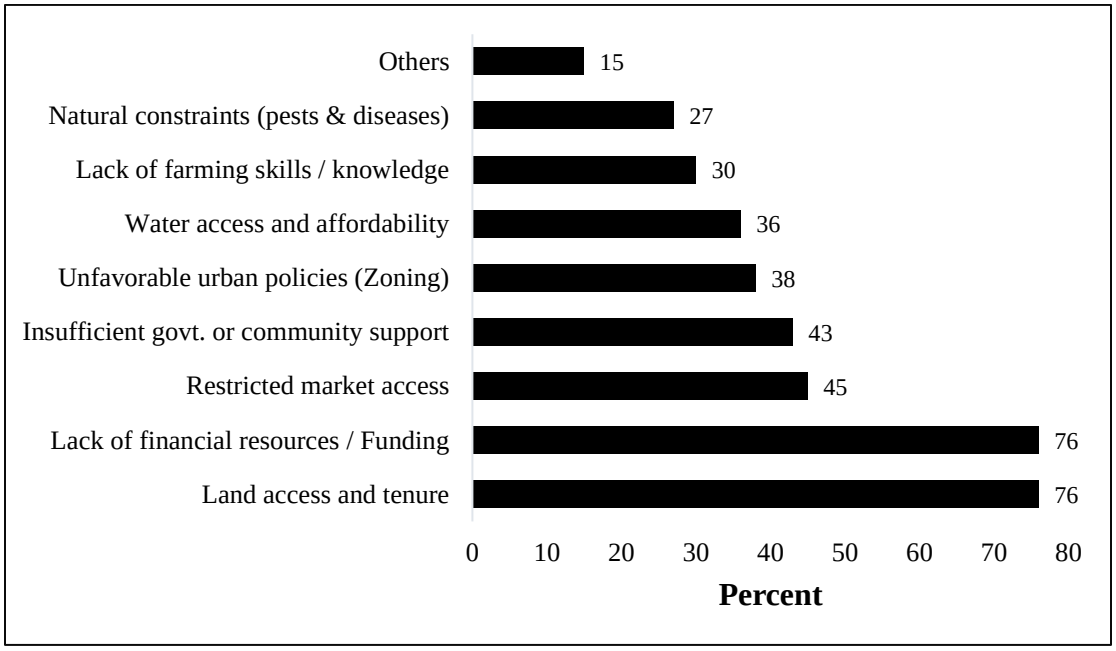

Figure 13. Study participants' responses to the question, "What do you think are the barriers to sustainable agriculture in Louisville?" These values are not mutually exclusive. (n=80).

4.4.2 Limited funding /lack of financial resources

Limited funding or lack of financial resources/capital, as hypothesized in this study, was mentioned by 76% of the study participants as a barrier (Figure 13). The operations associated with urban farming can be financially challenging and overcoming this barrier can sometimes require large capital investment or support from major donors or agencies (Kaufman and Bailkey, 2000; Pollard et al., 2018; Bisaga et al., 2019). As one farmer stated, “I need loans and grants to start and maintain operations. I would like to see more from Louisville Metro, like more funding." Some of the farmers listed challenges associated with costs of labor, equipment, seeds, leasing land, and water. In Louisville, many agencies, and nonprofits (e.g., Louisville Grows, Sustainable Agriculture of Louisville (SAL), and Community Earth Gardens) with their limited funding, have been playing important roles helping some of the farmers offset their financial challenges by providing seeds (Figure 5), tools, equipment maintenance, infrastructures (raised beds and high tunnels), free workshops, volunteer labor, and grants. For example, the Jefferson County Soil and Water Conservation District has been trying to make high tunnels (growing media or structures that use natural ventilation) accessible to residents in West Louisville by installing several high tunnels at no cost to residents engaged in urban agriculture. These nonprofit organizations have successfully utilized grant funding from local and federal agencies like the United States Department of Agriculture (USDA), donations, fundraising events, and proceeds from farm sales to meet their objectives. However, considerable time and effort are sometimes needed to submit proposals and access these grants, and even if funding is easily accessible,

meeting project objectives could be a challenge because of conflicting interests from funding agencies or donors.

Other stakeholders interviewed were more succinct in identifying limited funding as a barrier, mainly created by the limited efforts of the Louisville Metro Government. As the Jefferson County Cooperative Extension Service (JCCES) agent puts it, “Urban farming [is] not profitable [small-scale] in the city and not enough money for growers, not enough financial support from the city. Funding from the city for 50,000 USD annually for community gardens is not enough.” The JCCES, which oversees over ten community gardens in Louisville with over three hundred registered members, depends mainly on plot fees from growers (ranging from 15 USD to 200 USD per plot depending on size and location) for the upkeep of the sites and to pay water and other utility bills. The JCCES, according to staff of the agency, currently runs at an unsustainable loss with annual expenses far outweighing annual revenues derived from member’s plot fees plus Louisville Metro’s annual appropriations of 50,000 USD. This claim by the JCCES agent was corroborated by other stakeholders interviewed, in which one stated, “$50,000 does not sound like much of anything to fund any significant program from a government standpoint.” Another stakeholder from Sustainable Agriculture of Louisville stated, "I mean, certainly funding is a limitation. We could, if we had more funding, compensate our volunteers to do more of the work that they're doing.”

When the issue of funding was brought to Louisville Metro Council members during the interview process, the Councilmember for District 21, responded, “We do not collect the revenue that we need to be able to sustain our city in the long-term way. People don’t like to talk about that. But that is fundamentally the case.” Another Council

member was also quick to state that the issue of funding to combat food insecurity in parts of Louisville, especially in West Louisville, is becoming increasingly important to Louisville Metro government. As a result, they are investing heavily in West Louisville to bring grocery stores and fund other programs to bring fresh, healthy food to its residents. However, the councilmember's claim warrants further investigation due to inconsistencies among some of the study participants' responses, who claimed that Louisville Metro is not doing enough on the issue of limited funding.

4.4.3 Restricted market access

Restricted market access, as hypothesized in this study, could be a barrier to sustainable agriculture in Louisville, and was mentioned by 45% of the study participants (Figure 13). During the study period, I visited farmers' markets across the city to get first-hand information about their activities and operations (Figures 14, 15, and 16). A complete list of the markets visited is in Table 4. There was only one farmers' market (Opportunity Corner Farmers Market) in West Louisville that was functional during the study period. Most of the other markets have church affiliations, and some were located within parking lots or other unused premises within a church building. During the study period, the executive director of Feed The City Church explicitly mentioned the need for partnership to host farmers market and called for key stakeholders to support the initiative.

Most of these markets are seasonal, beginning their season around April and ending in September or December. Market operations vary, with different opening and closing times, and most are open during the weekends. Most of the markets offer fresh vegetables, fruits, eggs, meat, honey products, and seasonal specialties. Market rules and

regulations vary (Appendix C), outlining the types of vendors allowed (e.g., only those growers within the city), days and hours of operation, location, and products allowed. Some of the vendors or famers at these markets have non-agricultural full or part time jobs during the week, including industrial/manufacturing related employment. Consumers vary from children, couples with their families, single parents or adults, senior citizens, and low-income individuals or families (especially those from West Louisville with an annual income less than USD 25,000 USD).

Farmers, with most using farmers markets as their marketing outlets and a few using CSAs (Community Supported Agriculture) and local restaurants, complained of limited market access and related challenges when questioned about barriers relating to marketing their produce. One farmer said, "We need help to access the markets and to extend the market days to more than few days a week." His statement was corroborated by the interviews in which the Executive Director of Louisville Grows stated, "I would say restricted market access, but not that it is hard to get to the market. It is that we have limited market here. Looking at other cities Madison, Wisconsin, and even Cincinnati, they have seven day a week public market." Another farmer also mentioned the lack of willingness to pay more for local organic food by some residents. Due to their small-scale production with limited funding or capital investment, it is a challenge for these farmers to compete for resources and the market with larger commercial growers (Futamura, 2007; Cohen and Reynolds, 2015). During the study period, some of the markets (e.g., Fern Creek Presbyterian market) were not doing well in business due to low customer base or turnout, especially during the winter. Entry to some of these markets was also a challenge for some farmers because of membership requirements, legal procedures, and

market fees (Appendix C). For example, to qualify as a market vendor at Bardstown Road farmers market, one has to be "individually responsible to pay state taxes, local sales taxes, business fees, and any other applicable fees, and pay membership fees [400 USD annually] by the stated deadline." (Appendix C). During one meeting I attended between the farmers or vendors of Crescent Hill farmers market and the board of the market, some farmers raised the issue of being left out of the board committee, which they deemed unfair and unsustainable.

Consumers or city residents surveyed also highlighted some of their challenges to access fresh, healthy local food, including limited transportation and distribution inequities with the presence of few farmers market and grocery stores in West Louisville. One consumer said, "travelling to the markets could be a challenge due to lack of access to transportation. More network between markets is needed." Another resident added, "I really don't know! On a consumer level, the farmers markets are fantastic, but I don't know that these are equitably distributed or available to all consumers." These statements were corroborated with our interviews, in which a Louisville Metro Council member for District 5 representing parts of West Louisville said, "I would like for us to have farmers markets here. You know as a kid, I grew up on to the Hay market on weekends with my grandmother and my mother where they have fresh produce they buy every weekend ,whether it be greens, beets, onions, and potatoes. You don't have that now."

For the board member of the Louisville Community Grocery, and the owner of Lots of Food, an urban farm project located in the Portland neighborhood in West Louisville, she said,

> "Right now, Urban Ag coalition isn't serving that purpose in terms of helping with marketing products, and nobody's asked for that necessarily. But I'm just you know, it could be a function in the future

> that growers would benefit from. CFA [Community Farm Alliance] started a couple of farmers markets here [around 2007], and the farmers said they were not making money. The economics was challenging."

The majority of vendors or farmers at the markets do not participate in the Supplemental Nutrition Assistance Program (SNAP), which could be an obstacle for some low-income Louisville residents to access fresh local food due to their inability to use their SNAP dollars at the local farmers markets. However, other residents or consumers, especially those from the south and east end of the city, mentioned not having issues accessing fresh produce. Many of them have their own transportation and live at close proximity to farmers markets and grocery stores. The issue of limited funding and lack of partnership for the efficient operation of his market were mentioned by the market manager of the Opportunity Corner Farmers Market in West Louisville.

Figure 14. Jeffersontown Farmers Market. November 2021. (Photo by Sait Sarr)

Figure 15. Fern Creek Presbyterian Market. November 2021. (Photo by Sait Sarr)

Figure 16. Bardstown Road Farmers Market. November 2021. (Photo by Sait Sarr)

Some scholars have documented similar challenges related to limited or restricted market access as a constraint to the sustainability of urban agriculture (Lovell, 2010; Nchanji, 2017; Houessou et al., 2020). Others have proposed using urban agriculture as a tool to revitalize or stabilize dysfunctional markets, especially those in low-income

neighborhoods like Russell in West Louisville (Schilling and Logan, 2008; Warsaw et al., 2021). A good example would be some of the economically viable farmers markets in parts of Detroit, MI, where proceeds from urban agriculture have significantly increased due to additional healthy food financial incentive programs (e.g., Double Up Food Bucks) and the rising demand of local food from the city's residents, attracting many growers and other vendors in the city (Cohen et al., 2018; Warsaw et al., 2021).

Table 4. Partial list of Farmers Markets and grocery stores in Louisville, KY, including their locations, and hours of operation.

Name of Market	Location	Days & Hours of Operation
Opportunity Corner Farmers Market	636 18th Street Louisville, KY 40203	Saturdays (August – Nov.) Hours: 10a.m – 1p.m
Bardstown Road Farmers Market	1722 Bardstown Road Louisville, KY 40205	Saturdays (Year-round) Hours: 9a.m – Noon
Fern Creek Presbyterian Farmers Market	6104 Bardstown Road Louisville, KY 40291	Saturdays (May – September) Hours: 8a.m – Noon
Jeffersontown Farmers Market	10434 Watterson Trail Louisville, KY 40299	Saturdays (May – September) Hours: 8a.m – 12:30p.m
Rainbow Blossom Market	3738 Lexington Road Louisville, KY 40207	Sundays (May – November) Hours: Noon – 4p.m
Norton Commons Farmers Market	6301 Moonseed Street Prospect, KY 40059	Sundays (April – November) Hours: Noon – 4p.m
Douglass Loop Farmers Market	2005 Douglass Blvd, Louisville, KY 40205	Sundays (March – December) Hours: 10a.m – 2p.m
Westport Road Farmers Market	9705 Westport Road, Louisville, KY 40241	Saturdays (April – October) Hours: 8:30a.m – 12:30p.m
Crescent Hill Farmers Market	201 S Peterson St., Louisville, KY 40206	Fridays (May – October) Hours: 7a.m – 10a.m
Seventh Street Market	2900 7th Street Rd, Louisville, KY 40216	Saturdays & Sundays Hours: 9a.m – 5p.m

Market participation could be a challenge for some urban growers who do not have access to closer markets, and transportation costs become an issue making their produce difficult to sell (Mougeot, 2006; Houessou et al., 2020). During the study period, I encountered few farmers who would travel from the Douglass Loop farmers market to

Norton Commons farmers market in the other part of town just to sell their remaining produce, or to look for a more favorable market. Like many other farmers markets and marketing outlets across the nation, those in Louisville (over 25), are slowly changing to a more localized food network connecting farmers and consumers (Futamura, 2007; Brown and Miller, 2008; Randolph, 2012).

4.4.4 Insufficient community or government support

Insufficient community or government support could be a barrier to sustainable urban agriculture and was mentioned by 46% of the study participants (Figure 13). Negative attitudes and perceptions by the Louisville community and Louisville Metro government that are unsupportive of urban agriculture have been documented in this study. Even though most of the study participants acknowledged that the community support is there for expanding urban agriculture, when questioned about the issue of support from the community, some still expect the community to do more. One participant stated, "Absolutely, but the community needs to do more just as expected for Louisville Metro to do more. There is a role for government, but there is also role for people in the neighborhood." The participant's statement was further supported by another stakeholder interviewed, who stated, "I think there's kind of generally like a background, cultural understanding and support of faming and agriculture. Kentucky, you know, is a farming state." In contrast, there were other stakeholders who stated that the community support is still lacking for the expansion of urban agriculture, and one Louisville Metro Councilmember stated:

> "You know it is kind of hard for local government to dictate to citizens how they should eat. Part two of the issue is we can provide healthy food, but the residents have to make healthy choices. We have to figure out some way to encourage the community to even have an appetite for healthier food."

Urban agriculture is also influenced by government control and regulation, mainly at the local level (Kaufman and Bailkey, 2000; Orsini et al., 2013; Artmann and Sartison, 2018; Bisaga et al., 2019). Government impediments are mainly around issues of policy, practicality, and funding, and conflicts could arise among the different objectives of different government agencies or interest groups (Kaufman and Bailkey, 2000; Nchanji, 2017). On the political spectrum, the general lack of support and enforcement of urban development plans for urban agriculture by policymakers or city authorities could be an obstacle (Halloran and Magid, 2013; Houessou et al., 2020). When study participants were questioned to rate the degree at which the political support was playing out in Louisville with regard to promoting urban agriculture, the overwhelming majority (72%; Table 5) said it was weak. They called for more efforts from the city authorities, and one participant said:

> "No, they're not doing anything. They don't have anybody on staff who's really paid to work on food security. Our mayor killed the food policy council that was started. The whole thing was, it was started with, you know, a bad model in the first place. But Louisville Metro has no interest, as far as I know, in restarting a Food Policy Council. They are not trying to bring stakeholders together or communicate across sectors, they just wringing their hands a lot about food security and food equities and whatever. I say the three and a half million dollars that they promised to the grocery store, we still haven't seen a dime of it. And that is a whole different interview, but it's deplorable."

In her response, and corroborating with the statement above, one of Louisville Metro Councilmembers stated, "Government is slow, and we put like $3.5 million in the budget going on three years ago, and we still don't have a grocery store. And We've been doing the study and consulting and now it is a conflict with the group doing the study. It is just a mess. $3.5 million is not enough for a grocery store."

Table 5. Study participants' responses to the question, "Do you think the political support is weak or strong for the expansion of urban agriculture in Louisville? (n = 80)

Available Responses	Responses (%)
Weak	72%
Moderate	3%
Strong	6%
Do not Know	19%

4.4.5 Farming practices or production systems

Farm management strategies (e.g., record keeping) and urban agricultural production practices or techniques (e.g., application of chemical fertilizers), could be a barrier to sustainable urban agriculture (Graefe et al., 2008; MacRae et al., 2010; Mishra et al., 2018). As urban agriculture is here to stay, and is reshaping the urban landscape, creating sustainable systems of farming is necessary and needed (Wortman and Lovell, 2013; Ackerman et al., 2014). Survey questions asked sustainable farming practices or production techniques Louisville growers use on their farms/gardens (Table 6). Organic farming (67%), composting (52%), and crop rotation (52%) were the three most frequently mentioned practices by Louisville growers (Table 6). Few farmers practiced bee keeping (5%), 2% kept livestock or poultry (goats, chickens) on their farms, and 2% have an aquaponics system (Table 6).

Organic farming, which is regarded as a more sustainable system compared to conventional farming, has several benefits (De Bon et al., 2010; Kornegay et al., 2010;

Artmann and Sartison, 2018). It is cost-effective (no chemical fertilizer use), provides local organic and healthy food to city residents, supports the local economy, and most importantly, reduces urban soil, water, and food contamination (Kornegay et al., 2010; Topè et al., 2014; Artmann and Sartison, 2018). Only 5% of farmers mentioned using chemical commercial fertilizers, indicating a positive inclination toward more sustainable practices by Louisville growers.

Composting, which is gaining more attention among Louisville farmers (Whittinghill and Sarr, 2021), have been used for livestock feed, controlling plant diseases, and as a fertilizer source (Cofie et al., 2006; WHO, 2006; Prain, 2010; Orsini et al., 2013). Composting lowers the cost of public waste management in some cities in the United States (e.g., Chicago) and around the world (e.g., Nairobi, Kenya) (Orsini et al., 2013; Ackerman et al., 2014; Pai et al., 2019). For example, in Chicago, backyard compost contributed to reducing a quarter of the total food wastes in the city (Pai et al., 2019). Crop rotation, as a sustainable farming practice, includes growing of a series of different varieties of crops in the same plot over time, and is beneficial for pest, weed, and disease management (Kornegay et al., 2010; Orsini et al., 2013). It also improves farm productivity and reduces urban soil erosion and water loss (Lorenz, 2015; Gebremedhin et al., 2019).

No-till farming, a sustainable practice aimed at reducing the number or impacts of tillage operations on urban soils for agriculture, was noted by a small number of farmers (12%; Table 6). The benefits of low or no-till farming noticeably outweigh the costs, including minimum soil disturbance, preventing soil erosion, reducing the risk of pollution of urban and adjacent surface waters, eliminating plant pests and diseases, and

improving urban farm productivity (Kornegay et al., 2010; Holland, 2004; Busari et al., 2015). The low adoption of no-till farming adopted by Louisville growers could be attributed to the lack of knowledge about the practice, or the lack of access to tools and resources.

Mixed cropping (Figure 8) and cover copping (Figure 11) are both sustainable practices adopted by a small number of Louisville farmers, 2% and 7%, respectively (Table 6). Sometimes referred to as polyculture faming, mixed cropping (e.g., maize and a legume planted on the same plot) has multiple benefits, such as providing food and income for urban farmers and residents, and enhancing the urban environment through less need for Louisville growers to depend on synthetic fertilizers and herbicides (Kornegay et al., 2010; Garrett et al., 2009; Wolz and DeLucia, 2018). In addition, Louisville growers are able to diversify their farm productions to minimize risk and increase profits by adding high-value crops. Cover cropping, on the other hand, has multiple benefits, such as enhancing soil nitrogen and crop yield, reducing soil erosion, and protecting the urban environment from runoffs or water pollution (Sarr et al., 2019; Gebremedhin et al., 2020). However, cover crop use as a sustainable management practice among farmers in the United States, as evidenced in this study, is still limited (NRCS, 2005; Gebremedhin et al., 2022).

Forty-five percent of farmers surveyed practiced rainwater harvesting (Table 6; Figure 7) and some employ drip irrigation (Figure 8). Sustainable water use and management is critical for the sustainability of urban agriculture (Oberholtzer et al., 2014; Bisaga et al., 2019). As one farmer stated when asked about water sources for her farm, “I am capturing water off my neighbors' roof and then siphon it by gravity into

these two tanks. Altogether we can store 1200 gallons." Urban agriculture could consume considerable amount of water, and both the farmers surveyed, and the other study participants interviewed mentioned water access and costs as a big challenge.

Most of the farmers surveyed (64%) did not mention any form of soil testing performed for contaminants on their sites (Table 6). Only 5 out of 28 farmers surveyed from West Louisville, a neighborhood with many chemical industries and waste facilities, mentioned some form of soil testing, and one farmer simply stated, "I have concern for pollution." Agencies like the Jefferson County Soil and Water Conservation District have been aiding Louisville farmers in the form of free or low-cost soil testing, education, and training, but some efforts require major funding (e.g., soil remediation) to make the contaminated sites conducive to grow crops. In addition, most of these farmers are not aware of such programs or benefits due to limited funding, lack of communication, education outreach, or training. There are numerous benefits to contaminants testing on soil and nutrient management, including minimal or no risk of food contamination, less production costs due to limited or no expenses on chemical fertilizers, efficient use of nutrients as needed, and improved crop yield (Gebremedhin et al., 2019; Sarr et al., 2019; Silveira and Kohmann, 2020). Our previous study (Whittinghill and Sarr, 2021) and other studies (Dewaelheyns et al., 2013; Oberholtzer et al., 2014) have documented lack of nutrient management and soil testing for contaminants among farmers in the United States and beyond. Lack of nutrient management practices could have a detrimental effect on the urban environment, resulting in nutrient runoff and potentially polluting urban streams (Dewaelheyns et al., 2013).

Thirty-six percent of farmers surveyed indicated record keeping of farm expenses, yield, water use, and other farm utilities (Figure 9) as a sustainable practice, is critical for the success of urban agriculture (Wolf et al., 2011). It helps urban growers in many ways, such as tracking sales and losses (farm productivity) and better access to more farm certification, training, and other benefits administered by local, state, or federal agencies. For example, one of the requirements of the CAIP (County Agricultural Investment Program) program administered by the Kentucky Agricultural Development Fund is for farmers to submit their farm records/reports and farm certification forms.

Table 6. Sustainable farming practices/techniques and structures used by surveyed Louisville Farmers (n = 42). These values are not mutually exclusive.

Farming Systems / Practices	**Percent (%) of Farmers Surveyed**
Organic Farming	64
Composting	52
Crop Rotation	52
No-till Farming	12
Cover Cropping	7
Companion Planting	7
Integrated Pest Management	7
Bee Keeping (Pollination)	5
Chemical Fertilizer Use	5
Vertical Farming	5
Low Inputs	2
Mixed Cropping	2
Mycology	2
High Tunnels	2
Greenhouse	2
Aquaponics	2
Crop/Livestock or Poultry Integration	2
Farm Management	
Rainwater Harvesting	45
Record Keeping (Yield & Utilities)	36
Soil Testing (Contaminants)	36
Nutrient Management	7

4.4.6 Lack of collaboration and partnerships

Lack of collaboration/networking and partnership, as hypothesized in this study, could be a barrier to sustainable urban agriculture (NRCS, 2005; MacRae et al., 2011; Diekmann et al., 2017). During the study period, participants were asked about the level of communication or collaboration between Louisville Metro Government (which can serve a key facilitator) and other stakeholders (e.g., Louisville growers and consumers) in addressing the barriers to sustainable agriculture in Louisville. One participant stated, "There is poor communication and lack of interest from city officials." The issue of poor communication was also mentioned by another participant, who simply stated, "low level of communication." Some farmers mentioned the use of networking among themselves and other consultants (e.g., extension personnel) to enhance their farm productivity. Others called for more networking and community partnership with stakeholders that are interested in urban agriculture as an effort to address the barriers, and one farmer said, "Collective voice is powerful. And you know, as collective effort, it is a louder voice than ten individual voices. Louisville Metro communication and law enforcement is really good with our UAC [Urban Ag Coalition], and they usually give us information and at times attend some of our meetings."

These results were corroborated by interviews with other stakeholders. For example, the city planner stated:

> " I feel pretty good that us as a department are pretty good at communicating. Once somebody makes that point of contact, like, if you have a reason to call and ask about a zoning question, you have a reason to call and ask us about rules and what you could do, then we're right there, you know, we'll sit, I'll sit on the phone and talk to people for 45 minutes to an hour sometimes just go into just the code and talk, you know, just as customer service kind of thing."

One out of the three Louisville Metro Councilmembers interviewed stated similar sentiments about a positive move to promote more collaboration among stakeholders, and the councilmember stated, “I have a high level of communication between some of our partners like Food Literacy, Louisville Grows, Trees Louisville.” Others did not comment on the matter for the sole reason that they [Councilmembers] cannot speak for Louisville Metro because they are not directly involved with the department responsible for community outreach and collaboration. However, they called for more partnership efforts and stated that they are working with other partners/organizations to try and make sure that people in their districts are getting access to fresh produce.

4.4.7 Other barriers to urban agriculture in Louisville, KY

Water access and affordability

Access to clean, affordable, and reliable water, which is a major input in urban agriculture, is perceived by almost half of the farmers surveyed and mentioned by 36% of our total study participants as a challenge for urban growers (Nolasco, 2011; Oberholtzer et al., 2014; Houessou et al., 2020) (Figure 13). Urban farmers who have better access to abundant and affordable water or irrigation facilities are also more likely to adopt sustainable production practices than their counterparts who do not (Carlisle, 2016). As one urban farmer simply puts it, “Water is the biggest challenge.”

These results are corroborated by our interviews, suggesting that water access and affordability is a challenge to some of these farmers. For the Jefferson County Cooperative Extension agent, “access to water [is] a huge barrier because of expensive water and we still paying for water and garden fees not enough. The city [is] not doing enough. Water access and payment also varies based on the individual garden. At some

sites, JCCES pays the water bill while at other sites they do not." The executive director of Louisville Grows added:

> "The only issue with water here is that we have to pay for it at community gardens specifically. But the access is there, you know you in the city. So we have, you know, everybody can have an irrigation line. It's just more expensive than if you're in a rural area you can have a well, or you can have irrigation pumps from a creek or a pond or something like that. So the access to clean and abundant water is more, you know, yes. But it's like we have, you know, we've plenty of access, but it's at a premium."

Farmers mentioned different water sources, and most (86%) depended on municipal city water and 45% on harvested rainwater. Cities like Oakland, CA, where municipal waters are more expensive, have taken steps to reduce urban per capita water use incorporating sustainable water-use efficiency and conservation methods and programs to promote urban agriculture (Nolasco, 2011). Water is not only a vital resource for urban agriculture, but is in high demand in many cities, and is getting more unaffordable (Nolasco, 2011; Oberholtzer et al., 2014; Pollard et al., 2018; Bisaga et al., 2019). For example, irrigation accounts for more than 50% of urban water use in California (Nolasco, 2011). The heavy reliance on municipal city water by Louisville growers indicate that there are costs involved because water was not provided for free by Louisville Water Company. Most of the time, nonprofits, and other organizations such as Community Earth Gardens, bear most of the costs of the water bills.

Unfavorable zoning policies

Policies and regulatory barriers related to zoning were mentioned by 38% of the study participants (Figure 13). Zoning issues could pose a challenge for urban agriculture because zoning is the most prevalent land-use control by city authorities and planners,

and could prevent farms/gardens from locating on vacant lots, rooftops, or backyards in cities (MacRae et al., 2012; Castillo et al., 2013; Oberholtzer et al., 2014). Only 29% of urban farmers surveyed specifically mentioned having problems with zoning. Others mentioned that zoning is not an issue, and one farmer stated, “I am not aware of legal barriers or policy barriers necessarily, you know, for me like zoning. When I established the project, I had to do one little minor technicality of rezoning it so that I could start that project. And that was not a big deal. Now, the situation with the land development code has changed so that some of the things that I had to do it, you know, are no longer necessary.”

This farmer’s perspective was supported by the city planner interviewed in this study, who stated:

> “Just today, we finally get like the latest updated version of the code [Land Development Code] that is up online today. All of the changes we made today urban agriculture is one of the several. We created that definition for urban agriculture, and that actually was a direct suggestion from the Louisville Urban Agriculture Coalition. We make the process where it is allowed in all zones. It relieves the burden where, you know, you don’t have to go and get a special permit, or you know, conditional use permit, or changes zoning or anything like that, that's a big, you know, regulatory burden that we're able to remove. And then there was like some buffering requirements that didn't really make sense, you know, we remove some of that too.”

He was also quick to add that educating and informing the general public about current changes/updates on the zoning codes and regulations is a little challenging. The city cannot also regulate restrictions for those on HOA (Homeowners Association) that would not let them grow in their backyards. The statement was corroborated by the Jefferson County Extension agent, who stated, “Zoning changes are more favorable, and you can grow anywhere in the city as long as you own or lease."

During the study period, a copy of the revised Land Development Code (LDC) [Appendix D], which has long been a keen interest to Louisville Metro government and other key stakeholders, was obtained from the city planning department (Appendix D). With the LDC, the city allowed high tunnels to be approved for residential properties and rezoned urban agriculture to include properties under five acres. According to a staff of the Jefferson County Soil & Water Conservation District, "The revised LDC can make access to land easier." However, like other cities in the United States, such as Philadelphia (PA), the long-term success of the LDC in promoting urban agriculture in Louisville would most likely be facilitated by a permanent protection of the areas or spaces specifically zoned for agricultural use.

Pests and diseases

The presence of pests and diseases, which was reported by 27% of the study participants (including 16 of the 42 farmers surveyed), could be a barrier to urban agriculture (De Bon et al., 2010; Houessou et al., 2020). It can negatively affect crop and animal productivity, and hence reduce urban farm productivity (IPCC, 2007; De Bon et al., 2010; Tubby and Webber, 2010). In our previous study (Whititinghill and Sarr, 2021), we documented the presence of pests and diseases as a challenge to urban agriculture in Louisville, with 90% of Louisville farmers surveyed mentioning it as one of the challenges they faced with growing their crops. Only 7% of the farmers surveyed mentioned the use of IPM (Integrated Pest Management) (Table 6), including the use of companion planting and the elimination of host crops. In addition, the use of pesticides has been limited or banned in some urban areas due to the health risks associated with it (De Bon et al., 2010).

Lack of technical assistance, education, and training

Lack of technical assistance, education, and training were mentioned by few of the study participants as a challenge to urban agriculture in Louisville, and one farmer simply stated, "lack of knowledge regarding [land use] permits is an issue." In corroboration, the city planner interviewed stated:

> "I think that we've kind of done what we can for now, as far as supporting, or at least on the short term, supporting the ability of people to like farm land, and to sell their farm around the city. And so I think the problem then becomes, education could be a thing, you know, maybe we could do a better job at like informing the public that, hey, like, we've made these changes, and you all now have more rights to use your land in this manner if you want to."

He further went on to elaborate on the matter that there are tons of institutional knowledge about urban agriculture and great farmers in Louisville, but "to get that knowledge to the people that live in the city who are interested in growing their own crops is a challenge." Overall, most of the farmers surveyed mentioned the use of extension personnel, state, and federal agencies such as NRCS (Natural Resources Conservation Service), and nonprofits (e.g., Community Earth Gardens) as tools and resources to educate themselves about sustainable urban agriculture. The JCCES personnel have played a critical role in serving as partners in conducting educational training and workshops through cooperative extension. JCCES mission is to "serve as a link between the counties of the Commonwealth and the state's land grant universities to help people [including Louisville farmers] improve their lives through an educational process focusing on their issues and needs." This is achieved through better collaboration and partnership efforts with key stakeholders, including Louisville farmers.

Additional barriers to urban agriculture mentioned by the study participants include inadequate time for farm activities, lack of security or vandalism (pets, deer, and neighbors eating produce), cultural barriers (e.g., eating habits by the community, lack of awareness of farming culture or the perception that people in the city are not farmers), and lack of produce storage or food preservation. For the lack of time, one participant stated, "my family worked in a lot of manufacturing; they didn't have a lot of extra time to grow their own food. This lends itself to what we see now, which is a lot of quick convenience foods." Vandalism and other security challenges are common within the urban agriculture community where growing spaces are more visible within the urban settings (Brown and Jameson, 2000; Mougeot, 2006). Urban residents and animals (e.g., deer) have easier access to these farms/gardens, and as a result, trampling on the crops or stealing and eating them is easily facilitated. Lack of awareness of farming culture or the negative perception that farming does not belong to the city, which have been documented before (Mougeot, 2006), could hinder the efforts among policymakers and city authorities to promote urban agriculture.

5. GENERAL RECOMMENDATIONS

The overwhelming majority of the study participants mentioned the importance and benefits of urban agriculture, in terms of social, health, cultural, economic, and environmental benefits (Figure 4). As a result, the following recommendations have been made to unlock the barriers, and tap the full potentials of sustainable agriculture in Louisville, KY:

1) Promote community access to land and long-term tenure on land for urban agriculture

To address the barrier of limited access to growing space, Louisville Metro government needs to prioritize and streamline urban agriculture alongside, or as part of its economic development plans. This can be achieved by distributing vacant and abandoned properties to the community and other organizations that are interested in urban agriculture in a very transparent, equitable, and accountable process. Louisville has the potential to provide more growing spaces with over 600 abandoned vacant lots and properties (Louisville Metro government, 2022). With most of these vacant lots in West Louisville, a food-insecure neighborhood, little effort has been made by some of the stakeholders to utilize these lots to feed the community. The Louisville Metro Council Member for District 21, a strong proponent of using underutilized vacant lots, stated, “So I'll give you an example. And that is we have some vacant MSD property off of near a neighborhood called Preston Park, which is off Preston highway. These parcels that are just sitting vacant, we tried, MSD is agreeable to do a lease agreement with an entity,

whether that is, you know, a neighborhood association, [or] an organization like the Jefferson County Soil and Water Conservation." The Council member's statement was corroborated by that of the Food Literacy Project Program Manager, who stated, "I think there are some barriers that could be removed with over 600 vacant lots in Louisville." Louisville can learn from sister cities like Detroit, MI, and Cleveland, OH. For example, Cleveland, with over 3000 acres of vacant land and 10,000 vacant buildings, was able to partner with local and national funders to productively use these spaces to create and support more than 25 urban agriculture-related projects across the city as one of its sustainability goals (Hodgson et al., 2011; Grewal and Grewal, 2012).

Because limited access to land and land tenure has been mentioned as a barrier by most of the study participants (76%) and many other scholars (Ellis and Sumberg, 2008; Lovell, 2010; Orsini et al., 2014; Bisaga et al., 2019), there is a need for Louisville Metro planners and policymakers to fully incorporate urban agriculture guidance in the cities land development code (LDC) amendments. However, Louisville Metro planners, with the aid of multiple stakeholders, have made significant process towards more favorable zoning policies by successfully revising the LDC that promote urban agriculture. This corroborated with some of the responses of the study participants, in which many stated that progress has been made with regard to zoning challenges. However, some of the study participants called for more efforts, and one participant stated, "Gentrification is rampant. Get rid of commercial zoning laws that let people starve."

Land security is critical in the success and sustainability of urban agriculture because it directly influences the level of investment made by urban farmers (Brown and carter, 2003; Hodgson, 2012; Bisaga et al., 2019). Because long-term leases are not

available to some of the farmers in Louisville, with some stating they were about to lose their growing space to landowners including private developers, the combined efforts of stakeholders (including the Land Bank Authority) can assist farmers or interested individuals in acquiring vacant lots at reduced or affordable rates, increasing the minimum lease for urban agriculture projects, and implementing a lease-to-own program for Louisville farmers. One farmer stated, "We need lease agreements, more space to farm, and the vacant spaces in Louisville can be useful for that." With support from Louisville Metro and other stakeholders, some of the hundreds of vacant lots in Louisville can be put in a land trust owned and governed by community members limited to use for urban agriculture.

Regulation of Louisville Metro zoning designations and other favorable urban policies to promote urban agriculture need to be specified and enforced (Quon, 1999; MacRae et al., 2012; Castillo et al., 2013). This will provide opportunities and prospects to Louisville growers and other stakeholders to have a clear idea or knowledge of which agricultural activities are allowed in a specific zone or area, and which are not permitted (Quon, 1999; Ellis and Sumberg, 2008). For example, the revised LDC (Appendix D), which was planned and prepared with the involvement of other stakeholders (e.g., representatives from the Urban Ag Coalition of Louisville) clearly stated that, "Urban Agriculture may be permitted as a use with special standards within all zoning districts." However, some proponents of urban agriculture in Louisville are still uncertain about the full participation of the public for a free and fair rezoning process supported by the community.

2) Solicit more funding and other resources from public and private agencies

Lack of financial resources or limited funding was mentioned by most (76%) of the study participants as a barrier to sustainable urban agriculture in Louisville. As a result, measures to solicit more funding opportunities to improve access, education, and equity in Louisville's food system is warranted. To confront the barrier of limited funding/financial resources, Louisville farmers' equal access to financial resources or capital, including the revision of loan conditions with lower interest rates, creating micro-credit farm cooperatives, and providing incentives/subsidies, can go a long way in boosting the potentials of urban agriculture in Louisville (Kaufman and Bailkey, 2000; Bisaga et al., 2019). The overwhelming majority of the study participants explicitly called for more funding, especially from Louisville Metro government. One participant, when asked the question about how to address barriers related to limited funding, stated, "more funding from the city and other agencies." Louisville Metro, like other agencies and nonprofits (e.g., Louisville Grow) that are helping Louisville farmers offset some of their farm expenses, can subsidize water for urban agriculture, allocate more funding than an annual budget of 50,000 USD toward urban agriculture-related projects, sponsor programs that raise awareness of the importance of urban agriculture, and facilitate partnerships to solicit more financial and other forms of support with its limited budget.

With over 150 million USD allocated to Louisville Metro from the American Rescue Plan (ARP), many proponents of urban agriculture in Louisville have called on the city to take the opportunity to revitalize and strengthen the local food system so it will be more sustainable and equitable. The many benefits of urban agriculture in building resilient, sustainable cities, including enhanced food security (Nord et al., 2007;

FAO,2020), reduction of energy use and carbon footprints of cities (Ackerman et al., 2014), provision of open green space (De Bon et al., 2010), and community revitalization (EPA, 2015), should warrant Louisville Metro government and other stakeholders to make a case for more funding for urban agriculture. The question is whether it is a priority for Metro Council. As one Councilmember for District 1 in West Louisville claimed, "For the urban poor in my district [West Louisville], I do not think it [fresh local food] is a priority." One of the key stakeholders interviewed, who is an active member of the Urban Ag Coalition (UAC) in Louisville, was quick to mention that proposals have been drafted and are ready to be submitted to Louisville Metro Council to request appropriations from the ARP funds for urban agriculture. Partnership efforts can also be doubled between stakeholders and farm agencies and credit or loan bureaus, and in some instances, Louisville Metro government can facilitate between partners.

Given the financial challenges of limited funding for urban agriculture, there are some cost-share programs and other funding sources (excluding those from nonprofits like Community Earth Gardens) mentioned by some of the study participants that could address this barrier. For example, the County Agricultural Investment Program (CAIP) could make an impact. The CAIP program, administered by the Kentucky Agricultural Development Fund and the Jefferson County Soil and Water Conservation District, would be an opportunity for Louisville growers to increase net farm income and productivity through an award of 5,000 USD or more to each applicant depending on the size and nature of the urban agriculture project (Jefferson County Soil and Water Conservation District, 2022). The Urban Agriculture and Innovative Production (UAIP) Competitive Grants Program, administered by the USDA, is another opportunity that

could award up to 50,000 USD or more to successful applicants to support the development of innovative urban agriculture projects or programs. However, during the data collection process, most of the farmers surveyed were not aware of such cost-share or easement programs that could offset some of their farm/garden expenses. Louisville farmers need to be connected with local and federal agencies that administer these cost-share programs, and some of these agencies also offer funding for contaminants testing on soils and remediation on brownfields and other contaminated sites before use for urban agriculture. This is especially important for those growers in West Louisville considering the heavy presence of chemical industries, landfills, and brownfields in the area (ATSDR, 2006; Gilderbloom et al. 2019). Other stakeholders and community development financial institutions in Louisville can also help Louisville farmers in the form of grants, donations, loans, or credit with lower interest rates.

Cities like Cleveland, OH, have used multiple funding sources (including the United States Department of Agriculture, Cleveland Land Bank Program, and Cleveland Community Development Block Grant) to support its urban agriculture-related programs (Schuering, 2011; Pothukuchi, 2018). The success of urban agriculture in the city is linked to the annual funding of 100,000 USD or more for its Summer Sprout Program (SPP), a program that supports over fifteen community gardens in the city of Cleveland (Ghimire, 2008; Pothukuchi, 2018). The funds are used to help defray the cost of seeds, tools, tilling services, infrastructures (e.g., raised beds), educational tools, training, and soil testing and management. Over 1.5 million USD worth of produce is created annually from the SPP to provide alternatives for the youth and improve the diet of low-income households (Ghimire, 2008). Louisville can follow suit to venture for more funding from

community development agencies and other entities despite the reluctance from many cities in the United States to use community development block grants to support urban agriculture.

3) Increase access to markets for both Louisville farmers and consumers

The study participants mentioned challenges related to market access and expansion, including limited number of days and hours of operation for the farmers markets, limited transportation, and distribution inequities with the presence of few farmers market and grocery stores in West Louisville. To address this barrier, increasing access and the presence of more farmers markets and grocery stores, especially in West Louisville, can improve the sustainability of urban agriculture in Louisville. Louisville should learn from sister cities as suggested by one of the study participants, who said, "Cities like Houston, Madison, and Cincinnati could serve as examples with some having 7-days farmers markets. We need to expand the markets here." During the study period, I was able to locate only one seasonal farmers market in West Louisville, the Opportunity Corner Farmers Market.

After failed efforts by the Louisville Community Grocery and other stakeholders to bring more grocery stores to West Louisville, one great opportunity would be for Louisville Metro to adopt policies that would provide low-income residents easier access to local fresh produce. For example, Louisville Metro could designate some of the vacant lots or properties in food-insecure neighborhoods like Russell solely for food production and marketing.

Another opportunity, as suggested by some of the study participants, would be for Louisville Metro to form partnerships or encourage private investors through incentives

(e.g., tax breaks) or other subsidies to bring more grocery stores to West Louisville. However, one study participant was quick to mention that little effort was registered from city authorities and planners to address the situation, stating, "the city is not doing enough to revitalize West Louisville."

Another opportunity would be for nonprofits (e.g., churches and community centers in West Louisville including Feed The City Church of Louisville), to copy from, and consult with those in the East End and other partners (including Louisville farmers and other vendors) to have farmers markets in their premises. This opportunity will not only increase the safety net of the community's food desert challenges, but it will also connect the community. In addition, these nonprofits and other agencies can promote their programs and offer educational and other benefits to the community during the market hours. Establishing community-supported farms and markets in the city, and storage facilities, as suggested by some of the study participants, can motivate more farmers into urban agriculture while connecting them with the local consumers. For example, the Niagara Food Co-operative, located in Buffalo, NY, was seen by many as a successful enterprise bringing over three hundred community-supported farms and markets in the area within a brief period of time (MacRae et al., 2011).

New and innovative marketing initiatives and favorable marketing regulations, such as requiring all Louisville markets and grocery stores accept SNAP benefits and senior vouchers, promotion of local consumption (e.g., thru local restaurants, schools, and food pantries), direct marketing, virtual farmers market where some Louisville residents can order and pickup their produce at easily accessible locations, could auger well for the future of urban agriculture in Louisville. Louisville farmers can also take

advantage of local and federal funding and other resources for their business planning and risk management, including the Farmers Market Promotion Program (FMPP) and USDA's Agricultural Marketing Service grants. Both programs offer valuable resources to urban famers through better marketing techniques, and access to better processing and storage facilities. In addition to the above-mentioned initiatives to increase Louisville farmers and residents' access to the local markets, developing an efficient and reliable transportation network systems could assist those residents with low mobility, the majority of which are in West Louisville (Lovell, 2010; Bisaga et al., 2019).

4) Promote community and local government support for urban agriculture

In general, successfully implementing many urban agricultural projects in cities worldwide require strong community and political support (Okvat and Zauta, 2011; Clarke et al., 2018). Most of the study participants mentioned that the community support for urban agriculture in Louisville far outweighs the political or policy support. According to the study participants, some of Louisville Metro government policies or actions that fully support urban agriculture are still not clear or practiced citywide. However, one of the Louisville Metro Councilmembers interviewed rejected this sentiment and call for equal participation and efforts (from both the Louisville community and local government) to promote urban agriculture in Louisville. Some of the study participants recommended the leadership of Louisville Metro government in implementing urban agriculture projects, and one participant stated, "I think it is like a backburner, and I really think that it comes to be more important in the eyes of the government soon. I think there is lot of momentum from the community for kind of some adjustments to our food system that are more just and inclusive."

Community education programs such as the Food Literacy Project, if implemented and supported fully, could be a starting point to educate and demonstrate the benefits of urban agriculture to communities in Louisville. It will also assist communities with information about better food access opportunities and choices that promote community health or wellbeing. Louisville should copy sister cities like Detroit, MI, and Seattle, WA, in promoting urban agriculture through collaborative community-supported programs and efforts, as suggested by some of the study participants. These strategies attract more growers and local consumers (Bregendahl and Flora, 2006). Today, Detroit, MI, the formation of the Detroit Black Community Food Security Network (DBCFSN) as a community center, has promoted the establishment of more than thirty community-led gardens, and led to greater community food self-sufficiency (Horst et al., 2017).

The lack of strong political support for urban agriculture in Louisville (Table 5) could be attributed to the priorities of Louisville Metro government, as stated by one of the Councilmembers interviewed. To boost more political support for urban agriculture, advocates need to educate and demonstrate the several benefits and the associated challenges of urban agriculture to the public and policymakers (e.g., Louisville Metro representatives). This can be achieved through engagements, media outlets, Louisville Free Public Library series for local farming, and inviting Louisville Metro authorities and city planners to seminars and workshops that promote sustainable agriculture in Louisville.

5) Support more research, education, and extension into the local food system

The overwhelming majority of the study participants mentioned using extension services thru workshops, training, and other means as resources to make decisions about their daily farm operations (Table 3). Via research, education, training, and extension outreach, access to information and other resources for farmers can be improved, and knowledge transfer can be easily facilitated (MacRae et al., 2011; Castillo et al., 2013; Cohen and Reynolds, 2014). For the case of Louisville, the JCCES and other nonprofits like Sustainable Agriculture of Louisville, through their agents and staffs, are playing critical roles as partners in conducting educational programs, training workshops, and providing technical assistance, tools, and other resources to Louisville Farmers. Louisville Metro or partners can stimulate dissemination of information on sustainable farming practices through the provision of more financial support to JCCES and other nonprofits that are stretching their budgets or resources to assist Louisville farmers. There is the need for more extension involvement in Louisville's local food system for many beneficial reasons. First, it will educate the general public about the benefits of urban agriculture, including the health and social benefits (e.g., increased access to more healthy, fresh, local food). Second, it will assist Louisville farmers to have better access to the latest information/data (e.g., the Master Gardener Program), or technology through research and innovation. Third, extension involvement in promoting urban agriculture is a smart and viable strategy to educate farmers about sustainable farming practices (e.g., regular soil testing for contaminants) which could improve the lives of Louisville residents while protecting the environment. For example, some of the other barriers (e.g., prohibitive cost of water and the presence of pests and diseases) mentioned by Louisville farmers surveyed requires extension involvement to educate and train farmers on

innovative and sustainable techniques, such as efficient irrigation systems (e.g., drip irrigation) and pest control practices (e.g., organic and natural pest control techniques). Fourth, promoting more extension and outreach programs in Louisville's local food system can go a long way in bringing key stakeholders together. For example, during the study period, I attended one of the workshops run by JCCES at the 7th Street community garden, which brought farmers, consumers, and representatives of nonprofits and other organizations together to work on issues related to sustainable agriculture in Louisville. In other words, the work of extension personnel, if promoted, can enhance collaboration and partnerships among key stakeholders.

Innovative and sustainable farming ideas and techniques, (e.g., permaculture, vertical farming) through education, training, and research and development can sustain urban agriculture (Nolasco, 2011; Houessou et al., 2020; Gebremedhin et al., 2022). Given the limited availability of land for farming in parts of Louisville, especially in the food insecure neighborhoods, space-intensive production techniques (e.g., vertical farming and aquaponics) with the highest efficiency and income should be a top priority for researchers and Louisville farmers (FAO, 2012; Wortman and Lovell, 2013; Pollard et al., 2018). For example, vertical and aquatic food production techniques in high tunnels are alternatives where contaminated urban soils could be a critical challenge to grow crops (Wortman and Lovell, 2013; Ackerman et al., 2014). For example, AeroFarms, which is the largest indoor vertical farm in Newark, NJ, produces more than one million pounds of vegetables annually (Birkby, 2016). Louisville farmers surveyed revealed the small number of farmers involved or interested in such innovative production techniques, with few in aquaponics (2%) and vertical farming (2%) (Table 6).

However, nonprofits and agencies, such as the Soil and Water Conservation District, are making efforts with the installation of high tunnels at free cost to farmers in parts of Louisville with the approval of the city planners. Furthermore, educating and informing the farming community about current changes/updates on the zoning codes and regulations, as suggested by the city planner interviewed, could auger well for the sustainability of urban agriculture in Louisville.

6) More collaboration and partnership efforts

Stakeholders working collaboratively through action-orientation partnerships can promote the sustainability of urban agriculture (Diekmann et al., 2017). For example, in the San Francisco Bay area in California, stakeholders (including extension personnel, the community, government partners), through collaboration and partnerships, were able to facilitate a broader urban food system change through urban agriculture that attracted many underserved city residents, and noticeably improved their access to fresh, healthy food (Diekmann et al., 2017). In Louisville, some stakeholders, including the JCCES, Food-In-Neighborhoods Urban Agriculture Coalition, and Community Earth Gardens, are making efforts to some extent, facilitating collaboration and partnerships to promote urban agriculture through workshops, training, networking events, and helping newcomers and refugees interested in urban agriculture to build a social network. For example, the Master Gardener Association Project, created by the partnership efforts between JCCES and the Jefferson County Soil & Water Conservation District, supports and connects Louisville farmers and their partners in the city and beyond through classes, training, and workshop events. These events, one of which I attended during the study period, brought together many Louisville farmers and other stakeholders. However, there

is still the need for coordination of more resources as suggested by some of the study participants.

Many of our study participants called for more partnership and collaboration efforts, with some suggesting there are significant gaps in networking among key stakeholders, including Louisville Metro government. One participant simply stated, "There is low level of communication with the city [Louisville Metro government]. More partnerships with organizations that are interested in urban agriculture needed." More public-private partnerships, community engagement and networking, outreach programs, and the formation a food policy council could contribute to the sustainability of urban agriculture in Louisville. Through a food policy council, stakeholders can better plan, coordinate, and support urban agriculture projects that are more sustainable, resilient, and beneficial to Louisville residents. For example, the Cleveland-Cuyahoga County Food Policy Coalition in Cleveland, OH, which was formed in 2007 comprising five working groups, has been remarkably successful in partnering over one hundred stakeholders, including city authorities and planners, private entities, local farmers, and city residents (Hodgson et al., 2011). One of the coalition's working groups engages and provides information and advice to Cleveland policymakers and planners on issues such as existing zoning policies and important reforms needed at the local level to promote a sustainable community-based food network. Louisville can follow the same suit to promote our local food system. Partnership efforts, through cross organizational networks, can also be doubled between stakeholders and those with expertise, farm agencies, and credit or loan bureaus, and in some instances, Louisville Metro government can act as the facilitator between partners (DeCaro et al., 2019; Sarr et al., 2021).

7) Improve access to more affordable and sustainable water systems

Urban agriculture could use a considerable amount of water (Oberholtzer et al., 2014; Bisaga et al., 2019), and almost half of the farmers surveyed mentioned the price of water as a big challenge. As one farmer puts it, “Still Louisville water company is not providing free water to community gardens for agricultural purposes, or at discounted rates.” As a result, there is a need for a mechanism by which local authorities or water companies can subsidize water for agricultural purposes, or to explore alternative and more efficient water irrigation methods/ techniques. Stakeholders, including the nonprofits agencies in Louisville that support farmers by bearing some of the costs of water used on their sites of production, should continue to put pressure on Louisville Metro and Louisville Water Company (LWC) to underwrite or subsidize water and water installation infrastructures used for farming in the city.

Policies and plans that protect and conserve the safe use of urban water resources (e.g., drip irrigation) should be put in place as affordable and abundant clean water contributes significantly to the success of urban agriculture (Nolasco, 2011; Oberholtzer et al., 2014; Bisaga et al., 2019). Rainwater harvesting, which is a common sustainable practice aimed at conserving water, could be one of the alternatives that can be promoted as most of these farmers (86%) depend on expensive city water lines to irrigate their farms/gardens. Cities such as Oakland, CA, where municipal waters are more expensive, could be a learning lesson for Louisville. Oakland has taken steps, including the use of permaculture techniques and a series of bills and acts, to reduce its per capita water use incorporating sustainable water-use efficiency and conservation methods and programs to promote urban agriculture (Nolasco, 2011). However, most of the farmers surveyed may

need some form of training and education on water management techniques, such as drip or trickle irrigation methods and how to keep records of the amount of water needed and used on their farms/gardens.

8) <u>There is need for co-production</u>

Like any other complex socio-ecological issues or dilemmas, co-production, as a policy tool, can be used to address the barriers to urban agriculture in Louisville. It is a holistic approach that calls for more transparent public participation in policymaking, ensuring that participants that represent the urban farming community are well-positioned to monitor and hold local government agencies accountable, and a simultaneous bottom-up and top-down governance structure that refines a shared vision among stakeholders (Ostrom et al., 2007; MacRae et al., 2011; Sarr et al., 2021). Co-production is not a cure-all solution, and Louisville Metro government can facilitate co-production among stakeholders as a one of the policy tools to address the challenges to urban agriculture. For example, one participant mentioned, “I do not expect the agency to solve all the problems, and some of those don't even require money. Like there's plenty of solutions that don't require money.” Co-production could be one of the low-cost solutions with need for a shared decision-making, especially with decisions concerning zoning and land allocation to interested individuals (DeCaro et al. 2019; Sarr et al., 2021).

Early public participation and integrating the larger needs of the public in policymaking are recommended in the successful implementation of urban agriculture projects (Randolph, 2012; Cohen and Reynolds, 2014; Gasperi et al., 2016; Arnstein, 2019). Oakland’s Hope Project, in California, recruited and empowered over four hundred of its low-income residents in the local food-planning process (Cohen and

Reynolds, 2014). This was facilitated through strategies that removed barriers to public participation, including non-monetary (training) incentives for participants. Because projects related to urban agriculture could sometimes be challenging to govern (MacRae et al., 2011; Cohen and Reynolds), co-production could be a smart, strategic policy tool because it is a solution where everyone benefits (win-win situation) as they all work on shared agreed-upon plans and key objectives.

6. CONCLUSION

Urban agriculture offers many potential benefits to Louisville residents, as evidenced in this study, but its potentials in meeting the rising demand for local food by residents are not fully tapped. The potentials of urban agriculture to be one of the key strategies to combat food insecurity in Louisville, especially in West Louisville, requires the barriers to be unlocked through the combined efforts of all stakeholders, including Louisville Metro government. In addition, urban agriculture in Louisville is expected to contribute to Louisville Metro government's 2050 sustainability goals of reducing greenhouse gas emissions by 80%. This can be achieved through the adoption of sustainable farming practices among Louisville farmers (e.g., the use of greenhouses as a local condition to produce the highest yields). Urban agriculture must not be viewed as a challenge, but as one of the strategies in promoting sustainable urban development (Mougeot, 2006). However, planning for urban agriculture requires a careful consideration of many factors, including the economic, social, ecological, technical, political, geographical, and institutional drivers and constraints associated with it (Mendes et al., 2008; Hodgson, 2012; Graefe et al., 2019; Whittinghill and Sarr, 2021).

With surveys of Louisville farmers and local consumers, and supported by interviews of key stakeholders, this study, as expected, has examined the major barriers to sustainable agriculture in Louisville. In addition, it has outlined key policy-related recommendations that if fully implemented, could improve the lives of Louisville

residents, especially those in food-insecure neighborhoods like Russell and Portland. Efforts are already in place to combat food insecurity in Louisville through promoting sustainable urban agriculture, and to bring policymakers, communities, and food justice movements to the forefront of the dilemma (Louisville Metro Government, 2017).

This study proposed significant policy and program initiatives, including, but not limited to: i) increased access to land and tenure for urban agriculture; ii) increased investment, funding, and provision of more resources; iii) better access to markets by connecting producers to consumers, and the presence of more farmers markets and grocery stores with extended hours and days of operation (especially in West Louisville); iv) more local government and community support for urban agriculture; education, training, research, and more involvement of extension outreach programs; v) innovative farming ideas and solutions, and lastly; vi) creating new models for collaboration and creating partnership among stakeholders to collectively identify and find common solutions to the barriers of sustainable agriculture in Louisville (co-production).

From visions and objectives to shifting policies and budgets, stronger actions (designing, implementation, maintaining, communicating, monitoring, and evaluating plans) are needed to improve Louisville's local food system. In the near future, this can be achieved through the combined efforts of an accountable food policy council comprised of municipal staff, policymakers, city planners, extension agents, nonprofits, grassroots organizations, and local farmers and residents.

This study is expected to be beneficial in multiple ways: First, this study can be used for background information for other studies in the field, especially in public policy and in the discussions of building resilient, sustainable cities. Second, by

identifying some of the sustainable farming practices (also discussed in the literature), available resources, constraints, and opportunities specific to urban agriculture in Louisville, recommendations and lessons from this study will be pertinent to other urban communities and municipalities throughout Kentucky and across the United States, mostly benefitting urban growers and low-income urban consumers in food-insecure communities like West Louisville. Third, the study is expected to provide insights and directions for advocates, policymakers, city planners, and cooperative extension agents to collectively design better policies and plans, and develop transformative solutions to expand the adoption of resilient and sustainable urban agriculture systems in Louisville (Lawson, 2005; De Bon et al., 2010; Lovell, 2010; Bisaga et al., 2019). Fourth, the study highlighted how the sustainability of urban agriculture in Louisville is influenced by significant zoning laws (e.g., the recently revised land development code permitting urban agriculture as a use within all zoning districts), and other government policies and incentives, and the need to call for greater community-based and local government support for urban agriculture in Louisville. Finally, this study has revealed some of the current and past efforts, gains, deficiencies, and future outcomes in the co-production of addressing the barriers to sustainable agriculture in Louisville, KY. How these barriers can be addressed in a more holistic approach with the full and active participation of all actors or stakeholders is also addressed.

While urban agriculture continues to be embraced by many advocates, policymakers, planners, nonprofits, and local communities, there are still many unanswered questions about its adoption and sustainability in Louisville and other similar cities that warrants further investigation (Orsini et al., 2013; Wortman and Lovell, 2013;

Bisaga et al., 2019; Whittinghill and Sarr, 2021). First, can urban agriculture satisfy Louisville and other urban residents continuously increasing demand for local food and address food insecurity issues, especially in West Louisville? (Siegner et al., 2018).

Second, the economic impacts of urban agriculture, in terms of its profitability for growers and household savings on groceries for Louisville residents, needs further investigation. Research on urban agriculture has not fully considered the quantitative analysis of resources or inputs in the practice (Pearson et al., 2010; Goldstein et al., 2011; Pollard et al., 2018; Siegner et al., 2018). These include measuring labor, costs, water usage, amount of urban produced food consumed by the urban poor, and whether the activity can consistently save urban households money in the long run, or to assess its financial feasibility. In the United States, where most research on urban agriculture is limited to few cities, research on the economic impacts of urban farming are mainly centered around farmers markets (Balmer et al., 2005; Goldstein et al., 2011; Siegner et al., 2018). With new or more research or data on the practical aspects of urban farming, including costs, time spent, and productivity, the economic sustainability of urban farming would be better understood by practitioners, policymakers, and other researchers (Pearson et al., 2010).

Third, there is the need for evidence and science-based research for urban agriculture in Louisville to capture a bigger picture or understanding of the sustainability of innovative urban agricultural farming or production techniques (e.g., the efficient use of wastewater for irrigation, vertical or rooftop farming). Given the prohibitive water costs faced by urban farmers, it is necessary for researchers (including the University of Louisville and other higher research institutions) to begin exploring innovative ideas and

methods of water conservation for its optimal use, and search for alternative sources of water (Wortman and Lovell, 2013; Pollard et al., 2018; Graefe et al., 2019). This can be achieved through more research in improved irrigation technologies to optimize the amount and frequency of application, and strategies to improve soil moisture retention (e.g., using mulches, compost amendment, or cover crops). Recycling of water could also reduce the pressure or heavy reliance on municipal water sources for urban farms, and some cities have engaged in harvesting rainwater from rooftops and other impervious surfaces (Wortman and Lovell, 2013; Ackerman et al., 2014). One of the factors that the future of urban agriculture will depend on is water use efficiency (WUE), and it is a critical element to assess the performance of food production in our cities where temperatures are rising noticeably (Wortman and Lovell, 2013).

Fourth, most research on urban agriculture in Louisville are ethnographic and case study-based, which is a limitation to truly measure the social impacts of urban agriculture (Montgomery, 2016; Goldstein, 2019; Whittinghill and Sarr, 2021). Little attention has been given to the social functions at work within urban farms/gardens in some cities, including those in Louisville (Goldstein, 2019). Because of the social benefits of urban agriculture in Louisville and other cities, there is the need to explore more research on their social practices (Mougeot, 2006; Pearson et al., 2010; Wortman and Lovell, 2013; Anderson et al., 2019). For example, little or no research has been conducted on the relationship between urban agriculture in Louisville, and its role in reducing social inequity. More participatory and community-action on urban agriculture in Louisville and other urban areas can assist in better understanding its social impacts on city residents, including gender-specific issues, food access, justice, and economic equality (Lovell,

2010; FAO, 2011; Siegner et al., 2018). This will be effective not only in gathering data, but also enables the Louisville community to better participate in designing and implementing urban green space plans and policies.

Fifth, studies on the access to safe food produced at the city level remain essentially unexplored (Aubry et al., 2012; Orsini et al., 2013; Graefe et al., 2019). Producing food in polluted urban soils poses a serious threat to public health, and hence deteriorates the conditions of the urban poor (Orsini et al., 2013; Wortman and Lovell, 2013). Regulation, preventive measures, and all risks associated with the practice of urban agriculture should be carefully studied, and should not be overlooked (Artmann and Sartison, 2018; Graefe et al., 2019). To get a full account of both the positive and negative health impacts associated urban agriculture, new studies should take the extra step of an interdisciplinary approach incorporating all the sciences (Artmann and Sartison, 2018). For example, the impacts of wastewater and heavy metals on urban farming and the health of urban residents should be explored at a global scale, especially in cities of the developing world.

Finally, the complex inter-relationships between urban agriculture in Louisville and the Louisville urban environment, and the impacts of urban agriculture as a climate change and disaster reduction strategy (IPCC, 2007; Artmann and Sartison, 2018; Dubbeling et al., 2019), warrants further investigation. Rapid urbanization, associated with environmental degradation and increased urban poverty, compels a new and improved physical planning of the urban landscape that should consider the beneficial functions of urban agriculture (FAO, 2008; De Bon et al., 2010; Lee-Smith, 2010; Lovell, 2010; Ackerman et al., 2014). There is a critical gap in the literature of how urban farms

are shaped by, or contribute to the urban landscape, and their ecological potential and biophysical features are not quantified (Parker et al., 2008; Guitart et al., 2012; Anderson et al., 2019). As a result, there is the need for the development of more evidence-based policies and regulations for urban farming (Mougeot, 2006; Cole et al., 2008; de Zeeuw et al., 2011). Exploring the abiotic environmental factors (e.g., droughts, excessive rainfall) that relate to urban agriculture warrants further attention considering the challenges associated with climate change, food insecurity, and limited resources (Wortman and Lovell, 2013; Graefe et al., 2019). Few studies have documented how urban agriculture is incorporated in urban policies that address climate change (Shaw, 2012; Clarke et al., 2018).

Despite the future research needs and priorities, some progress has been made as some cities worldwide are recognizing the importance of urban agriculture, and have developed evidence-based policies and initiated programs to promote sustainable urban agriculture (Campbell and Salus, 2003; Mougeot, 2006; de Zeeuw et al., 2011; Bisaga et al. 2019). Whilst linking research to policy, future research needs to evaluate policy measures around urban agriculture, especially their outcomes in relation to benefitting the urban poor or marginalized communities. Examining which urban agriculture practices cities should integrate considering its multidimensional impacts warrants further investigation (Pearson et al., 2010; Artman and Sartison, 2018). For example, some cities can promote organic farming as a sustainable practice and set it on their political agenda. This study of the barriers to urban agriculture in Louisville, KY, as expected, may help in providing insights and directions for stakeholders to collectively and holistically develop

meaningful and sustainable solutions that will benefit the Louisville community and beyond, especially the low-income residents in West Louisville.

Limitations of the study

The study has few limitations that need to be considered. First, the length of the study period (amount of time for the data collection and analyses) did not allow me to include the projected number (n = 100) of study participants and cover other events as planned at the beginning of the study. However, I was able to cover participants from almost every zip code in Louisville. Second, the sample size (n = 80) may not be representative of the overall population of the urban agriculture community in Louisville, KY, and did not include residents without knowledge about the subject matter in addition to the knowledgeable ones surveyed and interviewed. Since some of the study participants knew that they were to be interviewed about issues related to agriculture in Louisville, they could have self-selected depending on their individual experiences, knowledge, concerns, and interests on the subject matter. Third, the study is limited to Louisville, KY, which reduces the generalizability of the policy implications as to other cities.

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APPENDIX A: SURVEY QUESTIONNAIRES (LOUISVILLE GROWERS)

(F) 10/4/21

Questions for urban farmers in Louisville

1) What motivates you into urban agriculture, and how long have you been farming?
Its has been a In my family's culture farming is our way of life. I have been farming for 12.

2) Have you experienced any successes with urban agriculture?
Yes, My family is able to save money thanks to the farm and selling our crops allows us to pay our bills.

3) How have you, or other residents, benefitted from urban agriculture in Louisville?
farming has put fresh vegetable into my neighborhood changing plenty of diets and organic food pallets.

4) What sustainable farming practices or production techniques do you use on your farm/garden (e.g., organic farming, composting, nutrient applications, soil testing, crop rotation, record keeping of farm expenses or yields, etc.)? I use composting, crop rotation, record keeping, and etc

5) What is your source of water for irrigation (e.g., city water line or rainwater harvesting)?
water line

6) What resources do you use to make decisions about your farm/garden operations (e.g., extension agents, other farmers in the area, or others)? Are they cooperative and helpful?
Other farmers especially those in my community

7) Are there any initial or current challenges/barriers that makes it difficult for you to continue to practice urban farming? (e.g., costs to implement or sustain a farm, poor soil conditions, lack of knowledge, or access to land, water, markets, or other resources).
Definetly access to land

8) What do you think are the barriers (including regulatory barriers) to the expansion of urban agriculture in Louisville KY?

1 Access to land and tenure insecurity
2 Lack of financial resources/capital
6 Access to clean and abundant water
3 Restricted market access
4 Unfavorable urban policies (e.g., zoning)
7 Insufficient government or community support
5 Natural constraints (e.g., pests & diseases)
8 lack of farming skills / unsustainable practices
□ Other:_____

1

9)What efforts, if any, are being done to overcome these barriers? Are there any successes or failures? New legislations on urban Ag has definetly brought some efforts into selling restrictions and land access.

10) How can we collectively address these barriers?

All of the fight is through pettions and letters of concern to sent to the city

11) Do you think the political support is weak or strong for the expansion of urban agriculture in Louisville? recently is been pretty strong but it takes alot to get any listners

Demographic information

1. What is your age? (Choose one)

☑ 18 to 25 ☐ 26 to 35 ☐ 36 to 45 ☐ 46 to 55 ☐ 56 to 65 ☐ 65+

2. What is your gender? (Choose one) ☐ Female ☑ Male ☐ Other

3. Are you Hispanic, Latino, or Spanish origin? ☐ Yes ☑ No

4. What is your race or ethnicity? (Choose one)

☐ American Indian/Native American ☐ Asian
☐ Black/African American ☐ Native Hawaiian/Pacific Islander
☐ Mixed race or ethnicity (non-Hispanic) ☐ White/Caucasian
☑ Other: Somali Kenyan

5. What is the highest level of education that you have completed? (Choose one)

☐ No degree ☑ High school diploma ☐ Vocational training/trade school

☐ BA/BS ☐ Master ☐ Professional ☐ Doctorate

6. a) In what range was your annual household income for last year from all sources, before taxes? (Choose one)

☐ Less than $15,000 ☑ $15,000-24,999 ☐ $25,000-34,999
☐ $35,000-49,999 ☐ $50,000-74,999 ☐ $75,000 or more

b) Was any or all this income earned from urban farming?

about 20%

7. Which best describes your farming/gardening experience?

☐ Full-time Farmer ☑ Part-time Farmer ☐ Hobby/resident/life-non-commercial

8. a) What is your farm/garden size and location (zip code included)?

2.2 acres

b) Do you rent or own it?

rent

(C) 10-23-21
(19)

Questions for residents / consumers in Louisville

1) How have you, or other residents, benefitted from urban agriculture in Louisville?
Pre - Sustainable - Yes

2) Do you think the political support is weak or strong for the expansion of urban agriculture in Louisville? Mid - Engagement

3) There is clear evidence that the demand for local food in Louisville has been increasing, and many residents (especially in West Louisville) do not have access to fresh, affordable, and healthy local food. How important is this issue to you?
Very Important -

4) What challenges, if any, do you face in having access to locally grown food, or access to the markets? How can we collectively address this issue?
Distribution is still Corporate / Transportation /

5) What do you think are the barriers (including regulatory barriers) to the expansion of urban agriculture in Louisville KY? partnerships - Angel Investing / not taking Capital

4. □ Access to land and tenure insecurity 3. □ Lack of financial resources/capital

□ Access to clean and abundant water 2. □ Restricted market access

1. ☑ Unfavorable urban policies (e.g., zoning) 5. □ Insufficient government or community support

□ Natural constraints (e.g., pests & diseases) 6. □ lack of farming skills / unsustainable practices

□ Other:_____

6) What efforts, if any, are being done to overcome these barriers? Are there any successes or failures? Lou Co-op / Fresh Stop

7) How can we collectively address these barriers?
Consistency - Financial Support & Literacy

1

Demographic information

1. What is your age? (Choose one)
   □ 18 to 25 ☑ 26 to 35 □ 36 to 45 □ 46 to 55 □ 56 to 65 □ 65+

2. What is your gender? (Choose one) □ Female ☑ Male □ Other

3. Are you Hispanic, Latino, or Spanish origin? □ Yes ☑ No

4. What is your race or ethnicity? (Choose one)

   □ American Indian/Native American □ Asian
   ☑ Black/African American □ Native Hawaiian/Pacific Islander
   □ Mixed race or ethnicity (non-Hispanic) □ White/Caucasian
   □ Other: _____

5. What is the highest level of education that you have completed? (Choose one)

   □ No degree ☑ High school diploma □ Vocational training/trade school

   □ BA/BS □ Master ☑ Professional □ Doctorate

6. In what range was your annual household income for last year from all sources, before taxes? (Choose one)
   □ Less than $15,000 □ $15,000-24,999 ☑ $25,000-34,999
   □ $35,000-49,999 □ $50,000-74,999 □ $75,000 or more

APPENDIX B: INTERVIEW QUESTIONS

1) Can you give a brief description of your organization, including your history and objectives?

2)There is clear evidence that the demand for local food in Louisville has been increasing, and many residents (especially in West Louisville) do not have access to fresh, affordable, and healthy local food. How important is this issue to your organization or to local government?

3) What suggestions or strides have you made to address this issue, or how can our local government take the lead in addressing this issue?

4)What is your organization's role in effectively engaging and disseminating information, education, and resources to folks in food-insecure neighborhoods in Louisville? How can you sustain it?

5) What do you think are the key barriers (including regulatory barriers) to sustainable agriculture in Louisville? How can we collectively address these barriers?

7) What efforts, if any, are being done to overcome these barriers? Are there any successes or failures?

8) What challenges (funding, legal barriers, policies, community, or political support, etc.), if any, do you face in meeting your organization's objectives or overcoming these barriers?

9) Do you receive any external funding or support (e.g., grants, loans, technical advice, etc.)?

10) Growing more food in the city requires access to land. What role has Louisville Metro Government played in increasing access to land in and around the city? What role can be played in the near future?

11) What is the relationship or level of communication or collaboration between Louisville Metro Government and your organization or other stakeholders (including Louisville growers and consumers) in addressing the barriers to sustainable agriculture in Louisville?

12) Do you think Louisville Metro is making enough efforts to develop and enact a comprehensive food vision and plan, grounded in community solutions?

13) Do you think the community and/or political support is strong or weak for the expansion of urban agriculture in Louisville?

14) Jefferson County Cooperative Extension Service manages over ten community farms in Louisville and oversees over 30 acres of the county's land. Can you elaborate on your organization and its objectives, and the activities on the urban farms you manage, including participants, size of the farms, membership, fees, access to land/plots, water, and equipment/tools, level of communication, rules-in-use or governance structure, decision making, conflicts resolution, monitoring, enforcement, and external support, funding, or partnerships?

APPENDIX C: BARDSTOWN ROAD FARMERS' MARKET, INC RULES & GUIDELINES

The Bardstown Road Farmer's Market. Inc. (hereafter referred to as the "Market" or "BRFM") is a non-profit corporation registered in the Commonwealth of Kentucky. The BRFM is currently held in the parking lot of the Bardstown Road Presbyterian Church, located at

1722 Bardstown Road, Louisville, KY 40205-1262, from the first Saturday in April to the last Saturday in November. The market is open from 8:00 am – noon. The Winter Market opens on the first Saturday in December through the last Saturday in March from 10:00am to 12:00pm. The following guidelines apply to all Producer/Members and Vendors who participate in the

BRFM.

The goal of the Market is to provide an opportunity for agricultural producers to market high quality products directly to the consumer.

The term 'Vendor' is defined as anyone selling at the Market. They shall reside in Kentucky or southern Indiana south of Columbus, Indiana. Vendors fall into categories:

1. Member Membership is available to those farmers who own or operate property (farms) and produce regionally grown products, whether on a full or part-time basis. Membership entitles the producer member to vote and sell at all market days.

2. Associate Member does not own, manage, or operate property where regional products are grown but their products contribute to the diversity of the market. They are entitled to sell on all market days. At the discretion of the board, a maximum of 10 spaces may be reserved for associate members.

Dogs: With the exception of service dogs, no dogs are permitted in the market area during regular season market hours. The board may lift the dog prohibition, as conditions permit, during the Winter Market.

Musicians: Musicians must schedule each appearance at the market with the Market Manager. Vendors are not allowed to 'hire' or otherwise schedule their own musicians.

Distribution of political/religious information/literature by groups is restricted:
Only groups with broad market support will be allowed to distribute information and only after board approval. The board will review requests and make final decisions on which groups will be allowed to distribute information. Individual full members may distribute information, but only from their own booth. We agree that the Bardstown Road Presbyterian Church will be allowed to distribute literature regarding their church.

Farm products sold may include: vegetables, herbs, fruit, bedding plants, Christmas trees, cider, ornamental produce, meat cuts, eggs, honey, potted plants, cut flowers, plant arrangements, firewood, and other farm-based products. Products not listed must receive clearance from the Board of Directors before sale. No live animals may be sold at the market,

though vendors may use live animals for entertainment purposes if such display is cleared through the Board in advance, is possible without harm to the animals, and the vendor provides for the thorough cleaning of the parking space before departure.

Producer-members may resell certain items, but on any given day, resale items cannot exceed 20%, by volume, of the Members' product.

Items being resold must be labeled on a card provided by the market, with the name of the product, the farm where it was grown, and the location of that farm. Resale items must be purchased directly from a local producer, and must be produced within Kentucky or southern Indiana south of Columbus. The member should be able to produce a sales receipt for resale items upon request. Resale of items purchased through a local wholesale produce business is not acceptable. Associate members and Guest Vendors shall not resell items.

Non-compliance with the resale rule as determined by the Market Manager will result in loss of resale privileges for four (4) weeks. A second offense will result in loss of resale privileges for the rest of the season. In addition, noncompliant vendors will be subject to a mandatory inspection of their production area and/or facilities.

Vendors may resale value-added items. They must be locally produced items, and the main ingredient **must be locally produced.** They must first be approved by the Board before bringing to the market for sale. Value-added resale items are included in the allotted 20%.

A value-added product is defined as a raw product (plant or animal) grown by the farmer and modified, changed and/or enhanced in order to turn it into another product with a higher net worth.

The following value-added products may also be sold, assuming that Vendors have complied with all applicable state and local regulations; baked goods, canned goods, cheese, preserves, sorghum, maple syrup, cider, meats, dairy products and bottled products, dried flower arrangements, wreaths and wall swatches, braided garlic, painted gourds, dried herbs, sachets, soaps made from home-grown herbs.

Eggs being sold at the BRFM must come from flocks managed by a BRFM member and produced on the member's land. The land, whether leased, owned, or rented, must be under exclusive control of the member/producer of the BRFM.

Meat Sales at the Market:

- Meats are defined as: beef, pork, chicken or other fowl, lamb, goat, rabbit, bison, fish or shrimp, or any other meat product the board may deem an addition to the market's variety.
- Meat cuts shall be considered a raw, unprocessed farm product. Processed meat products (sausages, cured meats, patties, lard, etc.) will be considered value-added.

- All meats and livestock which have been produced or purchased by a member of the BRFM shall be on their farm and under their management for a minimum of half the animal's life. In the event the stock was purchased from another producer, BRFM may require the member to allow review of purchase records to verify dates. The land, whether leased, owned, or rented, must be under exclusive control of the member/producer of the BRFM

- All meat products (cuts and/or value added) must be slaughtered and processed following state or USDA guidelines in a state or USDA permitted facility. All meat products must have a "safe food handling" label on the package and be sold in the unaltered package it was placed in at the processing facility. Processing plant receipts may be requested for verification of production.
- Vendors selling meat, poultry, or seafood, must obtain a mobile retail permit from the county health department yearly, attach a copy of the permit to the annual market application, and abide by all other State and Federal laws regarding meat sales at Farmers' Markets.

Vendor Applications: To qualify as a Market Vendor, application accompanied by all supporting documents and fees must be made to the market treasurer by March 15th. New market vendors will be selected annually by a majority vote of the Board of Directors as space allows and will be subject to a one season probationary period. At the end of the probation period the board may accept or reject the new member based on adherence to market rules, product quality, and fit for the market. Vendors are individually responsible to pay state taxes, local sales taxes, business fees (as applicable) and any other applicable fees, and pay membership fees by the stated deadline. New member applications are accepted throughout the year and will be reviewed for membership as spaces become available.

Only those items listed on the vendor application may be sold. A confirmation letter will be mailed to each vendor after acceptance of the application. Vendors must notify the Market in writing of any proposed changes before bringing previously unlisted items to the Market.

Vendor Fees: An annual membership fee of $400.00 for the season will be collected from each Member and Associate Member. Fees may be paid in one lump sum, or paid in two installments over the season as follows:

- Deposit of $200.00 ($400.00 for double space vendor)
- Balance of $200.00 ($400.00 for double space vendor)

Fees are due on March 15th or upon application. Vendors must be current on payments prior to setting up and selling at the market. The board may make fee adjustments in order to accommodate guest and other temporary or seasonal vendors.

Vendor Space: Membership entitles each Vendor to one (1) parking space in the parking lot. Booth space is non-transferable to anyone other than a co-owner or legal partner. A parking space may not be shared with another vendor. The Board President or the Membership Committee will be responsible for assigning spaces, with final approval by the Board. Priority on

space assignments will be based on seniority and attendance at the market. Associate members are allowed one space.

Each Vendor is responsible for staying within his/her allotted space, keeping it attractive and clean during and after the Market, and cleaning up and removing trash at the end of the Market. A farm sign and product prices shall be prominently displayed within the space, and necessary permits and licenses will be available upon request. A Vendor shall be in his/her space 30 minutes before the beginning of the Market and shall remain until the Market closes at 12:00pm. Vendors arriving late may carry their products to their spaces. All Vendors should normally inform the Market Manager by Thursday if they are unable to attend the Saturday Market. All emergency absences should be reported at once to the Market Manager. From April through November no vehicles will be allowed to drive into the lot after 7:30am. All offloading within the lot must be done before 7:15.

Vehicles used by the vendor for the sale of produce and other farm-based items shall fit within the confines of a single parking space. Those deemed too long or large for the market will be prohibited. Trailers and other attached means of conveyance should not extend beyond the length of the parking space. Due to limited parking space on the church parking lot, vehicles associated with market vendors or their employees and not being used for sale of produce or other farm-based products must be parked off the church parking lot or at least 1 block away from the market area. The preferred space for Vendor parking is across Bardstown Road in the Baptist Church parking lot next to the firehouse.

A Producer-Member may apply to the Board for a second space. A second space may be purchased only if the member attended the market a minimum of 32 market days out of the 38 week regular market season from the first Saturday in April till the last Saturday before Christmas. A second space must be applied for on the application form due March 1st and must be paid for, in full, by March 15th. There are a maximum of 10 double spaces available to the market in the current season.

Each Vendor is responsible for policing trash and litter surrounding his or her own space. At the request of the host church, no items of straw, hay, corn shocks or similar items will be permitted on the premises either for display or sale.

Trash and Recyclables: the BRFM Market Manager is the only person authorized to place trash or recyclables in the containers placed in the alley. Others may enter the alley with trash/recyclables only if requested by the Market Manager to help with trash disposal.

Each BRFM member is responsible for their booth helpers and employees. They must be certain all employees understand this policy.

Larger items or large quantities of items generated as a result of market activities (cardboard boxes, plastic jugs or bottles, bags of trash, etc...) are the vendors responsibility. These items should be taken with the vendor when leaving the market and disposed of using the vendors' disposal system. Please do not use trash cans on city streets, or trash dumpsters located in other neighborhood alleys or lots.

Inspections: farm inspections for any vendor may occur without notice any time during a market season. The Vendor agrees to provide all necessary information for a BRFM inspection on their farm or production location. New members will be required to pay for their initial farm inspection upon acceptance as a market member.

A mandatory one (1) time inspection will be done on each Member and Associate Member's property by an individual(s) appointed by the Board. Thereafter, any Vendor may be inspected randomly when a Member sells products he or she has not listed on application or previously offered for sale or upon request by any Member or Members. Enforcement of the "locally grown" policy covering all market vendors will result in an announced on-site visit to the farm in question by the member who raised the issue, one other board member, and another person appointed by the board. All new vendors will be subject to an inspection and will pay a one-time $75 inspection fee to defer expenses. A new vendor's membership will be conditional pending a satisfactory inspection and may be cancelled without refund of fees.

Regarding **certifications and permits,** Vendors must:

- Comply with all applicable local, state, and federal regulations
- Submit copies of all applicable certification and permits (commercial kitchen and/or food handlers permits, sampling permit, organic certification, etc) with their Vendor Application to the Market Treasurer.

Anyone selling items without proper paperwork will be asked to remove those items from their display and cannot sell them until they provide the paperwork. There will be no exceptions.

Information on approval seal on weighing devices, pesticide applicators permits, organic certification on claimed products, and any other food safety, sanitation, health permits and labeling as required for value-added products is available upon request to the market manager.

House Bill 391, passed in March 2003, allows home processed foods to be sold at farmers' markets, certified roadside stands or straight from the processor's farm. As long as a member abides by the rules and regulations of HB 391 and has provided the market treasurer with a current copy of their permit for home based processors or microprocessors they are allowed to sell their products at the Bardstown Road Farmers' Market.

Committees: A list of Committees and Committee members will be included with the membership directory. All members are encouraged and invited to participate on committees.

Pricing: Prices should be based on the cost of production and reflect the quality and freshness of the product. Vendors are asked to be fair and equitable in their pricing.

Grievances: Grievances for any Market matter should be submitted in writing on provided grievance form to the Market Manager or any Board Member. The Board will respond to the grievance within one week.

Termination of Membership: The Board of Directors may, at any time, recommend to the membership the cancellation of membership of any member. The membership may, at any time, by two-thirds (2/3) vote, of members present at a special meeting cancel any Membership or refuse Membership to any person, when, in their judgment, the Market's welfare justifies such action. If Membership is terminated, the Member may file a written appeal with the market manager within 14 days from the receipt of the termination notice. The Board of Directors and a committee of 3 appointed by the Board shall hear the appeal within 14 days of the receipt of the written appeal. If termination is reversed by a two-thirds (2/3) vote of board and committee, the Member's agreement and vending rights shall be restored immediately. Any Member may withdraw from Membership by written notice to the secretary. A Member who withdraws shall not be entitled to any share or part of the association's assets, property, or may not have dues rebated.

Member and Board Meetings are open to all members and associate members who have the right to attend, request copies of minutes and financial reports. Members and associate members shall not distribute such information to non-members.

A **Market Manager** is employed by the Market and answerable directly to the Board President. Market Manager duties include: being point of contact for Market Vendors; collecting data and fees and other duties as prescribed by the Board; administration of Market rules and guidelines; receiving of written grievances and handling of disputes; inspection of labels and posted price lists; and seeing that vendors maintain the physical area of the BRFM in good condition before, during, and after the market. The Manager arrives an hour before the market begins, directs Vendor to their spaces, sets up Market table and materials, and leaves after Market is over and area clean.

Producer/Member conduct: All comments and complaints must be presented in writing to the Market Manager or a Director. These written grievances must be signed by the Vendor and contain an address and telephone number. A grievance will not be handled during business hours. Every Vendor and/or their representative shall at all times be courteous and civil to each other, the public, and the media. No vendor shall, during market hours: discuss BRFM business or policies; interfere with another vendor's rights to conduct business, cause a disturbance, or behave discourteously. Any vendor who behaves in such a way during market hours will, by a decision of the Board, be suspended for a minimum of one week from market attendance. No vendor shall engage in making caustic or anonymous e-mails and telephone calls/messages concerning BRFM or its individual vendors or representatives. No vendor shall represent the BRFM to the public without the permission of the Board of Directors. Consumption of alcoholic beverages, or intoxication is also prohibited in the market. Smoking is not allowed in the Market area. The market manager shall ask any vendor to desist immediately from any inappropriate

behavior or infraction of its Guidelines or By-laws. The Vendor's failure to comply at once shall be the cause of immediate expulsion from the Market and possible termination of membership or participation. The BRFM is relieved and held harmless by the Producer Member from any legal action or loss damage caused by such removal.

LDC Reform Project
Text Amendment Report

Case Number:	21-LDC-0003
Text Amendment:	Urban Agriculture
Timeline:	6-month
Project Manager(s):	Jay Luckett
LDC Reform Group(s):	LDC Simplification and Environmental Justice

DESCRIPTION:

An amendment to Chapter 4, Part 3 to reduce barriers for community gardens, market gardens and other agricultural uses not regulated by KRS.

PLAN 2040 REVIEW

Community Form Goal 1.26: Review Land Development Code to ensure flexibility for use of urban agriculture to promote access to fresh food especially in areas known as food deserts as identified by the Louisville Metro Health Equity Report.

Community Facilities Goal 2.14: Encourage the use of vacant lots as small parks and community gardens.

Livability Goal 2.7: Address issue of food deserts. Develop policies and programs that encourage full service grocery stores to locate in identified food deserts and support innovative efforts to provide access to fresh food, such as: urban agriculture, community gardens and farmers' markets. Encourage communities to use vacant lots for gardens to enhance access to fresh foods.

EQUITY REVIEW

Reducing barriers to the establishment of community gardens, market gardens and other urban-scale agricultural sites may help increase accessibility of fresh food options within the community.

BEST PRACTICE RESEARCH:

The 2011 book *Urban Agriculture: Growing Healthy, Sustainable Places*, by Kimberly Hodgson details the value, challenges, and planning implications for urban agriculture. Among other conclusions, she writes "Urban agriculture, due to its social, economic, and environmental benefits, should be considered part of a dynamic urban system that is understood by planners and influenced through the mechanics of planning practice." It is recommended that cities facilitate and allow urban agriculture in the form of community gardens, market gardens and other means. The proposed changes would remove existing barriers to allow for the easier establishment of these uses within Louisville Metro.

The US Department of Agriculture *Urban Agriculture Toolkit* states "Small community gardens, urban farms that span several city blocks, and intensive indoor hydroponic or aquaculture facilities are all examples of urban agriculture. This fast-growing phenomenon has the potential to nourish the health and social fabric of communities and create economic opportunities for farmers and neighborhoods."

Policylink, a public policy research institution, published a report in 2012 entitled *Growing Urban Agriculture: Equitable Strategies and Policies for Improving Access to Healthy Food and Revitalizing Communities.* The report details ways in which urban agriculture may help improve equitable access to fresh and healthy food. A key recommendation for public agencies is to "include urban agriculture friendly policies in general plans and adopt urban agriculture-friendly zoning policies." Which can help reduce barriers of entry to citizens who wish to establish agricultural uses with an urban context.

PROPOSED TEXT AMENDMENT:

The following use definition is to be added to the Land Development Code:

Urban Agriculture – Agricultural activities that are not otherwise permitted and regulated by KRS. This may include any size tract of land, in any form district.

The following section is to be added to the definition of "Conservation Use:"

G. Restorative Agriculture practices such as permaculture, areas with perennial crops, orchards, native plants, and pollinator gardens

Section 4.3.17 Community Gardens is deleted and replaced with the following new section 4.3.17 Urban Agriculture:

Urban Agriculture may be permitted as a use with special standards within all zoning districts in conformance with the following special standards.

A. No activities shall take place within a required stream buffer of a perennial stream or wetland as specified in Chapter 4, Part 8.

B. Lighting for security purposes may be provided in accordance with the standards contained in this Code.

C. Composting shall be limited to plant materials generated on the site as well as materials such as plant-based food waste, wood chips, pre-composted materials or soil brought onto the site to enhance these plant materials. Compost may only be generated for use on site. Compost piles shall be set back in accordance with the form district regulations for structures and shall be surrounded with a fence or other appropriate enclosure to prevent migration of compost materials due to wind, slope, or water-based erosion.

D. Water for purposes of maintaining the garden and for dust suppression shall be available on the site, either in the form of a water collection system or an on-site or off- site connection to the municipal water service.

E. There shall be no more than one non-illuminated freestanding sign not to exceed 12 square feet in area and not to exceed 6 feet in height. The sign may be up to 24 square feet in area and 8 feet in height if setback beyond the minimum front yard setback.

F. Greenhouses, hoophouses, cold frames, chicken coops, garden sheds, washing/packing structures, rainwater storage systems, aquaculture areas, seasonal farm stands or similar structures shall be permitted. Structures greater than 200 SF must be setback at least 5' from any adjacent residentially zoned or used property, but shall otherwise be exempt from building setbacks except as necessary to meet sight triangle requirements as determined by Public Works.

G. Agriculture involving animals shall be permitted only in conformance with applicable state law and local ordinances including but not limited to those related to the keeping of animals and noise. Slaughtering and processing of animals is permitted for personal use only subject to applicable local, state, and federal law. Sale of live animals is permitted subject to local, state, and federal law.

H. Sites shall be operated so as not to create a nuisance condition for adjacent properties due to vibration or odor. Dust and noise shall be managed consistent with state law and local ordinance, and visible fugitive dust crossing property lines shall be corrected by sprinkling with water. The premises shall be kept free of debris at all times.

I. Selling agricultural goods produced on the site is permitted as an accessory use. Sales may only take place between 7 AM and 10 PM.

Section 4.3.18 Market Gardens is deleted and replaced with the following new section 4.3.18 Farmers Markets, fruit and vegetable stands and similar uses:
Farmers Markets, fruit and vegetable stands, and similar uses may be permitted as a use with special standards within all zoning districts in conformance with the following special standards.

A. No outdoor sales, storage or display areas shall be located in the sight distance triangle as defined in Chapter 5 Part 1 of the Land Development Code or located in

any manner that would restrict or limit adequate sight distances for interior vehicular traffic movement as determined by the Works Department.

B. All parking areas shall be a hard and durable surface. Any new permanent parking areas shall be screened and buffered per Chapter 10, Part 2.

C. Applications for farmers markets, fruit and vegetable stands and similar uses must be submitted with the Planning Director or Designee to document compliance with the above listed standards. Notice of the proposed market garden shall be provided to 1st tier property owners and persons and groups that have registered with Planning and Design Services to receive notices of development actions. The notice shall be sent by first class mail not less than fourteen (14) calendar days prior to the date of final action by the Planning Director or designee. The operator(s) and property owner should consider any comments and feedback received and make any reasonable and permitted change to the operations and/or the site.

CURRICULUM VITAE

Sait Sarr 6314 Cottage Field Circle, Louisville, KY 40218 □ 502-295-3516
sait.sarr@louisville.edu

Education

University of Louisville **Louisville, KY**

- *PhD. Urban & Public Affairs* May 2022
  Dissertation: *Barriers and opportunities to sustainable urban agriculture: The case of Louisville, Kentucky*

Kentucky State University **Frankfort, KY**

- *MSc.* (*Environmental Studies*) *and MBA* (*Management*) May 2018
  GPA 3.8
- *BSc. Agriculture, Food & Environment with a Minor in Business* May 2015
  GPA 3.6

Jefferson Community and Technical College **Louisville, KY**

- *Associate of Arts* May 2012
  GPA: 3.7

Summary of Skills

- Communicate effectively with students, professors, and co-workers.
- Collaborator who excels in building trusting relationships with individuals.
- Motivated initiative-taker who takes initiative with minimal supervision.
- Experience dealing with and handling customer complaints.
- Proficient in Microsoft Word, Excel, PowerPoint, and knowledge of applications. Ability to plan, organize, and prioritize work.

Experience

University of Louisville **Louisville, KY**
Graduate Research Assistant 08/18 – Present

- Assist Faculty and Students in conducting research & publications.
- Participate in research and learning projects.
- Engage in mentoring undergraduate students and peer-mentorship.

Kentucky State University **Frankfort, KY**
Graduate Research Assistant 08/15 - 07/18

- Assist Faculty and Students in conducting scientific research & publications.
- Engage in mentoring incoming students and peer-mentorship.
- Engage in career enhancement activities and professional society meetings.

Kentucky State University **Frankfort, KY**
Research Assistant 08/13 - 07/2015

- Assisted Faculty and College of Agriculture staffs in writing reports on status of research activities.
- Participated in data collection, entry, analysis, and management for related projects.
- Participated in developing research and evaluation surveys.

Applebees Whitmart Inc. **Louisville, KY**
Supervisor/Trainer 02/2010 - 07/2013

- Trained over ten crew members and new hires on their daily performance.
- Assisted management with decisions regarding number of staff needed.
- Participated with management in achieving goals and targets which included reducing labor dollars spent on production and food cost control.
- Evaluated employee's performance ratings for promotion.

Professional Affiliations, Certificates, and Awards

- President, KFTC (Kentuckians For The Commonwealth) KSU chapter.
- Member of American Society of Agronomy.
- Member of Phi Theta Kappa.
- Member of KAMP (Kentucky Association of Mapping Professionals).
- Member of Green Society at Kentucky State University.
- Head of Climate Change Committee at MANRRS, Kentucky State University.
- Dean's List- fall 2013, spring 2014, fall 2014 & spring 2015, KSU.
- Recipient of the Alden Scholarship from the Community Foundation of Louisville.
- Recipient of the Jefferson Jubilee scholarship for the academic year 2012/2013.
- Recipient of the African American Students of Excellence Award, JCTC.
- Recipient of the Presidential scholarship, Kentucky State University.
- Certificate in General Business (Real Estate Business), JCTC.
- Certificate of Merit for high distinction in academic achievement, JCTC.
- Certificate of Leadership for Sustainability, Smart Growth (online).
- Certificate of recognition and Citation of achievement for academic research work from the Commonwealth of KY House of Representatives and Senators.

Presentations and Publications

- Kentucky Academy of Science "*Analysis of barriers of participation in cost-share programs of Kentucky*" [11/15/2014]. Lexington, KY. http://ageconsearch.umn.edu/record/196992?ln=en [Published 01/2015].
- KSU Environmental group "*The role of GIS (Geographic Information System) in the healthcare Industry of Kentucky*" [12/9/2014]. Frankfort, KY.
- SAEA Annual Conference "*Cost-share programs in the State of KY*" [02/02/2015]. Atlanta, GA.
- Posters at the Capitol "*The causes & effects of Global warming*" [02/15/2015]. Frankfort, KY.
- ASA, CSSA, & SSSA International Annual Meetings *"Interactive Effects of Animal Manure and Cover Crop Use in Improving Agricultural Soil Quality in Kentucky*" [10/24/2017]. Tampa, FL.
- Energy-Water-Food Nexus International Summit "*Rubbertown Pollution Management in West Louisville, Kentucky"* [04/11/22] Tallahassee, FL.
- Sarr, S., Gebremedhin, M., Coyne, M., Topè, A., and Sistani, K. 2019. *Do Conservation Practices Bring Quick Changes to Key Soil Properties for Resource-Limited Farmers?* Journal of the Kentucky Academy of Science, 80(1): 6-16.
  URL: https://doi.org/10.3101/1098-7096-80.1.6.
- Sarr, S., Gebremedhin, M., Coyne, M., Topè, A., and Patel, S. 2020. *Cover Crop and Fertility Effects on Escherichia coli Abundance in a Composted Poultry Litter-Amended Silt Loam Soil.* Applied and Environmental Soil Science, vol. 2020, Article ID 4564289, 6 pages. https://doi.org/10.1155/2020/4564289.
- Gebremedhin, M., Sarr, S., Coyne, M., Freytag, A., and Sistani, K. 2020. *Does potentially mineralizable nitrogen predict maize yield in newly cropped soil?* Agrosystems, Geosciences & Environment, 3 (1): e20023. https://doi.org/10.1002/agg2.20023.
- Gebremedhin, M.; Sarr, S.; Coyne, M.; Sistani, K.R.; Simmons, J. *The Combined Influence of Cover Crops and Manure on Maize and Soybean Yield in a Kentucky Silt Loam Soil*. Sustainability 2019, 11, 6058. https://doi.org/10.3390/su11216058.
- Gilderbloom, J., Sarr, S., Washington, C.B., Quenichet, K., Manella, C., Dwenger, C., Slaten, E., Altaf, S., and Frederick, C. 2019. *What Cities are the Most Dangerous to Your Health? Ranking the Most Polluted Mid-Size Cities in the United States.* The Lancet. http://dx.doi.org/10.2139/ssrn.3506217.
- Sarr, S., Hayes, B., and DeCaro, D. 2021. *Applying Ostrom's Institutional Analysis and Development Framework, and Design Principles for Co-production to Rubbertown Pollution Management in West Louisville, Kentucky*. Land Use Policy, 104, 105383.
- Whittinghill L., and Sarr, S. 2021. *Practices and Barriers to Sustainable Urban Agriculture: A Case Study of Louisville, Kentucky*. Urban Science, 5(4):92. https://doi.org/10.3390/urbansci5040092.

Volunteer Work

- Habit for Humanity of Metro Louisville- revitalizing low-income neighborhoods [4/10/19].
- Feed the City of Louisville- feeding needy families in Louisville [01/2012].
- St. Joe's picnic- raising funds to support the orphans in Louisville [08/2017].
- YMCA Summer Activities- working with kids and families to develop their sports skills. [04/2018].

References

- Dr. Margath Walker
  Associate Professor and PhD Program Director,
  Department of Urban & Public Affairs,
  University of Louisville, Louisville, KY 40208.
  Tel: (502)852-7955 E-mail: aaron.rollins@louisville.edu
- Dr. Mark Coyne
  Director of Graduate Studies and Professor,
  Department of Plant and Soil Sciences,
  University of Kentucky, Lexington, KY 40546.
  Tel: (859) 257-4202 E-mail: mark.coyne@uky.edu
- Dr. Buddhi Gyawali
  Associate Professor of Geospatial Applications, Human Dimensions,
  and Climate Change Studies,
  College of Agriculture, Communities, and the Environment,
  Kentucky State University, Frankfort, KY 40601.
  Tel: (502) 597-5029 E-mail: gyawali.buddhi@kysu.edu
- Dr. Maheteme Gebremedhin
  Associate Professor, Soil science & Biometeorology,
  College of Agriculture, Communities, and the Environment,
  Kentucky State University, Frankfort, KY 40601.
  Tel: (502) 597-6830 E-mail: Maheteme.Gebremedhin@kysu.edu
- Dr. Abdul Turay
  Professor; Interim Dean, College of Business and Computational Sciences,
  College of Business and Computational Science,
  Kentucky State University, Frankfort, KY 40601.
  Tel: (502) 597-6916 E-mail: abdul.turay@kysu.edu
- Dr. Karamat R Sistani
  Research Leader,
  Food Animal Environmental Systems Research,
  USDA-ARS, Bowling Green, KY 42101.
  Tel: (270) 781-2260 ext. 222 E-mail: karamat.sistani@usda.gov