



# Reflecting on the Potential and Limitations of Urban Agriculture as an Urban Greening Tool in South Africa

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Urban green spaces have been researched extensively for their contribution toward livable, sustainable and resilient cities. Studies illustrate increasing awareness of the multi-functional roles such spaces can fulfill in addressing urbanization pressures and associated impacts such as increasing stress on global food systems, notably by accommodating practices of urban agriculture (UA). This paper investigates the potential for UA in South Africa as a citizen-led urban greening strategy, considering potential and limitations for the increased application of UA in spatial planning. The paper provides a review of core concepts and illustrates potential and certain limitations *via* UA cases studies in two leading South African provinces and a review of the national policy and legislative framework pertaining to UA. Findings highlight particular issues for consideration to augment the implementation of UA in South Africa, including opportunities to draw on existing citizen-led initiatives and increasing awareness of UA among communities, authorities, non-governmental organizations, and the private sector; the potential to utilize skilled and knowledgeable rural migrants; and possibilities to capitalize on a growing market for UA related opportunities to stimulate economic growth and employment creation whilst addressing food security concerns. Limitations highlighted in the paper, include many current UA initiatives not being self-sustaining and fully citizen-driven, requiring constant support and resources from multiple stakeholders; a cultural stigma attached to UA activities, hampering more uptake, especially among the youth; limited national support as no dedicated national policy on UA exists to direct the spatial planning community; and lastly, that South African spatial planners exhibit limited knowledge of UA and green infrastructure in general. The paper concludes with broad recommendations for the international planning community to advance the implementation of UA as a citizen-led urban greening strategy, drawing on the South African experience.

**Keywords:** urban agriculture, urban greening, South Africa, policy implications, citizen-led, community opportunities

## INTRODUCTION

Urban green spaces are widely revered in the literature for their contribution toward livable, sustainable and resilient cities, referring to amongst others, the relationship between urban livability and urban green spaces (Caspersen et al., 2006), as well as related benefits. In this way, sustainability thinking has evolved to include broader environmental concepts including inter alia, urban greening, green infrastructure planning, nature-based solutions, and eco-engineering approaches. The inclusion of these environmental concepts as part of mainstream spatial planning approaches has been proven to increase the sustainability and resilience of cities (Colding, 2007; Cilliers et al., 2011; Ahern et al., 2014). Environmental considerations are now an integral part of international spatial planning approaches and decision-making, supported by the expanded scientific understanding that urban green spaces are substantially beneficial to urban communities and cities (Anderson and Elmqvist, 2012; Cilliers, 2020) and as a result more cities across the globe are exploring urban greening initiatives (Thomas and Littlewood, 2010; Llausàs and Roe, 2012). This is not a simple task as authorities and decision-makers, especially in developing countries, often consider environmental aspects as a “luxury,” deserving attention and budgetary resources only when more pressing socio-economic needs have been satisfied (Cilliers and Cilliers, 2016a). The constant conflict between land uses, conservation, and development pressure (Cilliers et al., 2014) accentuate such perceptions regarding the value of green spaces, as urban areas and associated land uses (residential, commercial, industrial, etc.) are often prioritized because of the monetary value reflected in property prices, revenue from developments, higher taxes, and increased property prices (Cilliers and Cilliers, 2016b). In contrast, green spaces are often perceived as having little or no monetary value (Cilliers and Timmermans, 2014), and are only considered as visual attributes and not necessities, especially in developing regions such as sub-Saharan Africa (Du Toit et al., 2018) and its varied contexts, including South Africa (Cilliers, 2020; Combrinck et al., 2020).

The lack of value assigned to green spaces are argued to be part of the reason why green spaces are vulnerable to land-use changes. Despite the challenges facing urban green spaces, there is an increasing understanding that these spaces are crucial for urban living and quality of life, even more so in the contemporary urban environment where increasing urbanization and concerns related to food security are aggregated (Battersby and Haysom, 2019). The definition of food security, as given by the Food and Agricultural Organization of the United Nations (FAO), implies that food security encompasses elements of availability, access, utilization, and stability, referred to as the four pillars of food security (Battersby and Haysom, 2019). The food security debate has increasingly referred to the urban dimension, as the majority of the world's population now lives in cities (Sonnino, 2014), and urbanized poverty and hunger are on the increase (Morgan, 2009). Certain cities now realize that green spaces hold the potential to be multifunctional—serving as recreational spaces and providing various other ecosystem services to the city and its communities (Pauleit et al., 2011), including the potential to feed

the growing urban population. In recent years' contemporary social, economic and ecological challenges have peaked interest in the agricultural sector and the multifunctional outputs and externalities it can generate in response to food security and production within cities (Haysom, 2009; Polling et al., 2016).

Whilst some scholars caution that there has been limited evidence of the effect of UA on food and nutrition security (Frayne et al., 2014) and that the scope for UA may be curtailed by the wide variation in ability among urban farmers (Van Averbek and Mohammed, 2006) and the fact that smallholders in general are not as productive as large commercial farmers (Baiphethi and Jacobs, 2009), others are less pessimistic. UA has the potential to reduce food loss and waste within the post-harvest phase of the food distribution chain, which accounts for more than half of all wasted food in Sub-Saharan Africa. Thus, UA could contribute toward an increased fulfillment of local food demands (Egal et al., 2003; Warren et al., 2015). As such, noting that urban agriculture extends far beyond the remit of food production in urban areas (Lohrberg, 2016) and can even support high levels of biodiversity (Lin and Egerer, 2017), and presents the potential to increase the supply of fresh food to cities, support decent livelihoods, reduce waste, and create employment opportunities (De Zeeuw et al., 2007). In this sense, UA can contribute to social cohesion and inclusion and to climate change adaptation (Dubbeling et al., 2010). It is the attainment of these goals that currently drive the urban agricultural discourse (Malan, 2015). While UA addresses innovative approaches to food production in cities, it simultaneously addresses the objectives of urban greening under the broader umbrella of sustainable development as part of green infrastructure networks to present nature-based solutions (Bell et al., 2016). A systematic insight is however required into UA characteristics, in order to uncover its actual performance and the sector's promise for policymakers, planners, economists, farmers, and citizens (Vejre and Simon-Rojo, 2016). This paper considered UA specifically in reference to the five issues of (a) food security, (b) social development, (c) economic development, (d) environmental development, and (e) broader sustainable development objectives. Accordingly, the aim of this paper is to reflect on UA as an urban greening tool, based on these five issues and the link between UA practices and citizen-led urban greening activities. The paper also reflects on the application of such citizen-based approaches from a South African perspective, to identify the opportunities, but also challenges, of introducing UA as an urban greening tool.

## METHODOLOGY

In reflection on UA as a potential urban greening tool, a thematic literature review was conducted to explore the interface between UA practices and citizen-led urban greening activities. As these UA systems and practices are often diverse in terms of scope and scale, the literature review also explored the descriptions and applications within the spatial fabric. Accordingly, the empirical investigation considered UA from a spatial perspective, as applied in the South African context, based on the issues of (a) food security, (b) social development, (c) economic development,

(d) environmental development, and (e) broader sustainable development objectives. The empirical investigation consisted of two parts. The first part focused on selected case studies to identify the potential of UA within the local context, drawing on citizen-led approaches, while the second part entailed a policy evaluation to highlight the potential challenges pertaining to the realization and broader application of UA in South Africa.

## Case Study Analysis

The first part of the empirical investigation included a case study analysis focused on purposefully selected case studies of leading South African UA practices. These case studies were identified from limited existing South African examples based on their general prevalence in popular and scientific literature and the community interest these cases attracted over a period of time. Case study analysis is a popular approach employed in planning literature (AAPS, 2010, p. 5) where the aim is to understand more complex phenomena (Moore et al., 2012) and to evaluate different cases from different locations to highlight a series of instances of the same phenomenon occurring within different conditions (Swanborn, 2010). Accordingly, case studies in Cape Town (Western Cape Province) and Johannesburg (Gauteng Province) were identified as leading South African examples, chosen based on metropolitan location within South Africa, as well as the geographical diversity between these cases. While other potential cases were identified in other large cities, including Pretoria (Van Averbek, 2007) and Durban (Magidimisha et al., 2013) and in smaller towns (Thornton, 2008), the Cape Town and Johannesburg cases selected for further analysis met the selection criteria most satisfactorily. Multiple individual cases in Cape Town and Johannesburg were included to represent an overview of local trends, existing successes, lessons, opportunities, and challenges. The case studies were analyzed in terms of food security, social development, economic-development, and evident sustainability opportunities, with the objective to illustrate the link between UA practices and citizen-led urban greening activities.

## Policy and Legislative Analysis

The second part of the empirical analysis considered a spectrum of South African policies and frameworks at national level to identify support or shortcomings pertaining to the formalization of UA as a spatial consideration and urban greening tool. Policies and frameworks included in this paper were identified based on a literature review and textual analysis in relation to (a) food security, (b) social development, (c) economic development, (d) environmental development, and (e) broader sustainable development objectives. As a result, two legislative documents were included namely the National Environment Management Act (DEA, 1998), and the Spatial Land Use Management Act (DRDLR, 2013), along with five policy documents including the National Policy on Food and Nutrition Security (DAFF, 2013), the Policy on Agriculture in Sustainable Development (DAFF, n.d.), the Integrated Agricultural Development Finance Policy Framework (IADFP) for Smallholder Farmers (DAFF, 2015), the Integrated Urban Development Framework (COGTA, 2016), and the White paper on Agriculture (Department of Agriculture,

1995). A comprehensive screening of these documents was completed in order to identify whether, and to what extent, each document mentions or enforces UA directly, or provides support toward the realization of UA practices. Support in this sense includes the contribution to sustainable urban development; community development; environmental focus or protection; economic development; food provision and security. According to the level of support provided, a scale of 0–3 was used as part of a self-evaluation conducted by the authors, to subjectively evaluate the level of support for UA provided by each respective policy and legislative document. A score of zero indicated very weak support, one indicated weak support but meeting more than one criteria, two indicated medium support for example where UA was set as a policy lever and three indicated strong support for example where UA was set as policy priority. The aim was to broadly identify, the support given to UA practices from a national perspective and spatial planning context.

## Synthesis

The synthesis drew conclusions in terms of the potential and limitations of the implementation of UA as an urban greening tool, as evident from the South African case studies, as well as the policy and legislative framework presented. The interface between citizen-led UA practices and broader urban greening approaches were highlighted. The paper also identified the global relevance of this research when considering the implementation of UA as an urban greening tool. The paper concluded with a framework for employment of UA as citizen-led urban greening tool in South Africa, in an attempt to guide the successful implementation of UA practices as part of mainstream urban planning.

## URBAN AGRICULTURE (UA) PRACTICES AND THE LINK WITH CITIZEN-LED URBAN GREENING ACTIVITIES

Agricultural activities have been a part of urban life since the earliest cities were recorded. In pre-industrial cities, citizens kept domestic animals and maintained small farms or gardens. Larger farms were mostly responsible for food supplies in closed nutrient cycles in peri-urban agriculture. With the Industrial Revolution came garden cities and allotment gardens, providing urbanites with opportunities to cultivate and produce food independently (Vejre et al., 2016). There has ever since been continued concern for the ability of the global agricultural system to meet the demands of an escalating world population, projected to reach nine billion by the middle of the twenty-first century, despite increases in food production (Hertel, 2012; Pretty, 2012). Notwithstanding broad recognition of UA's potential to support supplemental food supplies, nutritional values, advance environmental protection and quality, community economic development, poverty reduction, community capacity building, social inclusion and participatory decision-making, a generally agreed upon definition of the concept has not been established. UA is multifaceted and finds a footing in multiple disciplinary fields, including the remits of agriculture, the built and natural

environment, social and economic studies and sustainability, and resilience studies. UA practices also assume different forms (Dimitri et al., 2016) and are developed and employed in diverse locations, within multiple cultures and socio-economic conditions (Malan, 2015). The United Nations Food and Agriculture Organization (FAO World Bank, 2008) defined UA as “an industry located within cities (intra-urban) or on the fringe (peri-urban) of a town, city, or metropolis; which grows and raises, processes and distributes a diversity of agricultural products; using largely human, land and water resources, products and services found in or around that urban area,” whilst serving a variety of social, environmental, economic, nutritional, and recreational needs (UAWG, 2013).

Vejre (2012) stated that varied definitions of UA have been constructed relating to spatial, functional, market, and other dimensions, but most research refers to food production in and around cities, weaving this practice into the urban form, to support the host city’s and related energy metabolism (Koc et al., 1999). Referring to several other studies Lin and Egerer (2017) highlighted the fact that UA does not only include vegetable cultivation but also several products from livestock (e.g., eggs, milk, meat, wool) as well as the cultivation of fruit trees, mushrooms, spices and medicinal plants.

Various parameters have been used to categorize UA systems and practices. These include delineations according to location, for example being ground-based or building integrated; and conditioning in management of and interface with natural elements, for example temperature and humidity control (Goldstein et al., 2014). More commonly, classification occurs on the basis of agricultural type, including inter alia horticulture, home garden, rooftop, aquaculture; and/or scale of activity, including subsistence farming, household, capital-intensive scales and others. It is also fitting to recognize the intention of an UA activity, for example becoming a community center or productive growing space (UAWG, 2013). In demonstration of the diversity of UA systems and practices in scope and scale, **Table 1** is provided. It must be mentioned that many UA systems and practices can fit into more than one category.

Vejre et al. (2016) state that adapting to a new urban reality would require further innovation and broader application. In reference to **Table 1** it is evident that certain UA systems and practices have the potential to be initiated and maintained as citizen-led greening activities as part of cross-sectoral networked movements (Mendes et al., 2008). Broader literature studies classify the potential of UA systems and practices under contributions to citizen-led place-making (Frangos et al., 2017), and highlight potential contributions to the quality of urban areas. Individual gardening practices have long contributed to domestic food production through small-scale cultivation of fruits and vegetables in urban areas (Lategan and Cilliers, 2013), often for own consumption. Communal gardening and allotment gardening is also a well-established practice globally, with forms of organization in establishment, development and maintenance varying considerably. Certain communal gardens and other UA activities may be the result of deliberate programs initiated by the state or NGOs, whereas others manifest more organically

as communities come to the realization that they have agency and do not have to wait for government and planners to intervene (Battersby and Marshak, 2013). It is not uncommon for individuals and groups to initiate urban gardens, often in underutilized or interstitial spaces like sidewalks, median strips, or vacant stands (Bach, 2016), akin to the practice of guerrilla gardening that has gained traction internationally. Guerrilla gardening is defined as “the illicit cultivation of someone else’s land” (Reynolds, 2008) often land belonging to local governments (Lin and Egerer, 2017). Whilst some engage in the activity in defiance, many others do so for its contribution to their communities. Many, but not all, citizen-led greening attempts are initiated informally and some may eventually receive support from authorities (Bach, 2016). As such, “formal policy processes can respond to informal networks, and networks of advocates can be oppositional while simultaneously participating in formal policy processes” (Cohen and Reynolds, 2015). When authorities involve multiple stakeholders in decision-making, they are more likely to develop policies that respond to both their own and the needs of their constituents, specifically marginalized communities (Mendes et al., 2008). A growing body of literature has framed UA and community gardens as spaces of democratic citizenship where citizens may challenge dominant power relations through grassroots citizenship and place-based community development to claim their rights to the city (Ghose and Pettygrove, 2014), initiating projects based on community need, developing responses based on stakeholder engagement or building on established insurgent approaches, relates to established planning theories (Lategan and Cilliers, 2017) and aligns with legislation calling for public participation in development decisions. Citizen-based approaches to planning for UA ensure that such projects respond to the city and adapt to what the city and its citizens dictate (Vejre et al., 2016). The emphasis on planning for specific places and people can be summarized as an approach of context-based planning for UA. The following section discusses the context of UA in South Africa in this regard.

## UA AS A SPATIAL CONSIDERATION IN SOUTH AFRICA

Spatial change is at a peak within the urban landscape of South Africa, with 65% of the country’s population currently residing in cities. Like others globally, South African cities are increasingly expensive places to live, characterized by urban sprawl and amplified travel distances, growing carbon footprints, increasing energy consumption, and complicated distribution networks (Cilliers, 2019). As a result, there is an increase in food prices and food wastage, neither of which are beneficial to the urban community. The urban poor continue to bear the brunt of such inequities. Recent data from Statistics South Africa suggests that the segment of the population living in poverty stands at 55.5%, which accounts for an alarming 30.4 million people (STATS SA, 2017).

Undernutrition, malnutrition, but also over nutrition form part of the “triple burden” of the food environment in South

**TABLE 1** | Different descriptions of UA systems and practices indicating the diversity of UA.

Categories	Description	References
Private gardens	May be the most prevalent form of urban agriculture as it comprises a large percentage of the urban space. Backyard gardens are also included as agricultural units for the production of horticultures situated adjacent to a temporary or permanent residential or commercial unit (such as restaurant gardens) for use by owners or residents.	Reinhardt, 2005; Reuther and Dewar, 2005; Lin and Egerer, 2017
Community gardens	Community gardens typically emerge as bottom-up initiatives and are tended collectively. Apart from growing vegetables, it also focusses on growing social networks, building meeting places, and establishing a sense of community. Their collective character is therefore essential.	Simon-Rojo et al., 2016
Allotment gardens	These gardens or farms are commonly located in close proximity to the amenity it serves. An allotment garden is an area subdivided into small plots, which are rented under a tenancy agreement. It is highly patchy and qualitative rich agro-ecosystems. Allotments are seen as a good option for underused areas.	Sherman, 2010; Vejre et al., 2016; Lin and Egerer, 2017
Urban consumer farm	An urban consumer farm is an area of urban land situated in private spaces such as backyards and vacant lots or public spaces such as parks or parking lots. Horticulture cultivation takes place primarily for wholesale and retail purposes.	EDRS, 2013
Educational gardens	These gardens are located in educational institutions that provide garden-based learning to their community, or gardens developed by environmental or social centers that offer educational services to visitors. School gardens are the most common form.	Simon-Rojo et al., 2016
Therapeutic gardens	The basic healing effects of gardening and agriculture are applied through these gardens, typically located inside the city, at physical and mental health care institutions.	Vejre et al., 2016
Easement gardens	Gardens often regulated by the local government but located within private or communal properties. Urban easements are established with the aim to improve water quality, erosion control, enhance biodiversity.	Lin and Egerer, 2017
Edible landscapes	Edible landscapes are located in the public realm, generally as aesthetically pleasing designs, using consumables, such as nuts and berries for public use, often maintained by volunteers, organizations and city management.	EDRS, 2013; Celik, 2017
Vertical farms	Vertical farming refers to systems organized in vertical space for cultivation of crops and food. These vertical growing systems can include trays and green walls and to increase growing efficiency and output in confined spaces.	Despommier, 2013; EDRS, 2013
Edible walls	Edible walls are an adaptation of the term "green wall" and refers to vegetated wall surfaces, cultivated for consumption and retail.	GRHC, 2008; Nagle et al., 2017
Indoor farming	Indoor farming entails cultivation indoors using scientific techniques such as light-emitting diode lighting and mineral-enhanced. This technique allows for year-round production irrespective of season.	Spire Research, 2015
Rooftop farming	Rooftop farming refers to the cultivation of crops within an engineered growing system on rooftops. It is either enclosed or open-aired and use a growing medium and underlying waterproof membrane material.	Loux, 2006; Grand et al., 2018
Rooftop gardens	Rooftop gardens vary in complexity and can be simplistic or engineered as part of a green roof system.	Peeters, 2015; Walters and Midden, 2018
Health clinic gardens	Government-funded gardens surrounding clinics and hospitals to contribute toward the nutritional needs of surrounding communities, especially the ill and the aged and may also serve as training grounds for sustainable vegetable cultivation practices to the community.	Cilliers et al., 2018
Aquaponics	Aquaponics combines edible plants and aquatic species, such as fish, in a system that allows for symbiosis to theoretically provide a self-sustaining food production system.	Diver, 2006; EDRS, 2013
Hydroponics	Hydroponics refers to the process of growing horticulture produce within an aquatic environment (soilless), through the controlled supplementation of nutrient and mineral solutions.	Diver, 2006; Schnitzler, 2012
Aquaculture	Aquaculture entails the, generally freshwater, farming of aquatic organisms, such as fish and shellfish for food provision and/or environmental, educational and commercial purposes.	Islam et al., 2004; AGNR, 2005
Urban orchards	Tree-based food production systems that can be owned and run privately or by the community. Food trees that provide crops, erosion control, shade and provide food for the local community.	Lin and Egerer, 2017
Apiculture	Bee-keeping, or apiculture, entails the manipulation of colonies of honeybees to produce honey and other by-products, for commercial and consumption purposes. This practice is often situated on rooftops and delivers value-added products, such as honey cosmetics.	FAO, 2011
Livestock farming	Livestock refers the controlled breeding of a range of animals and poultry in a farm environment, for the purpose of consumption or the production of animal by-products for retail. These practices can be situated in different urban spaces, even on rooftops. Livestock farming is often frowned upon due to noise, health and pollution concerns.	Womach, 2005; Alarcon et al., 2017
Mushroom cultivation	One of the most economically viable processes for the bioconversion of lignocellulosic wastes, in abundance in both the rural and urban areas - usually by-products from agriculture, forestry, and households, is the cultivation of edible mushrooms	Chang, 2007
Peri-urban agriculture	Peri-urban agriculture refers to farming units or fields that located within close proximity to towns or cities, functioning with a commercial purpose. This includes UA activities such as breeding livestock, production of animal by-products and the production of vegetables and other horticultures.	FAO, 2017; Lin and Egerer, 2017
Enclosed agricultural spaces	Greenhouses and tunnels are example of such. Greenhouses are translucent structures utilized for the cultivation of horticultures during all seasons, using temperature regulation. Tunnels are temporary structures erected in fields to protect crops.	Gorjian et al., 2011; Pool and Stone, 2014

Africa (Pretty, 2012). A study by the African Food Security Urban Network (AFSUN) demonstrated that ~22% of respondents in Southern Africa practiced UA to some degree, compatible to the South African situation. Although major variations in the production levels pertaining to UA systems and practices were evident (Crush et al., 2011), most respondents relied on UA as “coping strategies” to access food (Frayne et al., 2010), highlighting the extreme degree of food insecurity. Frayne et al. (2014) illustrated that in general, cities experiencing economic decline, with limited income opportunities for households, tend to have higher rates of UA participation than cities with economic growth, further emphasizing the need to investigate the potential of UA within the context of South Africa and its declining economy.

Several governing bodies and numerous metropolitan municipalities have been advocating a new urban agenda by recognizing and strategically developing cities as growth engines by means of “urban integration, compaction and densification” approaches (COGTA, 2016). These approaches are in line with international thinking pertaining to sustainable city planning (Wu and Wu, 2013; Cilliers, 2020) but fail to include comprehensive urban greening, and especially urban agricultural practices. Given the number of urban poor and lack of food security within growing societies across South Africa, urban agriculture could present viable opportunities to address these concerns and simultaneously conform to objectives of urban greening.

UA projects employed based on citizen-led approaches could be especially favorable in the South African context, where citizen-led planning approaches have gained importance as part of broader spatial planning strategies. Yet, not all citizens may be equally supportive. During South Africa’s apartheid regime, urban agriculture was not prohibited, but was mostly confined to small-scale black subsistence farmers. This has contributed toward a negative stigma regarding agricultural practices as substance activities related to an impoverished and marginalized past. The continuous migration of former rural and homeland families to South African cities, brings this stigma with them (Thornton, 2008). This has also been shown elsewhere in Africa, with the ruling classes framing UA as “the antithesis of modernization and indicative of an official failure in the urban development process.” Thus, stigmatizing UA as backward, rural and traditional (Drechsel and Dongus, 2010; Thornton, 2019). As urban agricultural initiatives and citizen-led approaches are assumed to contribute to environmental-, social-, economic-, and broader political considerations (Cilliers and Victor, 2018), it is worth revisiting the concept of urban agriculture from a cultural perspective, to understand and circumvent social challenges and stigmas. Nevertheless, UA as a citizen-led approach is also argued to provide opportunities to feed urban communities and address issues of food security. Citizen-led and participatory planning approaches often ensure that scarce resources are protected and used optimally, especially when public buy-in is aligned with infrastructure and service provision (Cilliers and Victor, 2018).

More evidence-based practices are however needed to convince decision-makers and authorities (and some communities who are still burdened by the stigma of urban

agriculture) to invest in UA projects. Thus, identifying and evaluating existing successes in the UA field in the local context could educate and motivate stakeholders and provide guidance for the planning and development of future initiatives. As part of an investigation of the South African UA context, the local policy environment in which limited examples of UA have been established is also critical toward future reform. The following sections address these issues through (a) selected case studies reflecting on the potential of UA, as well as (b) a policy evaluation of potential challenges pertaining to the realization of UA in South Africa.

## CASE STUDY ANALYSIS: REFLECTING ON THE POTENTIAL OF UA IN SOUTH AFRICA

Agriculture is considered an important source of employment in South Africa’s economy (DAFF, 2013). However, the location of agricultural production has always been spatially limited, being dependent on several variables such as climate-soil combinations, demographical placement, and water availability (WWF, 2010). In light of the limited potential of agricultural practices, acknowledging that only 12% of South Africa’s land surface has been classified as “arable land” (DAFF, 2015), UA practices are now being considered as an opportunity to grow food where it was previously not possible, especially since technological advances and optimized food production systems are becoming part of contemporary cities (Cilliers, 2019). These practices range from highly technological vertical farms and aquaponics cultivation, to small scale community gardens (see **Table 1**). These innovations disregard the spatial and environmental limitations of traditional agricultural practices and present an opportunity to optimize food security in urban environments. Prevailing approaches to UA in South Africa relate to smaller scale citizen-led initiatives, as evident from the two case studies pertaining to the cities of Cape Town and Johannesburg discussed accordingly.

### Case Study 1: City of Cape Town

The City of Cape Town is the capitol of the Western Cape Province and as a metropolis provides the most varied UA applications in the Province. Cape Town has a long history of supporting UA (Rogerson, 2010), and was the first South African city to develop an urban agriculture policy (Olivier and Heineken, 2017). In this sense, Cape Town is the leading city in South Africa when considering UA initiatives, with ~6,000 farmers, supported by NGOs, private companies as well as provincial and local government departments, all partnering to facilitate and enhance urban farming projects (Kanosvamhira, 2018). Here, UA is considered a community development initiative to address past economic and social imbalances that still burden the City (Battersby and Marshak, 2013). Different organizations with diverse ideological standpoints are involved in these UA initiatives, resulting in variations in projects and project implementation processes across Cape Town. Synergies between state and non-state actors are considered crucial to ensure that the gains of UA are enhanced in the city (Kanosvamhira,

**TABLE 2** | Broader spin-offs relating to the UA initiatives in Cape Town.

Issues	Focus of case study	Evident benefits from community-led UA practices
Food security	Accessibility	The case studies provided evidence that community-led UA practices enhance access to fresh organic produce. In this sense it could also be considered an instrument for poverty alleviation in poor communities.
Social development	Community well-being	As citizen-led UA practices include various stakeholders with diverse ideological standpoints, it is set to address past economic and social imbalances (inequities). It provides a platform for small-scale farmers to market upscale products and networks, contributing to broader social capital development and improvement of community well-being.
Economic-development	Income generation	Citizen-led UA practices provide development opportunities for individual small-scale farmers, evidencing larger returns on their products when sold through this system.
Environmental development	Climate change mitigation	Benefits of UA practices for surrounding communities and the broader environment are identified. Community-led UA practices are also linked to smaller food distribution footprints, which conforms to climate change mitigation objectives and urban greening initiatives.
Sustainability	Interconnected network	Citizen-led UA practices have the potential to be up-scaled to an interconnected network (engine for growth), drawing on innovation in the food security process, addressing poverty alleviation, while conforming to broader sustainability and urban greening objectives.

Source: Adapted from De Baat and Renting (2014), Small and Hoekstra (2015), The Fish Farm (2016).

2018). One of the examples of a successful UA initiative in Cape Town is the Harvest of Hope project which comprises of a community garden and vegetable box scheme operating in and around the city (Small and Hoekstra, 2010). Harvest of Hope is a civil society organization which has been operational for 37 years with the aim to empower the underprivileged community of the Cape Flats (Harvest of Hope, 2016). Harvest of Hope provides a platform for small-scale farmers to market their products, and on a larger scale, develop agricultural and market opportunities for these cultivators (Small and Hoekstra, 2015). Community stakeholders partaking in Harvest of Hope projects are responsible for packaging, marketing and sale of products, with the support of an umbrella company that provides technical support, production plans, seeds, organic fertilizers, and the maintenance and repair of irrigation equipment (Small and Hoekstra, 2015). As a non-profit community project, these small-scale practices contribute to food security, while simultaneously providing development opportunities for individual small-scale farmers who would have been unable to do so independently (De Baat and Renting, 2014). Annual reports evidence that small-scale farmers experienced larger returns on their products when sold through this system, although seasonal changes have resulted in fluctuating market prices at times. The main goals of the Harvest of Hope initiative were to create a sustainable and expandable market for producers in and around Cape Town, to use this market as an engine for growth and as an instrument for poverty alleviation in poor communities, to provide customers with access to fresh competitive organic produce and to contribute to fewer food miles (Small and Hoekstra, 2010, 2015; De Baat and Renting, 2014).

The Fish Farm in Phillipi is another success story in the City of Cape Town. The project employs aquaculture and supplies nutrient rich waste fluids to farms in the area. The farm comprises of six tanks of 1,500 liters each, a circulation pump, several filters to manage solid and fluid waste and an aerator (SA Info, 2013; The Fish Farm, 2016). These tanks are located on a vacant lot within a disused shipping container. The Fish Farm was developed to improve community well-being, for

those located in close proximity to the farm itself, emphasizing benefits for surrounding communities. The project provides local communities with employment opportunities and the design of the tanks demand reduced inputs in order to be “profitable, affordable, repeatable, transportable, lockable, and stackable” (SA Info, 2013). The additional advantages (broader spin-offs) of both Cape Town UA initiatives considered are captured in **Table 2**.

The examples presented in this case study were both initiated as citizen-led initiatives on the back of concepts and organizations established by passionate individuals. However, these projects attracted additional stakeholders and community support driven by the broader spin offs that are generated (**Table 2**), thus emphasizing the ripple effect benefits of citizen-led UA initiatives with long-term support. In a study on cropping systems used in UA in Cape Town, Olivier (2018) has shown that the “lack of interest from local government” may prevent small scale UA operations. It appears, however, that aspects such as “horizontal support networks among farmers; and cropping systems based on maximizing the use of locally-available resources and minimizing dependency on external inputs” are contributing to successful and sustainable UA operations in the city (Olivier, 2018), emphasizing the importance of citizen-led initiatives.

## Case Study 2: The City of Johannesburg

The City of Johannesburg is not only the largest city in South Africa but is also located in the most urbanized province, Gauteng. The Gauteng Province is implementing an urban agriculture policy as part of a larger food security initiative (City of Johannesburg, 2018). Farmers are arguably the most important actors in this policy (Dubbeling et al., 2010), emphasizing the importance of citizen-led UA approaches to tackle issues from food security to social inclusion (Dubbeling et al., 2010). Johannesburg’s Food Resilience Policy, “A City Where None Go Hungry” (City of Johannesburg, 2012), included agricultural development strategies, along with information on nutrition and social protection issues, aimed at supporting home, communal (often on school grounds) and larger commercial farming

activities. Additional social assistance programs also support this policy, including food parcel distribution initiatives and emergency nutrition and food exchange programs where waste can be exchanged for food. The “extended social packages” and “food empowerment zones” have been identified as crucial factors related to the broader success of UA initiatives in the city of Johannesburg (Malan, 2015). The policy is also clear on the importance of participatory initiatives linked to UA practices. Yet, farmers were not included in the design of the policy, which could be regarded as a potentially fatal misstep in avoiding conflicts between farmers and their organizations in civil society (Malan, 2015) and as detrimental to the idea of citizen-led UA.

Local stakeholders of UA initiatives have called for more effort to strengthen the local farmers’ own organizations whilst they contribute to broader city initiatives (Malan, 2015). The Urban Agriculture Initiative (UAI) was realized in 2017 to support the vision of co-benefit. The UAI initiated vegetable gardens planted in hydroponic farms on skyscraper rooftops in Johannesburg. The UAI was developed by the Johannesburg Inner City Partnership (JICP) with support from the City of Johannesburg, the Department of Small Business Development, and NGO’s. Reflections from stakeholders identified that the UAI was not primarily about putting the farm on the roof, but about the potential it had to change lives. The UAI generated employment opportunities through the establishment of an urban agricultural entrepreneurial ecosystem that supported young, disadvantaged farmers from the area. One of the rooftop farmers who started in 2017 now employs four people and supplies restaurants in the revitalized Maboneng district with fresh vegetables. Such knock-on benefits evidence the scope and success related to the small scale farming opportunities created. According to previous research, entrepreneurs undergo intense training, and participants have to present a business model and indicate financial support, before receiving starter packs consisting of seedlings, containers, irrigation systems, and pumps

(JICP, 2018). In 2018 there were 120 full-time, and 280 part-time jobs and 25 farms flourishing on rooftops across the city. The long term scope is to have 60 entrepreneurial businesses created and incubators set up in other cities across South Africa. Interest has been shown from various companies and property owners, to make the rooftops of their properties available to future UA initiatives, evidencing broader buy-in and citizen-led motivation.

Another UA initiative established in Johannesburg is a fish farming facility in the township of Soweto, launched by the Department for Health and Social Development (City of Johannesburg, 2018). This facility combined fish farming with hydroponic cultivation of plants in a closed recirculating fresh water system. The system presents one of the most water-saving and pollution-preventing technologies and uses no antibiotics or pesticides, while producing over 2,000 kg of vegetables a year. The produce is used to feed the community and surrounding schools (City of Johannesburg, 2018), acknowledging the high levels of poverty, inequality, and unemployment in the proximate area. The fish farming facility forms part of a broader strategy to address high levels of food insecurity and create economic opportunity across Johannesburg. From the initiatives considered within the Johannesburg case study it became evident that stakeholder involvement is a crucial consideration in realizing the success of UA practices. In agreement with Prové et al. (2015), these local examples identified the role of stakeholders such as the local government, non-profit organizations, funders, and volunteers. The role and contribution of national and regional governments, as well as government-led institutions were not evident in these cases and should be addressed in future endeavors to ensure the sustainability of UA practices. The broader spin offs of the various UA initiatives in Johannesburg considered in this paper are captured in **Table 3**.

From the two selected case studies it can be surmised that communities are optimistic about UA practices, evident from their willingness to participate, in most cases as volunteers. It

**TABLE 3 |** Broader spin-offs relating to the UA initiatives in Johannesburg.

Issues	Focus of case study	Evident benefits from community-led UA practices
Food security	Distribution	Benefit of citizen-led UA practices in terms of the distribution initiatives and emergency nutrition and food exchange programs, providing food parcels to indigent families, aiming to break the inter-generational cycle of poverty, whilst supplementing food supplies to augment food security.
Social development	Community empowerment	UA practices have the potential to change lives, addressing issues from food security to social inclusion. Community empowerment opportunities were evident, wherein households with food gardens were supported and developed into sustainable and viable emerging farmers, cultivating pride and a sense of ownership over food production to embed such practices within communities.
Economic-development	Entrepreneurial scope	It was evident that UA practices generated further employment opportunities and stimulated demand for supporting infrastructure and components. Shortened food distribution processes also resulted in financial gains, while local farmers were supported to upscale their produce and economic networks.
Environmental development	Green infrastructure potential	The potential of green infrastructure supporting UA practices was evident, ranging from hydroponic farms and green roofs, to water-saving and pollution-preventing technologies. Such infrastructure contributes to broader urban greening objectives and environmental considerations and highlight the potential for green retrofitting.
Sustainability	Long-term resilience thinking	Creating opportunities for UA practices to contribute to long-term sustainability and resilience objectives, driven by citizen-led approaches and thus conforming to the vision of co-benefit.

Sources: City of Johannesburg (2012, 2018), Malan (2015).



**TABLE 4** | Policy and legislative matrix applicable to the two selected case studies in South Africa.

Policy and legislation frameworks	Evaluation criteria						Evaluation	
	Direct		Indirect Support					
	UA enforced	UA mentioned	Sustainable development	Social development	Environmental focus	Economic development		Food security
White paper on Department of Agriculture (1995)	✓	✓			UA set as policy priority			3
National Environment Management Act (1998)	×	×	×	×	✓	×	×	0
National policy on Food and Nutrition Security (2013)	×	×	×	×	×	×	✓	0
Spatial Land Use Management Act (2013)	×	×	✓	✓	×	✓	×	1
Policy on Agriculture in Sustainable Development (n.d.)	×	×	×	✓	×	✓	✓	1
Integrated Agriculture Development Finance Policy Framework for Smallholder Farmers (2015)	×	✓			UA set as policy lever			2
Integrated Urban Development Framework (2016)	×	✓			UA set as policy lever			2

**Table key:**  
Evaluation scale: Level of support for UA as instrument of sustainable urban development capable of providing economic, social and ecological benefits to cities and their inhabitants.

0	Very weak
1	Weak
2	Medium
3	Strong

was also concluded that a system of urban farms could imply more opportunities for entrepreneurs who build supporting infrastructure (such as hydroponic infrastructure), and could furthermore benefit those entrepreneurs who supply materials to build said infrastructure. These potential knock-on benefits further motivate stakeholders to engage in UA practices and could explain the increase in the number of new farms established across Johannesburg during the last couple of years such as the cases included in this paper. In this sense, both the Johannesburg and Cape Town case studies presented various opportunities related to UA, ranging across various scales from socio-economic, to developmental and technological prospects. However, both cities also identified various limitations to the realization of UA on a broader scale, especially in terms of policies and frameworks guiding spatial planning approaches. Both cities have developed some legislative frameworks in support of UA, but no comprehensive approach exists at national scale. This is regarded as one of the most prominent limitations to realizing UA in South African cities, as discussed in the following section.

## LEGISLATIVE ANALYSIS: REFLECTING ON THE LIMITATIONS OF UA IN SOUTH AFRICA

Despite the vast opportunities presented in citizen-led UA practices, as explained in section UA as a spatial consideration

in South Africa, agriculture-related policies in the broader South African context are limited in their effectiveness given policy formalities and hierarchies and limited cross sectoral alignment that impair effective action (De Wit et al., 2015). This was also evident in the previous section, where neither the Cape Town, nor the Johannesburg case studies identify national or provincial governments as primary stakeholders of UA practices. The case studies included as examples of UA practices were not initially planned or designed, but rather developed into such spaces through citizen-led approaches. Yet, it is important to note that planning support for UA may already be imbedded in references within existing policies, albeit to varying levels of directness. This paper considered a spectrum of South African policies and frameworks at national level to identify support or shortcomings pertaining to the formalization of UA as a spatial consideration. Policies and frameworks included the White paper on Agriculture (Department of Agriculture, 1995), National Environment Management Act (DEA, 1998), National Policy on Food and Nutrition Security (DAFF, 2013), Spatial Land Use Management Act (DRDLR, 2013), Policy on Agriculture in Sustainable Development (DAFF, n.d.), Integrated Agricultural Development Finance Policy Framework (IADFP) for Smallholder Farmers (DAFF, 2015) and the Integrated Urban Development Framework (COGTA, 2016) as evaluated in **Table 4**.

From **Table 4** it is evident that neither the National Environment Management Act (1998), nor the National Policy

on Food and Nutrition Security (2013) provide support for UA practices, although it indirectly supports environmental objectives and objectives to ensure food security, which could imply UA practices. The National Environmental Management Act (1998) for example focusses on environmental principles and inclusive participation by recognizing the role of all stakeholders, especially vulnerable and disadvantaged inhabitants, to ensure equitable and equal planning and participation (Du Plessis and Landman, 2002), but does not refer to UA practices specifically. The National Policy on Food and Nutrition Security (2013) provides a broad framework to guide national, provincial and local government in pursuing food security at every level, referring to improved nutritional safety nets, nutrition education, investment in agriculture in particular in rural areas, market participation and risk management. This Policy is primarily focused on food security issues, but had no direct reference to UA practices.

The Spatial Land Use Management Act (2013) also does not mention UA practices specifically but does call for “land development that optimizes the use of existing resources...” and “land development in locations that are sustainable... and result in communities that are viable.” It also refers to “social inclusion, spatial equity, desirable settlement patterns, urban regeneration, and sustainable development” and the “principle of spatial resilience” to accommodate sustainable livelihoods. UA practices could fit into these broader categories.

The Policy on Agriculture in Sustainable Development (n.d.) does also not directly refer to UA practices but does “promote the production and consumption of indigenous foods” and aims to “improve support to under-privileged farmers’ organizations, cooperatives and similar institutions to enable them to extend their mandate to deal with issues of capacity building for their members and broader communities.” This policy also recognizes agriculture as main source of food for urban dwellers and accordingly recognizes the significance of the agricultural sector.

The Integrated Agriculture Development Finance Policy Framework for Smallholder Farmers (2015) referred to a strategy for UA development and the financial support that could be provided to agricultural actors through MAFISA, the first state-owned micro and retail agricultural scheme that specifically targeted the working poor, household producers, smallholder farmers, and micro-agribusiness entrepreneurs in both urban and peri-urban areas. This policy thus set UA as a policy lever, similar to the Integrated Urban Development Framework (2016) that recognized the need for “urban farming, recreational facilities for the young and retail space for informal traders as a short-to-medium policy lever.”

The White paper on Department of Agriculture (1995) was thus the only document considered in this analysis which enforced UA practices directly, and emphasized that food insecurity among the urban poor is the result of low wages and high unemployment levels, and that these insecurities can be reduced by amongst others “urban food production by means of food gardens.” The White Paper also stated that “the Government should support the full spectrum of production systems and practices, from urban food gardens and small-scale production for household income and food security to large-scale

production systems which can add considerably to national food security.”

The White Paper on Agriculture was the first published of the documents considered in this analysis, and the only to directly set UA as a policy priority. The policy and legislative frameworks that followed had limited reference to UA practices and decades since the publication of the White Paper of Agriculture, these principles have only been translated to the national spatial planning agenda to a limited extent. The lack of a dedicated UA policy to direct spatial planning, as shown here (Crush and Riley, 2019), limits opportunities to steer official UA projects and capitalize on citizen-led initiatives at any significant scale. According to literature there are several other challenges that hamper the successful implementation of UA (see section Legislative analysis: reflecting on the limitations of UA in South Africa). From a South African perspective, it is not evident that a dedicated UA policy will lead the inclusion of UA in spatial planning, as various authors argue a lack of knowledge and commitment by planners to apply ecological concepts as main impediments to UA initiatives (Cilliers, 2019). Ahern et al. (2014) calls for adaptive planning in an attempt to facilitate trans-disciplinary planning approaches, in this case to guide the implementation of more UA practices as part of broader mainstream urban planning. Accordingly, other issues that could further limit the successful implementation of UA should also be addressed, such as issues pertaining to the lack of land and water, inefficient knowledge on gardening, and other safety and security issues which are particularly relevant in developing countries (Reuther and Dewar, 2005; Phiri, 2008; Guitart et al., 2012; Cilliers et al., 2018). This paper acknowledges these challenges and limitations but evidences the need of proper UA policies, especially on national level, to support UA as a spatial planning tool.

## **SYNTHESIS: POTENTIAL AND LIMITATIONS FOR THE IMPLEMENTATION OF UA AS URBAN GREENING TOOL**

Previous sections evidenced various opportunities for the realization of UA in the South African context, but also that numerous limitations are present when considering current policy and legislative frameworks in support of a national approach to UA. A thematic synthesis is presented accordingly, evidencing the relationship between citizen-led UA practices and the interface with broader urban greening approaches.

### **Potential of UA From a South African Perspective**

#### **Increasing Awareness**

Cities should now reconsider how they can become efficient in terms of the use of resources such as land availability for the production of food (Costa et al., 2016). The case studies included in this paper illustrated the willingness amongst communities, NGO’s and local authorities to further UA on a broader scale. Although case studies pertaining to successful UA practices are limited in South Africa, there is an upward

trajectory evident. There is also an increasing awareness to further develop specific implementation techniques and context-based planning approaches that will target specific community needs and particular climatic conditions. Although there is currently no singular national policy to guide UA in South Africa, the development of policies and frameworks on city level emphasizes a community-driven need to implement UA within cities.

### Support by NGO's

The potential of UA within the South African context is encapsulated in the support provided by NGO's and local authorities. UA is currently mostly driven by NGO's, citizens and communities in South Africa. These entities provide communities with the adequate know-how and tools to further UA initiatives. There is potential to further explore UA from a trans-disciplinary planning approach, bringing more experts, small-scale farmers, communities and planners together, to co-create the urban spaces needed to sustain UA practices. This paper agrees with Warren et al. (2015) that UA could possibly fill the deficiency in food demand and contribute toward an increased fulfillment of local food demand.

### Context-Based Opportunities

The integration of UA practices differ significantly between cities (Costa et al., 2016). UA practices that are well integrated as part of green infrastructure, are usually those that emerged in cities with a morphology strongly influenced by the natural landscape, and those that were deliberately designed to enhance the quality of the urban environment (Costa et al., 2016). The South African cases illustrated that UA practices are currently not considered as part of urban green infrastructure, but rather considered as *ad-hoc* community initiatives. Context-based planning approaches based on both place and people are crucial in realizing successful UA initiatives on broader scale. Stigmas dating from the apartheid regime have resulted in some small-scale farmers not associating modernization and development with urban agricultural processes. Integrating new technologies may provide an antidote to such conceptualizations and may aid in luring the youth to the UA sector. The migration of rural communities to cities provides an opportunity in terms of the agricultural "expertise" that move from rural to urban areas. The expertise of rural communities that now inhabit cities [e.g., cropping systems which are "adapted to local socio-economic and geographical conditions" according to Olivier (2018)] should be capitalized on, as there are various potential small-scale farmers within the vicinity of the South African city whose expertise, traditional and indigenous knowledge could contribute to developing UA as a niche market in touch with the broader context in which it is applied. Much evidence would however be needed to convince and motivate these skeptical potential stakeholders.

### Potential Innovative Markets

From the case studies presented in this paper it is evident that there is indeed a need, and a market, for innovative products within the South African context. UA systems and practices, even on the limited scale of current operation, are contributing

to community-specific needs, providing food security to communities in close proximity, whilst simultaneously addressing issues of food production, social development, economic-development, and technological-development within their areas of service. The potential of these innovative markets have not yet been explored and could prove to be the catalyst for urban communities in South Africa to address food security, employment opportunities, empowerment prospects, and entrepreneurial development.

## Challenges Relating to the Implementation of UA in the South Africa Context Not Solely Citizen-Led and Citizen-Supported

Citizen-led UA in the South African context are currently not self-sustaining, but rely on various actors and support measures. Although communities are the core stakeholders and drivers of UA practices in South Africa, the two case studies illustrated that these practices would not be operational without the support of NGO's, local authorities and other professional support measures. It was further evident that it is not only financial and logistical support that is needed, but that training and education are also crucial to realizing the successful implementation of UA practices at a broader scale in South Africa. The willingness of communities to partake in UA initiatives should be supported with comprehensive community development programs, youth programs and educational approaches to equip the local community to fully engage in activities relating to UA. Investment in terms of space, equipment, infrastructure, expertise, and knowledge development would be needed to kick-start UA in the local context and it would take time to see UA being transformed into fully citizen-led practices.

### Cultural Stigma of Agricultural Practices

The current cultural stigma linked to agricultural practices pose a challenge to the successful realization of UA practices. Before UA can be scaled up in the South African context, there would need to be investment in terms of community training and awareness, to ensure that communities engage with the concept of UA, and especially the benefits related thereto. Culturally sensitive and targeted participatory planning processes would be required to illustrate to these communities that UA can enhance the sustainability of modern cities and societies to their own benefit.

### Limited Policy Support

To strengthen the implementation of UA practices on a national and city-wide scale, appropriate spatial planning approaches should be set in motion. UA should be recognized as a spatial planning tool and advanced from a systematic planning approach, that first acknowledges the systemic changes within the food system. Food systems are fundamentally networks or processes of interaction, which imply high levels of interdependency between the components of the food system (Battersby and Haysom, 2019). In a broader sense, a systemic approach, which approaches a larger goal (such as food security) by striving for sustainability, or structural soundness, would be more measurable and in effect, more achievable. From the investigation, it was evident that a single well-developed

UA site could provide for all the necessary phases within a sustainable food system including production (as from the farming site), processing (which could be realized through value-added products), distribution (which could be realized through delivery services), access (which could be improved by farmer's markets), consumption and waste recovery (which could be realized through a composting site). Such UA initiatives within a city would not only directly impact on a single livelihood, but also several others within the larger interconnected network of livelihoods. The possibility of such a singular national policy for the planning and management of UA as part of broader spatial planning should be considered, on the basis of broad consultation and citizen engagement. Inclusive governance models and planning frameworks are currently lacking, and these should be constructed to address broader objectives (food security, distribution processes, poverty etc.). Such policy and legislative frameworks should however not follow a top-down approach, as successful UA practices draw on community input and genuine, not tokenistic, engagement. The development of national policies may not guarantee the successful implementation of UA, but would provide direction for future spatial planning approaches toward integrative and context-based thinking to support UA. Comprehensive planning policy could be adapted to include new types of UA practices, as the discipline evolves (Caputo et al., 2016). The transformational impact of these new types of UA practices can be substantial, but needs to be successfully addressed as part of mainstream spatial planning approaches.

### Limited Knowledge

If UA is to play a more prominent part in food systems, it needs to become more productive, but also integrated in planning and development systems. This would require that spatial planners engage more with the concept of UA and that UA be considered as part of mainstream urban planning. Previous research illustrated that South African planners present limited knowledge pertaining to green infrastructure and urban greening (Cilliers and Cilliers, 2016a; Cilliers, 2020) and the assumption is that the same would be true for UA as a component thereof. Planners would need to engage with the concept and benefits of UA to understand related planning objectives and to ensure that UA manifests as a land-use within cities. Planners should be more engaged with the identification and utilization of UA as a form of social capital. UA, as social capital, should be recognized in terms of the broader benefits it can offer to cities and their inhabitants. This ultimately links to the objectives of the urban goal, the creation of sustainable and resilient cities. Planners could be the main custodians responsible for the realization of UA in the local context, given they have adequate knowledge and sensitivity to grasp its value.

## Global Relevance When Considering the Implementation of UA as an Urban Greening Tool

### Zoning and Land-Use Should Consider Diverse UA Practices

The advances in local and global UA theory based on scientific research should be acknowledged and included as

part of mainstream spatial planning, as part of strategic and development planning, to enhance the multiple benefits thereof. To promote UA initiatives at local level, zoning and land-uses should consider and accommodate a diversity of UA practices and systems presented in this paper (refer to **Table 1**). The context-specific nature of UA calls for comprehensive planning approaches as part of environmental management, that acknowledge and address the challenges, but also enhance the opportunities and benefits presented. For UA practices to further develop, a balance is needed between comprehensive planning and space for bottom-up initiatives, as a new approach to urban development (Caputo et al., 2016). Spatial planning is considered the science of managing change, and should thus be the main driver in changing the contemporary urban land-use system to accommodate agricultural activities in support of food security, food production, employment creation, empowerment zones, and community development.

### Citizen-Led UA Initiatives Require Context-Based Planning Approaches

UA cannot be applied according to a blue-print approach but must be guided by community-needs, climatic conditions, as well as available entrepreneurial and financial support. UA is complex in nature as it bridges various disciplines (Agricultural sciences, Urban Planning, Urban Ecology, Economics, Health sciences, Social sciences etc.) and thus calls for trans-disciplinary planning approaches in considering best practices (Lin and Egerer, 2017). Emphasis should be placed on the various benefits linked to UA in gaining political and financial support to further UA initiatives and to eventually strengthen UA as a citizen-led initiative. Cultural challenges and locational opportunities should form the basis of such context-based planning approaches.

### The Link Between UA and Urban Greening Should Be Enhanced

This paper confirms findings presented by Zammit and Erjavec (2016) stating the need for an integrated approach at a municipal level, with UA practices included as part of a comprehensive green infrastructure network. As gardens and other UA systems and practices (refer to **Table 1**) form an important part of urban green infrastructure (Cilliers et al., 2018), these UA initiatives could be included in mainstream urban planning to strengthen urban greening approaches, from the smallest scale. The multifunctionality of UA (food security, employment creation, service delivery etc.) would provide a new dimension to urban greening, moving from beautification and "sense of place" toward an ecosystem service approach that taps into the multiple benefits associated with UA (Cilliers et al., 2018). The links between UA and urban greening are evident, but these should be enhanced and supported by inclusive governance models and detailed frameworks to guide the "safe to fail" and "learning by doing" approaches (Ahern et al., 2014). These adaptive planning approaches could guide innovative UA practices and see urban spaces being transformed into edible and more functional spaces as important components of more sustainable cities. In this sense, UA can contribute toward the realization of broader sustainable development goals, especially when considering water sensitive cities, green cities, and resilient cities. UA systems and practices

**TABLE 5 |** Framework for employment of UA as an urban greening tool in South Africa.

Issues	Focus	Community-led UA practices	National planning considerations
		Evident benefits	Proposals to strengthen UA practices
Food security	Accessibility	<p>Increased access to nutritional food choices provided by citizen-led UA practices.</p> <p>Provided a broader range of fresh organic produce within the local context.</p>	<p>Create special zoning categories in spatial development frameworks to include a range of UA practices (refer to <b>Table 1</b>).</p> <p>Support organic produce through adequate national policies and legislative frameworks.</p>
	Distribution	<p>Citizen-led UA practices contributed to more efficient distribution processes, emergency nutrition and food exchange programs.</p> <p>Optimal distribution processes addressed some of the food insecurities and cycle of poverty.</p>	<p>Prioritize UA practices in line with the three pillars of sustainable development (conforming to social, economic and environmental contributions identified).</p> <p>Include UA as part of mainstream urban planning approaches, addressing food security objectives and poverty alleviation of poor communities.</p>
Social development	Community well-being	<p>Increased health and nutritional awareness, contributed to overall well-being associated with UA practices.</p> <p>Increased community-ownership and social capital through citizen-led UA practices.</p>	<p>Emphasize “healthy cities” and the health agenda within broad sustainability and resilience thinking, identifying UA practices as a possible tool to realize such.</p> <p>Strengthen collaboration networks and bottom-up planning approaches to support community development and well-being.</p>
	Community empowerment	<p>Enhanced sharing of and co-production of knowledge on UA practices, building a community of practice.</p> <p>Diverse stakeholders included and linked to addressing past economic and social imbalances.</p>	<p>Emphasize participatory planning approaches to enhance transdisciplinary planning, placing the local community as core stakeholder.</p> <p>Include UA as a policy directive on national and provincial level for increased social capital and support from a local community perspective.</p>
	Income generation	<p>Increased development opportunities for local farmers to upscale produce methods and quantities <i>via</i> expanded networks.</p> <p>Increased revenues and larger returns linked to citizen-led UA practices supported by diverse stakeholders.</p>	<p>Explore specific community development initiatives as part of broader spatial planning to emphasize the vice-versa benefit thereof.</p> <p>Create spatial opportunities in terms of land-use and zoning requirements, to support UA as marketable commodity within urban spaces.</p>
Economic-development	Entrepreneurial scope	<p>Enhanced employment opportunities and entrepreneurial ventures through UA practices.</p> <p>Shortened food distribution processes relating to broader economic spinoffs in terms of financial gains and savings.</p>	<p>Enhance locality preference linked to business innovation for small-scale farmers and local communities, through providing infrastructural requirements for UA practices.</p> <p>Support efficient distribution processes through integrated infrastructure planning, considering environmental-friendly options and solutions.</p>
	Green infrastructure potential	<p>Improved use of limited space in cities to reclaim nature through UA practices.</p> <p>Enhanced potential of green infrastructure to support UA practices and broader urban greening objectives.</p>	<p>Explore the potential of diverse UA practices in support of environmental objectives.</p> <p>Include hydroponic farms, roof gardens, as well as water-saving and pollution-preventing technologies as part of mainstream urban planning.</p>
	Climate change mitigation	<p>Optimized use of limited urban space to address food security and broader sustainability objectives.</p> <p>Reduced food distribution footprints which conforms to climate change mitigation and adaptation objectives.</p>	<p>Revitalize urban spaces into multi-use spaces that feed communities, build social capital, develop local markets and conform to broader environmental objectives.</p> <p>Include UA practices as part of broader green infrastructure planning, linked to the objectives of climate efficient cities.</p>
Sustainability	Interconnected network	<p>Increased awareness of benefits associated with UA practices and spinoffs through this “engine of growth.”</p> <p>Enhanced collaborative networks with diverse stakeholders to further support innovative UA practices on the longer-term.</p>	<p>Link urban greening and UA objectives from a spatial perspective. Consider diverse UA practices as part of zoning and land-use planning (refer to <b>Table 1</b>).</p> <p>Support context-based planning approaches, supported by adequate participatory planning processes, to include local communities (and small-scale farmers) in the policy making process.</p>
	Resilience long-term thinking	<p>Optimized local workforce and optimal use of limited space in cities, to enhance the cost-benefit analysis of food security over the longer-term.</p> <p>Enhanced citizen-led UA practices, built upon innovation and a bottom-up planning approach, conforming to the vision of co-benefit.</p>	<p>Highlight the potential of UA as an urban greening tool, aligned with the benefits pertaining to the three-pillars of sustainability (social, environmental and economic).</p> <p>Include UA as an urban greening tool as part of mainstream urban planning, bridging disciplines of urban ecology, spatial planning and the health sciences.</p>

could provide the urban fabric with quality spaces, and from an urban design perspective, contribute to the “art of making places” (Zammit and Erjavec, 2016).

In final conclusion **Table 5** identifies the specific benefits derived from community-led UA practices relating to each of the five issues considered in this paper namely (a) food security, (b) social development, (c) economic development, (d) environmental development, and (e) broader sustainable development objectives, and then proposes specific spatial planning considerations to guide the implementation of UA as an urban greening tool, drawing on the opportunities and challenges presented from the local South African perspective.

This paper framed UA as an urban greening tool that can be citizen-led, evident from the selected South African case studies included in the paper. To excel UA as an urban greening tool UA should be acknowledged as part of mainstream urban planning and intrinsically linked to urban areas (as the primary locality), recognized as the food system which could potentially link community well-being, food security, poverty reduction, and ideally employment creation for urban inhabitants. UA may be a successful urban greening tool if the

current citizen-led UA practices are scaled-up to conform to micro-climate regulation, natural disaster risk reduction, and waste management objectives amongst others in an attempt to apply conservation and restoration practices to optimize the delivery of ecosystem services by the entire urban green infrastructure network. This would call for a comprehensive national approach to acknowledge UA as an underutilized spatial tool, that could be explored to conform to broader sustainability objectives.

## AUTHOR CONTRIBUTIONS

EC was the lead author of this paper. This paper is a revised version of the MSc of KS completed in 2019 and led by co-supervisor SC. LL contributed to revise the text and add more literature and sources. All authors contributed.

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**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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