MA RESEARCH REPORT

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Urban agriculture and access to food: fresh produce for Johannesburg's urban poor

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Declaration

I hereby declare that this research is exclusively my own work except where otherwise indicated. I am aware of the University's regulations concerning plagiarism, including those regulations concerning disciplinary actions that may result from plagiarism. Any use of works of any other authors have been acknowledged in the text as well as in the reference list.

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Abstract

The current food system is contributing to the food insecurity of the urban poor. Local food systems and other food system alternatives benefit the urban poor in all four spheres in which the corporate food regime disadvantages them: accessibility, empowerment, sustainability and health. This research maps the overlap of poverty and types of agriculture in the City of Johannesburg to locate potential for urban farms to serve and benefit the urban poor. There are many areas where potential for food system alternatives is high, especially where smaller scale farms are growing vegetables in areas where there are many and mostly poor households concentrated over space. By engaging with farmers, from study areas in the City which meet at least some of these conditions, the research not only confirms that the potential identified in these areas is being realised and exceeded but suggests that the potential has been underestimated for all of the other areas of the municipality in which urban agriculture coexists with the urban poor. The combinations and variations of food system alternatives chosen by farmers, in the foodstuffs produced, nature of production and modes and channels of distribution, are evidence of the reciprocal influence of structure and their own agency. By reframing urban agriculture to recognize the diverse opportunities for farmers to do things differently, we can see that many are choosing to do so, and are thus making sustainably produced, healthy fresh produce locally available to the urban poor in ways that are accessible and empowering.

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CHAPTER ONE:
INTRODUCTION

Over one quarter (26.0%) of South Africans are experiencing hunger and a further 28.3% are at risk of food insecurity[1] according to recent research[2] (Shisana et al., 2014). A paper released by Oxfam in 2014 has publicized this statistic by revealing the human stories and faces of those who are amongst the one in four (Tsegay, Mistry, & Rusare, 2014). From their testimonies, some of the factors identified as leading to hunger and food insecurity included low incomes, poor access to quality and nutritious food, climate change and environmental degradation, and the market structure of the food industry (Tsegay et al., 2014). These issues are not unrelated, and they represent four key ways in which our food system, and the broader systems around it, perpetuate food insecurity, especially for the urban poor: Food is economically (and physically) inaccessible to millions of people. The food that is most accessible is not healthy. The food system is destroying its own ecological foundation, compromising the affordability and availability of food now and in the future. And food itself has been commoditized, as the market logic of neoliberal capitalism drives these realities onwards, disempowering the producer and consumer and physically and conceptually separating them from one another. The urban poor are amongst the most disadvantaged by the current food system in all four of these spheres of accessibility, health, sustainability and empowerment.

Income poverty and food insecurity follow each other in entrenched geographies of inequality, dislocation and marginalization in South Africa (Rudolph, Kroll, Ruysenaar, & Dlamini, 2012). In the recent research mentioned above, urban informal localities had one of the highest rates of hunger, with 32.4% of participants experiencing food insecurity and a further 36.1% at risk of food insecurity (Shisana et al., 2014). A 2009 study on the prevalence of food insecurity and its relationship to poverty in three impoverished communities in Johannesburg showed that 56% of households surveyed were not food secure (Rudolph et al., 2012). The survey also revealed unhealthy eating

[1] Assessed by means of the Community Childhood Hunger Identification Project (CCHIP) index based on eight occurrence questions that represent a generally increasing level of severity of food insecurity (access) – questions are related to issues such as the altering of food intake and perceptions of food insufficiency in quantity and quality. "A score of five or more affirmative responses out of eight indicates the presence of food shortage in the household, in which case household members can be considered to be hungry. A score of one to four indicates that members of the household are at risk of hunger. A score of zero indicates that the household is food secure." (Shisana et al., 2014, p. 144)

[2] The recent General Household Survey 2014 gives the figure of 16.6% with inadequate food access, and 5.9% with severely inadequate, based on the Household Food Insecurity Access Scale (HFIAS) developed by Food and Nutrition Technical Assistance Project (FANTA) – a set of questions asking households about "modifications they made in their diet or eating patterns during the previous month because of limited sources available where they can obtain food" (Rudolph, Kroll, Ruysenaar, & Dlamini, 2012; Statistics South Africa, 2015b, p. 59).

patterns with about one third of households in all three areas lacking the kind of dietary diversity considered a prerequisite for good health[3] (Rudolph et al., 2012). Diets consisted of an excess of sugar and fats, and a high consumption of foods rich in energy but poor in micronutrients and fibre, combined with a low consumption of foods rich in fibre and micronutrients, such as fruit and vegetables (Rudolph et al., 2012). A recent case study of an informal settlement (Hospital Hill) in Johannesburg, also pointed to the increasing trend of the urban poor eating less nutritional food and more cheap fast foods (Naicker, Mathee, & Teare, 2015). The fact that unhealthy eating options are more affordable inclines especially the poor to diets that sacrifice quality for quantity, in already constrained food purchasing decisions. This is exacerbated by the spatial neglect of lower income areas by formal food retail, such that poor consumers turn to supermarkets less frequently to minimise their expenditure on transport, and thus choose highly refined, heavily processed foods that will last without refrigeration until the next shopping trip (Battersby, Haysom, Marshak, Kroll, & Tawodzera, 2015).

Also as a result of the food system being increasingly shaped by the market logic of massive agro-food corporations, these same poor urban areas take on many of the social and environmental costs externalised by these massive supermarket chains and food production and processing giants. Already more vulnerable and less able to adapt, the poor are marginalised to areas of cities where they are exposed to environmental hazards, driven by the wastes, emissions and ecosystem damage of the current food system. The inferior and debilitated environments in these places subsequently exacerbate poverty (Aliber, 2002). Unsustainable practices in the production, processing and distribution of food contribute to the very challenges which, in turn, impact the food system, the foremost of which are climate change, land degradation, and the pollution and depletion of water resources (Battersby et al., 2015; McLachlan & Thorne, 2009). Intermingled socio-economic and environmental vulnerabilities are often silent, but put millions of South Africans at risk, such that widespread hunger and suffering could be triggered at any point, as has occurred with food price crises in the past (Drimie & Ruysenaar, 2010). Subjecting food to the volatility of increasingly transnational markets is made possible by the commodification of food (Trauger, 2015). Elongating the food system gradually undermines the contact between the people involved, and the human relationships in which the meanings of food are forged become irrelevant. The consumer is completely distanced from production and producer, as well as all the other people and processes which brought their food to them, and must unequivocally accept all its conditions, having no knowledge or influence beyond the food commodity itself. This form of powerlessness accumulates onto the constant exclusion of the poor from any control or decision-making.

[3] Prevalence of food (in)security was measured using the HFIAS whilst the degree of dietary diversity was measured using FANTA's Household Dietary Diversity Scale (HDDS) based on the number of the 12 food groups consumed within the household in the previous 24 hours, below four being considered inadequate.

At the bottom of these layers of disempowerment around food is what has been called the 'corporate food regime'. This notion emerges from taking a broad political economy perspective to uncover the relations and forms of accumulation that reinforce the global food hegemony of our times (Friedmann & McMichael, 1989). It identifies the source of contemporary hunger as the concentration of power over food facilitated by the globalization and corporatization of agriculture, processing and retailing. Whilst the impacts of the corporate food regime's deleterious features are widespread, they are disproportionately borne by the urban poor, in all four realms into which they can be organized: accessibility, empowerment, sustainability and health. Since the spread of food insecurity in Johannesburg develops from systemic issues rooted in the corporate food regime, confronting it requires a systems-wide approach that seeks change across a complexity of aspects, especially to provide relief where we find those most affected.

Agro-food scholars have increasingly recognized the need to understand the food system with its multiplicity of elements, and how these represent arenas in which alternatives to the corporate food regime can oppose the status quo, usually forcing an entry through cracks in its apparently impenetrable dominance. There has been an acknowledgement of a proliferation of food system alternatives, as people involved in the food system choose to do things differently at these numerous points. But studies engaging the people participating in food system alternatives, mostly coming from Europe and North America, has often centred on those driven by an explicit ideological or political desire to oppose the corporate food regime. By disaggregating the different features of some food systems in the developed world, their alternativeness has been maintained by the authors studying them, even where the motivations of those involved include some that are less 'alternative', such as "economic considerations" (Watts et al. 2005, in Ilbery & Maye, 2005, p. 842) and "business success" (Holloway et al., 2007, p. 8).

Because it is located in a poor area of Johannesburg, Abrahams frames her case study of an alternative food network as a "globally useful" theoretical contribution to an emergent literature which had been predominantly 'northern' (2006a). She describes how poor consumers in this part of the city are accessing, sustainably grown, healthy fresh produce, made locally available to them in ways that are not disempowering, by urban farms in the area and by informal traders supplied by them (Abrahams, 2006a). Urban agriculture has featured in research on food system alternatives, but less so in the developing south, where the practice tends to have been framed either as a household survival strategy or as a (sometimes still growing) conventional commercial farm, albeit city-based. By assuming a purely economic logic in these two framings, theorists were largely oblivious to the potential of urban agriculture in South Africa to be in any way alternative. But Abrahams contends that whilst the farmers and other people in that poor area of Johannesburg may not have intentionally established an

alternative food network, its features mean it ought to be acknowledged as one. Her research gives evidence of a local food system in which urban farms provide convenient access to small, affordable quantities of fresh and healthy, organically produced fruits and vegetables, which poor consumers obtain through a personal exchange, either directly with the farmer who is based within walking distance, or with their neighbouring informal trader who sources from these farms (Abrahams, 2006a, 2006b).

An important characteristic of the case study area in Abrahams' research is the proximity of urban agriculture to the urban poor. Since globalization is a thrust for the corporate food regime, localization represents a counterforce towards the alternative. Local food systems are inherently beneficial in terms of accessibility, empowerment, sustainability and health. Combined with this, in terms of what they produce and how it is cultivated and distributed, urban farmers in the Abrahams case study are choosing alternatives to the characteristics of the corporate food regime that maintain or add to these benefits. For example, direct retail is the kind of localization-supporting alternative distribution channel celebrated by numerous agro-food scholars (Allen et al. 2003; Sage 2003; Winter 2003; Holloway et al. 2007; Watts, Ilbery, and Maye 2005), and Abrahams' research shows the importance of this type of distribution for the case study community. "Some consumers are reliant on direct purchases from farms and the direct farm sale of produce plays a significant role in increasing food security" (Abrahams 2006b:31). Of the farmers whom Abrahams interviewed, a number chose farm gate sale over formal supply chains although the quality and quantity of their output allow them access to either, whilst for others "reliance on informal farm gate, small-scale retail is a necessity" (Abrahams, 2006b, p. 30). She therefore quotes a number of motivations for this choice from the producers' perspectives, but central to the research is how the food system alternatives which result are meeting the food security needs of the urban poor in the area, by providing numerous benefits in terms of accessibility, empowerment, sustainability and health (Abrahams 2006a).

With the corporate food regime compromising the sustainability of the food system, the accessibility, especially of healthy food, and even the function of food in society, the urban poor must look to alternatives for their food security. This research intends to explore if and how urban agriculture represents such alternatives the City of Johannesburg.

Research Question

The pillars on either side of this research are urban agriculture and the food security of the poor in the City of Johannesburg. At its centre are local food systems and other alternative features of food systems, which better serve and benefit the urban poor than those characteristic of the corporate food regime.

The main research question is thus:
Is urban agriculture providing access to fresh produce for the urban poor in the City of Johannesburg?

The sub-questions are based on the four spheres in which the corporate food regime impacts the food security of the urban poor, corresponding to the four types of benefits to food system alternatives:

- Is urban agriculture part of food systems which benefit the urban poor in terms of accessibility?
- Is urban agriculture part of food systems which benefit the urban poor in terms of empowerment?
- Is urban agriculture part of food systems which benefit the urban poor in terms of sustainability?
- Is urban agriculture part of food systems which benefit the urban poor in terms of health?

Overview of this report

In order to determine whether urban agriculture is making healthy, sustainably grown fresh produce available to the urban poor in the City of Johannesburg in ways that are accessible and empowering, this research involved four main investigations. The first looked at the distribution and types of farmland in the municipality, in relation to poverty, to locate the potential for food system alternatives that serve and benefit the urban poor. This considered the possibility for farms to supply poor consumers via a local food system, with the associated benefits, as well as the likelihood that these benefits would be compromised or added to by other farm related features of the food system. The second engaged with urban farmers in specific study areas to explore the high potential for food system alternatives which had been identified there and whether it was being realised as benefits to the urban poor. By considering these findings together, the research provides some light on urban agriculture across the City of Johannesburg and whether it is providing access to fresh produce for the urban poor in the context of the corporate food regime.

The research methods used to conduct these investigations are described in chapter two. Census data on average annual household incomes was mapped at ward level with Geographic Information Systems (GIS), as was satellite data on farmland in the municipality. Where the occurrence of poverty and agriculture overlapped this represented potential for a local food system to connect farms with the

urban poor consumer, whilst the classifications of the agriculture indicated the likelihood for other food system alternatives. The engagement with farmers in the study areas used two methods. A survey was conducted by trained researchers from the community, and the responses of 454 respondents were analysed. This was followed up by telephonic interviews of 18 farmers to provide more detail, especially on mode and channels of distribution. Some of the choices regarding the methods of the research were to hinder the limitations of the study or to ensure its compliance with ethics standards, which is included in this chapter.

Before getting to the main empirical findings, chapter three reviews literature and presents the conceptual framework of the research. The literature review begins by describing the corporate food regime, how it impacts on the food security of the urban poor in terms of accessibility, health, sustainability and empowerment, and the theory of food regimes. The way in which the 'alternative' has been understood by scholars is explored, justifying the separate consideration of different features of the food system and in what ways each differs from those characteristic of the corporate food regime. For this research, the food system characteristics are those influenced by urban agriculture, and the way in which they are alternative is measured in terms of benefits to the urban poor in the four spheres in which the corporate regime disadvantages them. Although their motivations may not be alternative, the people involved in the food system make choices which manifest as food system alternatives. The ways in which urban agriculture has typically been framed in South Africa disqualifies it from being alternative by disregarding that choice by farmers. What is required is a framework that sees the different food system characteristics in which urban farmers, regardless of their motivations, can choose alternatives that translate into benefits to the urban poor. The third part of chapter three initiates the findings of the study by constructing such a conceptual framework, which is informed by the literature but based on the empirical results of the research and serves to organize their analysis in the report.

The first part of chapter four shows how poverty in the City of Johannesburg is spatially clustered and concentrated in particular places, forming areas where there are many poor households (high absolute poverty wards), areas where poor households make up the majority of the population (high relative poverty wards), and areas where there are many and mostly poor households concentrated over space (high poverty density wards). This is an expected result but a necessary step to obtain a map which represents the chances that any farm making food available in that area would be reaching poor consumers via a local food system. The occurrence of agriculture, and its types, in relation to these poor areas reveals that much of Johannesburg's farmland has the potential to provide the urban poor with the benefits of local food systems and other food system alternatives. From the different classifications of agricultural data, the probability for the food system to be characterised by a particular foodstuff, nature of production and mode of distribution can be inferred, as well as the

possibility that it will remain local. Whilst it cannot really be quantified, the potential would be highest for areas of overlap between high poverty density and farmland, especially smaller scale, less intense forms of cultivation, growing crops that are naturally more nutritious and less likely to processed. The township of Ivory Park in the north-east of the municipality fulfils most of these conditions, but at least some are present for the area surrounding it, the area of Diepsloot in the north-west and that of Alexandra – for which the only condition present was high poverty density. These constituted the study areas for the following chapter.

The results of engaging with urban farmers themselves are presented in chapter five. By way of opening, the data to be analysed is fitted into the conceptual framework and the reader is introduced to the study areas and the farmers. Estimates regarding the amount of production taking place indicate that a substantial amount of food is being produced. All of the produce from almost all of the researched farms was made available locally through retention for subsistence, donation to local causes and sale to the local community. A few large farms selling their produce employed distribution channels which risked relocating the produce, but only for a portion of their harvest. And quite a number of farms grew maize, which introduced the possibility that it would leave the area to be processed, but the evidence suggested that this was an unlikely option. Thus most of the production bore the four types of benefits of local food systems, and many farms added to these benefits. The combination of different modes and channels of distribution employed made food available in ways that were empowering and accessible to the urban poor. Most farms were making use of a variety of agricultural methods which improved their impact on the natural environment and may even have enhanced the nutritional value of their produce. Nature of production was highly varied from farm to farm, but almost all of those researched were practicing some combination of the sustainability measures enquired about. Some farms were producing in monoculture, with large commercial or semi-commercial farms being more likely to do so than smaller farms. But the vast majority were producing a variety of crops, especially vegetables, but also fruit and legumes, all of which contain important nutrients. Maize and some starchy vegetables were cultivated, but these are nutritious when unprocessed, which was most likely the case according to the evidence. The chapter concludes by comparing the potential mapped in the study areas with the reality found there. The number of farms and area of farmland found in the study area exceeded what had been mapped, as did certain types of agriculture, which has important implications for the rest of the municipality, dealt with in the final chapter.

To conclude this research, chapter six reflects on the findings of the previous chapters in light of the research question and sub-questions. Chapter five not only confirmed and augmented the potential assessed for the study areas in chapter four, it also demonstrated how it was being realised by the many researched farmers who were indeed choosing to do things differently, resulting in a diversity of

food system alternatives. Smaller farms growing vegetables in high poverty density areas were considered to have good potential for food system alternatives. In the study areas, which were all characterised by high poverty density, most of the small farms, all of which were cultivating vegetables, operated in local food systems, produced healthy foods in a sustainable manner and made them available in ways that were empowering and accessible to the urban poor. But the map of poverty and farmland underestimated urban agriculture in the municipality and the nature of the omission suggests that there are more small farms, in areas of high poverty density, growing vegetables – farms representing great potential to be associated with food system alternatives.

In the study areas, larger farms selling their produce were more likely to be risking the relocation of some of their harvest outside of the local food system, but all of the large farms, even these ones, were also employing distribution channels that could serve and benefit the local poor consumer. Larger farms were also more likely to plant in monoculture, but again, all large farms, including these few, were making use of agricultural methods that improved their sustainability. A number of the researched farms were growing maize, but unlike what is implied in the crop type classification, few were growing it in monoculture. In addition, the evidence suggests that maize in the study areas was usually made available as unprocessed green mealies. The likelihood that these types of agriculture – larger scale and maize farms – are associated with food system alternatives may be greater when they are located in poor areas. By combining the findings of this research, we can conclude not only that urban agriculture is providing access to fresh produce for the urban poor in the study areas, but that there exists substantial potential for this to be the case in other areas of the municipality where poverty and agriculture overlap.

Chapter six concludes by suggesting further research related to farmers' choices. This study demonstrated the combinations and variations in foodstuffs produced, nature of production and modes and channels of distribution. It verified the influence of factors such as the access to land or size of the farm, but found exceptions for every rule, substantiating the view that urban farmers are choosing to do things differently, choices which result from the complex interplay of structure and agency.

CHAPTER TWO:
RESEARCH METHODS

The focus of this research is on the food systems in which farms within the City of Johannesburg operate, with regards to whether they present alternatives that are more beneficial to the urban poor consumer, in terms of accessibility, empowerment, sustainability and health. Local food systems oppose a number of the disadvantages of the corporate food regime, which are generally borne disproportionately by the urban poor. For a food system to be local, food producers (in this case urban farms) and food consumers (in this case residents of Johannesburg experiencing poverty) must be located within a certain physical proximity to each other. The spatial occurrence of both poverty and agriculture is thus explored for the municipality by mapping with geographic information systems (GIS), to locate areas of the City where there is a potential for such a local food system to exist. The benefits provided by a local food system can be enhanced or compromised by a number of other factors. By considering the spatial distribution of other aspects of the farms, various characteristics of the food systems in which they operate can be inferred.

Having located the potential across the municipality for a local food system that serves and benefits the urban poor, the research then focuses on a number of study areas where this potential exists, following up with a survey and interviews to confirm whether it is being realised. Acknowledging that any food system consists of numerous elements, each of which can take a variety of forms, this research studied a number of characteristics of a sample of farms in Ivory Park and the surrounding area, as well as in Diepsloot and Alexandra. Aside from confirming that the food system in which they operate is indeed local, the survey and interviews explored if, and in what ways, these farms make healthy, sustainably grown fresh produce available to the urban poor in ways that are accessible and empowering.

This chapter goes through three sections, on each of the main research methods, including information on the collection of data and its analysis in each case. The first section describes how mapping the occurrence of poverty in the City of Johannesburg and the occurrence of different types of agriculture gives an indication of the potential for local food system alternatives to exist across the municipality. The research then engages with farmers, in study areas which were identified as having high potential according to the mapping exercise. The second section thus explains the survey, which includes information on various food system characteristics and was responded to by a large sample of farmers. The third section explains the telephonic interviews which were conducted with a smaller sample of farmers, to obtain more detail, especially with regards to channels of distribution, which

was not covered extensively in the survey. The data obtained from the surveyed and interviewed farms was analysed together to reveal the variety of forms taken by the characteristics of the food systems around urban farms in these areas, and if and how these differ from the corporate food regime. Some of the limitations of the study are considered. The chapter concludes by giving the ethical requirements followed in conducting this research.

GIS mapping

To establish if and where there was potential, in the City of Johannesburg, for the existence of a local food system that serves and benefits the urban poor, mapping was used to seek places in the municipality where food is being cultivated in the same locality that many poor consumers reside. Both the spatial occurrence of poverty in the City and that of agriculture were analysed using spatial data from 2011. These were mapped and compared using free open source Geographic Information Systems (GIS) software called QGIS.

Mapping poverty

For the purposes of this research, poverty is defined as a lack of resources to meet basic human needs. It refers to a "condition of material and social deprivation in which people fall below a socially acceptable minimum standard of living or in which they experience deprivation relative to others in a society" (Hall and Midgley, 2004, p. xii, in De Wet, Patel, Korth, & Forrester, 2008, p. 5). In order to consider poverty across the municipality, Census 2011 data was used, which goes down to ward-level and so can be mapped onto the wards of the City[4]. The census reports the number of households per ward in different bands, according to annual average household incomes. There are conceptual and methodological concerns with using income as a measure of poverty (City of Johannesburg, 2004; Department of Social Development, 2007; Statistics South Africa, 2015a, 2015c). However, local research has found a strong correlation between low income and the likelihood and intensity of relative and multidimensional poverty (Mushongera, Zikhali, & Ngwenya, 2015; Statistics South Africa, 2015a). In attempting to map food insecurity across South Africa using expenditure and other variables, Alemu finds that poorer households who live in poorer municipal areas have a high level of food insecurity, and concedes that, despite the concerns, income is commonly used as a proxy for poverty and the related food security in the absence of other data at the scale required (2015). As such, household income data from Census 2011 was used, because it corresponds with the agriculture data, which is also from 2011, and because it is available at the sub-municipal scale.

[4] Many municipal areas in South Africa are spatially divided into wards by the Municipal Demarcation Board, based on the number of ward councillors required for local government in the municipality. The City of Johannesburg had 130 wards in 2011 (Municipal Demarcation Board, 2014)

Data on annual average household incomes has been used in other studies that appreciate the complex and relational nature of poverty. For example, a profile of urban poverty commissioned by the City of Johannesburg, which made use of various quantitative and qualitative measures of deprivation, used this specific type of census data, but from Census 2001, as an indicator of poverty (City of Johannesburg, 2004). It functioned as a measure of poverty in the study even though, as the authors explain, the income bands do not represent any specific poverty line. Another interdisciplinary mixed methods investigation called the Johannesburg Poverty and Livelihoods Study, cited one of the resulting figures, that over half of the households in Johannesburg earn an income of R1600 per month or less (City of Johannesburg, 2004 in De Wet et al., 2008). Although this figure of over 50% is now out of date, the benchmark of R1600 monthly household income (equal to an annual household income of R19200 in 2001) aligns closely with the definition of low income used by a 2015 review of poverty and income based on Census 2011 (annual household income of between R1 and R19600 in 2011) (Statistics South Africa, 2015a). Considering data from the Income and Expenditures Survey 2010/2011, the authors of this review state, "it would be practical to classify households in this [low income] category of income as poor households" (Statistics South Africa, 2015a, p. 17). In line with these studies, this research will define 'poor households' as those reporting annual household incomes of below R19601 (equivalent to R1633 per month), including the census income bands of 'no income', 'R1 - R4800', 'R4801 - R9600' and 'R9601 - R19600'. This is not intended to imply that the households reporting these annual incomes are homogenous, or that they can be statically characterised as "poor", rather it is an indicator which serves to locate consumers, as food system actors, whose economic circumstances make them disproportionately affected by the crises of the corporate food regime. A comparison between this definition of poverty and the national poverty lines reveals that most households defined as poor in this research are considered unable to meet their basic food needs, and all are considered unable to simultaneously meet both their basic food needs and their basic non-food needs (see Appendix A: Definition of a poor household used in the research in comparison to national poverty lines). By mapping where these households are in the municipality, we can get a sense of the spatial dimension of this form of inequality and social exclusion.

Using QGIS, the ward-level data on annual household incomes was incorporated as attributes into a publically available vector layer of the wards of the City of Johannesburg, obtained from the Municipal Demarcation Board. The layer thus included data on the area of the ward in square kilometres, the total population in households and the number of households in each income band. These variables were used to generate ward-level maps of population density, absolute poverty (the number of poor households in each ward), relative poverty (the proportion of poor households in each ward) and poverty density (the average number of poor households per square kilometre in each

ward)[5]. The data was also exported into Excel to be analysed as a spreadsheet. The occurrence of the three measures of poverty was studied using these maps, which revealed the spatial clustering and concentration of poverty in the City, revealing areas where many poor consumers reside. The location of poor areas in Johannesburg was not unknown, but this mapping was essential to correlate with the mapping of agriculture, thereby providing a complete picture of the municipality in terms of the probability that a farm located in a particular area could serve and benefit local poor consumers.

Mapping agriculture

As part of the fourth Gauteng Agricultural Potential Atlas, which serves to inform land-use planning in the province, the Gauteng Department of Agriculture and Rural Development have compiled spatial data on the existing agricultural land by visually analysing SPOT 5 satellite imagery from 2011[6]. All the farmland in the province was geo-referenced and the boundaries digitised into vector map layers, which were made up of polygons representing agricultural sites. A single farming operation, or even a single field, may consist of numerous polygons if it contains multiple classifications within it. The data was provided in two separate vector layers (or datasets) which for the most part overlap – one mapping the distribution of different cultivation strata, the other mapping the distribution of different crop types. Cultivation strata refers to the level of cultivation, and describes the physical form of the farm as well as the intensity of agriculture. The cultivation strata classifications which occur in the City of Johannesburg are 'enclosed', 'old fields', 'pivot irrigation', 'high cultivation', 'medium cultivation', 'low cultivation', 'small-scale farming', 'smallholding', and 'smallholding <5ha'. The crop type classifications are 'maize', 'pasture', 'soya beans', 'vegetables', 'horticulture', 'shade netting', 'sunflowers', 'fallow' and 'unclassified'. The crop type data covers a total area of 6 488ha within the Johannesburg municipality. Where it overlaps in some way with cultivation strata data, which is the case for 99% of the area, the crop type polygon has been attributed the cultivation strata classification with which it overlaps. For instance, a maize polygon which overlaps with some smallholding data is classified as a maize smallholding. The cultivation strata data covers 6 650ha in the City. Again, where there is an overlap with crop type data, as occurs for 99% of this area, the cultivation strata polygon is attributed the crop type classification with which it overlaps. For the purposes of this research, the area covered by agriculture refers to the average between the two datasets. Because point data was more practical for some of the analysis than polygons, new

[5] Note that the terms absolute and relative poverty are used in reference to the poor households in a given ward, they do not imply different definitions of poverty. The concept of poverty used for this research is one of structural inequality with a spatial manifestation, as detailed previously.

[6] SPOT is a commercial, high-resolution, wide-area optical imaging satellite system operating from space since 1986, run by Spot Image, based in Toulouse, France. SPOT is an acronym in French for "Satellite Pour l'Observation de la Terre," meaning Satellite for the observation of Earth. The SPOT 5 satellite was owned and operated by Airbus Defence & Space and collected image data down to a pixel resolution of 2.5 m. It was launched in May 2002 and decommissioned at the end of March 2015. (Satellite Imaging Corp, 2016)

vector layers were generated by deriving the centroid, or centre-point, of each polygon of data, to represent the location of each site.

Locating potential

Having mapped the agricultural data onto the ward-level poverty data using QGIS, spatial analysis was conducted to assign the correct ward to each of the agricultural data points. The area under agriculture in each ward was calculated in Excel and this was compared with the population and poverty characteristics of the ward that were mapped previously. Where clusters of agriculture occurred in wards that were part of the three types of poor areas, this represented a potential for these farms to make their produce available to the many poor consumers in these wards. The distribution of the different crop types and cultivation strata were then analysed for these areas, using the raw data in Excel and the map in QGIS. These classifications of the agriculture are generally associated with particular foodstuffs and forms of production and distribution, so they impact the likelihood for an alternative food system to exist there. Three areas of interest were considered in more detail: Kliprivier-Glenvista in the southeast of the municipality, Diepsloot-Northern Farm in the northwest and Ivory Park and the surrounding area in the northeast.

Survey with farmers in Ivory Park, Diepsloot and Alexandra

Aside from having particularly interesting characteristics in terms of the overlap of types of agriculture and poverty, Ivory Park was also the subject of a pilot study to get urban farmers 'online', which generated a large amount of data that was made available for this research. The study was part of the Youth AgrInitiative, a collaboration between the City of Johannesburg and Harambee, a youth employment accelerator, in partnership with the University of Johannesburg. The "Youth AgrInitiative: An Agroecology Business Solution for the City," was designed to unlock opportunities in the urban food system and advance local economies by facilitating connections through an online platform which was being piloted. I played a voluntary advisory role in this project, assisting with the fieldwork and training, which took place in Ivory Park itself, and participating in four meetings/field trips/events with different stakeholders, including staff of the University of Johannesburg, Harambee and the City of Johannesburg Department of Social Development, students from the University of Johannesburg and visiting students from a university in the USA, other consultants and trainers from various organizations, researchers from Ivory Park and farmers from Ivory Park.

As part of the initiative, a comprehensive baseline study to locate and register urban farms was conducted, focusing in Ivory Park but including some farms in the surrounding area, as well as in Diepsloot and Alexandra. The survey was conducted using a mobile data management tool, by 29 young people from the local community who had undergone nine training workshops in a 10 week

programme which ended in September 2016. The fieldwork then took place from late September to mid-December 2016. The young researchers were divided into teams, each with a postgraduate student with research experience to act as a mentor. Within each team, the researchers worked in pairs to survey any farms which they could identify in a particular part of Ivory Park to which they were assigned. They were also encouraged to identify and survey farmers in other areas. To start, a City of Johannesburg official, who manages the urban agriculture programme for the Department of Social Development for this region of the municipality, gave the pairs details of any farms she was in contact with in their area, and the pairs then employed snowball sampling as one way to identify other farms. They also visually identified farms in the field by moving through the area on foot and enquiring with local people. The survey respondents represent only a sample of the farms from each of the study areas including Ivory Park, generated through non-probability sampling since there was no sampling frame for the farms in these areas. The sample is thus non-random and is not necessarily representative of the area as a whole, rather it provides evidence of the existence of different variations of the food system in these areas. Although the pairs of researchers did not employ any systematic method to ensure that they reached all the farms in the area of Ivory Park which they were given to begin, after about 10 weeks of fieldwork, all of the pairs reported that they had exhausted the areas that they had been assigned to and were starting to look elsewhere. For Ivory Park, therefore, the survey sample represents a fairly comprehensive coverage of the farms in the township. Once a farm had been identified, a suitable representative was sought and invited to participate in the survey, given the nature of the data to be collected and how it would be used.

The survey was conducted in various sections, three of which were used in this study (see Appendix B: Farmer survey). The baseline survey included questions about the farm itself, the resources and techniques employed, the produce, and the benefits to the respondent, and it required that photographs of the respondent and the farm be taken and a Global Positioning Satellite (GPS) location be recorded for the site. This survey was linked, by means of a system generated identification number, to a member registration survey regarding the respondent themselves, and this in turn was linked to a survey on the outputs of the farm, as well as a number of other surveys. This research employed data from the baseline survey and the outputs survey but required the member registration survey in order to establish the link between the two and to confirm that consent had been obtained. So only those respondents for whom all three of these surveys had been completed and linked were selected for analysis. There were 457 of these ‘complete’ surveys, three of which were later excluded because they were located in wards with low poverty. Given their permission, the full name of the survey respondent was collected as part of the member registration, but this has been excluded from this research and the farm name has been referred to instead. Although some farms had the same names, for example there were multiple farms called Bokanyo, other details were used to confirm that there were no duplicates.

Using their GPS coordinates, the locations of the surveyed farms were mapped against the existing maps of poverty and agriculture in QGIS, and the correct ward was assigned to each farm. The survey responses were analysed using Excel with regards to the characteristics of the farm itself, what was being produced and how, and particularly where the produce was going after being harvested. The analysis focused on the forms of food system characteristics related to the farms, such as the foodstuffs produced and the types of production and distribution which they make use of, and whether these oppose the dominant corporate food regime by presenting an alternative that could provide more benefit to local poor consumers. To draw some conclusions regarding the potential mapped previously in light of the findings of the surveys, the 2011 satellite data on agriculture and the 2016 survey locations were compared for the study areas. Aside from using QGIS and Excel, the GPS coordinates of the 2011 point data layer, and the GPS coordinates from the surveys were exported online into Google maps where they could be seen in relation to current satellite imagery of the areas.

Interviews with farmers in Ivory Park and Diepsloot

In order to obtain a greater level of detail about the farms in the study areas and the type of food systems which they represent, telephonic interviews were conducted with representatives of farms in Ivory Park and Diepsloot (see Appendix C: Interview schedule). Contact details for 12 farms from Ivory Park and 12 from Diepsloot were provided by the aforementioned City of Johannesburg official, who manages the urban agriculture programme for the Department of Social Development for this region of the municipality. They were a sample of the farms that she was in contact with, some of which had received or were receiving support from the City in terms of inputs, extension visits, access to the Agri-hub[7], and facilitating training and market days. The official was willing to share the details of a selection of farms, and having understood the purpose of the research, provided this sample saying that it represented a diversity of farms in the two areas. Again, this purposive form of non-probability sampling makes the interviewees illustrative of the variety of food system characteristics in the area, but not representative of all agriculture there.

Of the contact details received, nine representatives of farms in and around Ivory Park agreed to take part in the interview (3 of which had been represented in the survey as well) and a further nine from Diepsloot. Having accepted the invitation to participate based on an explanation of the research and how I obtained their details, most of the interviews were conducted during work hours on weekdays,

[7] An Agri-hub is a "production, equipment hire, processing, packaging, logistics, innovation and training unit" made available in a central place within a municipality to support farmers in the area (Department of Rural Development and Land Reform, 2016). The Agri-hub in Ivory Park is located on the grounds of the community centre and is staffed by the City of Johannesburg Department of Social Development

although some interviewees scheduled an alternative time. The questions were semi-structured, covering the characteristics of the site, people involved, the nature of production, what is produced and how much, and what happens to the produce after harvest, focusing on how produce is distributed, where, in what quantities and at what price. Whilst the survey, even the outputs component, provided only some evidence regarding the ways in which consumers might be accessing locally grown produce, the interviews generated much more detailed information about the modes of distribution and how and to whom produce was made available. Data gathered from the interviews was integrated into the analysis of the survey data described above and formed the basis of the analysis regarding production for sale and accessibility. Most of the analysis combined the farms across the study areas, seeing them as equivalent examples of urban agriculture amidst high poverty density. They were only analysed separately in referring back to the mapping of the agricultural classifications, which differentiated the areas in terms of potential. As mentioned, the conceptual framework used to structure the analysis, of the potential for food system alternatives and then the realization of that potential in the study areas, was designed to accommodate the findings based on the literature and the data collected.

Limitations

The research methodology employed by this study included choices intended to hinder a number of limitations. These were related to the engagement with farmers and not consumers, the use of data obtained from the Youth AgrInitiative survey and the concentration of the survey and interview in the various study areas.

Engaging with farmers as the source of information about the food system was exceptionally fruitful, showing the complex diversity in the foodstuffs produced, and types of production and distribution employed by farmers. Also, as a result of the corporate food regime, consumers often do not know much about the food system behind their food. However, without the consumer's input, their experience of food system benefits was based on theory. For instance, making fresh produce available locally in small affordable quantities through informal traders, was expected to provide benefits to the urban poor in terms of accessibility and empowerment[8]. But the consumer could also provide their experience of accessibility and of empowerment. The four benefits explored were well-founded on the research, both literature and empirical findings, but without engaging with consumers themselves the

[8] Without studying the consumers themselves, the research also could not confirm that they were poor – the focus instead was on whether food is *accessible* to urban poor by making it available in *areas* where there were many poor consumers, and in ways that are known to be appropriate for the food provisioning practices of the poor. Whist many consumers buy food from areas other than where they live, whilst travelling to and from work for instance (Shannon, 2016), local sources of food are understood to be the most important to the poor (Battersby, 2012; Kroll, 2016a), so considering areas where many poor households reside was reasonable.

relative importance of these four spheres could not be confirmed[9]. Because this study didn't engage consumers themselves, it may have emphasised the materiality of the food system, to the neglect of the "the cultural realm of symbol, language, narrative and identity" (Kroll, 2016a). For example, the cultural appropriateness of the foodstuff, a widely recognised aspect of empowerment, was not included in the research because there is insufficient literature to say what foodstuffs would be culturally appropriate in the specific communities studied without empirically researching consumers themselves. That being said, the objective of the research was not to explore the consumption choices of the urban poor, which has been the subject of other studies that informed the conceptual framework of this research (Battersby, 2012; Battersby et al., 2015; Kroll, 2016b, 2016a; Pereira, 2014; Rudolph et al., 2012). Indeed, all actors in the food system make choices related to the food system, all of which could be the subject of study. But because this research pertains to urban agriculture's impact on the food system, so focussing on the farmer's choices and how these could better serve and benefit the poor was well justified.

Because the food system is so multidimensional and complex, this research had to create boundaries appropriate to its purpose, which delimited the scope to the elements and relationships depicted in the flow diagram of the conceptual framework. A limitation, however, was that the Youth AgrInitiative survey data was collected as part of a different research agenda from that of this particular study. The evidence that it made available shaped the scope of this study. Fortunately there was at least some data related to each of the elements of the food system included in the conceptual framework, but this was minimal in the survey for some aspects, such as the donation of produce and the distribution channels used. The interviews compensated for this deficiency considerably, albeit with a smaller sample of farms.

Finally, the study areas of Diepsloot and of Ivory Park and the surrounding areas emerged from the mapping as having high potential for local food systems and other food system alternatives. It was fortunate that the Youth AgrInitiative also chose Ivory Park as the focus for their pilot study, and even more fortunate that the researchers in that project recorded surveys in the surrounding areas and in Diepsloot, of all places, once they felt they had exhausted the population of farms in Ivory Park. The City of Johannesburg official who provided the contact details for the interviews was in charge of urban agriculture for the administrative region of the municipality in which both Diepsloot and Ivory Park are located, so she was able to provide a sample from both. Aside from that, the researchers also surveyed some respondents from Alexandra, so these were included in the study since they were also located in poor wards. The different study areas did not differ significantly in the urban agriculture

[9] This would no doubt differ from consumer to consumer, even between the four. For instance, some consumers would prioritize the accessibility in terms of price over the sustainability of production.

which they contained, and for that reason the analysis was usually presented with the results for the areas combined. Although there was incredible diversity between the researched farms, it only represents the variety found in these areas with similar characteristics. Given unlimited time and resources, the study could have engaged with farmers from other parts of the City, to provide a useful contrast to the areas studied. Nevertheless, the advantage of having multiple study areas was not to compare, since they were so similar, but to expand on and confirm the findings. Differing from project-based case study research, which gives a very narrow perspective of urban agriculture as it occurs more generally, this research not only explored the practice across particular areas rather than within a particular project, sampling in such a way as to capture as much diversity as possible, it also took a very broad look at urban agriculture across the entire municipality, possibly for the first time this has been done.

Ethics

Ethics clearance was obtained from the University of Witwatersrand for this research. A human research ethics clearance certificate was granted based on a description of the methods (see Appendix D: Ethics clearance certificate). In line with this description, research participants for the survey and interview were identified by physically visiting sites during fieldwork and based on contact details provided by a City of Johannesburg official. When a research participant had been identified, I or the researcher conducting the survey explained the purpose of the research, the nature of the data to be collected, including the GPS location and photographs, and how it would be used. In the cases where the participant's details had been provided by the City official, this was also explained, and the independence of the research from any support or initiative by the City was assured. It was communicated to all participants that the survey or interview was entirely voluntary, was not expected to result in any advantage or disadvantage to the participant, and could be terminated and omitted from the research at any point should they so choose. Participants' names and other personal details were not used in this report. The research proceeded as expected and participants were generally very willing, and quite proud, to share information about the farms they were involved in. My involvement in the Youth AgrInitiative was voluntary and did not involve compensation. Data from the project was made available in line with the project's 'open source' information sharing policy. Data from the Gauteng Department of Agriculture and Rural Development and from the Statistics South Africa Census were publically available.

CHAPTER THREE:
LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

By reviewing literature, this chapter situates this study in a theoretical context, and assembles the conceptual framework by which its results were organized. It is arranged in three main parts, the first covering research and theory on the corporate food regime and its alternative, the second part looking to urban agriculture in South Africa and how it has been understood, and the third part detailing the conceptual framework of the research.

Concerned with the food security of the urban poor, the first section describes how those experiencing poverty in cities are disproportionately affected by many crises which can be considered under four main spheres, and considers how these are provoked by what has been called the corporate food regime. This is followed by a brief explanation of the theory from which the notion of the corporate food regime emerges. The concept attempts to understand what characterises the current food system, but theorists in this field are also trying to recognise where alternatives are finding room to occur, for instance through localization. Having outlined some of the benefits of a local food system, the second section looks at the understandings around alternatives. 'Alternativeness' is generally observed in some characteristics rather than across an entire food network, and it need not be that the motivations of those participating are what makes it alternative or oppositional. Taking the very relevant example of informal food retail, the following section demonstrates that, in relation to the corporate food regime's failure to serve and benefit the urban poor, any given characteristic of a food system could be advantageous in some ways and disadvantageous in others. This complex, multifaceted nature of agro-food systems has resulted in a heterogeneity of spaces, relations and practices, gaining a foothold in the shifting terrain of the corporate food regime. Retaining the focus on those in poverty and without disregarding the structures and power relations at play, the next section considers how the agency of people in the food system, including food producers, is what is expressed on particular food system characteristics to create alternatives to the corporate food regime.

The second part of the chapter considers research on urban agriculture, especially how it is viewed in relation to the food system and its capacity to present alternatives to the corporate food regime. We review some of the ways in which urban agriculture has been understood in much of the literature. The state in South Africa has seen urban agriculture as just another cog in the machine of the corporate food regime, or as a marginal survival strategy for household food security. The latter is common in academia as well, due partly to the history of types of research regarding the practice. These prevalent framings mask the possibilities for urban agriculture to be part of an alternative food

system and have disempowered urban farmers as transformative agents. The conceptual framework presented in this chapter, on the other hand, by disaggregating the characteristics of the food system from the motivations for participation, reveals the opportunities for urban farmers to choose food system alternatives that better serve and benefit the urban poor.

Having reviewed the literature on agro-food systems and urban agriculture, this chapter concludes by drawing the emerging concepts together into a framework for this research. The conceptual framework was designed on the basis of the research results, including the empirical findings as well as the literature. In some ways, it is therefore part of the findings itself. It is included in this chapter before moving to the rest of the findings because of its importance in structuring the analysis and exposition of the results, which follows this chapter. A flow diagram is used to depict the elements of the food system which were considered in the study and their relationships to the four types of benefits for poor consumers: accessibility, empowerment, sustainability and health. Local food systems are expected to provide a beneficial alternative to the characteristics of the corporate food regime in all four spheres, and a number of other food system characteristics related to urban agriculture are expected to add to or compromise these benefits. The framework has places to accommodate all the data used in this research, but embedded throughout is the choice of the farmer, resulting from the reciprocal influences of structure and agency.

The corporate food regime

Compound crises and their impact on the urban poor

Over the last decades, the food system in South African, as in many other countries, has become increasingly consolidated, facilitated by the deregulation and liberalisation of agriculture and agro-food markets in the 1980s and 1990s, intended to boost foreign trade (Battersby et al., 2015; McLachlan & Thorne, 2009). Under the current dispensation, the market continues to have relatively free reign, and power and profit are concentrated in fewer and fewer hands (Greenberg, 2006; Wegerif, 2014). Several large listed companies control production and sales in most food sectors. For example, four companies control 73% of the maize market, another four control 87% of wheat milling, and another four companies account for 97% of all food sales in formal retail (Battersby et al., 2015; André Louw, Vermeulen, Kirsten, & Madevu, 2007; Mather, 2005; McLachlan & Thorne, 2009). Aside from dominating the retail sector, large supermarket chains have restructured food manufacturing and have increasingly influenced downstream production and processing through vertical integration (Battersby et al., 2015).

Small farmers, manufacturers and retailers struggle in the face of the market power of large consolidated agribusiness in this increasingly competitive commercial food system, overshadowing the limited progress of reform and transformation post-apartheid, as the inequalities of the old agrarian and land system remain largely unchallenged (Battersby et al., 2015; Pereira, 2014; South African Cities Network, 2015). Consolidation in the South African food system has thus been implicated in creating and perpetuating poverty and vulnerability and so, indirectly, being a cause of hunger (Battersby et al., 2015). But these changes have also faced more direct accusations. Deregulation of the agro-food sector was accompanied by the abolition of controls on food prices, resulting in relentless increases for the consumer from the 1980s until the 1990s (Battersby et al., 2015). Again, food prices have risen substantially up to today, regularly outstripping overall inflation, for instance reaching 10.3% between January 2011 and January 2012, during which time the country's main staple, white maize, increased in price by 90% (Pereira, 2014). In March of 2016 annual food price inflation reached 9.8%, its highest level in four years, attributed not only to a regional drought, but how this combined with the depreciation of the rand and its impacts on trade and prices. The mounting dominance of formal market-based food systems, which are increasingly open and global in character, means that international shocks are almost entirely passed on to the consumer via local wholesale and retail food prices (Pereira, 2014; Ruysenaar, 2013). Some argue that the prominence of formal food networks may in fact be aggravating food price volatility (Baiphethi & Jacobs, 2009).

The impacts of food price increases affect poorer households the most, since they spend a higher proportion of their income on food (Battersby et al., 2015; Pereira, 2014). "Food prices are probably the most important single factor to which the urban poor are extremely vulnerable." (Battersby et al., 2015, p. 21). Many studies have pointed out the growing dependence of southern African and South African households on markets in obtaining their food, especially in cities (Pereira, 2014; Ruysenaar, 2013). The African Food Security Urban Network (AFSUN) conducted the Urban Food Security Baseline Survey in poor areas in a number of towns across the region, including Johannesburg (Rudolph et al., 2012). Income was found to be positively correlated with food security, agreeing with other research that the dimension of food security that is most important in urban areas is the ability to access food by purchasing it (J. S. Crush & Frayne, 2011; D. Maxwell, 1999; Rudolph et al., 2012; Ruysenaar, 2013). The survey found that 42% of respondents from poor areas in Johannesburg were food insecure, and 54% indicated that food price increases had had a negative impact on their food consumption (Rudolph, 2012). The price of food largely dictates what a household having limited income to spend on food can access, meaning inflation in food prices not only increases food insecurity for these households but also results in dietary changes (McLachlan & Thorne, 2009; Pereira, 2014). Households experiencing financial hardship tend to sacrifice variety and quality,

within an already inadequate food basket, in an attempt to reach sufficient quantity in volumes and energy (Battersby et al., 2015; Shisana et al., 2014).

Rather than benefiting the consumer, in this context of insecure economic access to food, some make the case that supermarket retail may actually be perpetuating food insecurity (Malan, 2015). They point to both the unhealthy consumption patterns supported by the formal retail system and, more generally, a "significant disconnect between the needs of the poor and the goals of the market" (Ruysenaar, 2013, p. 225).

Millions still suffer the effects of malnutrition in the country, with indicators of some conditions even having worsened over the past decades and some studies suggesting that the dietary quality of South Africans has deteriorated since 1990 (McLachlan & Thorne, 2009). Energy, protein and nutrient malnutrition are high amongst the country's children contributing to 64% of all deaths under the age of five (UNICEF South Africa, 2015). Deficiencies are unacceptably common in many micronutrients, and in fibre, related to low dietary diversity and inadequate consumption of fruit and vegetables (Kroll, 2016a; McLachlan & Thorne, 2009). There is also the dual burden of insufficient energy consumption amongst those with greater requirements, and excess energy consumption in others whose lifestyles are more sedentary (Kroll, 2016a; McLachlan & Thorne, 2009). The result is persistently high levels of early childhood stunting occurring alongside high and rapidly growing prevalence of obesity, both being particularly prevalent in impoverished urban areas (Kroll, 2016a; McLachlan & Thorne, 2009). Unhealthy diets are considered the leading cause of chronic non-communicable diseases, like type 2 diabetes and cardiovascular conditions such as high cholesterol and blood pressure, although they are also related to other lifestyle changes associated with urbanisation (McLachlan & Thorne, 2009; Pereira, 2014). Furthermore, the link between diet and communicable diseases such as HIV/AIDS and tuberculosis is well-established (McLachlan & Thorne, 2009).

Amongst other factors, the 'nutrition transition' to diets low in diversity and high in fats, sugar and salt, is largely understood to be caused by changes which have made highly refined, nutrient-poor, fatty foods relatively more available, affordable and attractive than a healthier, less processed, more diverse diet (Battersby et al., 2015; Kroll, 2016a; McLachlan & Thorne, 2009; Pereira, 2014). The expanding influence of 'Big Food', understood as the massive corporate entities dominating the food system, is an undeniable factor in these changes (Pereira, 2014). Driven by commercial imperatives, the industrial food system has churned out higher calorific, lower micronutrient options by refining starches and adding sugar, salt and fat to them, and supermarkets have made these packaged foods, produced by large manufacturers, highly accessible to low income consumers seeking the easiest cheapest source of energy (Battersby et al., 2015; Pereira, 2014). Whilst supermarkets supposedly

offer better prices overall on a variety of foods, poor South Africans do not always have the disposable income to take advantage of the greater diversity and lower prices because of the larger quantities on offer, and their lack of refrigeration and storage favours processed, energy dense food products (Malan, 2015; Pereira, 2014). This is exacerbated by the distribution of supermarkets which gives preference to wealthy communities, meaning consumers from low income areas are forced to travel longer distances, usually on foot or paying for public transport, and so tend to shop at this form of retailer less frequently, buying less perishable items (Battersby, 2012; Kroll, 2016a). Supermarkets are located and stocked according to purchasing power and profit margins, and where they have penetrated poorer areas, they generally supply a smaller range, and less healthy foods (Kroll, 2016a).

This is indicative of a system in which "the motive force of profit prevails over concerns about equity and nutrition" (Weis, 2007, p. 13). The freedom of economic choice promised by neoliberal capitalism is being progressively separated from poverty and deprivation (Leyshon and Lee, 2003, in Watts, Ilbery, & Maye, 2005) and food aid programmes have to be employed to make amends for the fact that capital has been ineffective at getting food to those in need (Greenberg, 2006). The logic underlying the current food system is fraught with inefficiencies (Greenberg, University of the Western Cape, & Institute for Poverty, 2013), excesses (McMichael, 2000, in Allen, FitzSimmons, Goodman, & Warner, 2003) and invisible costs (Clancy, 1997, in Allen et al., 2003).

In terms of the environment, these have been well documented. The (ir)rationality of the corporate food regime has resulted in highly consolidated but geographically elongated food value chains. The equally fossil fuel dependent agriculture which feeds them is then made up of minimized agro-ecologies, subsidized by synthetic nutrients and indiscriminate pest control (Niles & Roff, 2008). Few remain convinced by the justifications of powerful industry giants about increasing scale and intensity of production in order to provide more and cheaper foods (Niles & Roff, 2008). The change in focus from issues of quantity to those of quality in agro-food studies is not only part of a broader 'cultural shift' in academia, but also results from mounting evidence that food systems contribute to resource depletion and climate change, and that they will be ever more severely affected by them (McLachlan & Thorne, 2009; Niles & Roff, 2008). South Africa's agricultural resource base was poor to begin with, having mostly shallow, sandy soils and very little arable land, coupled with a shortage of surface water and a scarcity of ground water reserves (McLachlan & Thorne, 2009). Inherently vulnerable, the land has been exposed to all sorts of soil degradation, extended by inappropriate agricultural methods such as intensive tillage, exclusive and excess use of synthetic fertilizers, monocultures and limited crop rotation (McLachlan & Thorne, 2009). The farming sector already sucks up 60% of the country's total water resources (Pereira, 2014). Expanding irrigation may not be possible in the face of higher temperatures, more variable rainfall and decreased soil moisture in the region, should climate change be allowed to progress (McLachlan & Thorne, 2009). Unless the agro-food industry

and other culpable sectors take urgent measures to reduce emissions, it is estimated that southern African maize production will fall by around 30% by 2030 (McLachlan & Thorne, 2009).

Again, it is those without the resources to avoid or adapt to the threatening changes in the climate that remain the most vulnerable, as the modernized model of industrial agriculture devastates our agricultural ecology and the environment at large. Whilst everyone connected to the global market is affected by volatility and crises, because the globalization of the food system has made us rely on international trade for our supply of food, it is the poorest who are especially at constant risk of hunger as a result of fluctuations in food prices. We are all increasing reliant on highly concentrated and consolidated food value chains, culminating in the rapid rise of the supermarket. However, consumers in low income areas face additional pressures to choose nutritionally poor options and so bear the brunt of the epidemiological shifts of the nutrition transition. Perhaps the more subtle threat we face, underneath it all, is that decisions about food have concentrated under the power of states, international organisations and transnational corporations rather than people (Goodman and Watts, 1997). This has resulted in the commodification of food and its distancing from its primary social function to provide nourishment. Once more, this disempowerment compounds poverty and marginalisation, having disproportionately severe consequences for those who already lack sufficient food for nutrition.

There is mounting recognition that we face multiple and related crises, all of which disproportionately affect those experiencing poverty. Many argue that it is the food system itself which is unsustainable (Wegerif, 2014) – the complex network of actors, institutions, activities and interdependencies involved in the growing, processing, distributing, storing, acquiring, consuming and disposing of food, as well as the outcomes thereof (Battersby et al., 2015; Kroll, 2016a). Various authors have associated the 'system' itself with: the concentration of ownership and control leading to lower returns to farmers, social inequalities and power imbalances; rising hunger among those unable to afford from the abundance of food produced; health issues such as malnutrition, obesity and non-communicable diseases; fossil fuel dependence and carbon and methane emissions contributing to climate change; the destruction of biodiversity; the depletion of scarce fresh water; the devastation of soil health; the erosion of the social fabric of communities; and the commodification of food through the radical separation of producers and consumers (Allen et al., 2003; Greenberg et al., 2013; Wegerif, 2014). The effects can be classified into four main ways in which the corporate food regime disadvantages the urban poor: in terms of accessibility, empowerment, sustainability and health. It is clear that the current situation is grave and will not be solved by approaches that fail to extend beyond a narrow focus on one or two processes or roleplayers at a single scale, 'tinkering at the margins' while the existing system continues to expand (Battersby et al., 2015; McLachlan & Thorne, 2009; Wegerif, 2014).

Food regime theory

These crises are the outcome of multifaceted interactions between numerous factors on various levels, and this complexity requires a perspective on the entire food system and broader systems (M. Lewis, 2011; Pereira, 2014). Food regime theory, emerging from work around the globalization of capitalism and the rise of the industrial agricultural model by Friedman and McMichael (1989), represents such a theoretical perspective. Typical of the macroeconomic viewpoint that characterised the beginnings of agro-food research (Niles & Roff, 2008), Friedmann and McMichael have continued to go to great lengths until more recently, to show that the processes affecting the agro-food system are not unintentional (see for example, Friedmann, 2005; McMichael, 2013). Rather, they are the result of purposeful decisions and alliances of states, organizations and corporations, who through distinct phases in history called 'food regimes', have used food to secure global hegemony in a capitalist competition to accumulate. Specifically, in the third 'corporate' food regime (1980s to 2000s), globalisation is the preferred mechanism employed by the dominant powers to (re)structure international political economy in their favour. Exemplifying much of the agro-food research, this work tackles broader questions about the realities of global capitalism in the twenty-first century, by claiming the centrality of food in both defining, and being defined by, the existing political economies, and the alternative forms of social organization which resist them (Goodman & Watts, 1997).

The food regime approach "linked the international relations of food production and consumption to forms of accumulation, broadly distinguishing (three) periods of capitalist transformation since 1870" (Friedmann & McMichael, 1989, p. 95). Friedmann and McMichael identify broad time periods of particular world (re-)ordering constituted by, and mutually conditioning, the food regimes of those times. The relationships and practices of a particular regime, when working well, soon come to appear natural, and it seems to operate "without rules" (Friedmann, 2005, p. 234) or the rules become implicit. The food regime is thus a time in which there is a political structuring of world capitalism by global food relations in such a way that seems quite rational. Hence the apparent inevitability of globalisation emerging from, and in turn shaping, the food system today. This normalization has been possible under various global hegemonies, all of which, according to food regime theory, have secured their power through food. Rooted in a Marxist tradition, the theory purports that the world economy is structured and its agricultures organized to provision labour and/or consumers such that wage costs are reduced and profits increased, in an expression of hegemony in which food plays an instrumental role.

The food regime is thus about the aggregate of food, capital and power, and who has it. Before the current reality it was in the hands of the British Empire and then the ‘empire’ of the United States of America. The first food regime, starting in the 1600s, was related to rising industrialisation (and consequent urbanisation) in the United Kingdom. The success of their "workshop of the world" project rested on the ability of Britain to acquire cheap food supplies from territories throughout the world, to supply their domestic workforce for industrialization. Trauger (2015) considers, for instance, how in the 1700s and 1800s, Britain passed Enclosure Acts to privatize common land, separating thousands of British peasants from the land that fed them and forcing them to seek factory work. She identifies how the Enclosure acts not only enlarged the ranks of urban labour who now needed to be fed by the British Empire, but also how this landmark in terms of private property was a key moment in the modernization of agriculture. Beginning to take over in the 1850s and persisting beyond the 1970s, the second food regime was characterised by the hegemony of the United States of America and their use of food aid to develop alliances, markets and opportunities for a model of agriculture that was increasingly intensive and industrial (McMichael, 2013). After the Second World War, variations of the modernist system of agriculture had taken root, and market economies of food largely replaced subsistence, to some degree almost everywhere (Friedmann 1993 in Trauger, 2015). This development path, entrenched by neocolonial processes, not only served for the capitalist transformation of the countryside, but, by dispossessing millions of their land, also recruited many into the urban/industrial economy (Trauger, 2015).

Most researchers writing about agrifood issues since the late twentieth century refer to the third 'corporate' food regime, with its organising principle of the market, in which globalisation of the food system has really been pursued with intent. During this time, all interests have become increasingly subordinated to the strategies of global corporations, which rely on securing transnational circuits of money and commodities, including food. The structuring of the world food economy is a process involving multiple forces in which a number of actors have been involved (Clapp, 2013). These same actors occupy what Clapp calls the new 'middle spaces,' which have developed and grown between the producers and consumers of food, spaces in which the very purpose of food is being redefined and where the interests of these actors dominate (2013). As the expanse between producers and consumers has figuratively and physically widened, their choices have increasingly become subordinate to the "mercantilist aims of states, the development goals of international organizations and private foundations, the profit motives of transnational corporations, and the financial objectives of investors" (Clapp, 2013, p. 152).

The food regime acts as a device by which to understand the reality of food insecurity and its relationship to power and capital. In the third corporate food regime, the consolidation and concentration of the food system into global market agribusiness and supermarket retail has impeded

meaningful transformation post-Apartheid and exacerbated food price volatility. Dominated by Big Food, the market has failed the urban poor, providing "bad access to good food and good access to bad food" (in the words of a key informant in Tsegay et al., 2014, p. 4). The same market turns a blind eye to the environmental costs of the forms of production and distribution that it upholds, and with its short-sighted lens, sees only the commercial value of food-as-commodity. Carried along by globalization, the corporate food regime has literally and conceptually created vast distances on all sorts of levels in the food system. However, in as much as these characteristics of the food system are not unintentional, neither are they inevitable. There are other food system options which persist, and these bridge the gaps by differing from the conventional in all four spheres in which the corporate food regime's crises afflict the urban poor. The following part of the chapter looks at how the 'alternative' has been understood in the literature, to provide the theoretical architecture by which to consider urban agriculture as an alternative to the corporate food regime.

What is the 'alternative'?

Localization

The notion of the corporate food regime is an attempt to theorize the causes and impacts of changes in these physical and conceptual distances between production and consumption processes, relations and players. McMichael takes up the concept in order to describe the pervasive and dominant trends in the political economy of food, but he is amongst the first to acknowledge that these are not totalising, and that the corporate food regime also involves significant counter-currents (2013). Agro-food research has not only grappled with ways to represent the predominant hegemonic transactions and movements of food, but also those which do not conform. Most studies mount their exploration on the local (Allen et al., 2003), relating well with food regime theory which sees globalisation as the main thrust behind the changes in this third regime.

The goal of (re)localizing is community-based food systems grounded in local supply for local needs and with local decision-making (Allen et al., 2003). By shortening the supply chain to a more human scale, this approach re-establishes trust and reciprocity relationships in food, known as "embeddedness" (Clapp, 2013). Sage (2003) uses the notion of 'relations of regard' to theorize further on 'embeddedness' by looking at the benefits of face-to-face transactions for the producer as well as the consumer. Value and meaning in food is derived largely from relationships, especially direct personal ones that are facilitated by evading the "faceless intermediaries" stationed along industrial food commodity chains (Allen et al., 2003, p. 64). There are numerous other benefits: Bringing the site of production closer to consumption also increases accountability, motivating both producers and consumers to internalise the ecological and social externalities in the real cost of food (Allen et al.,

2003). Reducing the physical distance that food must travel decreases the need for costly distribution systems which are energy and resource intensive and environmentally destructive. Lessening the dependence of an area or population on external sources of food also improves resilience and supports self-determination (Kelly & Schulschenk, 2011). Associated with the construction of community on the basis of common interest, local agro-food networks are also lauded as a seedbed for alliances and movements as counter-forces to challenge the control of national and global corporations and other 'middle-space' players (Allen et al., 2003; Niles & Roff, 2008). The alternative characteristics of local food systems, which yield numerous benefits, include this opposition to the corporate food regime, but this feature is not indispensable to alternativeness, as will be described below.

Motivation and other characteristics

Allen et al. see in the localization of food both the 'oppositional', in which case a critique of the existing food system is presented, and the 'alternative', which they understand as describing a given arrangement that presents a novel vision of social, economic and/or ecological relations in food (2003). Research from the global north, especially North America, has tended to emphasise the political agenda of food initiatives which are more oppositional and activist in their nature (Allen et al., 2003; Holloway et al., 2007). Whilst this literature also depicts their other features, illustrating how concerns for social, economic and environmental justice manifest themselves in aspects such as what is produced and how it is distributed, the defining characteristic highlighted by this literature is the intentions of those involved (Allen et al., 2003; Holloway et al., 2007). But a number of authors from Africa have studied food systems that may not have been purposefully established in critical opposition to the corporate food regime or even in order to envision a more just alternative, although they would argue that these systems manage to do both as a result of their other characteristics (Abrahams, 2006a; M. Lewis, 2011; Nicolle, 2011; Slater, 2001; Wegerif, 2014). Abrahams, for instance, makes a strong case that, whilst the foundations of alternative food networks in the south of Johannesburg are more survivalist than activist, they are *oppositional* to conventional food supply systems, and have emerged, in the context of increased access to supermarkets, as an *alternative* means of (culturally specific) food provisioning that responds to the needs of the poor (2006a). Similarly, in concluding his study of egg provisioning patterns in Dar es Salaam, Wegerif is hopeful that "alternatives to the unsustainable industrial food system are not only possible, but actually exist already, albeit with room for enhancement" (2014, p. 6). These researchers describe food networks which they readily term as alternative and/or oppositional, but more as a result of other characteristics rather than because the people involved in them are driven by an explicit intention to make them so.

Scholars have for the most part abandoned the dualistic idea that either every aspect of an entire food system will be conventional, or the entire system will be alternative (Holloway et al., 2007; Ilbery &

Maye, 2005; Niles & Roff, 2008; Watts et al., 2005; Wegerif, 2014). Whether framed as a food system, a value or supply chain, a food network, a pattern of provisioning, or a food environment or landscape, theorists accommodate the multiple actors and processes involved and increasingly agree that not all of these will necessarily diverge from the broader structural system or the value system that typifies the corporate food regime. The common factor in the 'alternative' is the existence of *some* characteristics that differ from or oppose those of the conventional or mainstream, thus avoiding, at least in *some* aspect or other, the corporate food regime's crisis prone features (Abrahams, 2006a). For example, at the stage of production, food may be organically grown, a quintessentially alternative option. But most sales of organic produce take place through conventional supermarket retail (Ilbery & Maye, 2005). Local alternative food enterprises along a given food network often 'dip in and out' of nodes of the global conventional food systems, or are connected to them by backwards or forwards linkages, refuting the single-system categorization that has been common until recently (Ilbery & Maye, 2005).

Watts et al (2005) conceive of a spectrum based on the strength of a given system of food provisioning to withstand the conventional, from weak alternatives based on alternative products to strong alternatives which establish alternative networks. Also in an attempt to overcome the alternative-conventional binary, Holloway et al. propose a methodological heuristic device according to which a food system or network can be described, made up of inter-related fields including 'motivations for participation', but also other characteristics such as 'food production methods' and 'arena of exchange' (2007). This research uses a similar scheme, as described in the chapter on methods, seeing the various characteristics of a food network as "important points of leverage" (Kroll, 2016a, p. 2) against the hegemonic, or as opportunities to avert some of the unfavourable aspects of the corporate food regime. Whatever the framework used, a food network has multiple dimensions or characteristics in which it can be 'alternative'. Thus studies of alternative food systems need not be limited to those where the 'motivations for participation' of the actors involved are overtly impelled by political or ideological objectives (although politics and ideology are performed in all food systems at least implicitly). As examples from the global north, in Ilbery and Maye's paper on producers of specialist livestock products in the UK, they cite Watts et al. (2005, in Ilbery & Maye, 2005, p. 842) when they assert, "The centrality of economic considerations for livestock enterprises does not, of course, preclude their alternativeness". Similarly, Holloway et al. include "business success" amongst the 'motivations for participation' which they encountered in their research on alternative food projects (2007, p. 8). In these cases, other characteristics are what give the food systems studied their 'alternative' identity.

Is informal trade alternative?

On top of these recent recognitions, that because food systems are so multifaceted they are generally hybrid rather than entirely conventional or alternative, agro-food authors are also recognizing that for each descriptor there exists a plethora of possibilities, not a simple set of binary opposites, and the distinction of a particular characteristic as conventional or alternative is not necessarily so straight forward (Holloway et al., 2007; Ilbery & Maye, 2005). If the only 'motivation for participation' is business success, it's quite uncomplicated to say that any alternativeness in that food system must be related to other characteristics, since capital accumulation is an undeniably normal motivation in the corporate food regime. However, looking to other characteristics, there are examples which may be more complicated. Using Holloway et al.'s field of 'arena of exchange' (2007), let us take an informal trader[10] for instance. In the South African context, hawkers, street vendors and spaza shops[11] certainly do not appear alongside the farmer's markets and pick-your-own initiatives referred to by these authors and other agro-food literature for this particular characteristic. But they definitely do not fit the mould of the commercial scale, formal, supermarket retail of the corporate food regime either.

There is wide agreement on the importance of the informal sector as a site of consumption in the food systems of South African cities. Studies on the food provisioning strategies of the urban poor show that the majority depend most frequently on buying small quantities, sometimes on interest free credit, from their nearest informal retailers (Battersby 2012; Battersby 2011; Crush and Frayne 2011; Battersby et al. 2015). There is generally consensus that informal food retailers are more attuned to poor consumers than formal retailers (Abrahams, 2006a, 2010; Battersby, 2012; Battersby et al., 2015; Ruel et al., 1998; South African Cities Network, 2015). They make food conveniently available spatially, even in poorer areas and informal settlements, and temporally, because most of these neighbourhoods are on the margins of the current urban form, so those who return to them get home late in the evening, long after supermarkets have closed (Battersby et al., 2015; Kroll, 2016a; Ruysenaar, 2013). However, there is mixed evidence as to how the prices compare with those at supermarkets. Kroll, citing Peyton et al. (2005, in Kroll, 2016a) argues that most products are cheaper from informal traders, but concedes that prices may be unstable. On the other hand, Battersby et al.

[10] Authors like Abrahams (2006a) and Wegerif (2014) take umbrage with the use of the term 'informal' to describe a food system, partly because it is such a broad term and should not be taken to imply negative or positive characteristics, but usually carries one or the other association depending on the scholar. Notwithstanding this, however, both use the term informal trader or retailer to describe a particular type of food system actor. This research accepts the definition of informal food retailers offered by (Kroll, 2016a, p. 10) based on a range of sources: "Informal food retailers have several characteristics which distinguish them from formal food retail, including that they: (1) are not registered for tax or employee benefits, (2) have few employees (often within the same household), (3) have minimal infrastructure and equipment, (4) have comparatively narrow margins, (5) have strong backward linkages into the formal economy, and (6) are located in public spaces with high pedestrian traffic or in small shops attached to people's homes – *spazas* (Neves et al. 2011; Chen 2007; Devey et al. 2006; Horn 2011; Lehola 2014)."

[11] Small shops attached to people's homes, literally from 'hidden' shops (Kroll, 2016a)

claim that they tend to be more expensive per unit volume (2015). Similarly, whilst there is an argument, detailed above, that supermarkets are accelerating the nutrition transition to unhealthier diets, especially amongst the poor, some sources allege that the food offered by informal traders is of low variety and sometimes perishing (Kroll, 2016a; McLachlan & Thorne, 2009; Tsegay et al., 2014).

When considering the alternativeness of a food system, it is thus not only necessary to disaggregate the various characteristics, but also to consider each in relation to the benefits it offers or the disadvantages it avoids in contrast with the corporate food regime. Taking the possible shortcomings of food system alternatives into account also prevents their romaniticisation, submitting them to the same critical appraisal as the characteristics of the corporate food regime (Holloway et al., 2007). Some benefits of the informal sector in terms of accessibility for the urban poor are generally accepted, such as location, operating hours, offering affordably sized quantities to suit an income pattern of irregular wages earned and spent daily, and the greater possibility of a loan when in need. But the financial accessibility in terms of price is more contentious. Few would challenge the relational embeddedness of an exchange with the neighbourhood's informal trader, but the foodstuffs sold may tend towards unhealthy commercial packaged foods as much as supermarkets do, and without the variety, or the freshness enabled by refrigeration.

Who's got the power

The food system characteristic of 'arena of exchange' is a good example of the dynamic of power happening between the corporate food regime and food system alternatives more generally. Some authors are concerned that the informal sector is being pushed out of food retail as supermarkets appropriate more and more market share (Battersby et al., 2015; Weatherspoon & Reardon, 2003). Others describe a range of vibrant, responsive informal food sellers, challenging the corporate food regime's dominance in retail by providing an alternative (Abrahams, 2006a; J. S. Crush & Frayne, 2011). Although the hybridized reality may indeed be the balance of a tension between the two, other researchers emphasise the fact that the formal and informal complement one another in terms of food retail, and will continue to symbiotically coexist (Peyton et al., 2015, in Kroll, 2016a). Holloway et al. extend to the realm of food, the post-structuralist work of Leyshon and Lee on global capitalism (2003, p. 16, in Holloway et al., 2007), which argues that the so-called hegemonic is more fragile than sometimes suggested, evidenced by the proliferation of examples of "performing the economy otherwise". Similarly, agro-food literature is now revealing a profusion of illustrations of alternative spaces and practices, rising through the cracks in the corporate food regime, and exhibiting a range of interactions and interdependencies with the conventional (Niles & Roff, 2008). Informal trade represents such an alternative, filling the gaps left by the formal sector to more comprehensively cater to the urban poor, who, as a result, can thus pursue food provisioning strategies that combine choices

between multiple sources (Battersby et al., 2015; Kroll, 2016a). Alternative choices are possible, although they may not be "entirely severed from the broader structural system" in which ordinary people are often "takers instead of choosers of goods and services" (Greenberg, 2006, p. 21)

This aspect of choice, albeit limited, or agency, albeit in relation to structure, is key in the politics of food. Abrahams insists that informal retail outlets continue to be the *choice* of residents in the south of Johannesburg, in the food system which she studied (Abrahams, 2006a, 2010). Their 'motivations for participation' may not be particularly alternative, as discussed above, related instead to the socioeconomic conditions in which they find themselves. But still, their 'choice' of an alternative option is "potentially transformative", disrupting the production and reproduction of agro-food hegemonies in the corporate food regime (Allen et al., 2003, p. 62). Allen et al. draw on Williams to describe how "alternative agrifood activities are increasingly celebrated in both popular culture and academic venues as agents of social change" (1977, in Allen et al., 2003, p. 61). But I would argue that it is not so much the activities but the actors who are agents. Again drawing on Williams, they state later, "*People* seek to change the structures of their everyday lives—but they must do so from within the circumstances in which they find themselves" (1977, in, Allen et al., 2003, p. 62, emphasis added). This statement locates a "cultural struggle" in the "spaces of everyday life", but also implicitly identifies those engaged in such a struggle as the people participating in alternative food networks, notwithstanding their situation and how this shapes their choices (Allen et al., 2003, p. 62). This is not to ignore the fundamental inequalities of power that exist (Holloway et al., 2007), but nevertheless to maintain, in agreement with Slater, that "while the opportunities open to the poor may be fewer than for those who hold political and economic power in society, people who are poor still make a plethora of economic, social and political decisions relating to their livelihoods," (Slater, 2001, p. 641) including at the inevitable points at which their lives connect with the food system.

In line with a more general academic divide between research on consumption and that on production (Holloway et al., 2007), the notion of choice as part of the cultural studies and political economy of food has usually been associated with the consumer as agent (see for example Jonathan Crush & Caesar, 2014, 'City Without Choice: Urban Food Insecurity in Msunduzi, South Africa'). Consumer concerns about the corporate food regime are seen to be generating interest in alternatives throughout the food system, even influencing production processes (Ilbery & Maye, 2005; Niles & Roff, 2008). Allen et al. cite a number of sources in claiming that "the agency of consumers acting within alternative agrifood efforts presents an opening for a significant restructuring and transformation of agrifood systems" (2003, p. 63). To balance this inclination towards the consumer, Holloway et al. prefer what they call 'production-consumption' approaches, which understand power and agency as not only attributed to consumers but throughout the food system, such as scholarship influenced by

actor-network theory which sees power as ubiquitous in food system relationships, creating endless possibilities for alternatives (2007).

In their empirical studies, researchers like Wegerif (2014) and Abrahams (2006a) see a range of interdependent food system actors who all have choices. Abrahams not only explores how consumers are choosing an informal retailer at the 'arena of exchange' but also how local urban farmers, who could be supplying formal chains, choose instead to engage in direct farm retail (2006a). The choices of the producer and consumer in the study area facilitate each other, making the existence of the alternative a "grassroots endeavour" of the community as a whole (Abrahams, 2006a, p. 7), demonstrating a more implicit type of alliance than the political or social movements between farmers and consumers recognised by Whatmore (1995, in Allen et al., 2003). Likewise, Wegerif highlights the choices of 'egg eaters', but also those of egg producers, who chose the way in which to reach the market and who to sell to (2014). For instance, he describes how Mirriam, a woman egg farmer, usually travels to town to sell her produce, but chooses not to on some days so she can be home with her baby, or how others choose to sell from home, directly to consumers or to traders on bicycles, so that they are free to carry on with household responsibilities[12]. These choices are undoubtedly shaped by factors outside of the control of the actors in question, such as the role which women play in household reproduction, but structure does not negate agency[13]. Surely both structure and agency are involved in the finding of Traugher (2004, in Winter, 2005, p. 614) that "women in the west are up to three times more likely to operate sustainable farming systems than productivist ones." Research on the changes in agricultural production has always considered the exogenous structural factors such as policy changes and macro-economic shifts, but there is growing recognition of the role of endogenous factors such as attitudes, perceptions and identities, related to the agency of people who play a role in food production, including producers (see for example Burton & Wilson, 2006). The choices made by food farmers, influenced by a multiplicity of interconnected factors, ripple through the food system (like those of consumers and other actors), manifesting in various characteristics and thus impacting whether alternatives exist to serve and benefit the urban poor better than the corporate food regime.

[12] Wegerif pays careful attention to whether or not the patterns of provisioning he studies perpetuate the human rights abuse of gender discrimination, seeing as positive that the possibility to work from home supports women's active participation in them (see Wegerif, 2014, pp. 3771–3)

[13] The relationship between structure and agency has been extensively theorized. This research considers the two to be in a dialectical relationship, rather than one having primacy over another. For an example of a theorist seeking a similar reconciliation between the two see Bourdieu (1984), or, for the application of these concepts in the context of agriculture see how Burton and Wilson (2006) employ Giddens' (1979, 1984, 1991) theory of structuration to study farmer's agency

Urban agriculture

The various elements of conceptual scaffolding detailed above provide a framework for this research, which concerns itself with the food security of the urban poor in the City of Johannesburg, in the context of the corporate food regime, and looks to urban agriculture to provide food system alternatives. Aside from describing some of the features of the corporate food regime and how these are perpetuating food insecurity, especially among the poor in cities, the agro-food literature above also provided some key points about food system alternatives and how they can be understood. A food system cannot be classified wholesale as alternative, rather there is recognition that it has multiple characteristics which, although related in many cases, ought to be considered independently. The motivations of those involved in the food system is one such feature to be considered, but there are various other food system characteristics that could also be more or less alternative. In addition, as evinced by the example of informal retail, a particular form of a given food system characteristic could be advantageous (from a certain perspective, such as for the urban poor consumer) in some aspects and disadvantageous in other aspects. Again, it cannot simply be labelled as alternative. Each food system alternative ought to be seen in relation to the burdens of the corporate food regime which it avoids (from a given viewpoint), or to put it positively, the benefits which it results in. This understanding accommodates the heterogeneity observed, as food system alternatives multiply, emerging as a result of the agency of people in the food system, acting differently, within and against the structures that shape their choices. In the pressures of the corporate food regime, urban consumers living in poverty are in need of food system alternatives that will serve and benefit them – this study looks to urban agriculture and the agency of urban farmers.

Urban agriculture can be defined as any agricultural production taking place within the boundaries of a city or metropolitan area (Ruel et al., 1998). Although it was commonly practiced in pre-modern cities, as the urban became the place of industry and manufacturing, and the principle of separate land-uses became established, policy makers and town planners began to consider urban agriculture as backward and rural, a nuisance, and a sign that development was not proceeding as it should (Centre for Development Support, University of the Free State, 2009; Slater, 2001). Some of the first studies on urban agriculture in Africa were the work of geographers from France in the late 1950s in West Africa, but academic interest grew in the 1970s and early 80s, when research on the developing world, in the wake of global economic crises and shocks, began to recognise the responding strategies of the informal sector in urban areas (Centre for Development Support, University of the Free State, 2009; Slater, 2001). Rooted in this paradigm, urban agriculture tends to have retained its framing as an informal source of livelihood or coping strategy for poor households, and its association with recession and failed development processes and economic backlashes such as those related to structural adjustment programmes (Baiphethi & Jacobs, 2009; Centre for Development Support,

University of the Free State, 2009; Ruel et al., 1998; Slater, 2001). This thinking meant that urban agriculture was prohibited by many of the colonial powers in Africa, and was either unsupported or banned by the national authorities that came after them (Centre for Development Support, University of the Free State, 2009; Slater, 2001).

More recently, urban agriculture has gained attention in a number of guises, which will be detailed further below. One way in which the state and development sector have seen it is from the perspective of economic development, in which case it is expected to be groomed to fit neatly into the corporate food regime with all its crisis prone features. Otherwise, they have seen it from a welfarist perspective, which is equally comfortable with the status quo, as long as it provides the appearance of a remedy without challenging the deeper disorder in the system itself. Unfortunately, most local scholars of the agro-food system tend to have understood urban agriculture in this latter framing, as a household food security strategy which diverts attention from the systemic changes which are so desperately needed. But there is increasing convergence with research from abroad on urban agriculture as part of alternative food systems, and on the transformative potential it holds.

How urban agriculture can be conventional

Urban agriculture re-emerged into development discourse over recent decades as a number of conceptual shifts took place with regard to food security and how it is addressed (S. Maxwell, 1996). To counteract the 'urban bias,' an influential theory which emerged in the 1970s, a rural framing of food insecurity has dominated in development thinking, resulting in an understanding of hunger as a problem of production and supply (Battersby, 2012; Battersby et al., 2015). The solution, which lay with agriculture, was therefore to produce as much food, at the lowest cost, as possible. This aligned well with neoliberal capitalism, and the model of agriculture that ensued was that of the corporate food regime. As the externalised social and environmental costs became unavoidable, the development sector, internationally and locally, turned its attention to the scale of production, and began to promote small-scale and family farming in earnest (Greenberg et al., 2013). At the same time, the population in cities in the developing world began to surge, along with an urbanisation of poverty, and it became impossible to remain exclusively fixated on rural areas when discussing food insecurity (J. S. Crush & Frayne, 2011). Until recently rural areas tended to have higher prevalence of food insecurity in terms of percentages, and the vast absolute numbers of food insecure people residing in cities was generally overlooked (Aliber, 2009). But urban food insecurity was increasingly raising alarm bells. All this was accompanied by a change in emphasis from food security at a global or national level to the household or individual scale, and the associated shift in focus from food availability to food access, including purchasing power (Battersby et al., 2015; S. Maxwell, 1996).

In response to concerns about the food system, the mainstream or dominant approach, promoted by nation states, development organisations and transnational corporations, can be summarised as the refinement and continuation of existing patterns and practices (Clapp, 2013). In the interests of these same middle space players, this can include urban agriculture in two ways – if it adopts the features of the corporate food regime, or if it allows small concessions, but without dramatic shifts in power or decision-making. Urban agriculture thus became, some believe, "the main point of intervention by the State and the NGO sector to address food insecurity" (Battersby et al., 2015, p. 24), since it was not in their interest for urban agriculture to be part of a full institutional response that could actually change the food system itself – which many agree is what is really necessary (Aliber, 2009; Battersby et al., 2015; Centre for Development Support, University of the Free State, 2009; J. S. Crush & Frayne, 2011; Greenberg, 2006; Kroll, 2016a; M. Lewis, 2011; D. Maxwell, 1999; McLachlan & Thorne, 2009; Pereira, 2014; Tsegay et al., 2014).

When South African food security initiatives fall under departments of agriculture, as often happens at various levels (Drimie & Ruysenaar, 2010; Rogerson, 2011; Thornton, Marais, Nel, Hampwaye, & Rogerson, 2009), the inclusion of urban agriculture represents an acknowledgement that the crisis of hunger and nutrition also affects cities. Although the focus is on smaller farmers, some recognise the persistent legacy of the rural slant in this productionist understanding of food security as requiring more supply from agriculture (Battersby et al., 2015; J. Crush, Hovorka, & Tevera, 2011; J. S. Crush et al., 2010; J. S. Crush & Frayne, 2011; White & Hamm, n.d.). In any case, state support for urban farmers is aimed at replicating the same environmentally harmful production methods and integrating them into the same agribusiness-supermarket value chains that have contributed to the corporate food regime's crises in the first place (Greenberg et al., 2013). The image of success peddled to smallholders, even for the cooperative forms that the government has been championing, is the maximization of profits at the expense of the environment and their own self-reliance, founded on fossil fuel based mechanization and 'modern' techniques which would eventually leave them dependent on high input use (M. Lewis, 2011).

Any advantage resulting from being located near to urban consumers is disregarded. As Greenberg puts it, "This ideological bias towards capitalist production models fails to consider the potential benefits of localised food production for its own sake, not for the sake of fitting into a bigger market economy" (2006, p. 20). Recent interventions in the City of Johannesburg, for instance, plan to ensure that urban farmers increase their production with the sole intention that they will then supply to the metropolitan fresh produce market (Malan, 2015). Here their produce would come together as indistinguishable from that grown anywhere else, and the benefits of *urban* agriculture as part of a local food system would be negated. Malan's participatory research with farmers in Johannesburg

found their own local systems approach to be widely divergent from the commercialization model being punted by City government (2015).

Scholars often discuss the 'purpose' of urban agriculture as either commercial or subsistence, often conflating this with the mode of distribution, and so categorizing farms based on an imagined spectrum between those whose produce all goes to the urban market and those who retain everything they grow for their own subsistence (Baiphethi & Jacobs, 2009; M. Lewis, 2011; Ruysenaar, 2013). Unfortunately such a classification has often served only to reinforce the dualist rubric of modern-traditional, with anything between the two being seen as a stepping-stone to conventional commercial production (Abrahams, 2006a; Greenberg, 2006). "Policy makers and government officials appear to perpetuate this dichotomy by basing governmental agricultural reports, social development and food security plans on the commercial, large-scale farming – subsistence home garden agriculture dualism" (Abrahams, 2006b, p. 23). Instead of being an acknowledgement of the heterogeneity of urban agricultural production, reflecting farmer's diverse responses to the conditions in which they find themselves, this understanding sees urban farmers as without agency, compelled by the structures of the corporate food regime to conform to particular ways of producing and distributing. This scholarship gives no value to subsistence agriculture "in its own right, not necessarily and only as a precursor to commercial production, but as a part of diverse food production and distribution systems" (Greenberg et al., 2013, p. 4).

On the other hand, the state and development sector have also, contrariwise, backed subsistence food production in cities. This form of support for urban agriculture has been implemented with a welfarist perspective, from the Department of Social Development at national level, to the Department of Social Development of the City of Johannesburg's Office of the Mayor (Centre for Development Support, University of the Free State, 2009; Malan, 2015; Thornton et al., 2009). Welfare is "by no means benign" when it serves to placate social unrest on the periphery of an unchanging corporate food regime, where power and capital can continue to accumulate virtually unchallenged (Greenberg, 2006, p. 10). Page has gone so far as to say urban agriculture policies can act as an 'anti-politics' machine (2002, cited in both Greenberg, 2006, p. 10; and Ruysenaar, 2013, p. 221). On the basis of limited evidence that state sponsored urban agriculture programmes are translating into real benefits for those involved (Ruysenaar, 2013; Thornton et al., 2009), a critical perspective is somewhat justified, but in some ways this perspective has been as disempowering to urban farmers themselves as that described above.

There has been substantial debate about whether the promotion of subsistence or semi-subsistence urban agriculture as this type of food security policy intervention has been effective (Rogerson, 1998; Ruel et al., 1998; Webb, 2011). Advocates broadly agree that there are food security benefits for the

producers, who gain immediate access to fresh produce and a source of income that offsets food expenses, but critics point to the lack of reliable, quality data, and instead have conducted their own case studies (Ruysenaar, 2013) or cite various other studies showing the limited evidence of measureable benefits to producing households (for instance, Battersby et al., 2015 cite Thompson, 2008; van Averbeke, 2007; and Webb, 1996, 2000; Ruysenaar, 2013 cite Crush et al., 2010; Ellis and Sumberg, 1998; Maxwell 1995; Shisanya and Hendriks, 2011; and Zezza and Tasciotti, 2010). However, Slater argues that in all this deliberation, urban agriculture has retained its original confined academic framing as a survivalist household coping strategy, and so this research has been preoccupied with proving or disproving whether it has benefits to farmers as such (2001). Because this (mostly quantitative) research tends to see the poor as powerless and urban agriculture as a coping strategy of the poor (Slater, 2001), these scholars do not recognise any possibility for urban agriculture to provide food system alternatives, nor do they attribute to these urban farmers any transformative agency against the corporate food regime.

Outside of South Africa, research on the household food security benefits of urban agriculture in cities such as Nairobi, Dar es Salaam, Kampala and Harare shows it meeting 20 to 60 percent of the food needs of many producing families, who tend to have more nutritious diets than non-farming families (Armar-Klemesu, 2000). It is seen as an important practice in Maseru, Lusaka, Windhoek, Libreville, Yaoundé, Lagos, Ouagadougou and the cities of Kenya, Uganda, Ghana and Tanzania (Thornton et al., 2009). Accra is estimated to obtain 90 percent of its fresh vegetables, and Dar es Salaam over 90 percent of its leafy vegetables, from production sites within the city (Armar-Klemesu, 2000). Aside from Wegerif's almost anthropological study of the food system in Dar es Salaam (2014), in which he begins with the 'eaters' to carefully follow a number of non-corporate provisioning patterns and their benefits, these studies from other African countries are as limited as South African research in their conceptualisation of these urban food systems as alternative or in considering the sociological benefits of urban agriculture stressed in literature from the global north.

How urban agriculture can be alternative

However, the same South African authors that are blind to urban agriculture initiatives as part of an alternative food system in developing countries, celebrate the practice in the developed world, reflecting a broad distinction in the literature between conceptions of urban agriculture as an attempt to improve household food security and where it is represented as an alternative to the mainstream. For example, in her work on the geography of food in the city, Battersby applauds "a localization of the food system, drawing on elements such as community gardens," but distinguishes this "bottom-up attempt critique of the dominant neoliberal food system" from urban agriculture as a "householdscale attempt to address food insecurity" (2012, p. 147). This has not been true of subsistence production in

general, which has been increasingly hailed as alternative and emancipatory by food sovereignty theorists (see Trauger, 2015 for instance) and proponents of 'peasant agriculture' (van der Ploeg, 2010 for example). Slater claims that urban agriculture, on the other hand, seen as subsistence, commercial or anywhere in between, has been evaluated according to a narrow economistic lens, informed by its intellectual heritage in development studies, to which she attributes the inability of researchers to see its alternative nature (2001). As a remedy, she initiates a focus on the 'social' benefits of urban agriculture (see also Dunn, 2010; Olivier, 2015), which Battersby and Marshak take up in an attempt to reconcile constructions of urban agriculture in the global north and those in the south (2013).

But other researchers expect that a convergence in the discourse around urban agriculture will come with a convergence in motivations as a result of increasing poverty in the global north (Abrahams, 2006a; McClintock, 2010, in Battersby, 2012). Urban agriculture has already served as a "legitimation of progressive politics"(Zerbe, n.d., p. 37), "related more to environmental ideals and concerns about the food system" (Battersby et al., 2015, p. 26), but this has been seen as the privilege of the upper middle-class in developed countries or in high-income areas. As the practice is taken up by more people around the world, driven not by ideological or political reasons but in response to economic hardship, scholars must surely begin to recognize that "the necessity of survival has an inherent critique that cannot be removed. It is a critique of a marginalising development model, of ongoing hunger and insecurity, of political favouritism and corruption" (Greenberg, 2006, p. 28). Urban agriculture could support a number of characteristics that are unquestionably alternative to the corporate food regime, even if the 'motivations for participation' in these food system alternatives are purely survivalist. Whether by design or default, these food system alternatives represent a challenge to the crises of the corporate food regime.

A more nuanced framework that sees urban agriculture in the context of a complex food system, not only allows us to reveal the social benefits of urban agriculture and trace these to its unconventional characteristics, it also challenges the idea that alternative motivations are a prerequisite for these alternative features. Such a framework affords the farmer countless opportunities to do things differently and allows us to separate out and identify the benefits of these food system alternatives, even when their motivations are not explicitly political or ideological. The social benefits recognised by Battersby and Marshak (2013), such as the ability of urban agriculture to foster community development for example, are inseparable from the production and distribution decisions of farmers. These are shaped by countless factors, from the farmer's perception of productivism (Burton & Wilson, 2006), to intra-household dynamics (Baiphethi & Jacobs, 2009), to whether or not the farmer owns a truck (South African Cities Network, 2015). Research on the exogenous factors which influence or limit the choices of farmers has considered, amongst others, circumstances such as the (un)supportive policy environment, macro- and microeconomic realities, and access to productive

resources including water, inputs, tools, labour, information, finance but especially land. These types of factors are all applicable to urban agriculture as well, with certain particularities (see for example the following articles, which include issues of land reform and access to land for farmers in the city: Karaan & Mohamed, 1998; May & Rogerson, 1995; Reuther & Dewar, 2006; Richards & Taylor, 2012). Similarly, there are an indefinite array of endogenous factors which influence the decisions of food producers, from issues of identity to ideology and innumerable others (see for instance, Dunn, 2010; Slater, 2001; Szewczyk, 2013; Tamlit, 2014). This study explores the alternatives, which manifest in the food system as the combined result of structure, and the agency of the producer, in this case the urban farmer, and which serve and benefit the urban poor consumer.

The corporate food regime is manufacturing food insecurity, especially for the urban poor. To explore whether urban agriculture is indeed making sustainably grown, healthy fresh produce locally available to poor consumers in Johannesburg in ways that are empowering and accessible, this research thus concerns itself with food system alternatives. To do so requires first replanting South African urban agriculture where it occurs, within the landscape of complex and multifaceted food systems, and then exploring the variety of forms cultivated for each food system characteristic and the fruit they bear for the urban poor consumer.

Conceptual framework

For this research, urban agriculture and the food security of the poor in the City of Johannesburg are seen in the context of complex and multifaceted food systems. Whether depicted as a chain, a cycle, a web, a landscape or an actor-network, any given food system is generally understood to involve a variety of actors and processes, inputs and outputs. In the literature on the corporate food regime and on alternative food systems, it is generally understood that changes to certain characteristics of a food system, and the wider repercussions of these changes, result in disadvantages or benefits from a particular perspective.

A local food system may include any number of elements, but is distinguished by the fact these are geographically close to one another, especially that the food does not travel long distances between production and consumption, or producer and consumer[14]. Having the food system elements in close

[14] Food systems do not begin with production nor do they end with consumption, but these two elements are essential to any food system and form the basis of most agro-food studies. Because this research is concerned with urban agriculture, the producers are a focus, and upstream actors and processes are less central. Similarly, the consumer is a focus, because the research concerns itself with the food security of the urban poor. Note that for the purposes of this research, the term consumer refers to a role in the food system rather than the free choice, and purchase of food, often implied by this term. To escape these connotations, Wegerif uses the term "eaters" instead (2014, p. 3749)

physical proximity to one another, and so reducing the spatial and temporal distance between production and consumption, is expected to have numerous benefits. Some of the benefits to local urban poor consumers, which were considered in this study, can be divided into four categories: accessibility, empowerment, sustainability and health. These correspond to the four main spheres referred to in terms of the crises of the corporate food regime and their disproportionate effects on the urban poor. Figure 1 below is a simplified flow diagram depicting the elements of the food system which form part of this research[15]. It is a depiction of the conceptual framework of the research, which was informed by the literature and the data available but, rather than being a preconceived model for the investigation, was designed towards the end of the research process in order to accommodate the findings. The four ways in which local food systems avoid the burdens of the corporate food regime form the basis of the conceptual framework for this research, depicted as green ovals in the flow diagram below. Local food systems are expected to provide benefits in each of these spheres, as indicated on the right-hand side of the diagram.

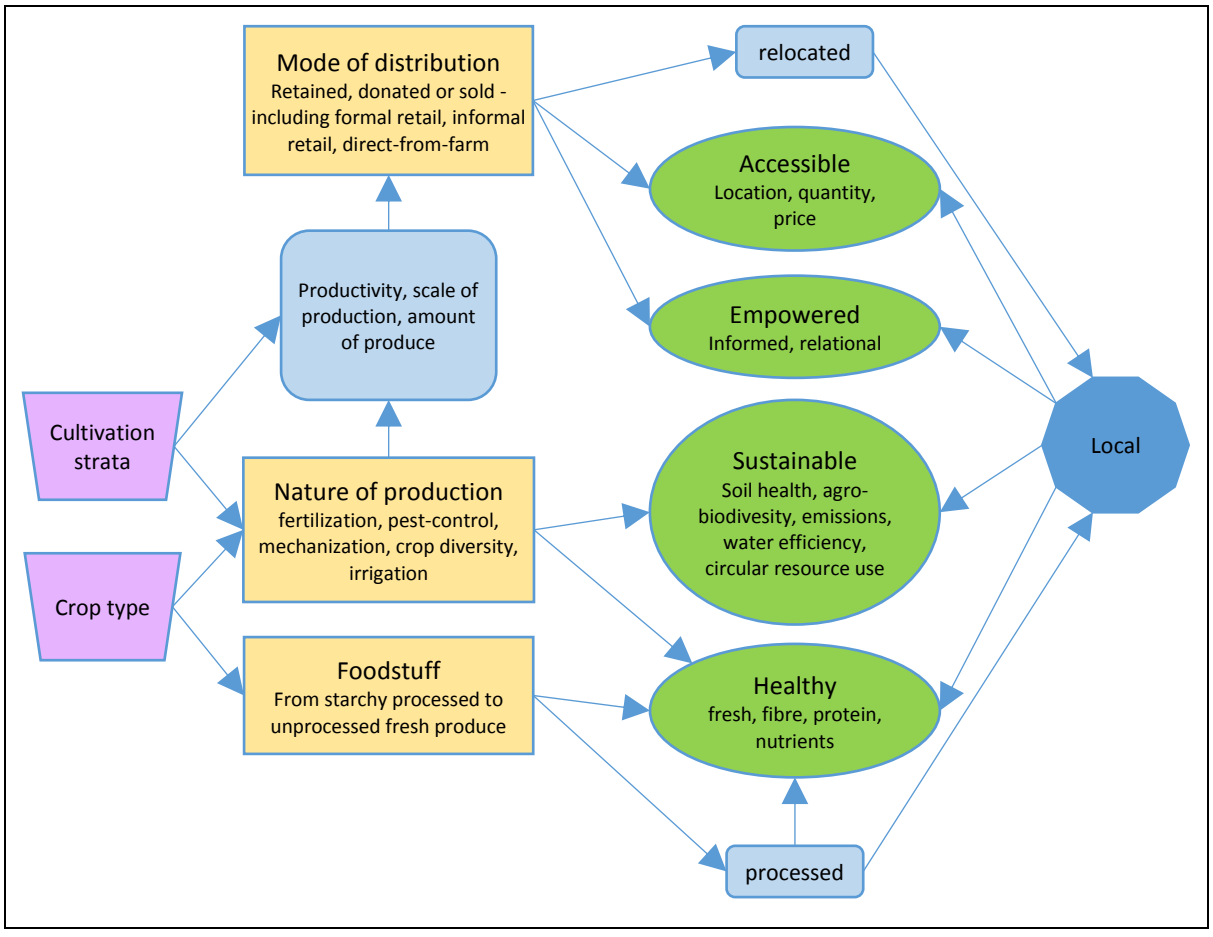


Figure 1: Flow diagram depicting the conceptual framework, including the four fields in which a food system can serve and benefit the urban poor, and some of the food system characteristics which influence these

[15] This framework is specific to this research, although the understandings of food system alternatives which informed it are not.

In terms of accessibility, having shorter distances not only means distributed food will be more conveniently located, but also reduces the financial expense of transport, incurred by the consumer as their own travel or as an increase in the cost of the food. In terms of empowerment, having the production of the food in the same local area as the consumer inhabits, means the process and actors involved are probably more familiar and the social and environmental impacts more likely to be observable, making the consumer more informed in their consumption choice. In terms of sustainability, less transport, which would often involve cold chain infrastructure as well, means lower resource use and lower emissions. In terms of health, reducing the time between harvest and consumption will make food fresher. Although these four types of benefits are what have emerged from this research, there are certainly other benefits to local food systems. This includes other consumer benefits, such as the resistance of culinary homogenization by the preservation of local culturally specific foods. There are also numerous benefits from other perspectives, such as that of the producers, or the community in general – for example, local food systems retain money and resources within the community and stimulate local related small businesses up-stream and down-stream, stabilizing local prices and contributing to local economic development and poverty reduction (Malan, 2015; Thornton et al., 2009).

The four ways examined in this research by which a local food system can better serve and benefit the urban poor, can be enhanced or compromised by countless other characteristics of the food system. Obviously when a particular characteristic increases the spatial and temporal distance between food system elements, making the system less 'local', these benefits are diminished. But there are also myriad other features of the food system which influence these four types of benefits for poor consumers. Because this study is interested in urban agriculture, the characteristics considered are some of those related to farms, which emerged from the literature and the empirical data. These are depicted as different rectangles throughout the flow diagram, with their relationships to other elements of the food system, including the four types of benefits, depicted as blue arrows. Rather than a simple juxtaposition between alternative and conventional for each characteristic, multiple components and different forms were accommodated based on the data, each having particular influences on the various benefits to the urban poor consumer.

Three food system characteristics which are directly related to the urban farms themselves are indicated in the diagram as pale orange rectangles, with blue arrows indicating their influence on the four types of benefits. One of the food system characteristics considered is the nature of production, in this case considered principally in terms of the agricultural methods and practices employed by the farm. The way in which the soil is fertilized, the way in which available resources are used, how pests and disease are controlled, the way in which water is obtained and used, and the way in which

different crops are combined, all have an influence on the sustainability of the food system, and, some would argue, on the nutritional quality of the food or the health benefits of the food system. Again, there are innumerable other aspects to the nature of production, but these have been selected for consideration based on this research.

A second food system characteristic, which is very much related to the farm, is the foodstuff. The range of food products possible is practically infinite, but different foods have different nutritional properties, which make them more or less healthy for the urban poor, especially in the context of the nutrition transition. Many foodstuffs available today are the result of substantial processing. If this is a characteristic of a given food system, it not only influences the health benefits of the system to poor consumers, it also introduces the possibility that the elements of the system will be separated by greater distance, if the processing doesn't take place locally. This element of processing, and its relationship with health and whether or not the food system is local, are indicated at the bottom of the flow diagram as a small blue rectangle and blues arrows. The foodstuffs which can exist in the food system are in turn directly influenced by the crop types cultivated by farms, which will be mentioned below.

The third farm-related food system characteristic considered in this research is the mode of distribution. Scholars generally recognize three main sources of food: own production, market exchange (barter or purchase), and transfers, such as from public assistance programs or other households (Sen, 1982, in Baiphethi & Jacobs, 2009; Ruel et al., 1998), although the latter tends to be less recognized. From the perspective of the farmer, this means produce can be retained for subsistence, donated, or sold. The farmer can sell produce through a variety of channels, including formal retail, informal trade and direct to consumers (these have been identified based on the research but there are numerous other options, including fresh produce markets, wholesalers, and even processors, which is represented above). The consequent way in which food is made available to consumers influences whether the consumer is informed in their consumption choice, and whether there is an exchange, and if so whether it is relational – the empowerment related benefits for the urban poor. It also influences the location, quantity and price at which it is available – the accessibility related benefits. These same benefits, as well as the other benefits associated with a local food system, can also be eroded, if the mode of distribution results in relocating the food from the local area. This possibility of relocation is indicated as a small blue rectangle at the top of the flow diagram, with an arrow indicating its influence on whether the food system is local or not.

There are many other characteristics, relationships and interlinkages which could be added to this[16], but one which surfaced repeatedly in this research has to do with the scale of production, the productivity and amount of produce. The nature of production has a direct influence on this, and it, in turn, is a determining factor in the mode of distribution, so this element is indicated as a blue rectangle between these two characteristics. Other elements explicitly included in the conceptual framework are the two agricultural classifications which form part of the data used in this research, represented by two purple quadrangles on the left of the flow diagram. The 'crop type' was referred to above as having an influence on the foodstuff characteristic, and also has some influence on the nature of production. The 'cultivation strata' refers to the level of cultivation and so is a factor in the nature of production and the scale of production.

The agency of the urban farmer is implicit in this conceptual framework. Aside from consolidating the findings of the literature review and empirical work, it frames the food system in such a way that recognizes some of the complex possibilities for farmers to do things differently, resulting in food system alternatives that can serve and benefit the urban poor consumer. However, this is not a study of farmers' agency in terms of what motivates their choices, which is recognized throughout the research as being the result of innumerable internal and external factors, which may or may not include the actual desire to oppose the corporate food regime and foster food system alternatives to it. The empirical focus of the study is not what determines the farmers' choices, but on the choices themselves, which manifest in the characteristics of the food systems which these choices influence. The concern of the research is the food security of the urban poor consumer, in the context of the corporate food regime. Much of the existing research about urban agriculture in South Africa tends to be concerned with the livelihoods of the producers (for instance, Battersby et al., 2015 cite Thompson, 2008; van Averbeke, 2007; and Webb, 1996, 2000; Ruysenaar, 2013 cite Crush et al., 2010; Ellis and Sumberg, 1998; Maxwell 1995; Shisanya and Hendriks, 2011; and Zezza and Tasciotti, 2010). This study is more interested in urban agriculture as providing benefits to the consumer, and not only when the consumer is also the producer as in the case of subsistence. These benefits result from urban agriculture when a characteristic of the food system takes on a form that is in some way alternative to the corporate food regime. These food system alternatives are understood to be a result of both structure and agency, particularly that of the farmer when considering urban agriculture. Making use of information about and from urban farmers, this research is an exploration of the potential for urban agriculture in the City of Johannesburg to make locally and sustainably grown, healthy fresh produce available for the urban poor in ways that are accessible and empowering, and the realization of that potential in particular study areas.

[16] For examples see sections on limitations of the study and further research

CHAPTER FOUR:
MAPPING POTENTIAL

In the City of Johannesburg[17], where the corporate food regime is clearly having its effects on the food security, the geographical overlap of poor consumers and urban agriculture represents the potential for an alternative food system to exist in these areas. This potential is even greater where the types of farming are more likely to be associated with forms of production and distribution that are appropriate for the urban poor and avoid the environmental, social and health disadvantages of the conventional food system. Vast numbers of households in Johannesburg are experiencing poverty, and most have their homes in particular areas of the City. This chapter first considers the geographical occurrence of poverty across the municipality and identifies three types of poor areas: where poor consumers make up much of the population (relative poverty), where many poor consumers reside (absolute poverty), and where they are densely concentrated in space (poverty density)[18]. It will then consider the agriculture in the City and where this is located. This is used to show that a substantial amount of farmland is situated in areas where there also are many poor consumers living. Finally the chapter will take into account the types of agriculture taking place, to consider whether these are likely to be associated with alternative or conventional forms of the food system. Much of the City's agriculture is located in poor areas of low population density, but some farmland is even located in very poor, crowded areas like Diepsloot and Ivory Park, and may well make use of alternative models of production and distribution that are beneficial to the local consumers. Whilst this chapter gives a City-wide picture of potential for urban agriculture to be operating in food systems which serve and benefit the urban poor, the following chapter confirms the realisation of this potential in such areas. Farms in these communities cannot be ignored when considering the food access of Johannesburg's urban poor.

The occurrence of poverty in Johannesburg

Household income data from Census 2011 showed that about 500000 households in the City of Johannesburg (about 35% of the population) survived on less than R19 600 a year, or about R1600 per month. After considering the numbers themselves in the first section, the following three sections look at the geographical occurrence of poverty, measured in three different ways. By integrating the

[17] City of Johannesburg refers to the metropolitan municipality of the City of Johannesburg, also referred to throughout the research as 'the City' or 'Johannesburg'

[18] The terms absolute and relative poverty do not imply different definitions of poverty but refer to the 'poor households' in a given ward. To locate this poverty within the municipality, the research uses a definition of a 'poor household' based on average annual household incomes that correspond to national poverty lines

census data onto a map of the wards in the municipality, we see that the poor households in Johannesburg are distributed in particular ways – being spatially clustered into certain places in the City and spatially concentrated in some of these areas. To show these dynamics, the ward-level poverty was analysed using three different variables: First we look at the wards of the City in terms of relative poverty, which refers to the proportion of the ward's population made up by poor households. This is then compared to absolute poverty, which refers to the number of poor households living in the ward. The next section regards the concentration of poverty in certain wards of the City and so considers poverty density, which refers to the average number of poor households per square kilometre in the ward. The subchapter concludes by showing the main types of poor areas that could be discerned in the City by considering the occurrence of these three variables, as depicted in the following Table 1, representing an increasing probability that a given farm in the ward will be local to many poor consumers.

Table 1: Description of the three main types of poor areas in terms of three poverty variables mapped

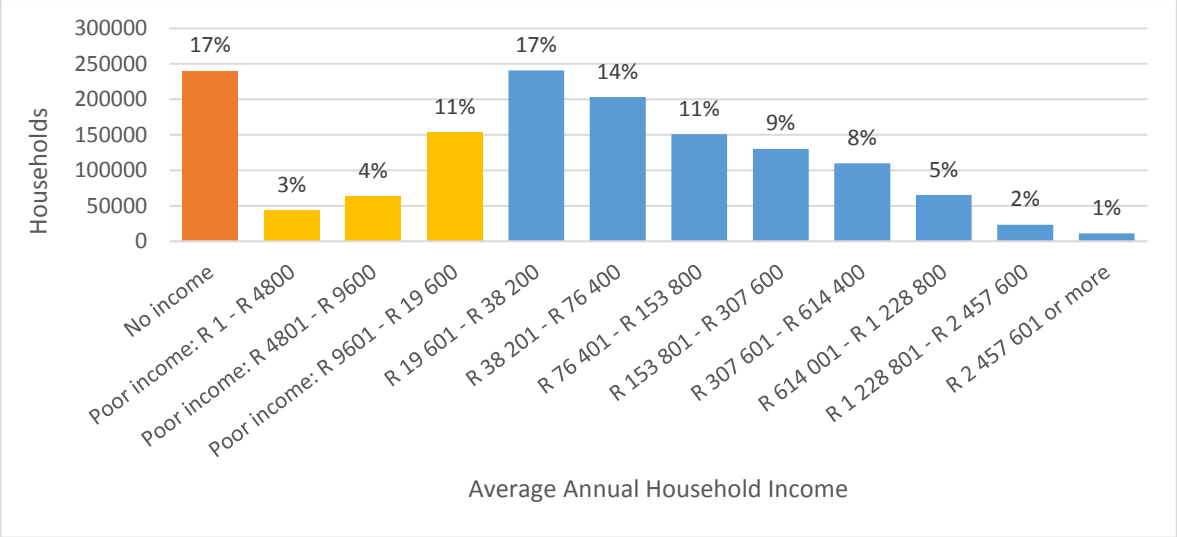
Example area	**Absolute poverty**	**Relative poverty**	**Poverty density**	**To be referred to as**
Austin View	High	Low	Low	High absolute poverty
Ennerdale	High	High	Low	High relative poverty
Alexandra	High	High	High	High poverty density / Concentration of poverty

Johannesburg – the dense, poor City

Gauteng is the smallest of South Africa's nine provinces, covering only about 1.4% of the country's land area, in the north eastern interior (Culwick, 2015; M. M. Lewis, 2013). The province has a sprawling spatial form in which over 12 million people reside, over a quarter of which are in Johannesburg, its dense, highly urbanized heart (Campbell, 2011; Culwick, 2015; De Wet et al., 2008; Schäffler et al., 2015). In the municipality of the City of Johannesburg, according to Census 2011, there were 4.4 million inhabitants making up 1.4 million households.

Figure 2: Map of South Africa showing the province of Gauteng in white with the City of Johannesburg municipality highlighted in red (Htonl, 2011)

The income distribution of the City as a whole is depicted in Graph 2 below. According to the definitions used for this research, this puts the poverty rate at 35%, over one third of the City, or about 500000 poor households. Almost half of these households (about 240000) report no annual income at all. Constituting almost 17% of the City, this is even higher than the national rate, which dropped to 15.5% in 2011 from 23.2% in 2001 (Statistics South Africa, 2015a). Based on the average household size in 2011, this means almost 750000 people in Johannesburg were surviving without any income to buy food or other necessities. In addition to this, over 800000 people (about 18%) reported poor household incomes of between R1 and R19 600 a year, or less than R1634 per month. Thus, in 2011, over 1.5 million Johannesburg residents were living in poverty.



Graph 1: Column graph depicting number and proportion of households in the City of Johannesburg reporting various average annual household incomes in Census 2011 (produced by author using data from Statistics South Africa, 2012)

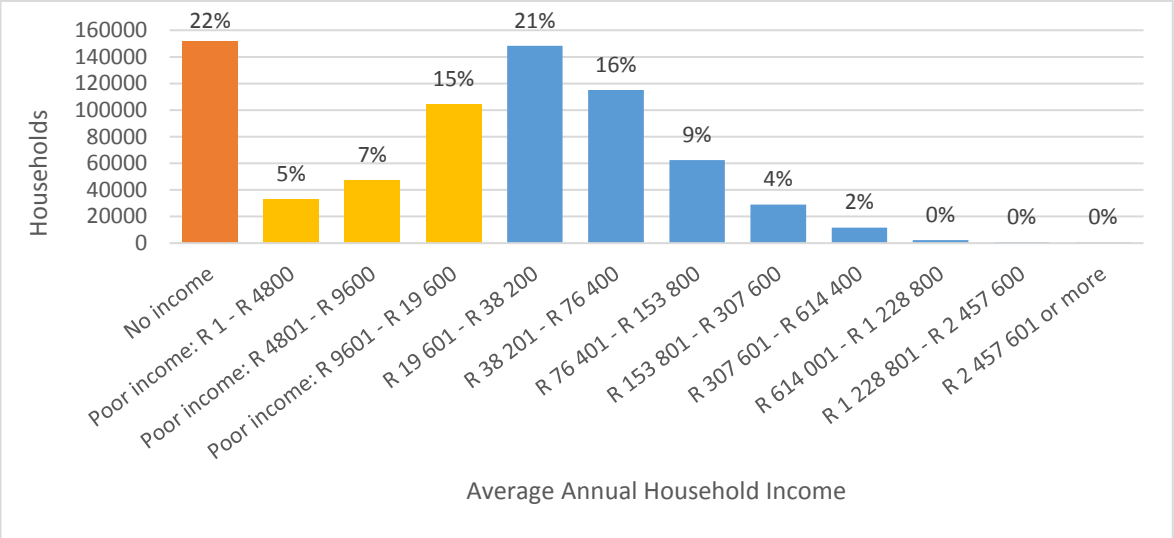
At a City level, 35% poverty rate is not as extreme as in some other municipalities in South Africa, such as Hibiscus Coast in KwaZulu Natal or Mafube in Free State, in which about two thirds (66-67%) of households are poor. However, as expected from the literature, it is the country's urban metros which contain the highest numbers of poor households. An important part of the shift in focus from the rural to the urban in terms of food security and other poverty related issues is the consideration of absolute poverty as opposed to relative poverty. Cities can accommodate huge numbers of poor households, although these may not represent such high proportions of the total population. Johannesburg has by far the highest number of poor households of all the municipalities in the country, even compared to the five other big metros,[19] which are the next highest in absolute poverty. Almost 8% of all poor households in South Africa reside in the City of Johannesburg (Statistics South Africa, 2012).

These vast numbers of poor households do not live in all areas of the municipality. Income distribution differs extremely from ward to ward[20]. All wards have at least some poor households, the lowest proportion being 7% in ward 93 around Sunninghill. This ward also has the highest proportion of wealthier households – 36% of the ward earning household incomes over R614000 a year, or about R50000 per month. There are a number of wards which have under 15% poverty, all of which have over one fifth of their households in these highest income bands. These relatively affluent wards,

[19] eThekwini in KwaZulu Natal, Ekurhuleni and Tshwane in Gauteng, Cape Town in the Western Cape and Nelson Mandela Bay in the Eastern Cape
[20] The City of Johannesburg was spatially divided into 130 wards in 2011 (Municipal Demarcation Board, 2014)

where levels of wealth are high and levels of poverty are low, definitely exist in the City, although they are not many.

However, from the census data it is clear that *many* wards have very high levels of poverty, both in terms of numbers of poor households (absolute poverty) and in terms of proportion of the ward (relative poverty). There are 130 wards in the municipality. In terms of relative poverty, half of these have 40% or more of their households reporting annual incomes below R19600 (R1634 per month). In other words, the median poverty rate amongst the wards of the City is 40%. Representing the half below the median, these 65 poorest wards accommodate about two thirds of the poor households in the City or over 330000 households. Combining their populations, their rate of poverty is about 48%, meaning almost half of the people in these wards are poor. Most of the remaining 370000 households in these 65 poorest wards occur in the low bands of household incomes between R19 601 and R76 400 per year, with insignificant numbers in the highest income bands. That is to say that the wards of the City with the most poor households also accommodate predominantly low and some medium income households, but very few wealthy households, as depicted in the following Graph 3.



Graph 2: Column graph depicting number and proportion of households according to average annual household incomes for the 65 wards with above median relative poverty

Poverty in the City is spatially clustered

Mapping ward level poverty in Johannesburg affirms that poverty in the City is clustered in particular areas. The median poverty rate is 40%, which means there are 65 wards out of 130 where 40% or more of the ward are poor, and there are 65 wards where less than 40% are poor. Figure 3 is a map which indicates the 65 wards in the City with above median poverty rates, and excludes the 65 wards with below median poverty rates. When we map these wards with the highest relative poverty rates, it is clear that the wards themselves are clustered or grouped in particular areas around the city. It is

obvious that these high levels of relative poverty occur predominantly in the south of the City and Soweto, and in some northern clusters – in the Inner City, Alexandra, Ivory Park and Diepsloot. (Ward 82 in the suburbs east of the city around Westbury is above median having a 41% poverty rate, so although it is not a grouping of wards, it ought not to be excluded).

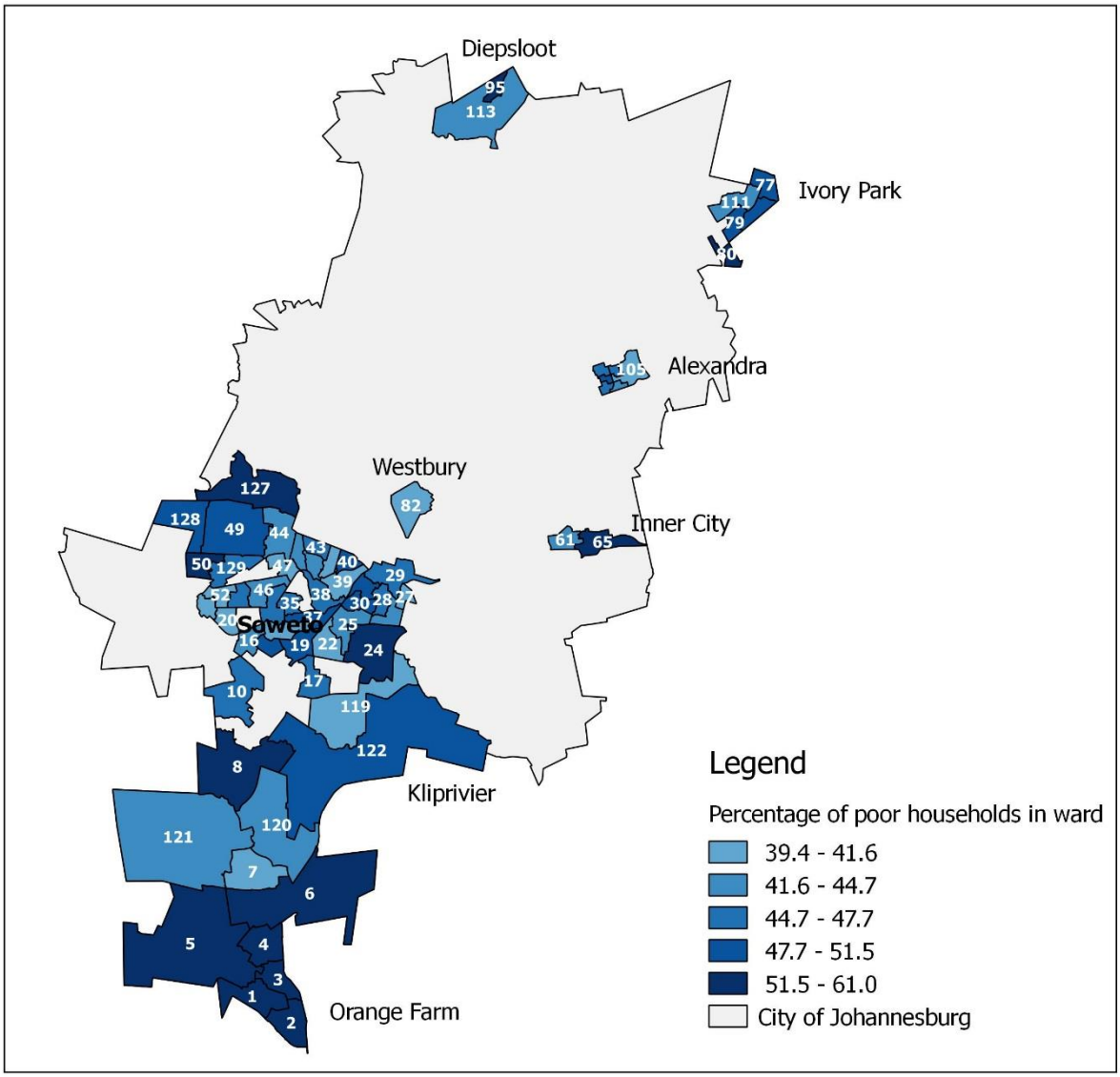


Figure 3: Map of City of Johannesburg depicting wards with above median percentage of poor households

Most of the wards with high relative poverty also have high absolute poverty (about 80% of them). When one maps the 65 wards with the above median absolute poverty (see Figure 4), the very same poor areas emerge as for relative poverty: wards are clustered around Diepsloot, Ivory Park, Alexandra, the Inner City and Westbury in the north of the municipality, as well as Soweto and most of the wards in the south of the City. One of the main differences is that some of the small wards with small populations tend to have low absolute poverty even if they have high relative poverty. For instance, one of the smallest wards with the smallest population is ward 59 in the area of the Inner

City, with a total of about 1900 households. About one third (33%) of the ward is poor, but this represents the smallest absolute number of poor households of all the wards in the City – giving it the lowest absolute poverty. The other obvious difference is that some large wards become important in terms of absolute poverty although they have lower relative poverty. For example, ward 96 in the northwest of the municipality, south of Diepsloot, has a relative poverty of only 30% (lower than the City average). But this represents over 7000 poor households, one of the highest levels of absolute poverty. The large populations of these wards enable them to have high numbers of poor households, or high absolute poverty. But their lower relative poverty is only because they also accommodate high numbers of non-poor households as well, which 'dilute' the proportions that the poor households represent.

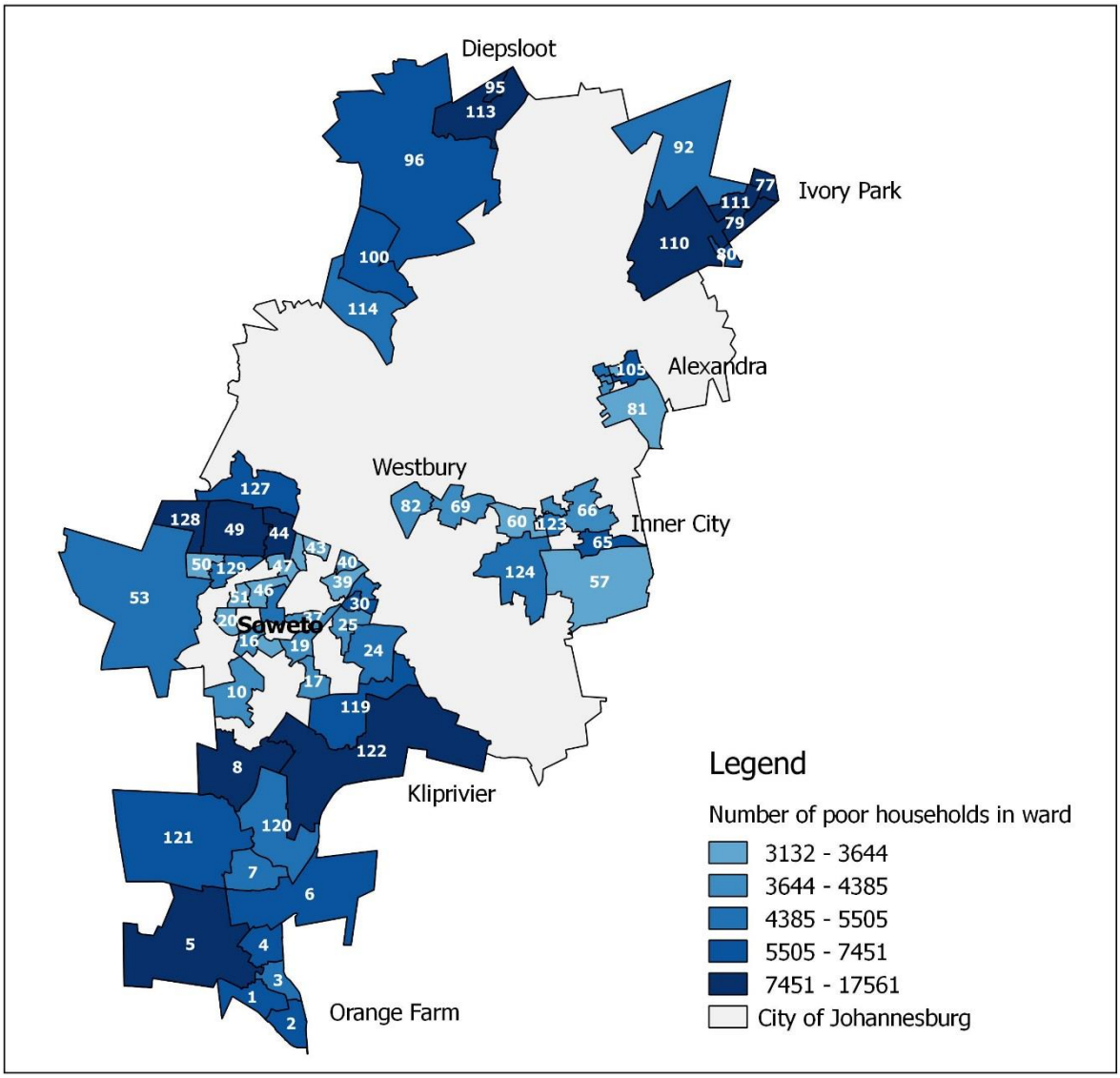


Figure 4: Map of City of Johannesburg depicting wards with above median number of poor households

One possible explanation for these wards with high absolute poverty but lower relative poverty is that the large geographical areas covered by the wards allows them to incorporate a diversity of settlements with different income distributions. For example, ward 96 has by far the largest area of all the wards in the city. Whilst it juts onto the Diepsloot cluster, it also includes other places known to be poor, such as the Lion Park Informal Settlement and Kya Sands Informal Settlement. However, within the vast area of the same ward a diversity of other places are also incorporated, from Lanseria, Northern Farm and Ruimsig which are relatively wealthier, to Chartwell and Dainfern, places known to be highly affluent. These large wards with high absolute poverty but lower relative poverty are understandably not part of the clusters of high relative poverty described above, but all occur alongside these clusters, particularly extending from Diepsloot, Ivory Park, Soweto, Alexandra and the Inner City.

Poverty in the City is spatially concentrated

In addition to the clustering of poor wards in particular areas, we also see a spatial concentration of poverty in certain of these poor wards – places where large populations of poor households are living under conditions of extremely high density. As mentioned above, the wards with above median poverty rate house over 67% (two thirds) of the households in poverty in Johannesburg. But they cover only 30% of the municipality's land area. Thus there are twice as many poor households in these wards, as there are in the rest of the wards, which represent over double the area. This already demonstrates that there is some concentration of poverty in the City. In addition, amongst these 65 poorest wards, some have extremely high population density in comparison to wards in other parts of the city. Because these wards have high relative poverty, a high population density means a high density of poor households. On the other hand, most poor wards in the south of the City have relatively low population density, except those in the southern tip of the municipality near Orange Farm. The poor wards in Soweto and the northern clusters have much higher population density. For instance, the poor ward 107 in Alexandra has almost 18000 households per square kilometre, giving each household an average of less than 56 square metres each – a 7m by 8m space. This is over 20 times as many households per square kilometre as the City taken as a whole, and almost 100 times that of the ward with the lowest population density. Over half of the households in this ward are poor.

We can observe the concentration of poverty by mapping the number of poor households per square kilometre – the poverty density. Figure 5 shows those wards which are above median in terms of poverty density. The highest is ward 63 in Hillbrow of the Inner City area, in which there are over 9000 poor households per square kilometre and a total population density of over 32000 households per square kilometre – by far the highest in the City. Although many large wards in the south of the City have above median poverty rates, their large areas and sparse populations means they have low

poverty density. In contrast, poverty is highly concentrated in the wards clustered in Diepsloot, Ivory Park, Alexandra, the Inner City, and Soweto, as well as Orange Farm, to a lesser extent.

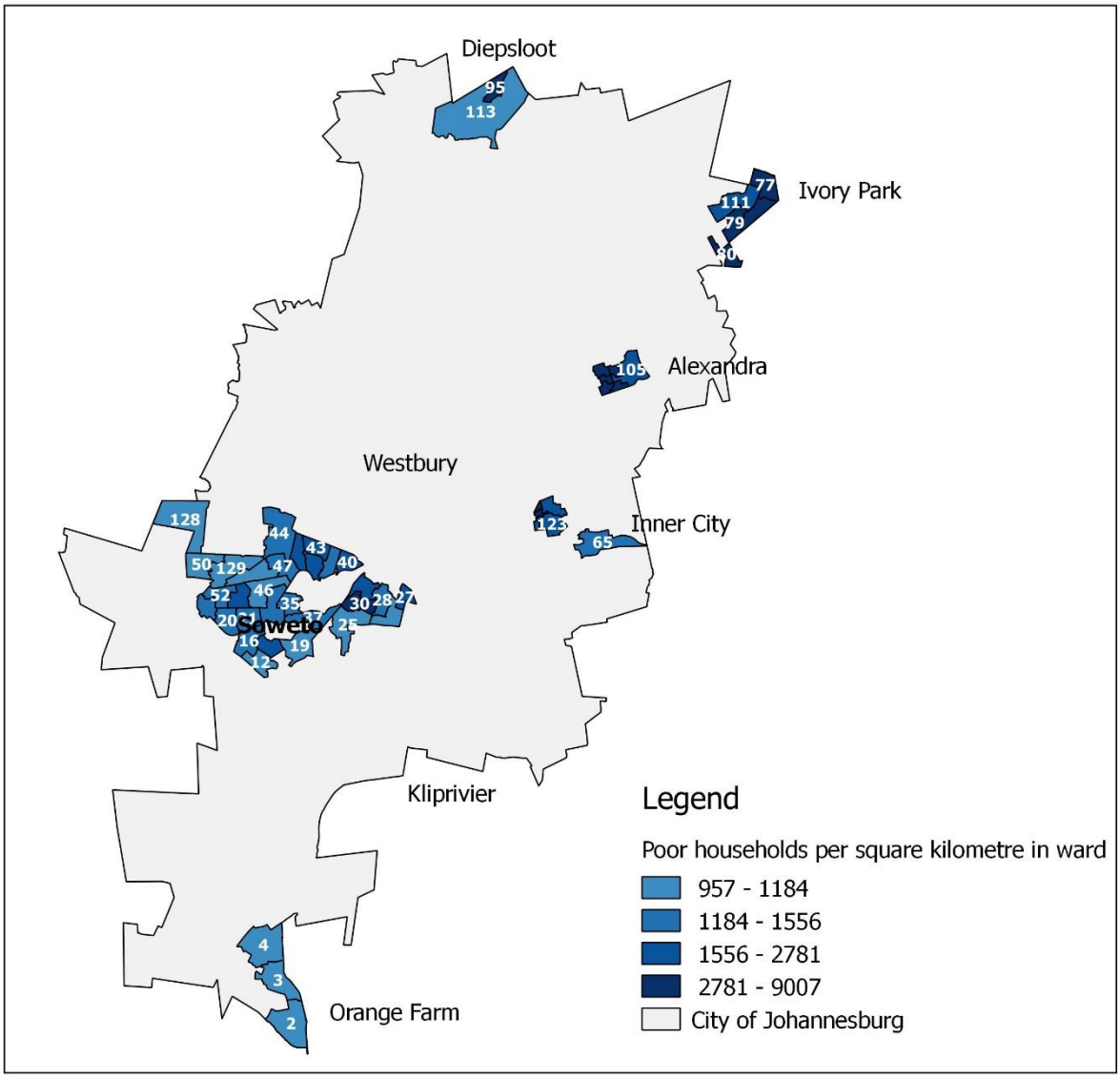


Figure 5: Map of the City of Johannesburg depicting wards with high poverty density, measured in poor households per square kilometre

Three types of poor areas

There are surely many and complex reasons behind the distribution of household incomes across the wards of Johannesburg, nevertheless, the results above indicate that poverty in Johannesburg is both spatially clustered and spatially concentrated in specific areas of the City. To summarise, most wards that are above median in relative poverty are also above median in absolute poverty, and these wards are clustered in the south of the municipality, in Soweto, in the Inner City, in Alexandra, in Ivory Park and in Diepsloot (see Figure 6 below). The clusters in the north of the municipality along with parts of Soweto also represent concentrations of poverty, where the density of poverty is high. In addition to

these clusters, some large wards extending from them also have high absolute poverty but they have low relative poverty. Poverty is not highly concentrated in these large wards adjacent to the northern clusters, or in most poor wards in the south of the City, because these wards all have low population densities, so despite the high absolute poverty, and even given the high relative poverty in the south of the City, their poverty densities are comparatively low. We can thus distinguish three types of poor wards: Those with only high absolute poverty will be referred to as high absolute poverty wards. Although they may be unevenly distributed within the ward, the large population of poor households means that a farm located anywhere in such a ward is quite likely to have poor consumers living nearby. Those which have high absolute poverty and also have high relative poverty will be referred to as high relative poverty wards. Here the likelihood that poor consumers will be near a farm in the ward is even greater. Those which have both high absolute and relative poverty as well as high poverty density will be referred to as high poverty density wards or concentrations of poverty. Farms in these wards have the greatest probability that many poor consumers reside near to them.

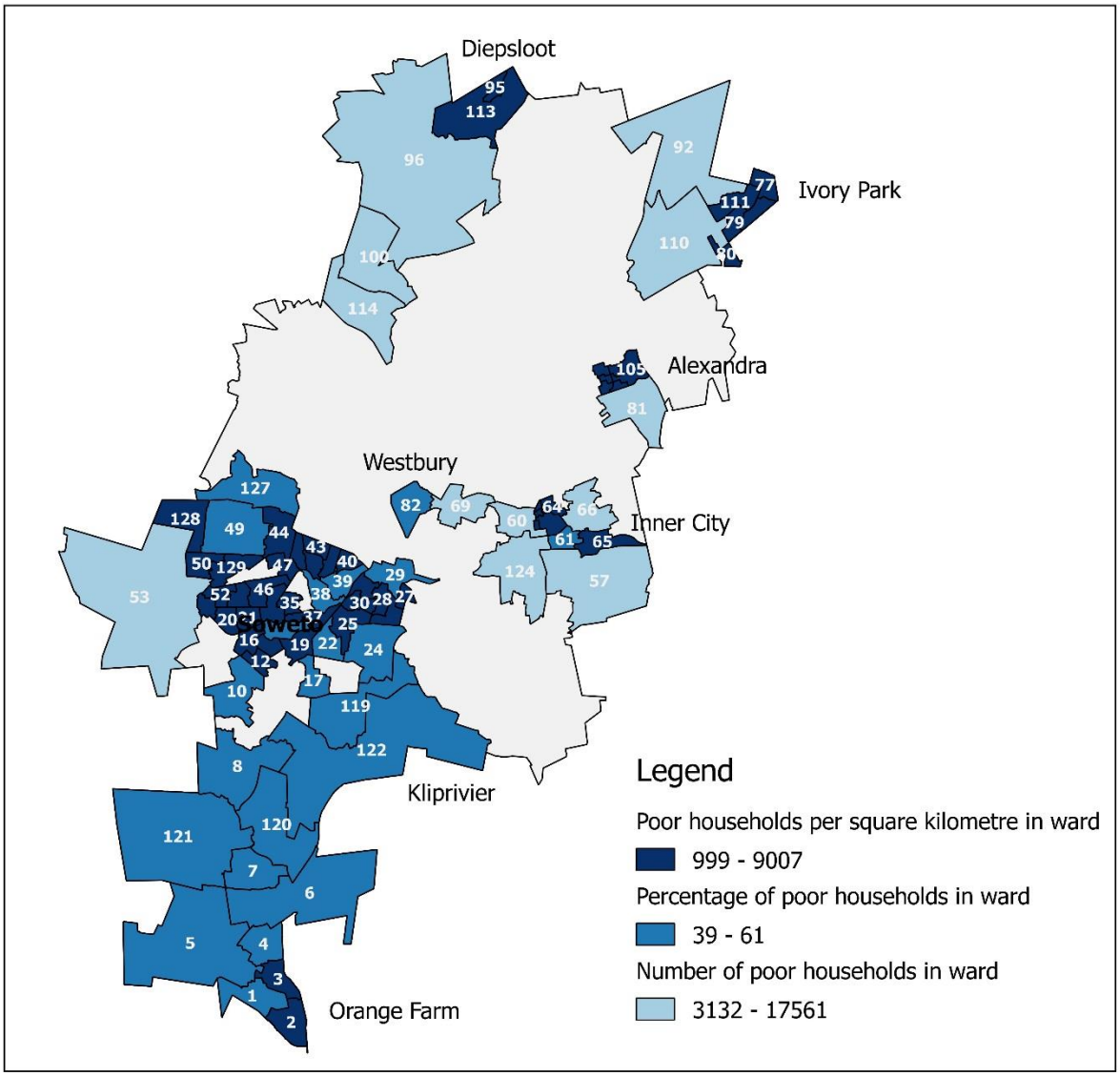


Figure 6: Map of City of Johannesburg depicting the occurrence of the three types of poor areas: high absolute poverty wards (pale blue), high relative poverty wards (medium blue), and high poverty density wards (dark blue)

The occurrence of agriculture in relation to poverty

For urban farms to represent a potential source of locally and sustainably grown fresh produce that is easily accessible to the urban poor, they must be located near to poor consumers and be making use of cultivation and distribution systems without detriment to the human and natural environment. Based on the analysis of satellite imagery, the Gauteng Department of Agriculture and Rural Development have compiled spatial data on the farmland in the province. This subchapter deals with the amounts and the main types of farmland which they found, particularly in areas of Johannesburg previously identified as having high levels of various measures of poverty. The first section concerns the occurrence of farmland in the municipality and its wards. Considering its dense urban character, the

City of Johannesburg contains a substantial amount of agricultural land, which is largely clustered along the edges of the municipality. The area under agriculture of each of the wards was determined through spatial analysis functions, and it confirms the relationship between the abundance of farmland and the lower population density of certain wards. Continuing with this ward-level analysis, the occurrence of agriculture in relation to the three types of poor wards is described, showing how together these support over three quarters of the City's farmland.

However, the various classifications of agriculture occur in particular patterns, which are relevant for their influence on the type of food system possible in these poor areas. The agricultural data was obtained in two spatial layers: one classified by crop type and one by cultivation strata. As such, the remainder of the subchapter looks at these agricultural classifications and their occurrence across the City in general, and then in the three types of poor wards specifically. One section describes the foodstuffs, nature of production and modes of distribution typically associated with the main crop types and cultivation strata, in relation to the likelihood of their being part of an alternative food system that serves and benefits the urban poor. In the following section, this is then evaluated according to the three types of poor wards identified previously. Some examples of different types of poor wards are considered in greater detail, being notable for the amounts and classifications of agriculture which they contain. Various areas show potential for the existence of local food systems that could provide healthy, sustainably grown, fresh produce to nearby poor consumers in ways that are empowering and accessible. To conclude, we highlight the high poverty density ward of Diepsloot, and three of Ivory Park along with the two surrounding high absolute poverty wards, as the following chapter will confirm that the farms in these areas are indeed producing and distributing food in ways that counter some of the disadvantages conventionally faced by urban poor consumers.

Agriculture in the dense, poor City

About 6500ha or 65 square kilometres of land in the City of Johannesburg is under agriculture, which constitutes about 4% of the total municipality. If it was a single field it could be a pivot (a round field) of about 9km in diameter or an 8km by 8km square. To give a sense of how much farmland this represents: If all the agricultural land in the City of Johannesburg was producing maize at the average rate of yield recorded for 2011, about 4 tonnes per hectare, it would produce over 26000 tonnes in a year, which would supply the maize consumption requirements of about 350000 people, if it was all processed for human consumption[21]. The vast majority of the farmland in the City of Johannesburg is in clusters of agricultural sites near the edges of the municipal boundary, many of which occur where

[21] On 3.1 million hectares of land, South Africa produced about 12.5 million tonnes of maize in 2011 (a particularly good year), and about 4.5 million tonnes of it was processed for human consumption (Department of Agriculture, Forestry and Fisheries, 2013). In the same year, per capita consumption of maize was 74.72kg per year (Department of Agriculture, Forestry and Fisheries, 2013).

large clusters of agricultural lands around the province as a whole have encroached into the City's perimeter. Although the Johannesburg municipality is 9% of the area of Gauteng, the metro contains only 0.8% of the agricultural land in the province. Large farming areas can be found in some of the western parts of the province, such as around Krugersdorp, Carletonville, and the Magaliesburg area, in the southern parts around Vereeniging, Vanderbijlpark, and Sebokeng areas, and in the east near Daveyton and Bronkhorstspruit. The City of Johannesburg is situated in the middle of the province, so much of the farmland in the City occurs where these agricultural zones extend across the municipal boundary – see Figure 7 below.

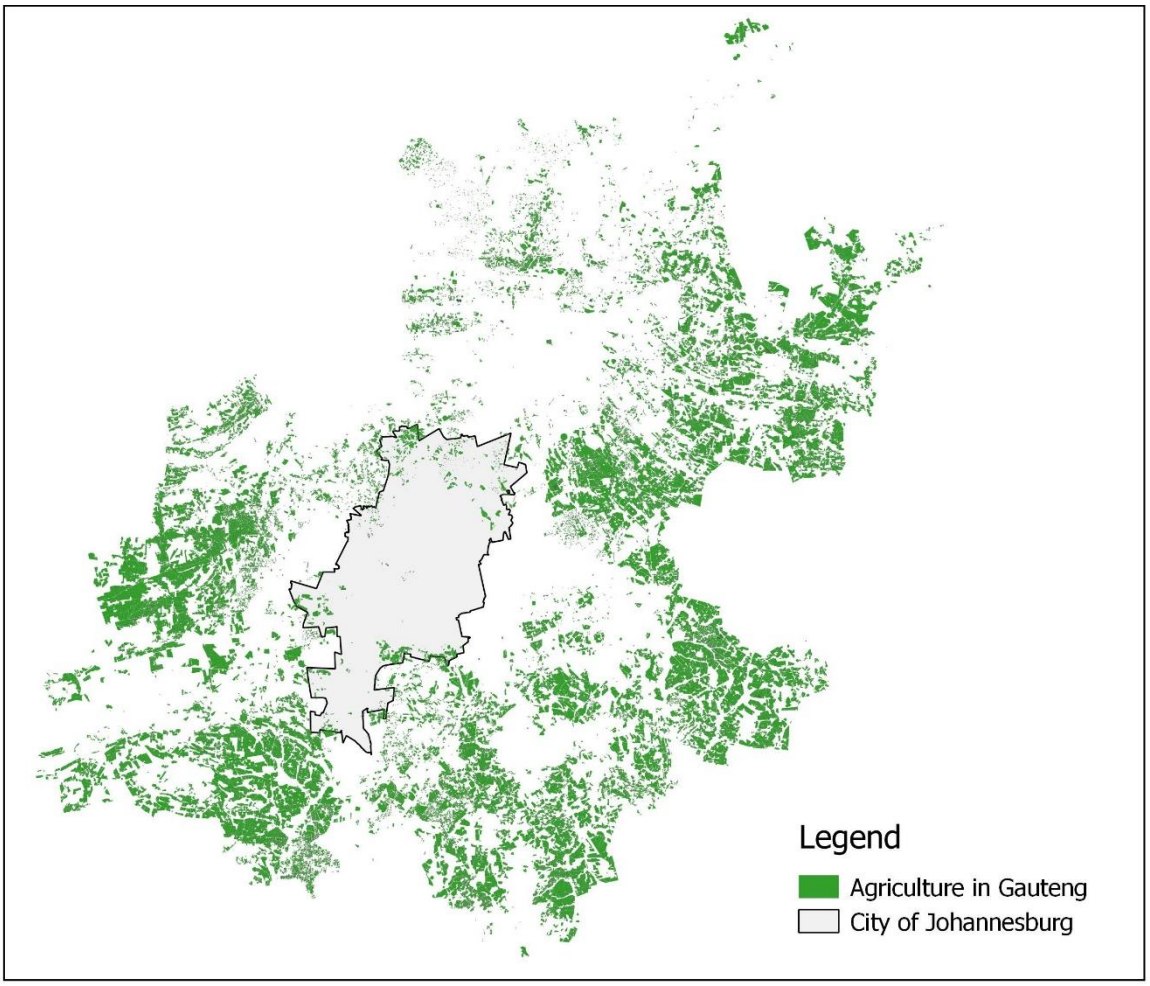


Figure 7: Map depicting areas of agriculture in Gauteng in relation to the City of Johannesburg

Whilst the location of agricultural land results from a complex combination of historical, political, social, economic and, of course, environmental factors, it is generally true that the more densely populated an area is, the less farmland it tends to contain, and vice versa. We see this at provincial scale with the relatively low occurrence of agriculture in Johannesburg, it being the extremely dense and highly urbanised core of Gauteng, which is already the most urban and populated province in the country. The same pattern is evident within the municipality – see Figure 8. The wards of

Johannesburg in which there is no farmland have a combined population density of about 1500 households per square kilometre, whilst that of the wards containing agriculture is almost a third of that at about 540 households per square kilometre. Two thirds of the agricultural land in the City (67%) occurs in the seven wards with the lowest population densities in the municipality. In fact, very little of the farmland (less than 5%) occurs in wards where the population density exceeds 800 households per square kilometre, equivalent to 1250 square metres per household, which is still relatively low. Whilst low population density does not guarantee that a ward will contain agriculture, the higher the population density, the less farmland is likely to be found there.

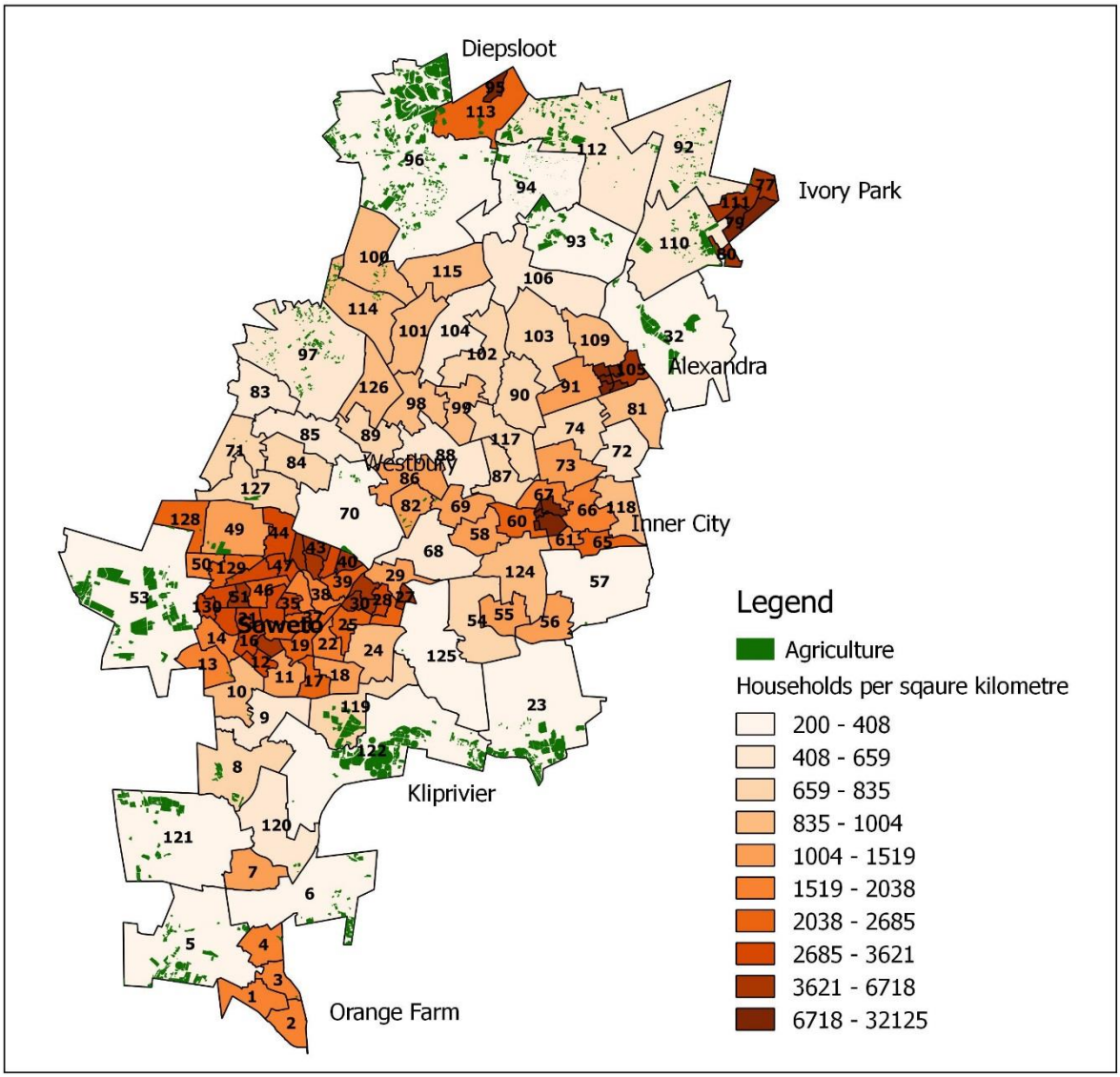


Figure 8: Map depicting agriculture in the City of Johannesburg with ward level population density in households per square kilometre

There is no such simple relationship between the level of income poverty and the area under agriculture of the wards – farms are not limited to wards with either high or low levels of poverty.

Substantial proportions of the City's agriculture can be found in some of the least poor wards and in some of the poorest wards. To illustrate this, combining the three wards with the lowest levels of zero income poverty in the City – wards 93, 94 and 112 in the Beaulieu area – makes up one tenth of the area under agriculture in the municipality. But combining a selection of wards in which over half of households are poor makes up 23% of the agricultural area in the City. Farms can be found in wards of diverse levels of income poverty – from the second highest poverty levels in the City (60% in ward 6 of Orange Farm, which has 183ha of agriculture), to the very lowest poverty levels of all the wards (7% in ward 93 around Sunninghill, which contains 246ha of agriculture).

That being said, a large amount of Johannesburg's farmland is found in wards where many poor consumers live, including all three of the types of poor wards described previously – see Figure 9 below. Since the areas of the City which represent concentrations of poverty have high population densities, the farms in these wards are most likely to be near to many consumers, most of whom are poor. The high population density, however, also means these wards contain the least agriculture. But the rest of the high relative poverty wards as well as the high absolute poverty wards make up a large proportion of the farmland in the City. Where these wards contain agriculture, they all have low population densities, and can be found close to the periphery of the municipality where much of the City's farmland is located. In total, the absolute poverty wards, which are all large and in the north of the municipality, account for over 2700ha or 40% of the City's agricultural land, whilst the high relative poverty wards in the south of the municipality account for about 2000ha or over 30%. In addition to this, about 3% of the City's farmland occurs in wards which represent some of the worst concentrations of poverty in Johannesburg – 88ha in Soweto, 113ha occurs in Diepsloot and 22ha occurs in Ivory Park. Together these poor wards make up almost three quarters of the farmland in the City. (Most of the remaining 25% of the agricultural land occurs in large wards with lower poverty rates around the edges of the municipality, aside from a few hectares in two areas in the centre of the City). Out of the clusters of poor wards identified originally, only Alexandra and the Inner City do not include wards where agriculture is taking place according to this data.

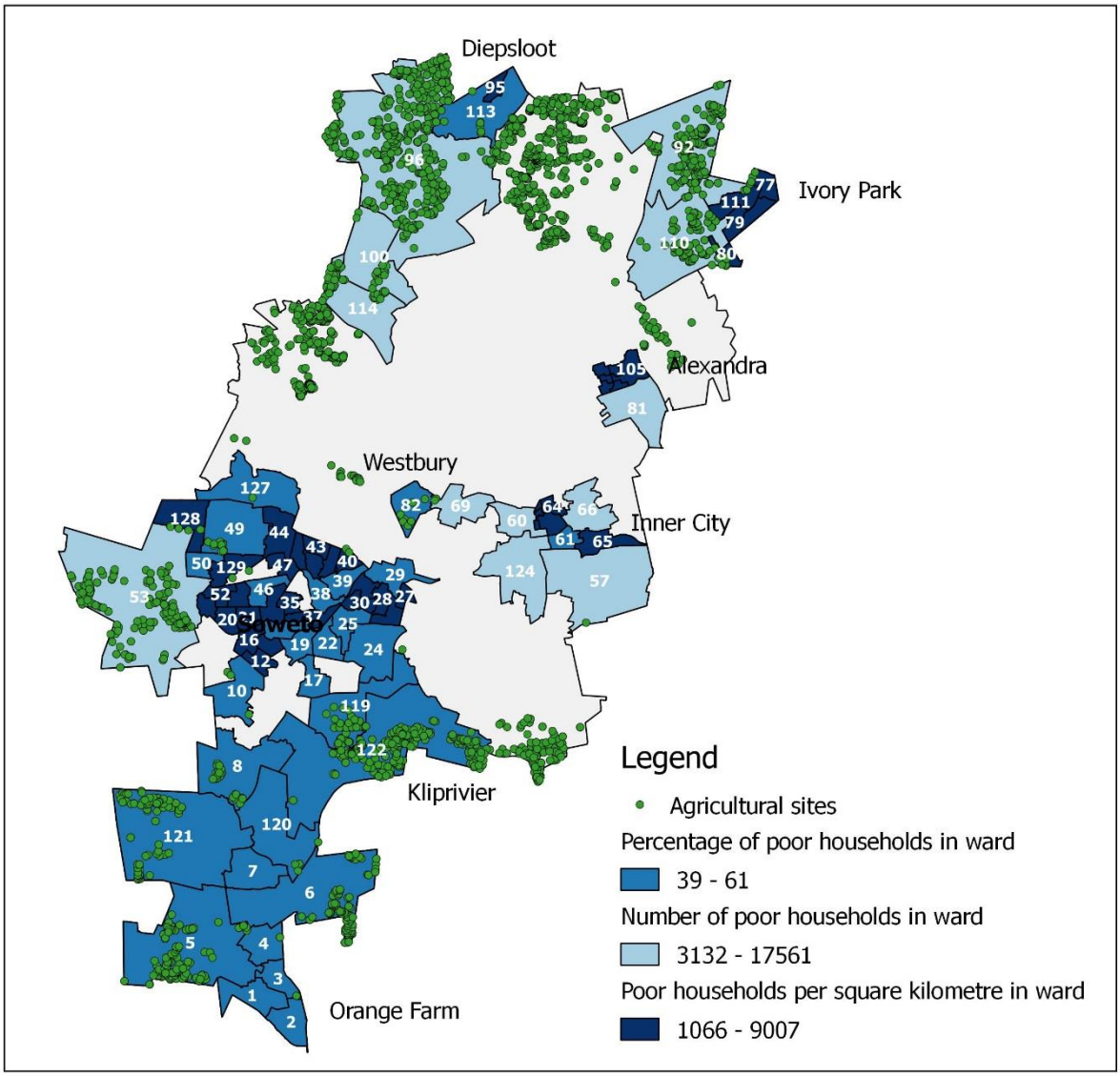


Figure 9: Map of agricultural sites in City of Johannesburg depicting high absolute poverty wards (pale blue), high relative poverty wards (medium blue), and high poverty density wards (dark blue)

Classifications of agriculture in Johannesburg

The geographical overlap between urban agriculture and poverty in the City represents the potential for poor consumers in many parts of Johannesburg to access fresh produce from nearby farms. Whether the agriculture in question is in fact part of an alternative food system which serves and benefits the local poor consumer, cannot be determined directly from the crop type and cultivation strata classifications used by the Gauteng Department of Agriculture and Rural Development. But these do provide some evidence regarding what foods are likely to result and what types of production and distribution are likely to be employed. These in turn speak to other characteristics of the food system, such as whether it is making locally and sustainably grown, healthy fresh produce available to poor consumers in ways that are accessible and empowering.

The flow diagram of food system characteristics depicting the conceptual framework for this research represented the four ways in which urban poor consumers can benefit from alternatives to the corporate food regime, and how these are influenced not only by a food system being local but also by various other elements of the food system (refer to Figure 1 in Chapter 3).

The spatial data in this chapter is related to whether the food system is local, as well as to the elements of the diagram referred to as crop type and cultivation strata. The exercise of mapping poverty and agriculture established where a substantial amount of production was located nearby to a large population of urban poor consumers, which has implications for accessibility, empowerment, sustainability and health. But the classifications of this agriculture also indirectly influence these four fields of benefits by their influence on the foodstuff, nature of production, scale of production and mode of distribution. The crop type and cultivation strata provide information about some of the possible forms of the various characteristics of the food system. The crop type classification describes what produce is being cultivated, which will determine the foodstuffs that might result and may impact what nature of production is likely. Cultivation strata refers to the level of cultivation, describing the physical form of the farm as well as the intensity of agriculture. This will give an indication of the associated nature of production as well as the volume of produce to be expected, from which we can infer something about the mode of distribution as well. So the occurrence of poverty and agriculture provides a picture of the potential for local food systems that serve and benefit the urban poor across the City, and by considering the occurrence of the different classifications of agriculture, we can speculate about the likelihood that the benefits in terms of accessibility, empowerment, sustainability and health will be enhanced or compromised by other food system characteristics. Whilst these give an idea of potential for food system alternatives to exist, there are numerous other factors involved as will be seen in the following chapter.

Generally speaking, the farmland in Johannesburg occurs in clusters around the municipal edges, much of which is in wards which are poor in some way. But some of the agricultural classifications are more restricted in their occurrence across the City, falling only in particular areas. Studying the data about these classifications, in areas where there are many poor consumers living, provides some more detail about the type of farming taking place there. This will not only determine what sorts and amounts of foods are being locally produced, which may potentially be accessible to poor consumers, but could also be associated with the forms of production and distribution that will impact whether food system alternatives are likely. The following sections consider each of the crop types and cultivation strata occurring in the City of Johannesburg, looking first at their general distribution, and then for each classification, providing an explanation of the term where required, and, before reviewing its specific occurrence, examining its possible influence on the other food system characteristics: the foodstuffs including the necessity of processing, the nature of production, the scale

of production, and the mode of distribution. Although the municipality is dominated by low cultivation and cash crops such as maize and soya beans, even these classifications entertain some potential for food system alternatives. Where some of the more restricted classifications can be found, overlapping with high levels of poverty, there is a significant possibility of local food systems which better serve and benefit urban poor consumers by differing from the characteristics of the corporate food regime.

Crop types

Most of the farmland within the City of Johannesburg (6488ha) has been classified according to crop type. The crop type describes what produce is being cultivated, which either could support the diets associated with the corporate food regime and the malnutrition currently resulting from it, or could make available foods which would contribute to improving food security. Whether or not the produce being grown requires processing also impacts the probability that the produce will leave the local area before being consumed. Certain crop types may be more associated with particular forms of agriculture which would thus influence the nature of production. Farmland classified as maize, pasture and soya beans is located in almost all the areas of agricultural land for Gauteng and so this land is clustered around the margins of the City of Johannesburg wherever agriculture is found (see Figure 10). As such, most of the agricultural areas include some of these crop types. Although they consist of far fewer sites, the minor crop type classifications also follow the general occurrence of agriculture in the City. Most land of these crop types occur dispersed amongst the clusters of agriculture at the edges of the City. The vegetables crop type has the only really unusual occurrence across the municipality, with all of the land being found in only two places in Johannesburg.

Table 2: Crop type classifications occurring in the City of Johannesburg according to combined area of farmland

Crop type	**Combined area in hectares**	**Proportion of total area**
Maize	2601	40%
Pasture	2273	35%
Vegetables	1075	17%
Soya beans	431	7%
Fallow	62	1%
Horticulture	15	0.2%
Sunflower	13	0.2%
Shadenetting	11	0.2%
Unclassified	6	0.1%
Total	6488	

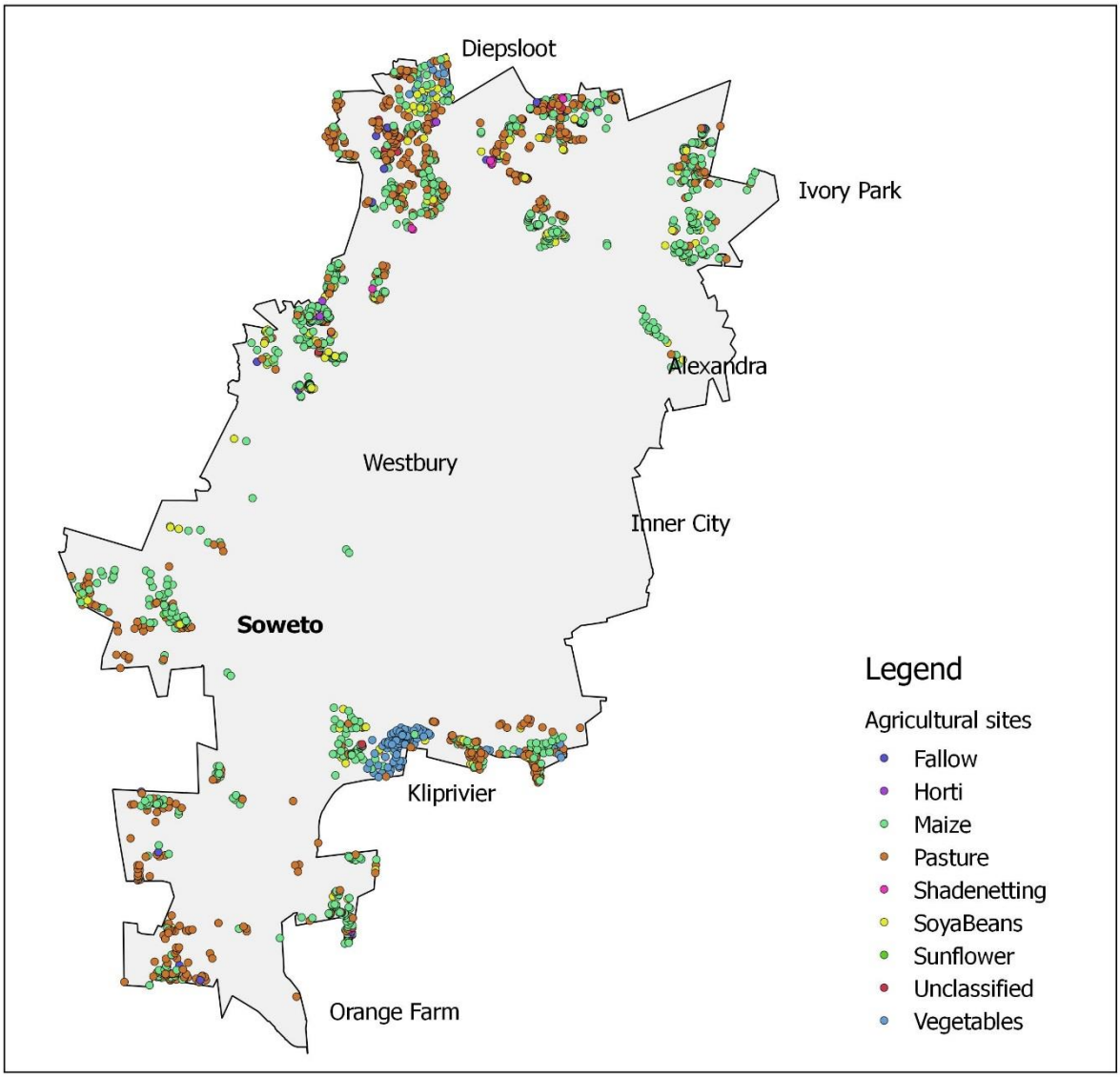


Figure 10: Map of agricultural sites in City of Johannesburg classified according to crop type

Maize

The crop type which represents the largest proportion of the City's farmland (40%) is maize, with a combined area of about 2600ha. Given the yield conditions described above for the country as a whole in 2011, the farms in Johannesburg could supply the annual maize consumption of about 140000 people. More than half of the maize produced in South Africa is yellow maize for animal feed, but some yellow and most white maize is eaten by humans, which restores the possibility that this farmland could be making maize available for the urban poor. Maize is an essential staple in the diet of most South Africans and is considered part of the typical food purchasing of poor consumers. Here, grains generally account for over thirty percent of the food expenditure of urban households in the lowest income deciles (Aliber, 2009). Maize meal, probably the most standard food item derived from maize in the country, requires a mill to be processed, which may not be located on or near the farm. This introduces a likelihood that maize grown in one area will be transported to another area to

be milled. The same is true of other processed maize products, such as corn syrup, which is common in many commercially prepared foods typical of the urban transition, such as soft drinks and sweets. Whilst maize meal is low in fat and sodium, contains some protein and, in South Africa, is generally fortified with vitamins and minerals, in the end it is a processed starchy food, characteristic of diets associated with poverty related malnutrition. However, another very common maize product is 'green mealies', the fresh heads of maize, which are generally sold with the husk still on, for cooking. Green mealies are similarly rich in carbohydrates, but unlike the processed meal they have not had the germ and hull of the grain removed, so they are high in fibre and retain the naturally occurring B-vitamins, potassium, magnesium, iron and zinc. Because they are sold in the condition in which they were picked, there is certainly potential for green mealies grown in poor wards of the City to remain available locally and so be accessible by poor consumers in these areas.

In terms of forms of production associated with the crop type, and their impacts on the food system, maize is grown at all scales and using a variety of methods, techniques and technologies. However, an area of farmland classified as maize according to this data is by definition growing exclusively maize and is therefore an area of monoculture, which has negative environmental effects, especially if the area is large. In addition, maize is one of the three crop types in South Africa which is highly likely to be genetically modified. Whilst the adoption of this technology by large-scale capital intensive maize farming, for which it was developed, has been rapid, with 86% of the commercial 2012/13 season maize crop being genetically modified, it has also been introduced to South African small-scale farmers for many years (Department of Science and Technology, 2014; Fischer, van den Berg, & Mutengwa, 2015; Zubeida Jaffer, 2015). There is substantial debate about the socio-environmental effects of modes of agriculture using genetically modified crops in South Africa, which is probably the only country in the world where most of the main staple crop (maize) is genetically modified (Daily Maverick, 2015; Fischer et al., 2015; South African National Biodiversity Institute, 2011). Many varieties are genetically modified to work in conjunction with other synthetic inputs, for instance being engineered to be able to withstand a certain herbicide which then kills all other vegetation. The use of such seeds not only demands the application of highly toxic chemicals which are detrimental to the environment, it also compels farmers to purchase more chemical inputs, making them increasingly reliant on the market. Patents on genetically modified seeds make them the intellectual property of corporations, threatening the control farmers have always had over their own cultivation.

Farmland classified as maize is located in almost all the areas of agricultural land for Gauteng and so is clustered around the margins of the City of Johannesburg in most of the wards where agriculture is found, including wards where many poor consumers reside.

Soya beans

About 430ha of Johannesburg's farmland (6% of the total area) is classified as soya beans. The average yield per hectare of soya beans is much less than that of maize. Also given this much smaller amount of farmland than maize, the City would have produced less than 600 tonnes of soya beans in 2011, given the national average yield of 1.4 tonnes per hectare for soya beans, compared to the aforementioned 4 tonnes per hectare for maize (Department of Agriculture, Forestry and Fisheries, 2013). Like maize, soya beans can also be sold fresh (or dried), or they can be more thoroughly processed. Fresh soya beans, also called edamame beans, are being promoted for local production in parts of South Africa (Government Communication and Information System, 2016). Although they are touted as a very good source of dietary protein to combat malnutrition amongst the poor, the initiative focuses on generating employment and income opportunities and doesn't prioritise making them more affordable or available for purchase. As such they remain quite an exclusive food item which still features little in the diets of ordinary South Africans. Processed soya, on the other hand, is an ingredient in many foods, which creates a likelihood that the soya grown will be transported out of the local food system to be processed. Some soya products, like tofu and soy milk, are expensive health store purchases, whilst others, like soya bean oil and soy lecithin derived from it, are highly ubiquitous in commercially produced foods. In general, the dietary benefits of soya are hotly debated (Huffington Post, 2012; The Nutrition Source - Harvard School of Public Health, 2014). This crop doesn't have a defining influence on the nature of production except that land classified as soya beans is assumed to be an area of monoculture cultivation. Also, like maize, most soya beans (90%) cultivated in South Africa are genetically modified, which increases the chances that this crop type would be associated with high input methods of agriculture and their controversial impacts on society and the environment (Department of Science and Technology, 2014).

The occurrence of soya bean farming follows the general occurrence of agriculture in the City, so it occurs in many poor agricultural wards although it may not be likely to contribute to the food system in ways that support the consumers there.

Pasture and minor crop types

Land classified as pasture makes up the second highest crop type with about 2300ha, or 35% of the total area, and is found in most agricultural areas of the City. This could speak to the importance of livestock farming in the municipality, which AFSUN found equally prevalent to field cropping in some poor communities of Johannesburg, albeit at a rate of only 1% of residents (J. S. Crush et al., 2010). Serious changes in production and consumption of meat have been brought about by the corporate food regime, and these have had complex repercussions for the urban poor. Meat production also represents such a different food system to that of fresh produce, with very unique variables in terms of production (such as stocking capacity) and distribution (such as abattoirs). Being beyond the

scope of this research, the conceptual framework of the study is not intended to accommodate these variables. Nevertheless, the fact that a substantial amount of farmland in poor areas has been classified as pasture suggests that there is a likelihood for these pasture lands to represent a local food system that serves poor consumers. Whether it is associated with other food system alternatives that enhance the benefits in terms of accessibility, empowerment, sustainability and health is impossible to infer without more information. The Abrahams case study in the south of the City involved informally traded meat foodstuffs as part of a series of food system alternatives, but it was not clear if the livestock were locally raised (Abrahams, 2006a).

Farmland classified as 'horticulture', 'sunflower', 'shade netting', 'fallow' or 'unclassified' each make up less than 1% of the total farmland, with a combined area of only 108ha across the whole municipality. Classified separately to vegetables, the horticulture crop type is likely to refer to the production of fruit and ornamental plants such as cut flowers. Although they consist of far fewer sites than the other crop types, the minor crop type classifications also follow the general occurrence of agriculture in the City. Most land of these crop types occur dispersed amongst the clusters of agriculture at the edges of the municipality, some of which falls in poor wards.

Vegetables

Land where vegetables are grown makes up a combined area of 1075ha or 17% of the total area under agriculture, making it the third highest crop type by area. Of all the crop types, the vegetables classification is probably the most relevant in terms of improving the access of poor consumers to fresh, healthy local produce. The nutrition transition is resulting in poor South Africans consuming an excess of energy-rich foods, sugar and fats, and fewer foods such as vegetables which are rich in micronutrients and fiber (Rudolph et al., 2012). Vegetables are a source of essential vitamins and minerals, such as potassium and vitamin A, without which many South African children suffer from compromised development (Morris, 2001). Since most vegetables can be sold with minimal processing, it is not always necessary for produce to leave the site of cultivation. As a foodstuff, unprocessed vegetables thus epitomise the antithesis of the urban nutrition transition, and aside from the social and environmental benefits of a shorter distribution chain, locally grown vegetables also remain more fresh and nutritious to the consumer. The nature of this crop type classification allows for an area identified as vegetables to contain a diversity of varieties, rather than being a monoculture by definition, like maize and soya beans. Although some vegetables require more irrigation and richer soil than maize, there are varieties of vegetables that will suit the different conditions that can be provided by the farmer. As such vegetable cultivation is not particularly associated with any scale or method of production – some crops do well planted hydroponically (with their roots in water) in large temperature controlled tunnels, some do well out in the sunshine in a bucket of sandy soil that catches

the occasional rainfall. This crop type thus allows for the cultivation of food through the adoption of whatever nature of production is possible for the farmer.

Having said that, in this data most of the vegetables crop type overlaps with cultivation strata classified as pivot irrigation and high cultivation, which are associated with particular forms of production. The overlap means that these cultivation strata are also largely limited to the same areas as the vegetables crop type. The amount of farmland classified as vegetables is substantial, but it is tightly restricted in its occurrence in the City, unlike the other major crop types. Maize and pasture land each account for more than double the area of vegetables, but they are spread across the various clusters of farmland around the City edges, as is soya beans. All the agricultural land for vegetables, on the other hand, is concentrated in just two areas: 332ha is located in Northern Farm (ward 96), close to Diepsloot, and the remaining 743ha is in the Kliprivier-Glenvista area (wards 23 and 122). Ward 96 has high absolute poverty and ward 122 has high relative poverty, which means that the location of many of the vegetable farms in Johannesburg gives them the potential to provide local access to nutritious fresh produce for the many poor consumers living in these wards.

Cultivation strata

The classification of cultivation strata has been used by the Gauteng Department of Agriculture and Rural Development to refer to the level of cultivation, giving some indication of the physical form as well as the intensity of agriculture. This speaks directly to nature of production with its impacts on the natural and human environment, as well as the volume of produce one could expect. This in turn affects the mode of distribution, for instance the likelihood that the farm could supply retailers in the formal sector or not. These are all indications of the potential for these agricultural sites to form part of an alternative food system which would best serve and benefit the urban poor. In terms of occurrence, low cultivation can be found in almost all of the areas where agriculture occurs, but each of the other classifications occurs in particular areas only (see Figure 11). Pivot irrigation, high cultivation and most medium cultivation is restricted to the same two areas as the vegetable crop type. Some medium cultivation occurs on the west of the municipality as do many smallholdings. Other smallholdings are in the northeast, which is also where much of the small-scale farming occurs.

Table 3: Cultivation strata classifications occurring in the City of Johannesburg according to combined area of farmland

Cultivation strata	Combined area in hectares	Proportion of total area
Low Cultivation	3230	49%
Medium Cultivation	932	14%
Pivot Irrigation	878	13%
Smallholdings < 5ha	524	8%
Small Scale Farming	244	4%
Old Fields	101	2%
Smallholdings	95	1%
Total	6650	

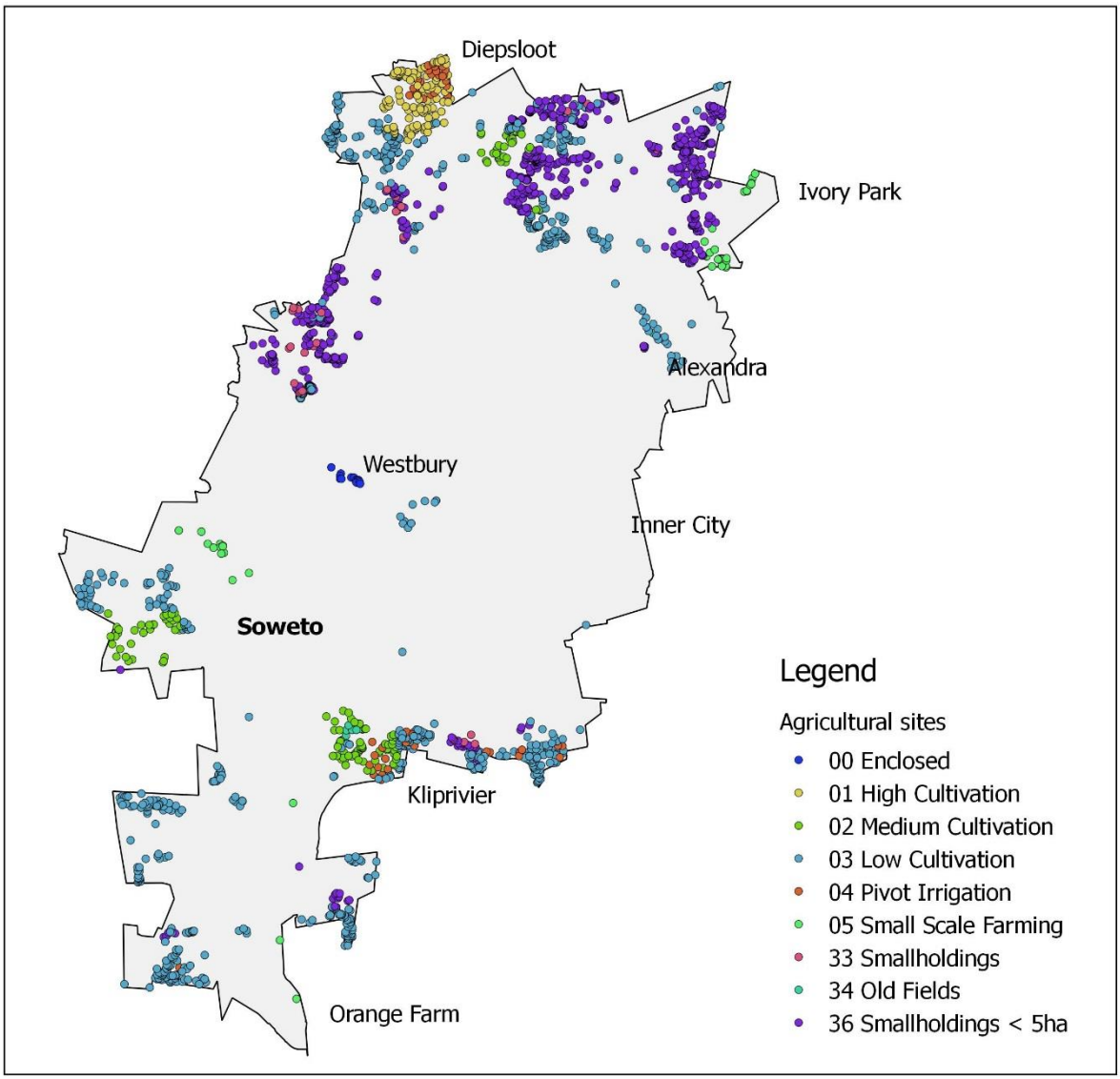


Figure 11: Map of agricultural sites in City of Johannesburg classified according to cultivation strata

High cultivation and pivot irrigation

Pivot irrigation describes a form of agriculture characterised by a round field, with a mechanised linear irrigation system forming a diameter or radius to the circular plot, which rotates or pivots from the centre point to irrigate the entire field. Along with high cultivation, it refers to a more intensive mode of agriculture, which is likely to be high yielding and quite resource demanding. On one hand, this means that the quantity of local produce will be substantial, but on the other hand it also increases the likelihood that the farms are part of more formal retail arrangements. This needn't necessarily mean the produce won't be made available locally but it is more likely to be transported out of the area to a centralised pack house first, involving expensive and environmentally costly transport and cold chain infrastructure (South African Cities Network, 2015). This scale of production could also reduce the chance that produce will be retained or donated, or will be accessible directly from the farm by poor consumers themselves, or by local vendors, who represent the most frequent source of food for poor urban consumers (Battersby et al., 2015), although it is quite possible to make use of multiple modes of distribution. For instance, the farms which Abrahams describes near Lenasia, which sell directly to the public and to informal traders, seem to be the same farms which she describes as supplying formal retailers through contract or via the municipal fresh produce market (Abrahams, 2006a). Pivot irrigation, and high cultivation to some extent, are also less likely to be associated with more ecologically sound, healthier farming methods which retain or improve agro-biodiversity and soil health and make optimal use of available human and natural resources (M. Lewis, 2011). These cultivation strata are associated with the types of agriculture for which genetically modified crops were really designed and which have taken them on the most (Zubeida Jaffer, 2015). As mentioned, this further increases the likelihood that the farm relies heavily on the purchased inputs which are tied in with genetically modified seeds.

Largely because pivot irrigation and high cultivation tend to overlap with the vegetable crop type, the same two areas of Kliprivier-Glenvista and Northern Farm-Diepsloot are important in terms of the occurrence of these particular cultivation strata. In total, half of the area classified as vegetables (537ha) overlaps with pivot irrigation agriculture, and in Northern Farm (ward 96), all of the vegetables sites overlap with high cultivation or pivot irrigation agriculture (although not all of the land classified as these cultivation strata is for vegetables). As a crop type, vegetables need not be restricted to particular scales or forms of production by definition, but there is a strong association evident in this data. Aside from two isolated sites (in wards 5 and 94), pivot irrigation agriculture is only found in Northern farm (ward 96, 331ha) and the Kliprivier-Glenvista area (wards 23 and 122, 551ha). High cultivation is also tightly restricted in occurrence, with the 120 sites – 628ha total area – all located together, also in the Diepsloot-Northern Farm area (mostly ward 96 and some ward 113). Except for ward 23, all of these are poor wards, with ward 113 of Diepsloot even representing one of the concentrations of poverty in the City.

Medium and low cultivation

Medium and low cultivation farms will produce lower volumes than pivot irrigation and high cultivation, because they are less intensive forms of agriculture. They are not necessarily less likely to be formal commercial producers, however. As mentioned, formality doesn't immediately mean the produce won't be locally accessible, but it increases the likelihood of a longer distribution chain and of methods of cultivation, fertilization, irrigation and processing which are also financially, socially and environmentally costly. Again, however, even if these farms are supplying formally to the conventional corporate food system, they could also be supplying informally to local consumers and vendors, which better suit the food provisioning practices of the urban poor. They may also be retaining some produce for their own consumption or subsistence, or donating some produce.

Like the major crop types of maize, pasture and soya beans, low cultivation occupies land in all the clusters around the municipal edges, making up almost half (49%) of the classified farmland, so this type of agriculture is found in most areas that support farming, including poor wards. Medium cultivation agriculture also takes place in the Kliprivier area especially near the N1 (wards 119 and 122) and in the Diepsloot-Northern Farm area (wards 96 and 113), as well as in ward 53 on the Westrand around Soweto's Protea Glen. Wards 96 and 53 are high absolute poverty wards, those in Kliprivier are high relative poverty wards and ward 113 in Diepsloot is a high poverty density ward. More medium cultivation in the north of the municipality, which occurs along William Nicol Drive between Diepsloot and Beaulieu, actually falls in wards 94 and 112, which have amongst the lowest poverty rates in the city (9-10%).

Smallholdings and small-scale farming

Both smallholdings and small-scale farming imply a certain 'smallness' of production, but their classification is not based entirely on the size of the site, it is also based on the physical form and circumstances of cultivation. Agricultural sites classified as smallholdings tend to occur within relatively large residential plots of land where there is also a house or living quarters. These are often located in areas where the majority of properties are of this nature. Small-scale farming on the other hand is generally not bounded within the same property as a residence, and can therefore be much larger, although it needn't be. It often occurs in open areas, sometimes within or on the outskirts of residential areas but not inside the residential properties themselves.

Unlike those discussed up to this point, the smallholdings and small-scale farming cultivation strata are by definition more likely to be associated with more holistically beneficial forms of production, either as an automatic result of the smaller scale of production or access to resources, or by more

easily employing specific types of sustainable agriculture like organic, conservation agriculture, permaculture or agro-ecology[22] (Greenberg et al., 2013). Whether by explicit choice or as a default result of their land size, smaller farms are more likely to intercrop and rotate their crops, which promotes agrobiodiversity. Rather than pay for chemicals, which destroy many beneficial organisms and disrupt the ecology, small farmers are more likely to opt for pest control methods such as companion planting, or for natural pesticides such as ash or tinctures made from particular plants such as chilli and garlic. Similarly they generally plant nitrogen fixing crops, make their own compost or source animal manure, rather than buy chemical fertiliser, ensuring that an improvement in yields does not compromise the health and longevity of the soil. They are also more likely to make efficient use of scarce water resources by adopting water harvesting techniques, and to avoid unnecessary mechanization which would be costly for them and would increase their carbon footprint. Making use of existing human and natural resources and minimizing dependence on external inputs means small farms can be more self-reliant and self-determining. Proponents of these methods tout their environmental benefits as well their human benefits, saying that they enhance the liveability of areas where they are employed and result in more nutritious produce. Besides being more likely to adopt particular forms of agriculture, smaller farms are also inherently less likely to be part of the conventional formal distribution and retail system. Whilst this definitely does not preclude a commercial orientation, these sites are probably the most likely to have shorter, more local distribution systems, or even to be producing purely for subsistence. If these farms are producing a surplus, this could easily be entering the local food system directly or through informal traders, in convenient locations and small, affordable quantities, to improve the access of poor consumers in the areas in which they are located.

The 727 agricultural sites classified as smallholdings make up a total area of 619ha. The majority (681 sites, 541ha) are clustered in parts of the north of the municipality: Beaulieu (wards 94 and 112), the Randjespark-Austin View area (wards 92 and 110), the Ruimsig-Wilgeheuwel area (wards 97, 100 and 114) and in Farmall (ward 96). This means, like medium cultivation, that smallholdings occur both in wards with low poverty as well as wards with high poverty. Wards 94 and 112 in the Beaulieu area and ward 97 in the Ruimsig-Wilgeheuvel area on the west of the municipality accommodate comparatively low numbers of poor consumers. But high absolute poverty characterises ward 96 mentioned above, as well as wards 100 and 114 on the west, and wards 92 and 110 that extend from Ivory Park, meaning that many poor consumers live in wards containing smallholdings. About one quarter of the area occupied by smallholdings is fallow or pasture, which are not food crop types, and another quarter is either ‘unclassified’ or does not overlap with any crop type data. But 42% overlaps

[22] These terms describe different philosophies of production, which combine diverse methods in particular ways, but all attempt to improve the environmental impact of farming by employing principles informed by natural processes

with the maize crop type, more than half of which is in wards where many poor consumers could potentially access any surplus production made available locally.

Small-scale farming occurs mostly in poor areas, including some in the northwest of Soweto (wards 49 and 128) and in the south of the City (ward 3), but the majority (70%) in the high poverty density wards of Ivory Park (wards 77, 80 and 111) and the high absolute poverty ward adjacent (ward 110). Small-scale farming makes up a total of 244ha, the majority of which (55%) is also maize. The largest small-scale farming site in the city is 65ha in ward 110 of Austin View near Ivory Park – about one and half times the area of the nearby Grand Central Airport. This site overlaps with the maize crop type, and so is also the largest single site classified as maize in the City. As a result of some such large farms near Austin View and President Park, much of the small-scale farming (140ha) is in this high absolute poverty ward 110, in which almost 8000 poor households live, albeit at a low density of about 240 poor households per square kilometre. But some small-scale farming is also found in wards 77, 80 and 111, forming part of Ivory Park itself, which together accommodate almost 24000 poor households at an average density of about 3000 per square kilometre, representing one of the worst concentrations of poverty in Johannesburg.

Old fields and enclosed

The 'old fields' classification describes a non-productive level of cultivation, whilst the enclosed classification refers to the physical form of being enclosed within a compound, such as the grounds of an institution. The old fields cultivation strata is attributed to about 101ha of land with an average plot size of 15ha. Six of the seven sites are located in high relative poverty ward 119 in Kliprivier area, while the remaining one is in Modderfontein in a ward 32 with low rates of poverty.

The wards in which all the enclosed land occurs are also without high poverty of any type. Consisting of just 14 sites of unknown crop type in the Florida area (13 in ward 70, one in ward 84), this cultivation strata makes up a total area of only 19.3ha. This cultivation strata classification tells us about the physical form of the farm not the intensity of production, but in any case it is of little consequence to this research since none of it falls in poor areas.

Agriculture in the three types of poor wards

The three types of poor wards identified in the first part of this chapter represent increasing likelihood that a farm located in such a ward will be near poor consumers. Absolute poverty means there are many poor households in the same ward as the farm. Relative poverty means that, within the ward, households which are located close to the farm are likely to be poor. Poverty density means, wherever the farm is in the ward, there are probably poor households nearby. In the high poverty density wards, all three of these conditions are true.

Table 4: Three types of poor areas and their potential for local food systems for the poor

Type of poor area	**Absolute poverty**	**Relative poverty**	**Poverty density**	**Probability that there will be poor consumers near any farm in the ward**
High absolute poverty	High	Low	Low	High
High relative poverty	High	High	Low	Higher
High poverty density / Concentration of poverty	High	High	High	Highest

To conclude the picture of potential for local food systems which serve and benefit the poor throughout the City of Johannesburg, we review the findings on the occurrence and classifications of agriculture in the municipality in these three types of poor wards, beginning with high relative poverty wards. In order to facilitate the discussion, this section will refer to a number of wards that exemplify the three types of poor areas, and where important amounts or types of farmland can be found. The characteristics of these wards are indicated in Table 3 below.

Table 5: Examples of the three types of poor wards that contain farmland, detailing the characteristics and classifications thereof, and organised in order of area under agriculture

Ward number	Some places in ward	Population density (hh per sq km)	Absolute poverty (poor hh)	Relative poverty (proportion poor hh)	Poverty density (poor hh per sq km)	Area under agriculture (ha)	Proportion of City's agriculture (by area)	Proportion of ward area (ha) covered by farmland	Cultivation strata and crop type classifications
96	Lanseria, Northern Farm, Kya Sands Informal Settlement	228	7137	31%	71	1424	22%	14%	Most of the high cultivation, one third of the vegetables including one third of vegetables pivots, some smallholdings, low cultivation maize, pasture and soya beans
122	Kliprivier - along R554 around N1	245	7708	50%	121	941	14%	15%	One third of the medium cultivation, half the vegetables including half of the vegetables pivots, medium and low cultivation maize, pasture and soya beans
53	West of Soweto, near Protea Glen	282	4839	24%	69	913	14%	13%	One third of the medium cultivation, mostly low and medium cultivation maize and pasture
5	Near Orange Farm, Drieziek	328	8793	59%	195	289	4%	6%	One fallow pivot, mostly low cultivation pasture and maize
121	Lawley	288	6448	44%	126	283	4%	6%	Low cultivation maize and pasture
119	Kliprivier - near Nancefield	779	5864	42%	323	225	3%	12%	Almost all old fields, some medium cultivation maize and soya beans
110	Austin View, Rabie Ridge	628	7963	39%	243	219	3%	7%	Large small-scale farming of maize, smallholdings and low cultivation maize and soya beans
6	Grasmere	355	7424	60%	212	183	3%	5%	Low cultivation and smallholdings maize, pasture and horticulture
113	West part of Diepsloot	2265	17561	44%	1002	113	2%	6%	High and medium cultivation especially pasture, horticulture
92	Randjespark, Glen Austin	411	4989	31%	129	95	1%	2%	Mostly smallholdings, some low cultivation maize and pasture
49	Near Thulani north of Soweto	1044	7697	49%	507	61	1%	4%	Small-scale farming pasture and maize
114	Sundowner	944	5148	32%	302	44	1%	3%	Mostly smallholdings maize and pasture
100	Cosmo City, Zandspruit	982	5572	30%	292	14	<1%	1%	Low cultivation and smallholdings maize and pasture
127	Near Bram Fischerville	779	6815	59%	462	12	<1%	<1%	Maize (unknown cultivation strata)
80	Near Rabie Ridge and Ivory Park	6391	5847	52%	3295	11	<1%	6%	Small-scale farming maize and pasture
77	Ivory Park east	6697	9050	49%	3307	8	<1%	3%	Small-scale farming maize
111	Ivory Park west	5241	9042	42%	2212	2	<1%	1%	Small-scale farming maize
128	Tshepisong	2292	9068	51%	1158	1	<1%	<1%	Small-scale farming maize

<u>High relative poverty</u>

Having a large population of poor households, which also make up most of the inhabitants of the ward, if an area of this type contains agriculture there is a good chance that it could be part of a local food system which serves and benefits the urban poor. Most high relative poverty wards are in the south of the City, and many contain farmland. This includes ward 122 southeast of Soweto, in the Kliprivier-Glenvista area, which follows the R554 Kliprivier road east from Lenasia. More than half of the population in ward 122 in Kliprivier are poor households. It is the ward with the second most

farmland contained within in, with a sizeable 941ha constituting 14% of the total area under agriculture in the City. This is enough to produce over 3600 tonnes of maize in a year using the national average yields for 2011 cited above, or over 28000 tonnes of vegetables, given typical yield rates of 30 tonnes per hectare per year[23] (Department of Agriculture, 2008; Department of Agriculture, Forestry and Fisheries, 2013). In terms of the occurrence of poverty and agriculture, this represents a high potential for local food systems. Aside from the usual low cultivation maize, pasture and soya beans, it contains half of the vegetables crop type, numerous pivots and one third of the medium cultivation, translating into a potential for large quantities of some healthy foods but a relatively high likelihood of conventional types of production and distribution. Of all the wards in Johannesburg, the area of ward 122 is the most dominated by farmland, which covers 15% of its total ward area of 63.5 square kilometres.

Still in the Kliprivier-Glenvista area, a substantial proportion of the adjacent high relative poverty ward 119 near Nancefield is also agricultural land. Containing about 225ha of farmland this makes up almost one eighth (12.4%) of the ward's area. Much of the agricultural land here is classified as old fields and so is unlikely to be productive, but there is some medium cultivation maize and soya beans which represents some potential. This ward also has a high relative poverty rate of 42%. All of the wards in the south of the municipality have above median relative poverty rates and those in which most of the remaining 800 odd hectares of farmland in this region can be found are quite large in area with low population densities – such as wards 5, 6 and 121 in the Grasmere and Lawley areas around Orange Farm and Ennerdale, which combined contain approximately 750ha. The high poverty rate represents a potential for poor consumers to benefit from local food systems, but the large size and low population density means farms could be located quite far from poor settlements. This agriculture is mostly classified as low cultivation maize and pasture but includes some smallholdings in ward 6. This represents mixed possibilities in terms of healthy foodstuffs and local, sustainable, empowering and accessible production and distribution systems.

Wards 49 and 127 in the north of Soweto are also high relative poverty wards which contain 61ha and 12ha of agricultural land respectively. Both include maize, which has mixed potential in terms of its benefits, and in ward 49, where the cultivation strata is known, it is small-scale farming. This makes it much more likely to be part of a food system which serves and benefits the urban poor in the area, despite the fact that it is not nearly as much farmland as found in the south of the City.

[23] Likely yield rates for vegetables such as cabbage, carrots and swiss chard

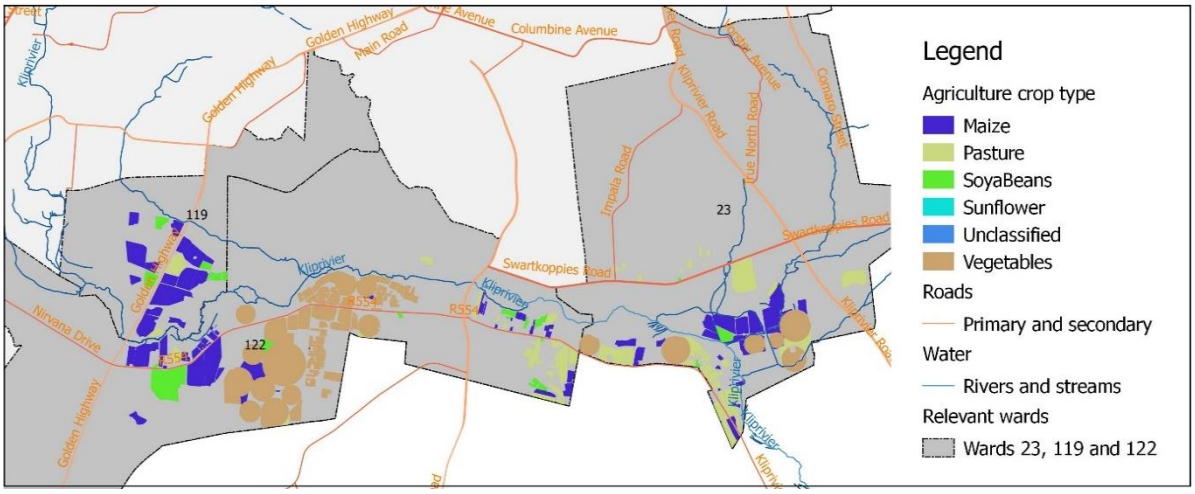


Figure 12: Map of agriculture in the Kliprivier-Glenvista area classified according to crop type

High absolute poverty

The second type of poor area comprises wards with high absolute poverty, as occurs in some large wards in the north of the City, most of which accommodate agriculture. Here, the large poor populations are within the same wards as the farms, but the vast size of the ward could put them at quite a distance from one another. Directly west of Soweto towards the Westrand, ward 53, has almost as much farmland as ward 122, containing over 900ha of farms or 14% of the City's agriculture by area. This includes one third of the medium cultivation farmland, in addition to the more common low cultivation maize, pasture and soya beans, which represents a good potential for food production but no particular indications that the food systems will be alternative in some way. Even though it is the second largest ward in the city, this expanse of agriculture covers almost 13% of the ward's area. Because it occupies so much of the ward, there is a greater chance that farmland will be located near a poor settlement, in order for local food systems to exist. About 4800 poor households reside in this ward, making up a relatively low 24% of the population.

The single ward which contains by far the largest area under agriculture in the City is ward 96, a vast ward adjacent to Diepsloot, which contains a diversity of places, from the relatively affluent Chartwell to the much more impoverished Kya Sands Informal Settlement. Despite having the third largest population, its extensive size means the ward has the second lowest population density, which combined with low relative poverty results in a low poverty density. About 31% (well below the City average) of its approximately 23000 households are poor, constituting a high absolute poverty of over 7000 poor households but at a low density of about 70 poor households per square kilometre. That a given farm will be near to a poor settlement is certainly not guaranteed. Aside from the diversity of settlements, the ward includes characteristically agricultural areas such as Northern Farm and Farmall. Over 1400ha of farmland is found in this ward, constituting more than one fifth (22%) by area of the

agriculture in the City. The largest in the municipality, the ward itself has an area of 100sq km, so farmland makes up a slightly lower proportion of the land area than for ward 122 mentioned above (14% compared to 15%). But this is still substantial and spatially represents a better potential that poor consumers will be nearby. This farmland includes one third of the vegetables crop type, many pivot irrigation farms and most of the high cultivation. Like for ward 122, this is promising in terms of quantities of healthy foods but less so in terms of sustainable forms of distribution that are appropriate for the poor. It also supports the smallholdings cultivation strata, as do many other high absolute poverty wards, such as wards 100 and 114 on the west of the City, and wards 92 and 110 on the northeast near Ivory Park. This represents a greater potential for local food systems which serve and benefit the large number of poor households in these wards.

In the northwest of the municipality, south of ward 96, wards 100 and 114 contain a combined 58.2ha of agricultural land. Situated in the Sundowner area, ward 114 accommodates over 5000 poor households, which make up 32% of the population. Ward 100 contains Cosmo City as well as Zandspruit informal settlement – there are over 5500 poor households living in this ward, although they make up only 30% of the population. On the other side of the City, alongside the Ivory Park cluster, ward 92 in the Randjespark area and ward 110 in the Austin View area contain a combined 315ha or 5% of the farmland in the City. Although they have poverty rates less than 40%, almost 8000 poor households live in ward 110 and almost 5000 live in ward 92. The occurrence of poverty and agriculture in these wards represent substantial potential for local food systems. In terms of the types of agriculture taking place, these wards support the more common crop types and low cultivation strata but they all also contain smallholdings, and much of the small-scale farming also occurs in two of these wards, in the Randjespark-Austin View area near Ivory Park. Smallholdings and small-scale farming are the most likely types of agriculture to be associated with local, sustainable food system alternatives that are empowering and accessible for the urban poor.

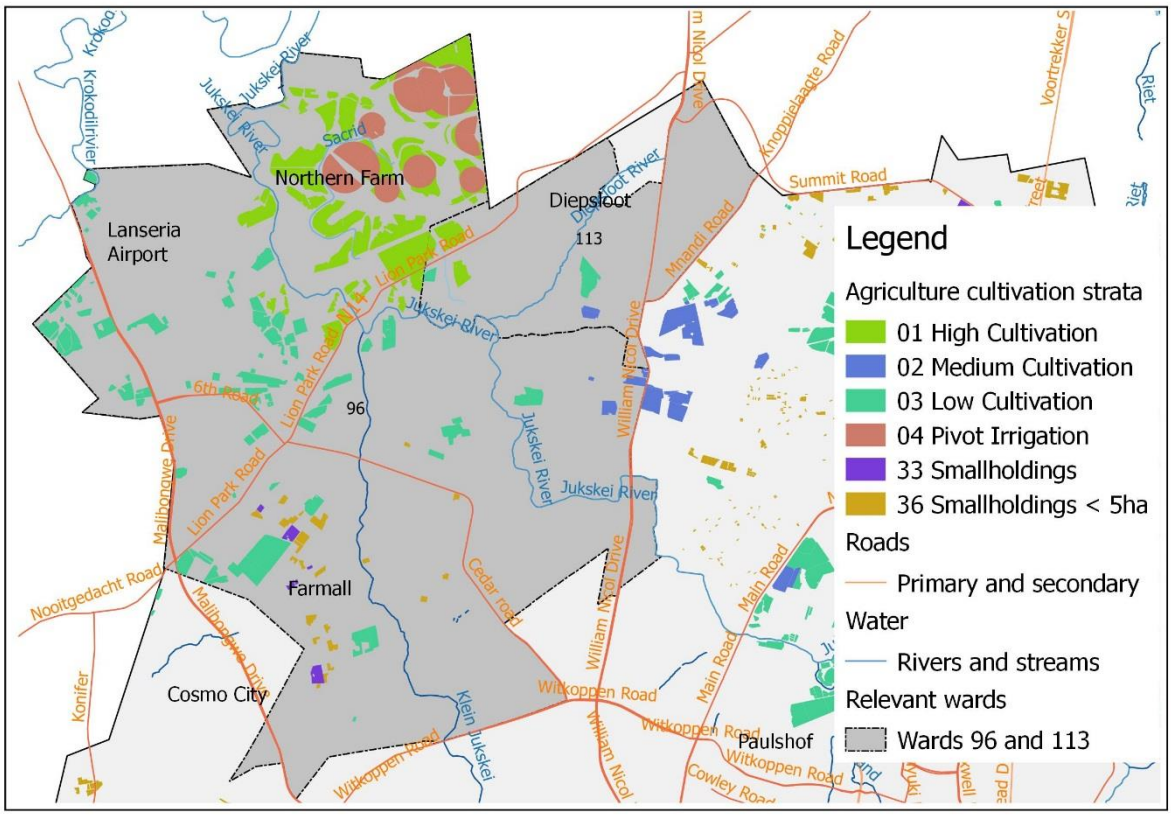


Figure 13: Map of agriculture in the Diepsloot-Northern Farm area classified by cultivation strata

<u>High poverty density</u>

Ward 3 of Orange Farm, ward 128 near Tshepisong in the north of Soweto, ward 113 of Diepsloot and the three agricultural wards of Ivory Park are the four farming areas where there is a concentration of poverty, which is the third type of poor area in the City. There is a very high chance that farms in these wards have many poor consumers nearby. Unfortunately, ward 3 of Orange Farm, near the tip of the municipality, amongst the high relative poverty wards in the south of the City, contains only one site of less than 2ha. Whilst the cultivation strata is small-scale farming, the crop type is pasture, according to which it is not cultivating food for the local poor consumers. In the north of Soweto, another single small-scale farming site occurs in ward 128 near Tshepisong, giving the ward an agricultural area of only about 1ha, but this time overlapping with maize crop type. Whilst it unlikely to represent much production, the characteristics of the farm make it quite likely to be operating in an alternative food system, making heathy, locally and sustainably grown fresh produce available in ways that are empowering and accessible to the many poor consumers who probably reside nearby.

Although an absolute poverty of 7000 households in the aforementioned ward 96 is a substantial number, it is less than half of the approximately 17500 poor households living in the extremely poor, densely populated adjacent ward 113 of Diepsloot, which has a poverty density of over 1000 poor

households per square kilometre. Over 6% of the total ward area is agricultural land constituting 113ha or 2% of the City total. Aside from the low cultivation maize and pasture found in most agricultural areas, ward 113 also includes high and medium cultivation and about one third of the City's 'horticulture' crop type. There is good productive potential and a high chance that many poor consumers live nearby, but the chances that this produce is being grown and made available in alternative ways, that avoid the disadvantages of the corporate food regime, are somewhat tempered by these types of agriculture.

Ward 113 has the largest population of all the wards, which combined with high proportions of poverty, means it accommodates the largest number of poor people in the City within its relatively small area. But combining the three agricultural wards of Ivory Park means they accommodate even more poor households in an even smaller area. Wards 77, 80 and 111 form part of Ivory Park itself. Probably related to their small size and high population densities, the wards of Ivory Park together contain only 21.5ha of farmland - less than 1% of the agricultural land in the City. However, in ward 80 for example, which is only 1.8 square kilometres in size, the 11ha of farmland constitutes over 6% of the total ward area. Combined with the extremely high poverty density, this means these farms probably have many poor consumers around them. All of the classified farmland in these wards is small-scale farming and either maize or pasture crop type. Together, this represents a very high potential for food system alternatives in the foodstuffs produced and the types of production and distribution employed. The farms in these wards are located in open areas along the main road of Ivory Park, with those in wards 77 and 111 being near the Kaalspruit stream – see Figure 14.

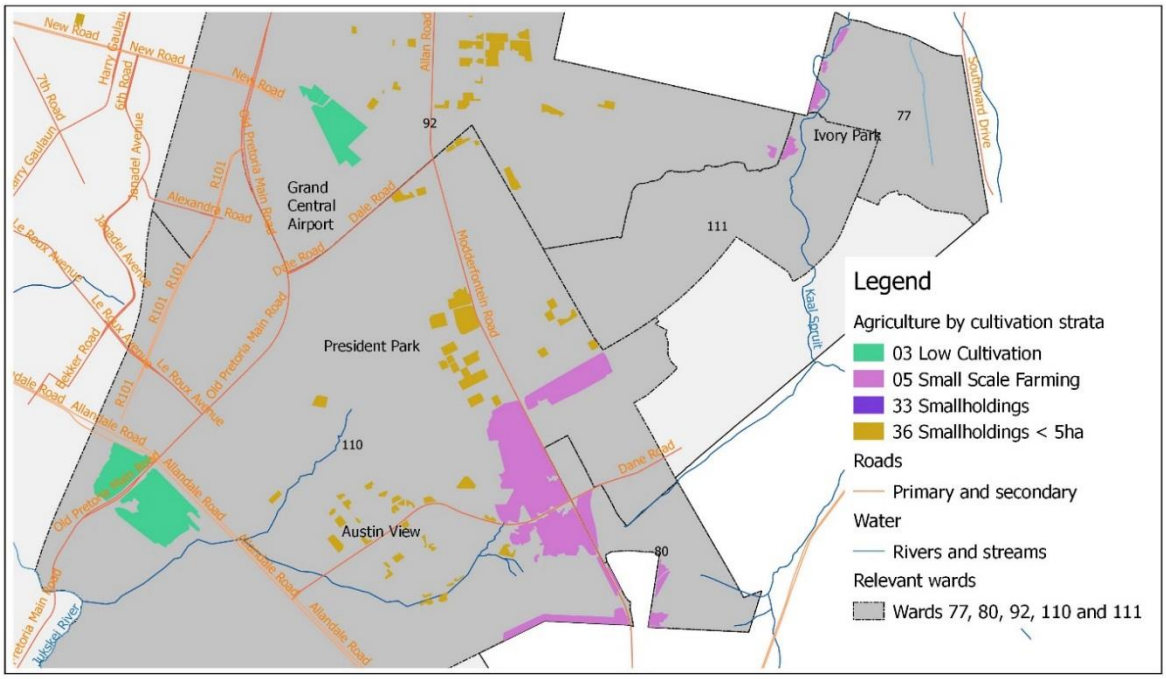


Figure 14: Map of agriculture in Ivory Park and surrounding area classified by cultivation strata

Conclusion

Wherever poverty and farmland coexist, there is potential for poor consumers to access locally grown fresh produce. Mapping annual household incomes below R19600 at ward level showed three types of poor areas in the municipality, with differing probability that farmland located in them would be local to many poor consumers. Mapping agriculture and considering the occurrence of the different crop types and cultivation strata, revealed factors which could increase or decrease the likelihood that the food systems in which these farms operate would serve and benefit the consumers in these poor areas. The different foodstuffs and types of production and distribution typically associated with the different crop types and cultivation strata affect the probability that produce will leave the area. Furthermore, the combination of these elements will also determine whether produce will be made available in ways that suit urban poor consumers and what sort of environmental, social and health benefits or disadvantages will result for the consumer and the local community in general. Many parts of Johannesburg were identified as holding some potential that alternatives in the food systems could make locally and sustainably grown, healthy fresh produce available to poor consumers living there, in ways that are empowering and accessible to them. Given the highly complex possibilities for alternatives in a given food system, it is difficult to quantify or rank the potential in the various areas of the municipality, and a qualitative description of some of the factors involved will have to suffice – see Figure 15. Nevertheless this gives a relatively complete picture for the City of Johannesburg.

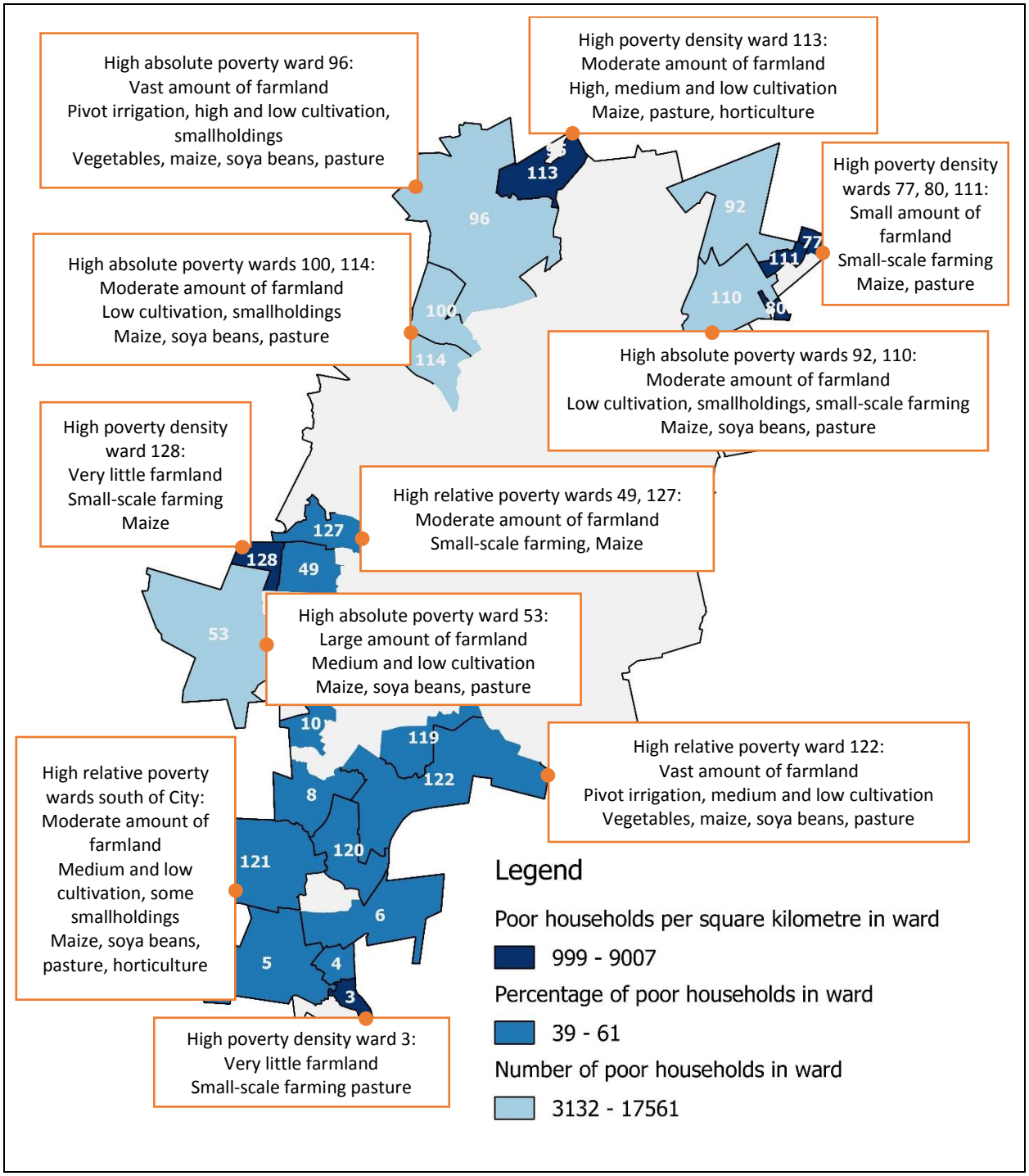


Figure 15: Map of the City showing the three types of poor wards which contain agriculture, with annotations giving detail

Considering the classifications of the farmland, we see that maize and to a lesser extent soya beans are in most agriculture areas. Common foodstuffs derived from these crops typically require a certain level of processing, which not only robs them of nutritional value but often involves infrastructure, such as a mill for making maize meal. This increases the likelihood that this produce will leave the area in which it was grown in order to be processed. Eaten unprocessed, these crops contain protein and other nutrients which are especially lacking in the diets of the urban poor as a result of the

conventional corporate food regime. But nothing is quite as oppositional to the nutrition transition as vegetables. This crop type is restricted to only two locations in the City, both including poor wards with substantial amounts of agriculture. These areas are dominated by pivot irrigation and high cultivation types of agriculture. Unfortunately these cultivation strata are more likely to be associated with commercial scale, formal production and distribution systems which could hinder the potential for the large volumes of produce which come from these areas to reach poor consumers in ways are appropriate for them and that maximize the environmental, social and health benefits that they enjoy. Smaller, less intensive forms of agriculture such as smallholdings and small-scale farming are much more likely to be associated with forms of agriculture which are low-input and encourage ecological health and smaller, more informal distribution systems which better suit urban poor consumers and promote credibility and social relations with their local producer. These forms of agriculture occur in all three types of poor wards, but are especially abundant in Ivory Park and the surrounding area. Here we find the majority of small-scale farming, most of which is maize, as well as many smallholdings. Aside from Ivory Park, the only other concentration of poverty in the City with a substantial amount of agriculture is in Diepsloot, which contains medium and low cultivation agriculture. Whilst these forms of farming are still likely to form part of a conventional food system, there is always the possibility that farms include local, more alternative forms of production and distribution as well.

For a food system alternative to exist in reality requires a combination of structural factors and the agency of the people in the system. The following chapter will make use of empirical data from Diepsloot and from Ivory Park and the surrounding area, as well as some data from Alexandra – a high poverty density area which accommodated no agriculture according to this spatial data – to confirm if the potential mapped in this chapter is being realised by farms located there and in what ways.

CHAPTER FIVE:
URBAN FARMERS

The previous chapter demonstrated the potential for urban agriculture to provide access to locally grown fresh produce for many poor consumers in the City of Johannesburg by virtue of its location in poor areas. It considered the occurrence of measures of poverty across the municipality and the occurrence of different types of agriculture to identify areas of noteworthy overlap. The classifications of crop type and cultivation strata could be associated with certain foodstuffs, natures of production and modes of distribution which gave an indication of the likelihood for features of the food system to be more alternative, better serving and benefiting the urban poor. In this chapter, by engaging those producing food in poor areas, much of this detail can be confirmed for the farms being studied.

By way of introduction, the section below revisits the characteristics of the food system in the conceptual framework to clarify what information was collected from farmers in the surveys and interviews, which will form the basis of the analysis in the rest of the chapter. It then gives a brief introduction to the study areas and the farmers surveyed and interviewed. The first part of the body of the chapter assesses the amount of agriculture taking place in the study areas, beginning by trying to quantify the food being produced overall. Using the area and average yields, one estimate is that the researched farms produce 5340kg of vegetables per day, enough to meet the recommended daily consumption of about 13000 people. Another estimate based on the average weekly earnings is that the produce sold has a minimum value of over R30000 in farm gate prices each week, which converted to retail value is equivalent to the weekly fruit and vegetable expenditure of between about 4500 and 10000 poor households. The focus then turns to individual farms. Having shown that almost all of the researched farms are productive, we attempt to consider the different scales of production, using the area and earnings as above. Since the scale of production has a relationship to the modes of distribution employed by the farm, this leads to the second part of the chapter. This part looks at the three main modes of distribution observed – retention of produce for subsistence, the donation of produce and the sale of produce – and how these are combined by the researched farms. The section on selling looks at the main channels by which farms are retailing their produce, considering whether these could compromise or enhance the benefits of being locally grown. Direct-from-farm purchase seems to epitomise alternative in avoiding disadvantages to the poor consumer of the corporate food regime, in terms of accessibility, empowerment, sustainability and health. The third part of the chapter considers what is being produced and how. The first section looks at the variety of techniques and types of agriculture in use and their potential food system impacts. The diversity of crops being grown leads us from the nature of production to the next section on the foodstuffs produced. The majority of

the researched farms were producing vegetables, which were generally being sold unprocessed, a very valuable foodstuff in countering the trends of the urban nutrition transition. To conclude the chapter, we review the potential mapped in the previous chapter in light of the results obtained from the study areas. Diepsloot and Ivory Park had features that indicated potential for urban agriculture to be serving and benefiting the poor in these areas, and engaging with farmers about the reality on the ground demonstrated not only an even greater potential, but also the realisation of that potential as a multiplicity of food system alternatives.

Food system characteristics

As suggested by the literature, a wholesale juxtaposition between conventional and alternative isn't helpful when talking about the food system. Rather than a strict polarisation, many of its characteristics consist of a range of possibilities which make them more or less beneficial and appropriate, in this case to the urban poor, in various aspects. In addition, many food system actors employ a mix of the options for a given characteristic. For instance, a farm might produce a variety of foodstuffs from the same crop. Similarly, whilst it is true that certain forms of one characteristic are typically associated with particular forms of another characteristic, such as industrialised agricultural production and formal retail distribution, there are always exceptions. Using the crop type and cultivation strata classifications, the previous chapter could provide a sense of the potential that the food systems in certain areas could have some alternative features, which would overcome some of the disadvantages faced by the urban poor in the conventional food system. To see if this possibility is being realised and how, this chapter takes an empirical look at some food system characteristics associated with urban farms in specific study areas.

Having already established that production from the researched farms is local to poor consumers, the information gathered from the surveys and interviews provided direct and indirect evidence regarding a number of other food system characteristics – see Figure 1 in Chapter 3. The survey produced data about the crops grown, whilst the interviews added detail on the actual foodstuffs entering the food system from the farms, including some information about possible processing, with its implications for whether the produce remains local or not. The various aspects of the nature of production on the farms were explored through the survey, including the crop diversity, the use of compost, chemical fertilizer and chemical pesticides, the knowledge and practice of organic agriculture, as well as other techniques such as crop rotation, intercropping, water harvesting and mulching. Interviewees were also asked about the nature of production on their farms. Some indicators of the scale of production were considered in the survey and interviews, such as land size. Whilst it was not possible to quantify the exact amount of produce since many farms don't keep such records, an estimate was obtained from the survey for the value of produce entering the food system in exchange for money. The interviews focussed particularly on the mode by which the farms were distributing their produce, also

collecting direct information on the factors of accessibility such as the prices and quantities of food being made available and from which locations. The survey also included a question on outlets, as well as some questions which provided evidence regarding subsistence production. Whether the mode of distribution kept produce in the local food system or not impacts the probability of the associated benefits to the consumer in terms of health, sustainability and accessibility. Even with regards to empowerment, whilst there was no direct measure to determine if the consumer felt more informed in their consumption choices, there was evidence from the interviews of the relational value of direct-from-farm exchange.

Study areas

Following on from the mapping of potential for food system alternatives across the municipality, this chapter is based on engagement with urban farmers in only some areas of the City. In terms of the types of agriculture, Ivory Park and the surrounding areas were considered to hold high potential because these areas contain food crop types, as well as many smallholdings and most of the small-scale farming land in Johannesburg – the two cultivation strata which were most likely to be associated with alternative forms of food system characteristics that better serve and benefit the urban poor consumer. Although the types of agriculture differed for ward 113 of Diepsloot, the area contained a moderate amount of farmland and, like Ivory Park itself, had a high poverty density, which spatially means that there are probably poor households near to a given farm in the area. Alexandra also had a high poverty density, but no farmland was mapped in the area. The aforementioned area surrounding Ivory Park (wards 92 and 110) did not have a high poverty density or a high relative poverty (which would mean that a household near to a given farm would probably be poor), but these areas had high absolute poverty, which spatially means at least that there are many poor households in the same ward as a given farm.

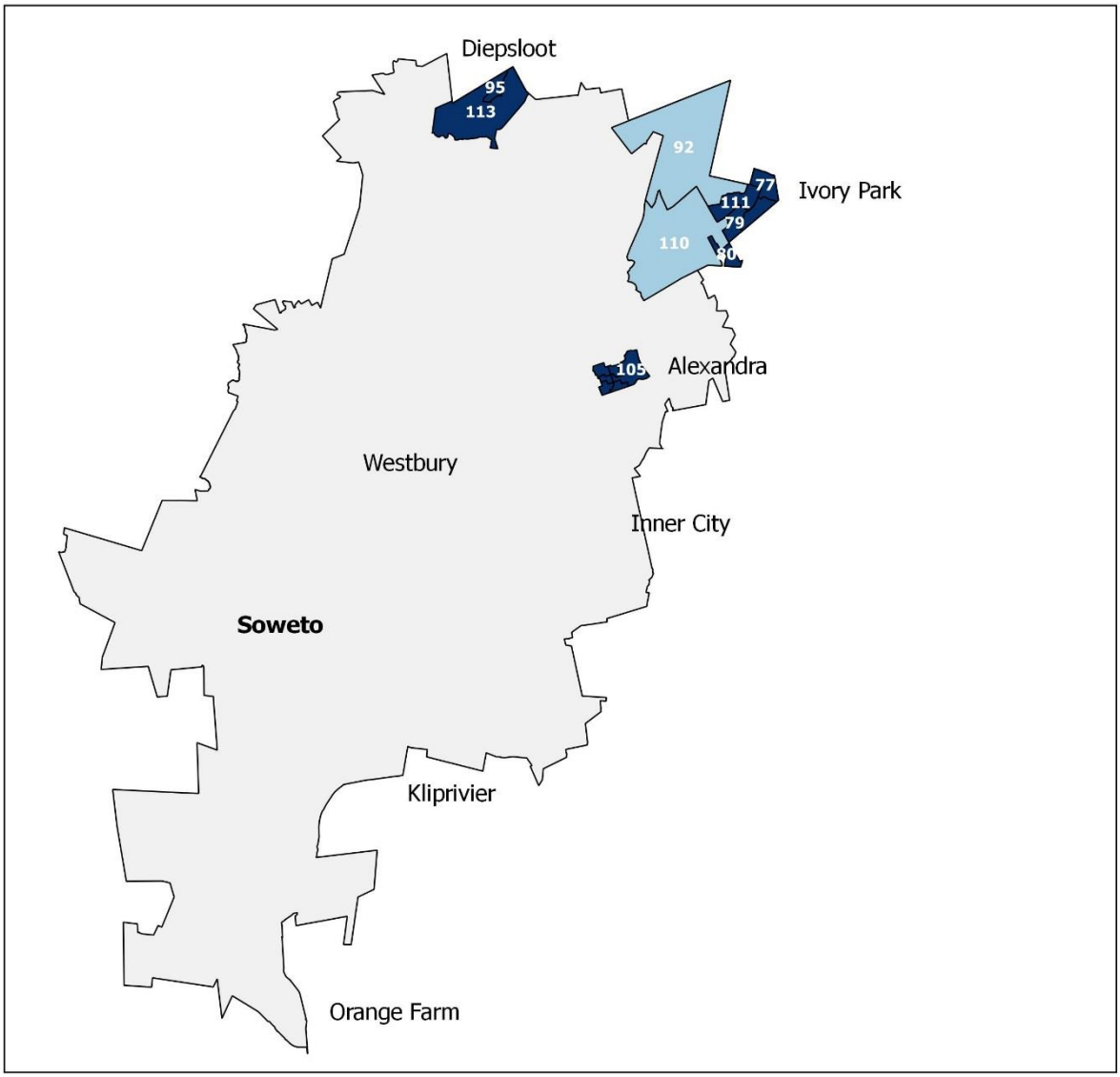


Figure 16: Map of City of Johannesburg depicting the study areas

Diepsloot, Ivory Park and Alexandra are named in numerous studies of poverty in the City or the province (De Wet et al., 2008; Mushongera et al., 2015; Noble, University of Oxford, Statistics South Africa, & Human Sciences Research Council, 2006). The social conditions in these areas resemble those in urban townships throughout the province (De Wet et al., 2008). Aside from the low household incomes and high population density which defined them as high poverty density for this research, they are also characterised by elevated levels of unemployment, comparatively low levels of education, high rates of population growth, and a distortedly young demographic (De Wet et al., 2008). The oldest of the three townships is Alexandra, which was established as a residential area in 1912, and so was excluded from the general provisions of the 1913 Land Act, and freehold title could be acquired by the black and coloured households who settled there (De Wet et al., 2008). Strong social divisions persist there between original residents and recent arrivals, who are vying for the

limited space and opportunities available (De Wet et al., 2008). The township seems not to belong where it is located, about 16km from the inner city, amidst the mainly white suburbs in the north-east of the Johannesburg. Ivory Park, on the other hand, is relegated to the north-eastern perimeter of the municipality, amongst other low income areas like Thembisa, from which residents access Edenvale, Kempton Park and Midrand. The population has not stopped growing since the township was established in 1990 and the area consists mainly of informal settlement housing (De Wet et al., 2008). Diepsloot began developing in 1993, mainly as makeshift homes were constructed on unoccupied land in the north-western extent of the City (De Wet et al., 2008). In early 2000, the population surged with over 45000 migrants from other parts of Johannesburg, including Alexandra (De Wet et al., 2008). The township is spatially constricted between the N14 highway to the north-west and the R511 to the east, so although it has amongst the smallest households in the City, it has amongst the highest number of households per stand (De Wet et al., 2008). Adjacent to the wards of Ivory Park, towards Midrand, wards 92 and 110 include parts of other townships like Kaalfontein, but most of the area is made up of agricultural holdings. The area retains a rural countryside character, which was the norm in this region of the Highveld, called Halfway House, before Midrand sprawl began to fill the area between Johannesburg and Pretoria ('SA-Venues.com', 2017). The area has largely avoided the development and expansion of the neighbouring suburbs.

The farmers

Each of the researched farms was represented by a farmer: an individual involved in the farm itself who responded to the survey conducted during the fieldwork in the study areas or who participated in a telephonic interview. The farmer surveyed or interviewed did not have to be the person who established the farm, but they all had a sense of ownership of the farming project, whether individually or as part of a group – they were not hired labour. The survey enquired about 'garden helpers' but did not establish explicitly whether the farms were employing external labourers or not. But from the interviews it was clear that some farms did hire labour to assist, sometimes on a temporary ad hoc basis, when there was too much work for the farmers themselves to manage. The interviewee from Reatlegile cooperative in Diepsloot explained that the other 4 members are also "involved in other projects" besides the farm, "so we do hire labour, for example, today I had three men helping me". The interviews included a non-governmental organization (with "five executives and nine volunteers") and a proprietary company ("a Pty of six people"), but the remaining 16 of the interviewed farms were all cooperatives[24], consisting of up to 15 members. A few farmers described how some of the other cooperative members had become 'inactive' or 'unresponsive', in one case because they are old, in another case because "they are young, so they looked for other jobs and didn't

[24] This is unsurprising considering that the cooperative structure is being heavily promoted by local government and these farmers were all in contact with the City of Johannesburg official who provided their details, and many have received support from her office in the municipal Department of Social Development.

work properly". Over one third of the surveyed farms (168 respondents) responded that they had no helpers. Even in the interviews with cooperatives, there were times at which the interviewed farmer was the only one involved in the farm, which sometimes meant production stopped for a month or two, or reduced. One of these interviewees explained, "Sometimes it's just me, which makes the process slower. I feel if I make a sale it should go to me, since I am the one watering and working". But the majority of the researched farms involved more than one person, including all of the interviews at least most of the time, and about 60% of the responding surveys.

The study didn't focus on the demographics of the farmers, but of the surveyed farms who responded regarding their race, almost all selected black (only one respondent selected Indian) and of those who responded regarding their gender, about 60% were female. In the interviews, of the 11 cooperatives which provided this information about their members, eight (about three quarters) had majority female membership, two of which were 100% female. Of those who responded in the survey, approximately half of both the women and the men were married, the remainder being mostly single but with about 9% of the women being widowed against less than 1% of the men. Male respondents ranged in age from 18 to 76, with an average age of about 44, whilst female respondents ranged from 19 to 77 except for one 93 year old woman, making the average age about 48 years old.

Table 6: Comparing female and male survey respondents by marital status and age

		Female	**Male**
Total	N	167	109
	%	61%	39%
Married	N	82	53
	% of gender	50%	48%
Single	N	67	56
	% of gender	41%	51%
Widowed	N	14	1
	% of gender	9%	1%
Minimum age in years		19	18
Maximum age in years		93	76
Average age in years		48	44

It is highly probable that most of the farmers lived in the same area in which the farm was located, if not on the same property. As such, there is a good chance that many farmers themselves were part of poor households. They were thus likely to have limited access to productive resources, which would restrict the choices available to them, including those related to the food system. The land of the farm was not necessarily owned or controlled by the farmer. In fact, the interviews revealed that many of the farms were on municipally owned land which had been allocated for use to the farmers by the City of Johannesburg. This insecurity of tenure is a disincentive for farmers to invest in long-term

improvements to the site, such as fostering soil health or installing infrastructure. However, farms were often assisted by the Department of Social Development with support such as fencing or boreholes, which they facilitated with other relevant departments of local government on behalf of the farmers (for instance, Johannesburg City Parks would be approached to erect fences). Most of the surveyed farms made use of their access to municipal water, but many kept their usage below the City's free water allocation of 6 kilolitres per month. At the time of the interviews, water was of critical concern in some of the study areas as there had been no rain for over ten months and the municipal water to Diepsloot had been disconnected for weeks due to a maintenance problem. Even when tap water was available, farms seemed to only use it to supplement irrigation, rather depending on the rain, especially to plant. As one interviewee explained, "There's municipal water, but that it just buckets". Only six survey respondents said they had access to a dam or stream as their water source. Two interviewees from Diepsloot also mentioned "getting water from the stream" or the "river behind the farm" but explained that this required development – digging furrows in one case whilst the other hadn't finished installing pipes and were "risking using water from the borehole of the house which supplies the toilets".

All of these factors, from the age and gender of the farmer (Slater, 2001; Szewczyk, 2013), to the support provided by the City government (Karaan & Mohamed, 1998; Malan, 2015), to the incidence of drought, influence the choices that farmers make. The remainder of the chapter considers what farmers in the study areas chose, especially with regards to the modes of distribution employed, the foodstuffs produced and the nature of production adopted. We see how many urban farmers in these areas of Johannesburg are choosing food system alternatives, and so make sustainably grown, healthy fresh produce locally available to poor consumers in ways that are empowering and accessible.

Quantifying the farms and the food

Amount of production overall

In the previous chapter, the area of farmland which occurred locally to many poor consumers was considered an important factor in how much potential an area had for food system alternatives. This research is not primarily about the amount of agricultural production taking place in the study areas. It is about whether this agricultural production is part of a food system that has alternative features which serve and benefit the urban poor. But where such food system alternatives do exist, the amount of production translates into the volume of more sustainably grown, healthier food, being made more accessible locally, in ways that are more empowering for poor consumers. The amount of agriculture is thus very relevant. It can be considered in terms of the number of farms, or the amount of land they represent, which can provide an estimate of production using average yields, or it can be assessed based on the value of the produce sold. At the level of the individual farm, the scale of production is

considered to be a defining feature (Greenberg, 2006; Greenberg et al., 2013; M. Lewis, 2011), having its impact on the food system via the modes of distribution and nature of production with which it associated.

Number of farms and area of farmland

In total, 454 surveys were analysed along with 18 interviews, each representing a farm from one of the study areas. However three of the seven interviewees from Ivory Park represented the same farms as three of the survey respondents, so these were excluded from the count of interviewed farms in Table 4 below. Thus, altogether this research included 469 unique farms.

Table 7: Number of farms surveyed and interviewed in the study areas

Area	**Wards**	**Farms surveyed**	**Additional farms interviewed**
Ivory Park	77-80 and 111	349	4
Surrounding areas	92 and 110	66	2
Diepsloot	95 and 113	34	9
Alexandra	105 and 109	5	
Total		454	15

For the survey, researchers were asked to pace out the area of the farms which they surveyed and all but nine gave a value, ranging from 2 square metres to 12000 square meters, or 1.2ha. According to these responses, the surveyed farms make up a total area of about 170000 square metres or 17ha of land For the interviews, the representatives were asked to give the size of their land and 11 had a clear answer, excluding those already represented in the survey, ranging from 247 square metres to 30ha, which combined make up an area of about 48ha. Together this constitutes about 65ha of agricultural land. Of the 353 researched farms in Ivory Park itself, 344 responded representing about 41.7ha.

Table 8: Total and average area of farms surveyed and interviewed

	Farms surveyed	**Farms interviewed**
Farms which responded regarding area	445	11
Average area per farm (sq m)	380	43659
Total area (sq m)	169196	480247

Since most of the farms are cultivating vegetables, we can use the same average yield rate as in the previous chapter, of 30 tonnes per hectare per annum (Department of Agriculture, 2008; Department of Agriculture, Forestry and Fisheries, 2013), to estimate that this amount of farmland could produce almost 2000 tonnes of vegetables in a year. This is equivalent to about 5340kg of vegetables per day.

The World Health Organization recommends that a person consume at least 400g of fruit and vegetables a day to remain healthy, a minimum which most South African are not reaching (Backeberg, 2014). In reality, in 2012, South Africans consumed an average of about 270g of fruits and vegetables per day, with poor households generally getting well below average (Ronquest-Ross, Vink, & Sigge, 2015).If producing at the average yield rate above, each day the researched farms could supply over 13000 people with the recommended daily consumption of 400g of vegetables, or about 8600 people if considering the researched farms in Ivory Park alone.

Value of produce sold

Whilst the size of the land can give an estimate of production, the interviews confirm that many farmers do not make use of all the land available to them. In addition to this, different intensities of production can yield very different volumes of produce on the same size ground. Unfortunately not many of the farms researched keep records of the amount of food they produce – out of the over 450 surveyed farms only 124 keep any records at all and of these only 37 included records of the amount harvested. In the interviews, whilst some representatives could give a round estimate of bunches of spinach or heads of cabbage produced, for instance, others were more vague, giving responses such as "one truck per month". Because they were all sold, one farm hadn't kept count of the number of green mealies that had been harvested, but undoubtedly they knew how much they had been sold for. Rather than the volumes of crops produced, a number of the farmers interviewed reported the amount of production in terms of the average income generated by the farm over a month or a week. A representative from Sedilaka farming project in Ivory Park, for example, said in an interview when asked about the amount produced, "I can't really say. In one week, let me tell you how much we sell - R300 or more, from Monday to Friday".

The amount of money made from the sale of produce gives a relatively good indication of the amount of production, although it excludes the other modes of distribution, since it only includes that which is sold. The value is obviously complicated by the selling prices and different types of crops being produced as well. But taking these things into account, the amount of money made by these farms from the sale of their produce provides one measure of their contribution to the food system. All except two of the surveyed farms that were selling some of their produce made some estimate as to the amount of money the farm earns each week. Seven farms said that they made no money and 167 farms chose a response ranging from 'less than R50' to 'over R4000' per week. By assuming the value at the lowest end of each of these brackets, starting from 20 farms earning R1 each, at the very lowest estimate, over R30000 worth of fresh produce grown in the study areas is entering the food system from these farms every week – see Table 6 below. This represents a vast amount of produce considering that, in the interviews, all the farms were selling products for R10 or less, for example, R3 could buy a bag of four tomatoes, a green mealie or a bunch of beetroot. Likewise, for R5 four of the

farms would give a regular bunch of spinach, whilst for R10 four others sold large bunches of chomolia, morogo or Chinese cabbage.

Table 9: Minimum values of responding farms' weekly earnings

Weekly earnings	Minimum value in range	Farms responding	Total minimum value
Less than R50	R1	20	R20
R50-R100	R50	61	R3050
R100-R200	R100	49	R4900
More than R200	R200	33	R6600
More than R4000	R4000	4	R16000
			R30570

In 2011, poor South African households spent about a third of their expenditure on food, an average of R8 485 per annum. Of this, 12,3%, or about R1044, was being spent on the fruits and vegetables category (Statistics South Africa, 2014). This means that a poor household spends an average of about R20 on fruit and vegetables each week. Rather than the World Health Organization recommendation above, which represent the ideal consumption of fruit and vegetables, this reality corresponds to the unhealthy low consumption of fresh produce by poor households. There is likely to be a large difference between what the farm makes at farm gate prices, and what the household spends at retail prices. For example, in 2012, the proportion of the retail price which was comprised by the farm value of cabbage was 15%, whilst that for onions, tomatoes and potatoes, were 31%, 34% and 31% respectively (Department of Agriculture, Forestry and Fisheries & National Agricultural Marketing Council, 2012). Based on these figures, the retail value of the income derived by the farms selling at their own prices could be three to seven times more than the minimum value of about R30000 a week calculated above[25]. Converting to the retail value, this represents between about R90000 and R203800 a week. This is equivalent to the weekly fruit and vegetable expenditure of between about 4500 and 10000 poor households, or between about 14000 and 31000 people, using the average household size for the City. Although this is not an accurate measure, it gives some indication based on the lowest estimate of the farm incomes, and the farm value share of the retail prices for some common vegetables.

In summary, the research identified 469 farms in the study areas, making up over 65ha of agricultural land. Of these, 174 of the surveyed farms were selling a combined absolute minimum of over R30000 worth of fresh produce into the food system each week. Using average annual yield rates for vegetables, all of the farmland could be supporting the recommended consumption of vegetables for

[25] This aligns with the empirical data collected. For instance, Ikgantsheng in Diepsloot gets 20% of the retail value obtained by informal traders for the spinach which they produce

over 13000 people every single day. Considering only the farms selling produce, their lowest possible weekly earnings, converted to retail value, is equivalent to the average weekly fruit and vegetable expenditure of between about 14000 and 31000 poor South Africans. These farms are producing food in areas of Johannesburg where there are many poor consumers, and any of this fresh produce which is made locally available will already have numerous benefits to them in terms of accessibility, empowerment, sustainability and health. The foodstuffs produced from the crops grown on these farms, as well as the nature of production and modes of distribution which they employ, will determine whether the produce remains in the local community and will influence the realisation of these benefits in a number of other ways as well.

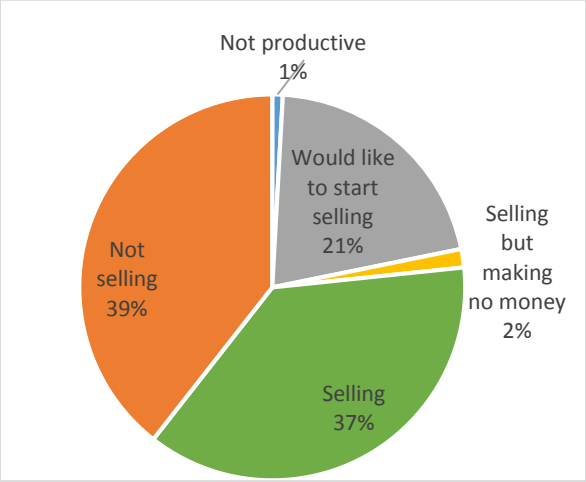
Productivity

A handful of the researched farms were not contributing anything to the food system because they were not productive when this research was conducted. This constituted very few farms from the survey and interviews. Of the over 450 farms surveyed, only 4, all in the Ivory Park area, considered themselves 'not productive' rather than identifying with any particular type of production. This included Thuthukani, which also specified that their usual mode of distribution was donating produce, as will be discussed later. Together these farms represent 2280 square metres of farmland (about 0.4% of the total area of researched farms). From the interviews, one farm, Mbokodo, about 2km north of Ivory Park in Randjesfontein in ward 92, explained that there was "a problem with the site so we are not producing at the moment." Another of the farms interviewed from that area was only in their "6th or 7th week", and so had not harvested anything yet. Still without a name, the farm was situated in Kaalfontein, a township adjacent to Ivory Park, also in ward 92. Similarly, in Diepsloot, having recently registered the Bright Life cooperative, the members were in the middle of their first season when the interview took place, and whilst they hadn't reaped any of their produce yet, they were seeing it grow and exclaimed, "Our vegetables are so beautiful!" These two young farms couldn't really be considered 'not productive', although they are not yet producing a harvest.

Aside from these seven farms which were not producing, there is evidence in the survey that a number of productive farms are not yet as productive as they aspire to be. For instance, seven surveyed farms were mentioned above as stating that they made no money from their produce. Despite their intention to sell produce, it is likely that these sites were not making money because they were not managing to produce enough to sell some for income. Although they didn't consider themselves 'not productive', their productivity could have been limited by facing challenges on the farm such as those faced by Mbokodo. Or, like the unnamed farm in Kaalfontein and Bright Life in Diepsloot, it could be because the survey took place before these farms were established enough to reap a harvest for sale. For one or another reason, whilst these farms were 'productive' and intended to sell their produce, they were making no money. As with all food system characteristics, productivity results from the agency of

each of the food producers conditioned by the structures in which the person finds themselves. In this case, their intention appears to be production for sale, so it is likely that they are facing some limitations resulting in their not managing to sell. This could put these farms in a similar position to the 95 survey respondents who considered themselves subsistence farms, and indicated that they were not selling, but that they would like to start selling if they could. This constitutes about 35% of all the surveyed farms which were not selling.

Thus, from the survey, there were 271 productive farms which were, or would have liked to have been, selling produce, of which 102 were either not making money or still considered themselves subsistence. Still, whilst some farms may not have been producing as much as they would like, only four surveyed farms and three interviewed farms were not producing at all – the rest (about 99%) were all productive.



Graph 3: Pie chart related to productivity of surveyed farms

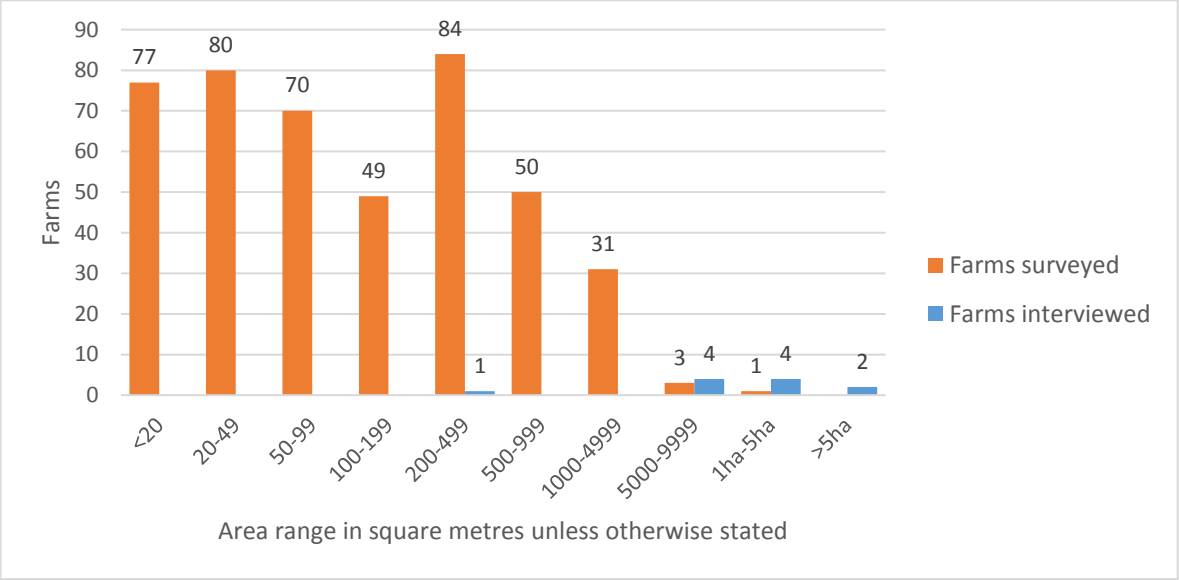
Scale of production

As indicated above with regards to the researched farms as a whole, scale of production of a farm can be measured in various ways, especially where the actual amount harvested is not known. The size of the farm's land is one means, although we know it may not all be under cultivation at a given moment, as always, for reasons of choice conditioned by structural influences. The surveyed farms range in size from 2 square metres to 1.2ha, whilst those interviewed range from 247 square metres to 30ha. Comparing the study areas, there were not vast differences that could not be explained by the different sample sizes in the areas. Except perhaps the fact that proportionally more of the larger farms were in Diepsloot, but these were all interviews, and their larger size is probably a result of the different sampling techniques. Generally, the survey appears to have included many more small farms, whilst the interviews included a few much larger farms. The same City of Johannesburg official, responsible for urban agriculture in the northern region of the municipality, provided contact details for both the interviews and as a starting point for the survey fieldwork. However, for the interviews they provided details for a diversity of farms, thus including a number of small farms and a number of large farms, which may not have been proportionally representative of farms throughout the area. They also focused on farms selling at least some of the produce, which are generally larger than those which do not, as will be seen below. The survey researchers, on the other hand, were given the details of all the farms which the City official was in contact with, which may have included

proportionally more small farms. In addition, they then sought out as many other farms as they could whilst carrying out the fieldwork, their sample thus including many farms which the City official may not have been in contact with.

Table 10: Responses regarding the sizes of researched farms according to study area and area range

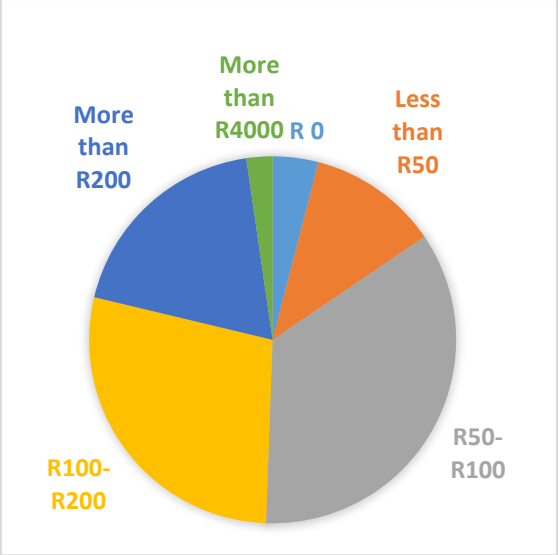
Study Area	**Wards**	**Area of farm in square metres (unless specified)**										
		<20	20-49	50-99	100-199	200-499	500-999	1000-4999	5000-9999	1ha-5ha	>5ha	Total
Ivory Park	77-80 and 111	58	64	57	40	68	39	20	2	1	1	350
Surrounding areas	92 and 110	17	12	9	3	9	8	5	1	0	0	64
Diepsloot	95 and 113	2	4	4	4	8	3	6	4	4	1	40
Alexandra	105 and 109	0	0	0	2	0	0	0	0	0	0	2
Total		77	80	70	49	85	50	31	7	5	2	456
Proportion		17%	18%	15%	11%	19%	11%	7%	2%	1%	0.4%	



Graph 4: Number of farms which gave responses in the surveys and interviews, with areas falling in different ranges, from less than 20 square metres to over 5 hectares

Scale of production can also be measured by the income generated, as described above. Although it does not include that which is retained for subsistence or given away as donation, the amount of money made from the sale of produce gives a relatively good indication of scale of production for farms selling produce.

From the survey, 174 farms selling their produce responded regarding the amount of money made each week, of which seven farms made no money (about 4%), 20 farms (about 11%) earned less than R50, 61 farms (about 35%) earned R50 to R100, 49 farms (28%) earned R100 to R200 and 36 farms (about 21%) earned more than R200, four of which reported earning over R4000 a week. More than half of the farms earning money were selling fresh produce valued at R100 or more in farm gate prices into the food system each week. This excludes any contributions made through retention or donation of produce.



Graph 5: Pie chart depicting surveyed farms selling produce according to their weekly earnings

Obviously there was a relationship between these two measures of scale of production. The four surveyed farms earning R4000 or more each week were all amongst the larger farms in terms of size having an average area of 2300 square metres. Similarly, almost all of those earning R200 or more were in the higher area ranges, above 200 square metres. The exceptions were two farms in Diepsloot with areas of 42 and 50 square metres which reported earning over R200 a week. It follows logically that a farm needs to be of a certain size in order to produce a sufficient surplus to generate a large income. However, some particularly large farms were earning very little. Whilst the largest 18 surveyed farms (all being 2000 square metres or more) were all earning money, including three reporting weekly earnings of R4000 or more, a number of them were earning a fraction of this. The biggest farm surveyed, Mdimonthuse in Ivory Park, was 12000 square metres and reported earnings of less than R50 per week. The remaining two farms in the top 20 by area (Radebe at 1974 square metres and Dumasi at 1950 square metres), were not even selling any produce for money.

Modes of distribution

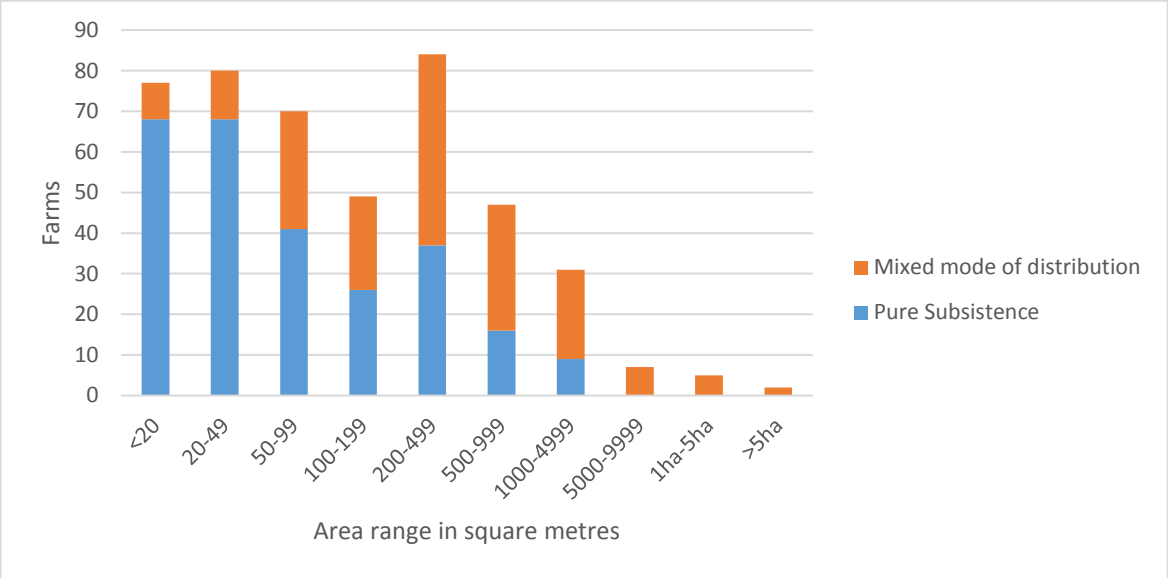
What happens to the produce from the researched farms after it has been harvested can be divided into three main modes of distribution: retention, donation and sale. The most common categorization of agriculture is between ‘subsistence’, in which produce is grown to be retained for consumption by the producer and their household, and ‘commercial’, in which produce is grown to be sold in order to generate an income. This definition is based on the mode of distribution but is essentially an attempt to classify the orientation or purpose of cultivation, and it generally associates these two modes of distribution with certain other food system characteristics, from the foodstuffs produced to the nature

and scale of production. Subsistence agriculture is assumed to be small scale, low input and often low tech and low efficiency, resulting in small quantities of a range of basic unprocessed vegetables. Commercial agriculture is thought of as industrial scale and high input, often mechanized and high tech to obtain massive yields of a few market relevant crops at a time, destined to be processed into an assortment of commercially prepared foods. This dichotomy is reinforced by the common framings of urban agriculture, in which the farmer is seen to be either compelled towards conventional commercial production, or forced to produce for subsistence out of sheer desperation – in both cases having no real choice. Conflating the mode of distribution with the farmer's 'purpose' supports the assumption that a farm which sells produce must be conforming to the corporate food regime's mould of commercial production in every way, as well as the assumption that retaining produce for subsistence is always a course of action taken as a last resort.

But in reality, many farms fit neither one nor the other of these stereotypes, just as the food system is seldom completely conventional or entirely alternative. Farms often employ multiple modes of distribution, retaining some produce, selling some produce through a variety of channels, and even donating some produce. A farm could be using one mode exclusively, or one mode could be more dominant, but this is not necessarily the primary purpose or orientation for production and it need not define the other choices taken by the farmer. In the same way as for all of the food system characteristics, the mode of distribution is a result of a complexity of reciprocal influences: both structural factors in and on the system, as well as the agency of the people involved. What the producer chooses to do with what is cultivated is essentially a choice, but this person might be driven by any number of motivations and limitations, many of which are beyond their control.

We see this in the relationship between the area of the farm and the mode of distribution employed. Access to land is an important factor which shapes farmers' choices and one that has been heavily theorised, especially in the context of South Africa where land is inextricably linked to the country's history of racial oppression (Anseeuw & Alden, 2011). Using the responses to a number of the survey questions, it was possible to determine that a large number of the productive farms surveyed were producing only for subsistence (although this could include some unindicated donation as will be discussed below). This constituted 229 farms in Ivory Park, 33 in the surrounding areas and seven in Diepsloot. As expected, this tended to be the smaller farms (see Graph 6 below). Using the average yield rate of 30 tonnes of vegetables per hectare (although it is unlikely to be appropriate at this small scale), farms under 50 square metres would not produce enough vegetables to supply even one person's recommended consumption of fruit and vegetables each day. This was true for about 35% of the researched farms. If these farms are retaining produce for subsistence, in theory they are likely to be retaining all of it. On the other hand, farms over 500 square metres, producing at, or above, the same average rate of yield of 30 tonnes of vegetables per hectare, would each be cultivating enough to

supply more than ten people's recommended daily consumption. Less than 7% of those who responded regarding the number of people depending on the farm chose 'more than 10 people'. So, even if they are retaining produce for their own consumption, the 95 farms with areas over 500 square metres would be producing more vegetables than they need to retain for their own subsistence, if achieving this rate of yields. Such large farms would probably be employing other modes of distribution as well for the surplus, such as sale or donation. However, even some very small farms were selling some produce in addition to retaining produce for their own consumption. And some relatively large farms, like Radebe and Dumasi mentioned above, were not selling any and were probably producing exclusively for subsistence. So although there is an association between the size of the farm and the mode of distribution employed, the reality is much more complex than a simple binary between mainstream large-scale commercial and marginal small-scale subsistence, as anticipated by the corporate food regime. This will be evident throughout this chapter, as we see exceptions emerge to every generalization.



Graph 6: Column graph showing that surveyed farms employing only subsistence as a mode of distribution tended to be smaller in area compared to those employing other modes of distribution instead/ as well

Clearly, the modes of distribution employed are related to other food system characteristics such as the scale and nature of production, but are also independent – essentially the choice of the producer, but influenced by a multiplicity of factors. Adding to the complexity is the fact that the modes of distribution are by no means mutually exclusive and are employed by farms in various combinations – somehow depending on other food characteristics, but also independent of them. The following Venn diagrams show the 454 surveyed farms and the 18 interviews, representing the number of each according to the combinations in which the three modes of distribution have been employed. They

also indicate the four farms in the survey which were not producing (including Thuthukani which would usually donate its produce) and the three in the interviews. Because donation is not commonly acknowledged as a mode of distribution, it was not anticipated in the survey design, so the exact numbers of farms donating produce in addition to retaining and/or selling some is not easily determined. Hence the uncertainty indicated in these sections of the survey Venn diagram. Whilst this provides an overall picture of the researched farms, the following sections explore each of the modes of distribution in greater detail.

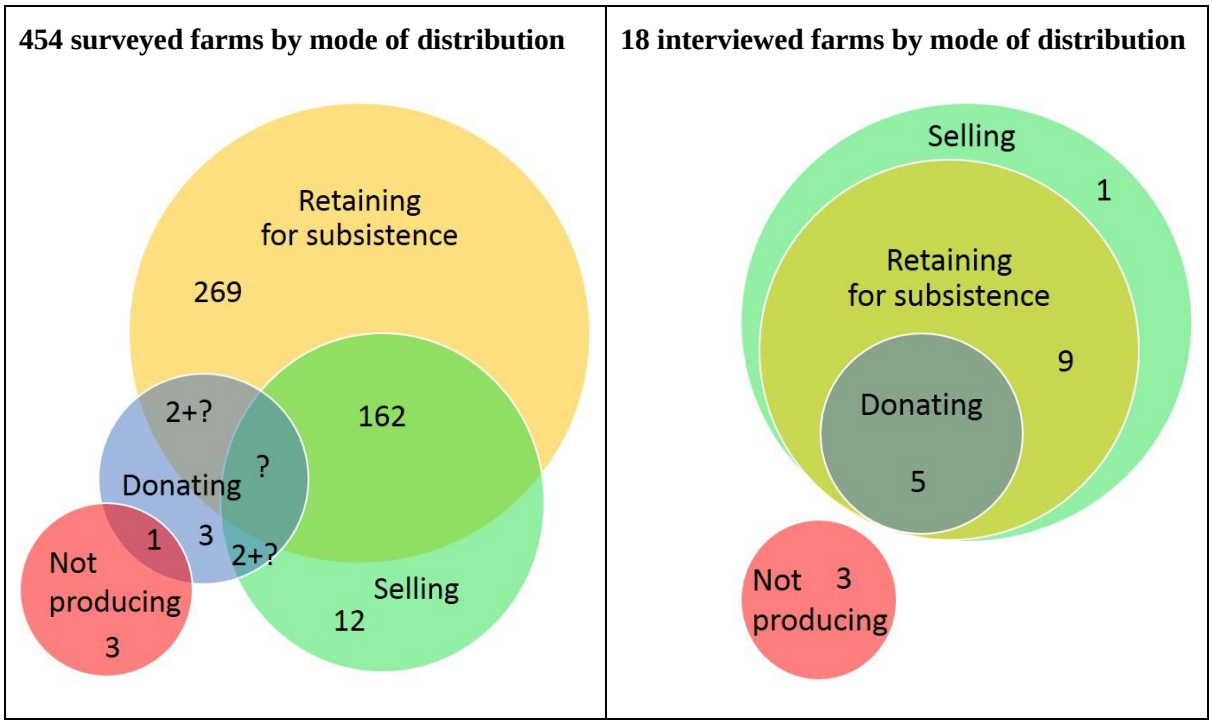


Figure 17: Venn diagrams indicating the number of farms employing different combinations of modes of distribution, according to the survey (left) and the interviews (right)

Production for subsistence

Although it is generally seen as less important in urban contexts, one way in which the poor obtain food is by producing it themselves (Rudolph, 2012). From the producers' perspective, this mode of distribution was employed by almost all of the researched farms. As per the above, 262 farms surveyed in Ivory Park and the surrounding areas were purely subsistence, retaining all of their produce for their own consumption, and from the surveys in Diepsloot a further seven were purely subsistence. Of the remaining 181 productive farms in the survey, 164 (over 90%) included 'feed your family' as one of their 'gardening benefits'. From the interviews, only one farm was not making use of subsistence as a mode of distribution. Rather than associations of hardship and desperation, production for one's own household is increasingly understood as a form of empowerment and self-reliance, especially by proponents of food sovereignty, for instance (Cherry, 2016; Edelman et al., 2014; Trauger, 2015). But such perspectives are not the norm in scholarship on urban agriculture in

South Africa (see Tamlit, 2014 as an exception). It is thus interesting to note that for almost all of the researched farms, which represented an incredible variety in terms of other food system characteristics, farmers were choosing to employ this mode of distribution.

The interviewees from Diepsloot were all members of cooperatives and all spoke of themselves and the other cooperative members as consumers of the agricultural produce. In a number of cases the interviewer explained that "members buy like anyone else", whilst one said, "For now, members just take, and they will pay later." The produce is still being retained for the producers and their families as oppose to being sold to others or donated, so in terms of the mode of distribution this could be considered a type of subsistence, although it is in exchange for money and would thus contribute to the farm's income. However, in other cases, produce was retained for free by those working on the farm, for instance one interviewee explained, "Members and labour do take, but like four or five leaves for instance, so it's not a problem". Farmers and hired labour could retain produce in exchange for their work in the garden. This could also be considered a form of the subsistence mode of distribution, the only difference being that the amount of work put in by those involved would be used to determine how much produce ought to be retained in exchange for their input, which may affect how much could be sold. This mode of distribution represents a significant input to the local food system from farms in the Philippi Horticultural Area in Cape Town, for example (Battersby-Lennard & Haysom, 2012; Jackson, 2010).

An important consumer benefit to the subsistence mode of distribution is that food is usually obtained by the farmer or labourer without any commercial exchange. This not only means that the consumer does not bear the additional expense of retail, but also that food can be accessed when the consumer doesn't have any money to spend on food. This represents a vital option for consumers in difficult times, providing resilience so that a household can withstand and recover from possible crises. Many households in the study areas rely on intermittent incomes and unemployment is extremely high. Periods where one is without work could also be a result of illness in the household, which brings other unexpected expenses as well. The corporate food regime is not only related to many prevalent diseases, it also implicated in food price fluctuations and inflation that drive households into these times of crisis. Urban agriculture is seen by some as "a deliberate effort by urban households to ensure a more secure source of food that is not dependent on cash incomes or fluctuating markets" (Maxwell, 1994, in Baiphethi & Jacobs, 2009, p. 469). The advantages to this source of food is the main reason why "feed your family" was included by over 94% of the 452 farms that responded regarding their gardening benefits.

Although almost all of the productive farms researched retained at least some of their produce for their own consumption, farmers do not necessarily represent the majority of consumers in the study

areas. Although this research was not designed to be an exhaustive count of all the cultivation in the area, the coverage in Ivory Park itself was quite comprehensive, and in this area alone, the survey identified 393 productive farms retaining at least some of their produce for their own consumption, 229 of which were purely subsistence. More than half of these survey respondents said that less than five people depend on the farm. But even if we assume that each farm retaining some produce for subsistence represents up to five separate households obtaining food through their own production, we are unlikely to be looking at more than 2000 households. Considering that there are about 24000 poor households in the wards of Ivory Park, relative to the whole population this suggests a low prevalence and thus importance of subsistence production as a source of food, agreeing with other research on urban agriculture in poor areas of the City (J. Crush et al., 2011; J. S. Crush et al., 2010; Rudolph, 2012).

The low prevalence as a source of food does not make subsistence agriculture insignificant as a food system alternative. Although it may not be supplying the majority of consumers, for those obtaining food in this manner there are numerous benefits to this mode of distribution. In terms of accessibility, produce is usually growing at or near to the farmer's home and can be freshly harvested as required, at no additional cost. In terms of empowerment, the food and the production process are not veiled in any way to the consumer, who is in fact the farmer in this case[26]. A farm retaining produce for subsistence also has a diversity of opportunities for alternative options in terms of foodstuff and nature of production. In addition, as argued in the literature review, it bears an inherent critique of the corporate food regime and carries the seeds of transcendence to a different logic around food (Greenberg, 2006).

However, this study is not limiting urban agriculture to only this mode of distribution. Without disregarding what some households obtain from their own production, this research also looks beyond the households of those involved in producing food in poor urban areas, to consider the contribution of locally grown fresh produce made by these farms to the food system more generally, especially for access by other consumers in the poor area where the farm is located. In addition to the contribution made by the researched farms to the families of those involved in them, many are making their produce available to other members of the local community in the poor areas of Johannesburg where they exist, either by donation or sale or both. Rather than set these farms apart from those retaining produce for their own consumption, the section above shows that almost all of the researched farms,

[26] This overlap of roles means that benefits and disadvantages from the perspective of the producer are also relevant to these consumers, but this research is focused rather on the consumer benefits of food system alternatives. For instance, there is substantial debate on the advantages and disadvantages of subsistence as a livelihood strategy, since it fails to contribute to an essential cash income for households.

in spite of their diversity, are employing a subsistence mode of production for at least some of their produce.

Production for donation

The modes of distribution commonly considered for agriculture are the retention of produce for subsistence, and the sale of produce for income, with the donation of produce receiving less recognition (exceptions who also recognize formal and informal 'transfers' include Sen, 1982, in Baiphethi & Jacobs, 2009; and Ruel et al., 1998). Even the design of the survey didn't take donating into account and there were no questions which were intended to determine if farms were doing so for some or all of their produce. However, it was unmistakeable from the survey and interviews that this represents a mode of distribution being employed by a number of the researched farms. It was even possible to identify several farms that make their produce available to the broader local food system by supplying all of their surplus without cost towards their own community project or another worthy cause. The survey respondent from Thuthukani Centre in Ivory Park stated, as mentioned above, that the land was non-productive at the time of the research, but also that the farm did not sell its produce and that the only outlet for it was that it was "given to the orphanage". Four others, Mpumelelo garden and Shabangu in Ivory Park, and NJC Perma Culture and Kenneth's garden in the surrounding wards, were not considered non-productive by their representatives, but they similarly stated that produce was not sold and no money was made, as their produce was going to orphanages, a crèche and orphanage, a school feeding scheme and a clinic. In Diepsloot, Muzomuhle also produced for a school feeding scheme, selling none of its produce. For Muzomuhle and Shabangu there was evidence that they were retaining some produce for their own families as well.

Many other farms retain some of their produce, sell a part and give another part away as a donation, sometimes having donation as their dominant motive. As with those above, all of the donated produce remained within the local community. From the interviews, there were five farms which retain some produce, sell some produce and donate some produce. Two were actually community projects which grow fresh produce for their beneficiaries and only sell some of it to buy other necessities. Khusel'Ingane in Ivory Park sells some of their produce to people from the community who come to the project, so they can buy other food such as mealie meal, to cook with the fresh produce for donation. They provide meals for the elderly, orphans and vulnerable people in the local community. Also from Ivory Park, the interviewee from Matsogo explained that they were able to buy their landline with money they made from their garden the previous year, by selling to people doing quarters, to neighbours, to passers-by and to people in the project. The site was associated with an NGO called Love of God Disability Foundation, and normally vegetables were taken door-to-door and given to disabled people who were its beneficiaries.

Blessings Cooperative in Diepsloot was amongst the larger more commercially successful sites interviewed, selling to retailers, vendors and directly to consumers. But the farm also donated some produce, in this case to a disabled school nearby called Bona Lesedi and to "the Church, like the Zion, who collect to give to the unemployed and those without anything". Ntokozo in Ivory Park sells both fresh and locally processed foods, mostly to hawkers. Another way that the produce reached the local community was by providing it to a school in the neighbourhood, where the interviewee explained, "I give to school children who are orphans". The interviewee from Batho ba Kopane in Ivory Park said that most of the produce was donated locally, to a children's home, crèches and old age homes. The interviewee explained this as being because of "the area we are coming from". A lesser part of the produce is sold directly to consumers from the street at a small market close by, and from the site itself.

Aside from the interviews, the survey also included evidence of farms which sell some of their produce and donate some locally – to members of the greater community, schools, clinics, charitable initiatives or churches. For instance, some of the answers provided by farms as 'other' outlets for their produce, included 'orphans', 'donating to orphanages and vulnerable kids', 'donating to charities', 'giving back to the community', and 'giving those who ask'. But aside from those who specified this explicitly, there are probably many more who did not, who may simply have included 'local community' amongst their outlets. For instance, whilst the interviewee from Batho ba Kopane, mentioned above, revealed that most of the produce was donated and only some was sold to consumers, a different representative responded to the survey, and listed only 'local community' as the outlet for their production, since the term could encompass both donation or sales. For most farms employing multiple modes of distribution, it was not always evident from the survey how they combined selling some produce for income, donating some produce and retaining some produce for subsistence. As another example, 24 farms which were selling some produce include 'school or crèche' as one of their outlets, which, like 'local community' may be an outlet for selling or for donation.

In summary, five farms from the interviews were retaining some produce, selling some and donating some, two of which were producing primarily for the community projects of which they were a part. The survey was not designed to identify donation as a distinct mode of distribution, since it is seldom recognized as such. So in spite of the evidence that a number of farms are in fact donating produce, it isn't possible to say how many include donation in the modes of distribution they employ. It was possible to identify six farms in the survey which were not selling their produce but were producing for donation instead, one of which was not productive at the time of the research and two which were also retaining some produce for their own consumption. But other surveyed farms (amongst the 269 'pure subsistence' farms which were not selling any produce, or the 181 which were selling all or part

of their harvest) could also be donating some of their produce. Again the agency of those in the food system combines with structural factors to result in the particular realities. A number of the farms evidently exist primarily to produce for donation, even though they may retain some produce for their own families as well, or may sell some to generate an additional income. Other farms may be established to produce for the household and/or for selling, but those involved choose to donate part of their produce for specific reasons. Whilst community projects and school feeding schemes are not a long term solution to the problems of the corporate food regime, the donation of food completely contradicts its capitalist logic, and in a way represents a deeply alternative form of food system.

Production for sale

This research shows how production for subsistence and donation of fresh produce are important ways in which food grown in poor areas, without the exchange of money, is reaching the local community, but there is generally consensus that most of the urban poor obtain their food through purchase (Battersby, 2012; City of Johannesburg, 2004; Rudolph et al., 2012; Smith, 1998). Whilst it may not be the most common mode of distribution employed by the researched farms, many are selling some produce into the food system. Over one third of the farms surveyed in Ivory Park and the surrounding wards state that they are selling at least some of their produce. This constitutes 145 farms in this study area, which excludes all those mentioned above which are not selling any of their produce, either because they are non-productive, purely subsistence farms, or give it all away as a donation. The telephonic interviews were all conducted with representatives of agricultural sites that were known to be oriented to sell some produce. Besides the farms in nearby Randjesfontein and Kaalfontein, which were not producing at the time, seven other farms in Ivory Park itself were interviewed, all of which were productive and selling some of their produce. In terms of the other study areas, this mode of distribution is employed by all of the eight productive cooperatives in Diepsloot which were interviewed, and over three quarters of the surveys of farms from that area – 26 surveyed farms in Diepsloot were selling produce, not counting the seven subsistence farms and Muzomuhle, the one supplying the school feeding scheme. All five of the farms surveyed in Alexandra were selling produce.

Altogether, farms selling some or all of their produce make up 176 of 454 surveyed farms, or about 39% in terms of number of farms. However, they make up a much larger proportion of the area. The 171 farms selling produce which gave their size had a combined area of over 120000 square metres or 12ha – over 70% of the total area of the surveyed farms. Since all of the 15 productive farms interviewed were selling produce, 10 of which gave their area, these represent a further 47.5ha. Altogether, farms selling produce thus make up almost 60ha of farmland, albeit that for most of the farms some of this land is being used to produce for subsistence or donation.

Few farms were exclusively selling and not using other modes of distribution. As mentioned above with regards to subsistence, most of the interviewees and survey respondents from productive farms were also consumers of at least some of what they harvested, including those from farms selling produce. Only one interviewee, Luxting Pty, asserted that "all of the produce is sold," and didn't say that any produce was donated, or that he or any of the other people involved in the farm benefit from food grown there. Luxting is by far the largest of the agricultural sites interviewed or surveyed, having an area of 30ha or about 100 times the size of a tennis court. Similarly, only one farm out of all the surveys, considered themselves 'commercial' – Miludwaoi in Ivory Park. This farm was one of only four which reported weekly earnings of 'over R4000'. Among the largest sites in the area in terms of size, this farm was 2200 square metres or about one-fifth of a hectare in area – equivalent to about eight and a half tennis courts. Of the surveyed sites which didn't include 'feed your family' amongst their 'gardening benefits' and on this basis were not assumed to be retaining produce for subsistence, only 14 were selling some produce, including Miludwaoi. Two of these were obviously donating some as well – Kwa-Bhekilanga secondary school in Alexandra listed the gardening benefits as 'income' and 'other - school feeding scheme', whilst the second, an initiative of the government's Community Works Programme in Diepsloot, included 'donating to charities' as an outlet for their produce. This leaves only 12 out of the 454 analysed surveys from the various study areas (less than 3%) who exclusively employed sales as a mode of distribution, and not subsistence or donation (according to the evidence available).

Although only Miludwaoi identified itself as such, 'commercial' is generally used to describe any farm producing exclusively for sale, including the 12 from the survey and one from the interviews. Whilst 'commercial' agriculture is generally associated with a relatively large scale of production and high income, not all of the farms only selling their produce were as large or profitable as Miludwaoi and Luxting. The smallest was only 84 square metres in area, and five of them reported weekly earnings of under R50. Again, whether a farm sells all or some of its produce is evidently a choice, but influenced by any number of considerations and forces. The farms that sell produce vary substantially in size and in their weekly earnings, and in how they combine the different modes of distribution. But whether this was the only mode of distribution employed by the farm or not, production for sale represents a vast amount of food entering the food system from farms in the study areas, with the lowest estimate for the combined farm gate value of only surveyed farms being over R30000.

Channels of sale

Whilst having the estimated earnings made it easier to quantify the amount of locally grown produce being sold than that which was being retained or donated, there is a greater chance that, for this mode of distribution, some of the food is leaving the local community. Whilst the farms selling produce

were all located and producing in areas identified as having many poor consumers living in them, it is not necessarily true that their produce is being consumed locally. By considering how and to whom the farms are selling their produce, the likelihood that it will be made locally available and in ways that would make it serve and benefit poor consumers in the area can be assessed.

In the survey, respondents who were selling some or all of their harvest were asked to choose from a list of outlets for their produce. Of these 176 farms, about four fifths (139 farms) responded regarding the outlets for their produce and almost all (137 farms) included 'local community' in their response. All of the other outlets included by respondents were also local (for example, 'neighbours', 'local market', 'Agri-hub'), and there was no direct evidence to suggest that any of the surveyed farms were selling outside of the area in which they were located or selling to customers who might relocate the produce, so it quite possible that all of the food sold by surveyed farms remained local to where it was grown.

The interviews provided much more detail with regards to the channels by which the farms sold their produce. Each of the interviewed productive farms confirmed that they make all or part of their produce available for purchase by local consumers in one way or another, the main channels being described below. However, a number of farms were also selling to customers that were not from their area, introducing the possibility that their produce would be relocated and the benefits of being a local food system would be compromised. These channels will be discussed in the following section. Some farms sold to informal retail from other parts of the City, whilst others sold to formal retailers, seldom knowing where their produce would eventually be when it reached the consumer. Even if a supermarket in the same poor area stocks locally grown produce, there is a good chance that it has been centralised for packaging, processing and logistics purposes first. So whilst it retains some benefits of being local, it loses others as a result of the emissions and added expense of transport. However, whist retailers from elsewhere were interested in relatively large quantities of a few key crops, the farms which supplied them were also growing more or other produce for purchase by local customers.

Formal retailers and informal retailers from elsewhere

Only the three largest farms interviewed sold to formal retailers. The largest by far of all the researched farms, Luxting Pty in Ivory Park, was previously identified as being one of the few purely commercial farms, selling all of its produce and neither retaining nor donating any. Luxting produced large volumes of mostly spinach only, growing about 150000 bunches at a time and each week selling about 10000 bunches to fruit and vegetable shops and restaurants but were also selling about 3000 bunches to local vendors. In Diepsloot, the Blessings and Kondelelani cooperatives were also selling to formal retailers. Fruit and Veg City were collecting over 200 bunches of spinach a week from the

Blessings farm at the height of the season and were also buying the mealies they grow to be sold as green mealies. In a month the cooperative were producing over 10000 bunches of spinach, only a small portion of which was being bought by Fruit and Veg City, as well as 5000-10000 cabbages, 350 bags of butternuts and "even more" green pumpkin. Shoprite collected all the cabbages produced by Kondelelani cooperative throughout the season prior to the interview: about 200 heads every week for three months. They had previously sold to the Pick 'n Pay in Braamfontein. The cabbages had occupied half a hectare of land, but they also produced beetroot on a quarter of a hectare which was sold to the local community. They had used some ground to plant carrots but hadn't harvested a lot due to a problem of the soil. The cooperative actually had 8ha of ground, north of Diepsloot towards Northern Farm, but had only managed to fence 5ha due to lack of finances and were only planting 2ha when interviewed. Still this means that Kondelelani, Blessings and Luxting had the largest areas under production of all the sites interviewed and were bigger than any in the survey, the largest of which was 1.2ha. This is unsurprising since, despite pressure from government to integrate emerging farmers into agro-food value chains in South Africa, supermarkets and formal retailers still generally favour the larger of these producers, which can guarantee certain volumes of a few market relevant crops (Greenberg et al., 2013; Heijden & Vink, 2013; Andre Louw, Chikazunga, Ndanga, Bienabe, & Jordaan, 2008; South African Cities Network, 2015). This is a good example of where the agency of the farmer who wants to sell through this channel may come up against concrete external limitations.

Usually limited to larger scales of production, formal retail systems increase the likelihood of a longer distribution chain. Few of the farms selling to formal retailers were able to say where the produce would eventually be sold. Kondelelani knew that the Pick 'n Pay, which had bought from them previously, was located in Braamfontein, about 45km away by road. But even assuming that some of the formal retailers were ones which operate in the same area as the farm that supplies them, there is still a possibility that the produce would be relocated, especially if selling to the group or supermarket wholesaler and not directly to the local branch. Many large chains purchase their stock and then centralise it in a single pack house, from which it is distributed to branches around the City (South African Cities Network, 2015). For example, whilst another farm, Reatlegile in Diepsloot, had sold all the tomatoes and green mealies of their previous crop in the local community, on the day of the interview they were meant to have a meeting, based on their estimated production of about 16000 cabbages and 20000 beetroot, with the regional buyer for Boxer retailer, located at City Deep. Although there is a Boxer superstore located in Diepsloot, should an agreement have been made for Reatlegile to supply the retailer through the regional buyer, their produce would undoubtedly have been transported away from the area, even if it was eventually to return to supply the local poor consumer through this nearby branch. Whilst this is the case for supermarkets with a centralised procurement and distribution system, there has been an increasing trend for supermarket branches to have independent procurement contracts with local suppliers, which are also more likely to be small-

scale producers (Baiphethi & Jacobs, 2009; Chikazunga & Paradza, 2012; André Louw et al., 2007; South African Cities Network, 2015).

The closest supermarket is an important source of food for the urban poor, but it has its disadvantages – to benefit from lower prices supermarket customers tend to buy items in bulk or larger quantities, which usually means that they have to pay for transport and that they choose to stock up on less perishable items since they do not have refrigeration in their homes (Battersby et al., 2015; Rudolph, 2012). Poor urban consumers turn more frequently to informal traders, from whom they can buy small, affordable quantities of daily necessities without needing to travel far or requiring paid transport, and often benefiting from credit arrangements typical of informal systems (Battersby et al., 2015; Rudolph, 2012). A number of the farms interviewed supply to informal traders, but this includes those from the local community as well as those from other areas of the City.

Three of the farms in Diepsloot supplied to informal retailers from beyond the local community. Aside from Fruit and Veg City, Blessings cooperative had regular customers – "ladies from Midrand" – who came to collect some produce, whilst the rest went to the Diepsloot community through local informal traders, direct sale and donation. Whilst the interviewee from Hunters and Tracers said most of the produce from the farm was sold to the community of Diepsloot, they also had some customers who would tell their order in advance and come in cars from Cosmo City, Kempton Park and Fourways, taking 10-20 large bundles of chomolia at a time. Operating on 1ha of land, the cooperative produces mainly chomolia and onions, but also spinach, mustard leaves, beetroot and carrots. Ikgantsheng cooperative similarly have regular buyers for the chomolia which they produce. Women come from Kempton Park in a bakkie, buying about 150 bunches of chomolia each time. The cooperative also supplies spinach for selling to about 10 people per day, not only from Diepsloot itself but also vendors from Cosmo City and Lion Park informal settlement. Generally the same people come every day, buying only four to six bunches as they have no private car to carry a lot. They pay R10 for each big bunch of spinach, which they divide into five bunches to sell for R10 each, making R40 profit on each big bunch. Ikgantsheng harvest 50-60 bunches of spinach a day, and every day they sell – sometimes 30, sometimes 60, on Friday maybe 100 bunches, each day representing spinach worth R300-R1000 in farm gate prices or R1500-R5000 in the retail prices given. Whilst chomolia and some spinach from the farm were leaving Diepsloot, some of the spinach as well as the green peppers, beetroot, spring onion and tomato which they grew were remaining in the local community.

All of the farms selling to formal retailers that potentially take the produce out of the area, or to informal retailers from beyond their own locality, also supply produce to the local community in various ways. In Ivory Park, Luxting sell about three quarters of their spinach to fruit and vegetable shops and restaurants and one quarter to local vendors. On the topic of street vendors, the interviewee

explained that entrepreneurs buy from them rather than from the shop because there is no mark-up. Since each vendor buys 30-50 bunches of spinach at a time and Luxting sells 3000 bunches to vendors each week, the cooperative is stocking local street stalls, with their 30-50 bunches of spinach each, about 60-100 times a week. The Diepsloot cooperatives mentioned (Blessings, Kondelelani, Reatlegile, Hunters and Tracers and Ikgantsheng) tended to sell only one or two types of produce to formal retailers or customers from outside the area (spinach, green mealies, cabbages, chomolia), and even then, they often had more of these crops remaining, which went into the local community along with all their other types of produce. In addition to these six, all the rest of the productive farms interviewed were making produce available *within* the poor areas in which they were located, in a variety of ways. Many farms knew that their customers were buying to sell further locally, whilst many were selling directly to the consumers of the produce. Some farms were delivering produce to their customers, some were selling it from markets or busy public places in the area, and some had customers walking onto the farm to buy what they wanted.

Local informal traders

The informal market is understood to be such an important source of food for poor urban consumers, it is noteworthy that most of the interviewed farms supply locally grown fresh produce to informal traders in their area. Of the 15 productive farms interviewed, 11 were sure that some of their customers were local informal traders such as hawkers and street vendors. As mentioned Luxting was providing substantial amounts of spinach to street vendors in Ivory Park each week. Every day, Blessings cooperative had some customers from the Diepsloot community come to the farm, many of whom would buy stock for selling – each time taking about three bunches of spinach, or four to five cabbages, which they quarter or halve for selling. Some would buy for the whole month and if Blessings didn't have stock they would go to another cooperative located next door. Besides those from Cosmo City and Lion Park informal settlement, Ikantsheng sold spinach to local vendors from Diepsloot. At the time of the interview, Kondelelani, to the north of Diepsloot, had begun supplying only to "hawkers – people who sell in the community". In the previous seasons they had produced cabbage for sale to formal retailers, but, because of a problem of water, they were just growing spinach at the time of the research, 500-700 bunches per week, both outside and in tunnels, because they felt "there is a market" in these local informal traders. Coming from the community, the hawkers would walk onto the farm, "every day a person", each buying small amounts – a few bunches, at R5 each. Also in Diepsloot, Reatlegile cooperative, which at the time of the interview was planning to make an agreement with Boxer retailer for the cabbages and beetroot they were producing, previously sold all of the tomatoes and maize they had produced in the local community, with most customers for the green mealies being street vendors who paid R3 for each. In all of these cases, the traders would come to the producer to buy their stock, usually walking onto the farm or sometimes coming by taxi.

Informal traders tended to be interested in particular crops, which they would repackage for selling into small quantities, 'singles', 'halves' or 'quarters'. Mentioned above as being associated with a non-governmental organization for the disabled, Matsogo in Ivory Park made money from their garden the previous year by selling potatoes and lettuce to "people doing quarters". Setumo in Diepsloot were producing a variety of vegetables – "whatever I can get my hands on" – but what they were selling was mostly chomolia for vendors, with a bunch of 45 leaves or 65 stalks going for R10. They made their sales on the road and from a training site, but people buying to sell would "sometimes place orders and come with bakkies to collect". Operating on half a hectare in Ivory Park, Evergreen grows over eight different crops and at the time of the interview were even starting to grow trees. They sold all of their produce to the community who came to the project, and, like Setumo, found that those buying chomolia were generally buying it to sell – "yesterday someone bought five bunches of chomolia for R75". This may seem like a small amount, but the interviewee explained that typically a person buying for their own consumption would spend no more than R50 – "Sometimes only R5. Sometimes they will not buy at all! That is the business!" Also in Ivory Park and selling from their premises, Sedilaka said that while "most buy to eat", some buy mainly spinach to sell – typically a box of 10-15 bunches.

Overall, informal traders from Diepsloot and Ivory Park were generally going to the farms themselves to buy produce, taking from as little as "a few bunches", to bundles or boxes containing up to 50 bunches each, requiring a bakkie to come and collect. They were taking mostly spinach, chomolia, green mealies, potatoes, cabbage and lettuce – dividing the leafy vegetables into smaller bunches, selling single mealies and cutting the heads into 'halves' or 'quarters'. Although they would have marked them up before selling on to consumers, the informal traders paid between R3 and R10 for most products and where the selling price was known it also didn't exceed R10. These prices and quantities are particularly appropriate for poor consumers, who rely on informal traders in their area for frequent regular purchases, often having neither the expendable cash nor the space and refrigeration to buy more (Battersby et al., 2015; Rudolph, 2012). Because hawkers and street vendors tend to situate themselves throughout informal settlements, as well as at sites where many people pass or congregate, such as major intersections and taxi ranks, many consumers are able to reach them without needing to travel far from home, let alone pay for transport (Jonathan & Abel, 2015; Rooyen, Mavhandu, & Schalkwyk, 1997).

Direct-to-consumer and direct-from-farm

At least ten of the farms were themselves making produce available directly to consumers, many doing so in similar ways to those typical of informal traders. One of the ways which Blessings cooperative in Diepsloot sold their produce was by having a stall at the local taxi rank. Some of the produce which Batho ba Kopane did not donate was sold at a small market close by, where they sold

from the street. The interviewee explained, “Someone has to be there to sell, and we try to go at rush hour.” Reatlegile had identified a busy corner at which they sold bags of four tomatoes for R3 each. Whilst they sold their green mealies to hawkers, they normally sold the tomatoes directly to consumers on the street. Like the informal traders, some interviewees explained that they needed to take their produce, generally by public transport, to their customers or to an appropriate place. One farm in Diepsloot made all of their sales of Chinese cabbage by delivering to the customers. The interviewer explained, “I ask and they place orders and then I go to them and sell. If I need to, I take taxis.” At the time she was supplying four street vendors with four or five bundles each and 5-6 people from the community – neighbours or friends – with two or three bundles, all at R10 per bundle. She had sold 50 bundles of Chinese cabbage in the month prior. Another cooperative from Diepsloot, Ratanang, was producing only two leafy vegetable crops which they took in taxi to “where there are people”. Most people would buy one or two bunches at R5 each, and despite the transport cost, the cooperative were making about R1000 a month by selling in this way. Similarly, the interviewee from Setumo in Ivory Park said that, whilst other vendors buy some of the chomolia which they grow, they take “government transport or a taxi” with the rest of their produce to go and vend it themselves on the road – they had no stall.

Although not many of the farms had a permanent stall in a market, they made use of other physical spaces from which they could sell their produce, the most common being the farm itself. The interviewee from Setumo trains gardeners in Alexandra in a yard near London Road, where he also takes advantage to sell produce to consumers from around there. Aside from this example, the other spaces are all in the same area as the farms if not the farms themselves. The Agri-hub in Ivory Park sells produce on behalf of farmers, so Sedilaka sometimes take their produce there and “those near the hub go buy”. The interviewee also said, “Sometimes we get together as farmers in a big hall to sell”. Speaking to the head of the local farmers’ forum at an event in Ivory Park, it seems these market days are organized by the farmers themselves in the community hall on a fairly irregular basis. But Sedilaka, like seven of the other farms, also sell some produce directly from their farm – “People from the community come to our place and buy.” Even Luxting sells some spinach, at R5 a bunch, to people who walk onto the farm to buy directly. Both of the farms associated with community projects, Matsogo and Khusel'Ingane sell directly from the project. People from the community who come to the project to buy, generally take two to three bunches of morogo at R10 a bunch, earning Khusel'Ingane about R270 per month, which they use to buy other foods to accompany their produce in the meals they provide to their beneficiaries. Although they are only selling vegetables to cover other costs such as their landline, Matsogo were making various types of produce available from their project to local consumers. “People buy spinach with R5. Potatoes we sell at 50c each. Beetroots at R3. Spring onion – there is competition because people like spring onion. We make a bunch with two hands which we sell for R5 each.” The interviewee from Batho ba Kopane gives some indications of

the additional benefits to the consumer of buying directly from the farm, which is worth quoting in full:

"Passers-by want to buy. Especially spinach, which is where we make our money, like that. People like it fresh. When it is still on the plant it has life in it, not like later. Well after some few hours it still does but when you are about to harvest, it has life. That's how people like it – very fresh. So when you are in the garden working and people come and ask. And they buy a bundle. And then you can suggest what they can mix it with – take the opportunity to sell other products. Especially on a Sunday, people will take carrots, potatoes, beetroot… A person normally spends R20 or R15. Maybe R10 - sometimes you can give a discount."

All of the various informal means of sale into the local community have avoided the expensive and environmentally costly long distances and times between production and consumption that have become commonplace in the conventional corporate food regime. By making available produce which was grown locally, it is intrinsically more likely to be fresher. Most of the informal traders were buying small quantities of stock on a regular basis, however, seeing as they generally lack refrigeration capacity, it is possible that the produce loses its freshness quite quickly (Battersby et al., 2015). Farms that are selling directly to the consumer, on the other hand, are often able to harvest on demand, retaining all the nutritional value of the crop[27]. Having the farms located close to where they live means that the conceptual distance between these consumers and the production of their food is greatly reduced and the environmental impacts of their food choices are much more readily observable. Nowhere is this more true than where consumers are buying directly from the farms in their area. The smaller scale of production already increases the likelihood that it is associated with more healthy and environmentally sound forms of agriculture (Greenberg et al., 2013), but what would be a more credible certification than for the consumer to actually visit the farm. Aside from the money saved on transport, farmers selling directly are even able to provide a discount or loan to their customers, many of whom will be people they know – as is typical in small-scale food systems (Wegerif, 2014). For the consumer to personally know and engage with the farmer who produces their food, and see it being harvested, strengthens the 'relational value' of the exchange (Sage, 2003). All of these elements epitomise food system alternatives, which decentre and oppose what is currently dominant and disadvantageous to the urban poor.

[27] There is always the risk that the intensity and timing of demand for locally grown fresh produce may not meet the supply, which could lead to wastage. But many vegetables have flexible harvest times and can be left on the plant or in the ground until they are consumed, reducing spoilage.

What is being produced and how?

Nature of production

The mode of distribution, and the retail channels employed by farms discussed above, directly impact the accessibility of the produce and the quality of the exchange, and, by affecting whether it is relocated or remains local, they also have an indirect effect on these potential benefits, as well as those related to health and sustainability. Nature of production, on the other hand has direct bearings on consumer benefits related to how nutritious food is and, especially, on the impact that its production has on the environment.

Nature of production also has an influence on other aspects of the food system which translate into benefits for the producer. The corporate food regime is characterised by a nature of production which is too capital intensive for many smaller farmers and compromising to their self-reliance. Restricting the use of external inputs frees the farmer from dependence on input markets. Facilitated by policies that limit the storing and sharing of seeds on the grounds of phyto-sanitary concerns and intellectual property rights, powerful seed corporations rope farmers into the use of products which grow into plants without viable seeds, meaning the farmer cannot save some seed to plant and must buy again next season. These seeds are usually genetically modified and are designed to be inseparable from other environmentally hazardous commercial products, which eventually leave farmers completely reliant on synthetic inputs because the natural resource base has been demolished. Farmers escape from getting caught up in this cycle of increasing dependence on unpredictable markets by investing in methods that conform to nature and make optimal use of on-farm environmental and human resources. A separate survey on inputs which was conducted with less than 200 of the food producers revealed that about 60% of the respondents included saving or swapping seeds amongst their sources of seeds, an option that is impossible with many of the commercially available seeds since they tend to be hybrid and, if viable at all, often reproduce inferior varieties when saved. These farmers are not only avoiding the regular expense of new seeds every time they plant, they are also protecting a form of sovereignty by retaining this genetic material under their own control. There are even efforts amongst the farmers to establish a local seedbank, with support from the Agri-hub (Researcher's observation in field). Family farms and communal or cooperative farming projects make use of their own labour, which provides employment for those involved. Almost half of the researched farms included 'self-employment' in their gardening benefits and most farms (almost 60%) were being worked by more than just the farmer, who was being helped by more than eight family and friends in some cases. There was evidence that labour was being hired by at least one of the interviewees, but all farms were contributing to the livelihoods of multiple people involved in them, even up to 15 cooperative members.

These same alternative forms of the nature of production also avoid some of the externalised environmental costs which the corporate food regime is ridden with. The poor bear the brunt of ecological damage, being both more vulnerable to its consequences and less able to adapt to them. In addition they are often relegated to marginal areas of the city where the effects of different forms of pollution have reduced the value of land. As with the mode of distribution, the nature of production on each of the researched farms could not simply be labelled as conventional or alternative. Farms make use of a number of methods and techniques, in the way they fertilize the soil, make use of available resources, control pests and disease, obtain water and irrigate, and combine different crops. Each of these have particular impacts on the human and natural environment.

For some farms a whole suite of methods and ways of doing things is determined by a particular philosophy of production which they employ, such as organic agriculture. Out of the 15 interviews with productive farms, when asked about the nature of production on their farms, nine volunteered that they practice organic agriculture, adding details such as "they taught me how to plant so I don't use pest control", "we don't use fertilizer or chemicals", "we don't use anything" or "everything we use is organic." Thus organic as an approach was the most common and familiar to those interviewed, the only other mentioned being agroecology, which was practiced by Luxting Pty. The survey respondents were specifically asked about organic agriculture, both if they know it and if they practice it. Just over half of the productive farms replied yes to both questions (231 farms) and a further 65 try to practice organic based on their understanding of it but don't know exactly what it entails. It is likely that someone has been training farmers in organic methods in the study areas, as the interviewee from Setumo in Diepsloot was doing from a yard in Alexandra – in this study site all five surveyed farms knew and practiced organic agriculture. Similarly, some of the organizations and service providers which the City of Johannesburg have engaged in programmes to support urban agriculture, promote an organic approach (Researcher's personal observation; City of Johannesburg, 2008). Whatever the reason for the popularity of this approach, organic agriculture represents a number of benefits for the consumer. Organic farming involves a range of techniques and management practices that enhance agro-ecosystem health by working with natural processes to promote biodiversity, biological cycles and soil biological activity. Organic systems also conserve water and make use of organic waste as compost or mulch, not only reducing what goes to landfill but making optimum use of available resources. In addition to the environmental benefits resulting from avoiding chemical fertiliser and synthetic pesticides and herbicides, which will be discussed independently below, many argue that organic agriculture also results in healthier produce. Organic farming does not permit the use of genetically modified organisms, the long term health effects of which are still highly contentious. There is also evidence that organic food has higher levels of antioxidants and certain vitamins and minerals, such as vitamin C, iron, magnesium, and phosphorus (Worthington, 2001).

Aside from this holistic management of the agricultural system, which entails a collection of practices and values, many farmers made isolated use of techniques which improved the sustainability of their production. There was no obvious relationship between these components of the nature of production which were considered and the other food system characteristics such as mode of distribution or scale of production. Very few farms (only six of the 454 surveyed) did not claim to be making use of at least one of the methods enquired about, each of which will be detailed below.

About two thirds of the survey respondents from productive farms never use chemical fertiliser, and 54% of survey respondents never use chemical pesticides. As expected, most of these farms were practising organic agriculture, but some were avoiding these inputs despite not claiming to be organic. Resource-poor farmers who cannot afford synthetic inputs have been referred to as 'organic by default' in some literature, but this term can be misleading since there are also other standards and principles involved in truly organic agriculture (Kelly & Metelerkamp, 2015). Synthetic fertilizer produces short term improvements in yields but ultimately depletes the soil of organic matter and soil life, making the farmer completely dependent on inputs for fertility. Eventually soil is degraded, containing high levels of acidity, salt and toxins, making it vulnerable to erosion. Run-off from fertilized lands pollutes water, and creates algal blooms which destroy aquatic ecosystems, and release the nitrogen from the fertilizers into the atmosphere in a form that is a potent greenhouse gas. This run-off is exacerbated when soils are less absorbent and prone to leeching as a result of over-fertilisation. Chemical pest-control can kill indiscriminately, both directly and through bioaccumulation, compromising biodiversity and resulting in weeds, diseases and other pests that are resistant to pesticides and herbicides and have no natural enemies. They are dirty to produce and difficult to get rid of, polluting the ecosystem and often remaining on the foods produced.

Replacing purchased chemical inputs like fertilizer and pesticide is not only more environmentally sound, it often works out cheaper and it improves the farmer's self-reliance. Instead of synthetic pest-control, farmers weed their fields mechanically, and make use of alternatives such as ash or tinctures made from chilli, garlic and other plants – some of which are cultivated specifically for that purpose (Researcher's observation in field). Whilst some of these homemade pesticides include Sunlight soap or other domestic chemicals, they are likely to be less toxic than synthetic agro-chemicals. Unlike conventional herbicides, which kill weeds but at the expense of insects and birds, or chemical pesticides, which kill not only pest insects but also those that feed on them, natural pest-control methods often encourage a higher diversity and abundance of organisms to control pests through the existence of their natural predators in a more robust ecosystem. Techniques such as companion planting or intercropping thus contribute to pest control and can also increase soil nutrients. A number of the surveyed farms practise intercropping, either growing different crops in different fields (31%) or, better still, growing different crops in the same field (30%). Another technique used by farmers,

which spatially and temporally fosters biodiversity and so similarly improves soil, is crop rotation, either planting different crops in rows (22% of survey respondents) or planting different crops each year (50% of survey respondents). One of the interviewees practising organic farming explained that, aside from refusing to use fertiliser, they proactively improve their soil quality by using organic manure made from leaves and clippings. Making use of their own organic waste as compost or mulch prevents it from becoming trash, which is a significant problem in cities, and it begins to create a closed-loop system (Malan, 2015). Many of the surveyed farmers were improving soil health by applying compost (79% of survey respondents) and just over half were mulching by covering the ground around their crops with organic matter.

Mulching is also a good practice in efficient water use, as it slows evaporation from the ground and keeps the soil cool which helps the plant to thermo-regulate without transpiring excessively. South Africa is extremely water scarce, and can be expected to face an ever greater water deficit as a result of increasing drought, declining rainfall and rising demand for water. As mentioned above, synthetic fertilizers and pest-control are major sources of water pollution, which removes this water from an already constricted availability, unless it undergoes expensive water treatment and purification. But many other farming practices impact water use, especially irrigation. Irrigated agriculture is already extracting almost two thirds of the available surface water in the country, meaning that practices that improve water efficiency are becoming more and more essential if irrigation is to be used. About two thirds of the surveyed farmers were using municipal water to irrigate, but most of these were using less than the government allocated free basic water of 6 kilolitres per month, including their domestic water use and so were not paying for the water. Less than 12% of the surveyed farms were using over R100 worth of municipal water. Other farmers used naturally occurring water sources, especially rainfall, which was sometimes stored in tanks. Over a third of the farmers were investing in some rainwater harvesting – collecting and storing rainwater, and treating water. Certain forms of irrigation are more efficient than others. Rather than sprinkler systems which spray water into the air and onto the body of the plant, much of which is evaporated, the best option in hot, dry climates is to apply water directly to the soil around the roots of the plant, using drip irrigation or manually with a watering can or bucket. The method used to irrigate was not enquired in the survey, but just under a third of the respondents specified that they use a watering can or bucket as part of their equipment.

Another important aspect of the nature of production, related to what is being cultivated, is the crop diversity that characterises the farm. Having a single crop, or monoculture, dominating a piece of land has become emblematic of farming in the corporate food regime. The lack of plant variety corresponds with a decline in the biodiversity of the system as a whole, which becomes unable to support healthy insect and soil life. Monocultures also compromise resilience, since the entire harvest will be lost if the single crop fails, as a result of weather, pests or disease. These negative effects can

be countered through rotating the crop with other crops each season, or by improving soil health and agro-biodiversity through other methods such as those detailed above.

Just 26 of the over 450 farms surveyed (less than 6%) list only one crop being cultivated, including both the wet and dry seasons, and 11 of these claim to be practicing crop rotation by planting different crops annually. Of the 26 single-crop farms, 12 were producing purely for subsistence, including the two largest subsistence farms surveyed – Radebe growing only kale, and Dumasi growing only sugar cane. The only three farms in the survey which were growing just maize were retaining all of their produce for subsistence and were under 200 square metres in size. Others producing a single crop for their own consumption were between 3 and 100 square metres and grew onions, spinach, pumpkin or chomolia. Even though they are producing a single crop, which has implications for the local agro-ecology, these subsistence farms are a far cry from the massive scale operations typical of the corporate food regime, that dominate the landscape with commercial monocultures, which, in combination with synthetic pest-control and fertilization, destroy the natural functioning of the ecosystems across the whole area.

A further ten of the farms growing only one crop were retaining some produce and selling some produce and four were producing only for sale. As observed generally, the farms selling some or all of their produce tended to be larger in size, and included the largest farm in the survey, Mdimonthuse in Ivory Park, which was 12000 square metres and was cultivating only sugar cane. The rest were growing only chomolia (ten of the 14 farms), mentioned above as a popular crop for informal traders, or only kale (three of the 14 farms), including Pikinini Farm in ward 110, which makes over R4000 per week selling its produce. From the interviews, the only farm growing a single crop was Luxting Pty, the vast 30ha farm in Ivory Park growing only spinach. Thus, some of the largest, most profitable farms researched were amongst the relatively few farms cultivating a single crop. Some of these big farms tended to differ from the corporate food regime stereotype for commercial nature of production in other ways. For instance, Luxting used strictly agroecology methods, whilst Mdimonthuse rotates their crops annually so would not be planting sugar cane the following year. However, Pikinini Farm did not say whether they made use of crop rotation, and although the respondent knew organic agriculture, it was not practiced on the farm and chemical fertiliser and pesticides were used always. The existence of large, intensive areas of commercial monocultures is an environmental concern, but thankfully only a handful of the farms growing and selling only one crop were large scale producers, most being under 500 square metres and one reporting no earnings at all.

Over 94% of the researched farms were producing a variety of produce, some up to twenty different crops, the average being about five. This diversity was a feature despite mode of distribution. The interviews suggest that many of the farms that sell some produce do so for fewer crops than they

grow. Demand for specific crops was mentioned in relation to various distribution channels – as examples, demand for green mealies from formal retail chains, for spinach from informal traders and for spring onions from consumers themselves. But these interviewees all cultivated a range of other crops, rather than focus solely on the most sought-after. It is quite likely that certain varieties were more saleable whilst production for donation or own consumption would naturally tend to be more diverse. This is supported by the fact that out of the 15 productive farms interviewed, only Luxting, which was not donating or retaining any produce for subsistence, was producing in monoculture. In any case, the greater majority of producers from the interviews and surveys were cultivating multiple crops, which would support a more robust biodiversity and healthy agro-ecology.

Foods produced

Most of the crops grown are root, leaf, squash or bulb vegetables but there are also others including tomatoes, and tubers like potatoes, sweet potatoes and amadumbi, as well as some other crops, such as beans, peanuts and fruits (including peaches, bananas, strawberries, watermelons etc).

Table 11: Frequencies of a selection of some more common and less common crops cultivated

Selection of some more common crops cultivated, in alphabetical order						**Selection of some less common crops cultivated, in alphabetical order**				
Crop type	Surveys		Interviews			Crop type	Surveys		Interviews	
	N	%	N	%			N	%	N	%
Beetroot	248	55%	8	50%		Aloe	5	1%		
Cabbage	153	34%	8	50%		Banana	5	1%		
Carrot	217	48%	7	44%		Beans	46	10%	2	13%
Chomolia	117	26%	6	38%		Butternut	77	17%	1	6%
Maize	154	34%	3	19%		Chilli	88	19%	1	6%
Onion	294	65%	6	38%		Kale	32	7%	1	6%
Potato	212	47%	4	25%		Lettuce	63	14%	3	19%
Pumpkin	191	42%	6	38%		Morogo	14	3%		
Spinach	355	78%	13	81%		Peanuts	69	15%		
Spring Onion	228	50%	2	13%		Sugar cane	9	2%		
Tomato	164	36%	5	31%		Watermelon	4	1%		

154 of the surveyed farms and three of those interviewed grew maize. Of all the crops, this is probably the most likely to lose its nutritional value through substantial processing. Blessings used to have some of their mealies processed into meal, but the demand for unprocessed green mealies from Fruit and Veg City was sufficient to take what was being produced, and the fact that the mill is located far away was sufficient reason for them to discontinue. The fact that they had milled some of their harvest in the past suggests that this may be the case for some of the surveyed farms, but at the time of the research Blessings and the other interviewees actually specified that they were distributing

or consuming the maize as green mealies, which are high in fibre and nutrients. This is probably the case for most of the surveyed farms as well, considering the popularity of green mealies in all distribution channels and therefore amongst consumers. Not only does this avoid the conversion of the maize to a less nutritious foodstuff, it also removes the possibility that it would leave the area for processing, which would be necessary since the nearest mill was not located close by.

Almost all of the food sold by the interviewed farms consisted of the unprocessed fresh produce which they harvested, in which case any possible transformation to other foodstuffs would have to take place after distribution if at all. The exception was Ntokozo in Ivory Park, which grows a variety of produce for subsistence and donation, but what was sold to hawkers had been processed at the Agri-hub into tomato sauce, dried tomato, pickles, pickled beetroot and jam. Although there may have been some loss of nutritional value compared to the vegetables as eaten fresh or cooked, the fact that the processing took place in Ivory Park meant that the food system lost none of the benefits associated with being local. Other than Ntokozo, there was no evidence that any of the produce was processed by those who received it, beyond repackaging and cooking it, whether it was retained for subsistence, donated, or sold to formal retailers, informal retailers or consumers themselves. As mentioned, hawkers and vendors often divided produce into smaller portions, whilst Khusel'Ingane prepared some of the vegetables into cooked meals for its beneficiaries, as would no doubt happen in most cases before consumption. It is quite possible that produce sold into the formal sector could be more fundamentally transformed, other than simply being cooked by the final consumers or by the restaurants which bought from Luxting, but there was nothing to suggest this.

The most popular crop amongst the researched farms is spinach, which was grown by 355 of the survey respondents (78%) and 13 of the interviewees (81%). Spinach and other green leafy vegetables like chomolia (which was also quite common among the researched farms), and kale and morogo (which were less common), are a typical part of South African meals and are all an excellent source of vitamins, minerals and fibre, raw or cooked. The next most common crops are onion, beetroot, spring onion, carrots and potatoes (in that order). These not only represent some of the most popular everyday ingredients locally, with important health benefits, they are also relatively easy to grow, even in poorer soils. One interviewee said they grow mostly organic root vegetables, having found that "some things you can't grow in an urban area because of the challenge of rats". Potatoes are a key ingredient in some of the high carbohydrate, high fat street foods associated with the nutrition transition in South Africa, such as the kota – a quarter loaf of white bread typically filled with potato fries and polony, with various additions (Kroll, 2016b). However, potatoes are not an inherently unhealthy food, providing a good source of potassium, vitamins C and B6, and fibre. Where it was known, those who bought potatoes from the farms were selling them to consumers as fresh.

In total 48 of the researched farms were growing beans, making them amongst the less common crops cultivated. From the interviews and observations in the field, these were mostly green beans, also known as French beans, rather than other varieties such as soya/edamame beans. Like peanuts, which are a ground nut and another example of an annual legume, beans are often cultivated because of the soil enhancing quality of the plants themselves. Nitrogen fixing bacteria living symbiotically in nodules on the roots of these plants make nitrogen available for organic use, some of which is absorbed by the plants and the rest of which is released into the soil. As a foodstuff, beans are also exceptionally valuable, being a good source of soluble fibre and protein, and rich in various minerals, phyto-nutrients and antioxidants. There were also a variety of fruits amongst the less common crops. Most South Africans do not eat enough fruits, which are important sources of many nutrients, including fibre and potassium, helping to prevent deficiencies of vitamin C and A, which are highly prevalent in the country, with devastating impacts on health and development (Backeberg, 2014).

Many of the varieties cultivated could be considered traditional vegetables, including chomolia, morogo, rape, cassava and okra. Out of the productive farms surveyed, 51 listed 'traditional crops' amongst the categories of their current products and 10 included 'medicinal herbs'. These traditional, often indigenous, varieties are relatively easy to cultivate, promote biodiversity, contribute to traditional knowledge (Shackleton et al., 2010), and being less conventional, these crops are less likely to be associated with conventional production and distribution systems. In addition, they have numerous benefits in terms of nutrition and are widely consumed by South Africans and immigrants (Shackleton et al., 2010).

By studying areas where a high density of poor consumers reside, there was already potential that the urban farms located there were feeding into a local food system which serves and benefits these consumers. The alternatives represented by virtue of being local could be compromised by a distribution channel which relocated the produce, but also by the production of a foodstuff which required processing, introducing the possibility that this would take place outside the area itself so that the system would no longer be local. None of the crops grown necessitated processing, but maize was quite common amongst the researched farms, and this crop is often milled into meal which is a staple for South African consumers. There was evidence that a farm in Diepsloot had removed some of their maize from the area to have it milled in the past, but the distance was a strong disincentive and the market for unprocessed green mealies was more than sufficient. Although the conditions were similar for the other researched farms, the survey wasn't able to confirm whether the 154 respondents growing maize were having it processed or not. The only other substantial processing mentioned was done locally. All evidence suggests that most of the foodstuffs produced from the crops cultivated by the researched farms were unprocessed fresh produce products, especially vegetables but also including some legumes and fruits. These exemplify the opposite to the foodstuffs characterised by

the corporate food regime. By providing a good source of dietary fibre, vitamins, minerals and other nutrients, these foodstuffs present a strong divergence from the nutrition transition.

Potential versus reality

In the previous chapter, the potential for urban agriculture to represent food system alternatives that better serve and benefit the poor was assessed for the City of Johannesburg on the basis of the occurrence of crop type and cultivation strata data in relation to poverty. The study areas of Diepsloot, and Ivory Park and the surrounding areas, were identified as having potential because they contained farms which were very likely to be local for many poor consumers. The crop types and cultivation strata also supported this potential, especially in Ivory Park and the surrounding wards where much of the farmland was small-scale farming or smallholdings, and thus expected to add to the benefits of being local in terms of accessibility, empowerment, sustainability and health. There was no agriculture taking place in Alexandra according the analysis of the previous chapter. It is useful to revisit the analysis made in the previous chapter given the findings of this chapter, as this could provide some light on the municipal scale picture of potential which was reached.

Amount of agriculture

Regarding the amount of agriculture, Ivory Park itself was the only study area which had sufficient coverage by the survey and interviews to really merit comparison with the mapped data. From Ivory Park itself, 349 surveys were analysed, each representing an agricultural site which was identified in the area. Even though this is not expected to be exhaustive, this far exceeds the farms recognised in this area in the previous chapter. The interview identified seven sites in Ivory Park, three of which were already accounted for by the survey, taking the total number of researched farms in the area to 352. Using the cultivation strata data layer, the wards of Ivory Park contained only 12 small-scale farming sites, even fewer according to the crop type layer. The difference is made obvious when considering the map of agriculture in Ivory Park with the addition of the surveyed sites. The map in figure 18 and the satellite image in figure 19 show more or less the same area, which includes Ivory Park as well as some parts of the surrounding areas. The small-scale farming and smallholdings identified in this area and discussed in the previous chapter are depicted, as well as the locations of the analysed surveys which were recorded here, many of which were located in the centre of the township where no agriculture had been recognised previously.

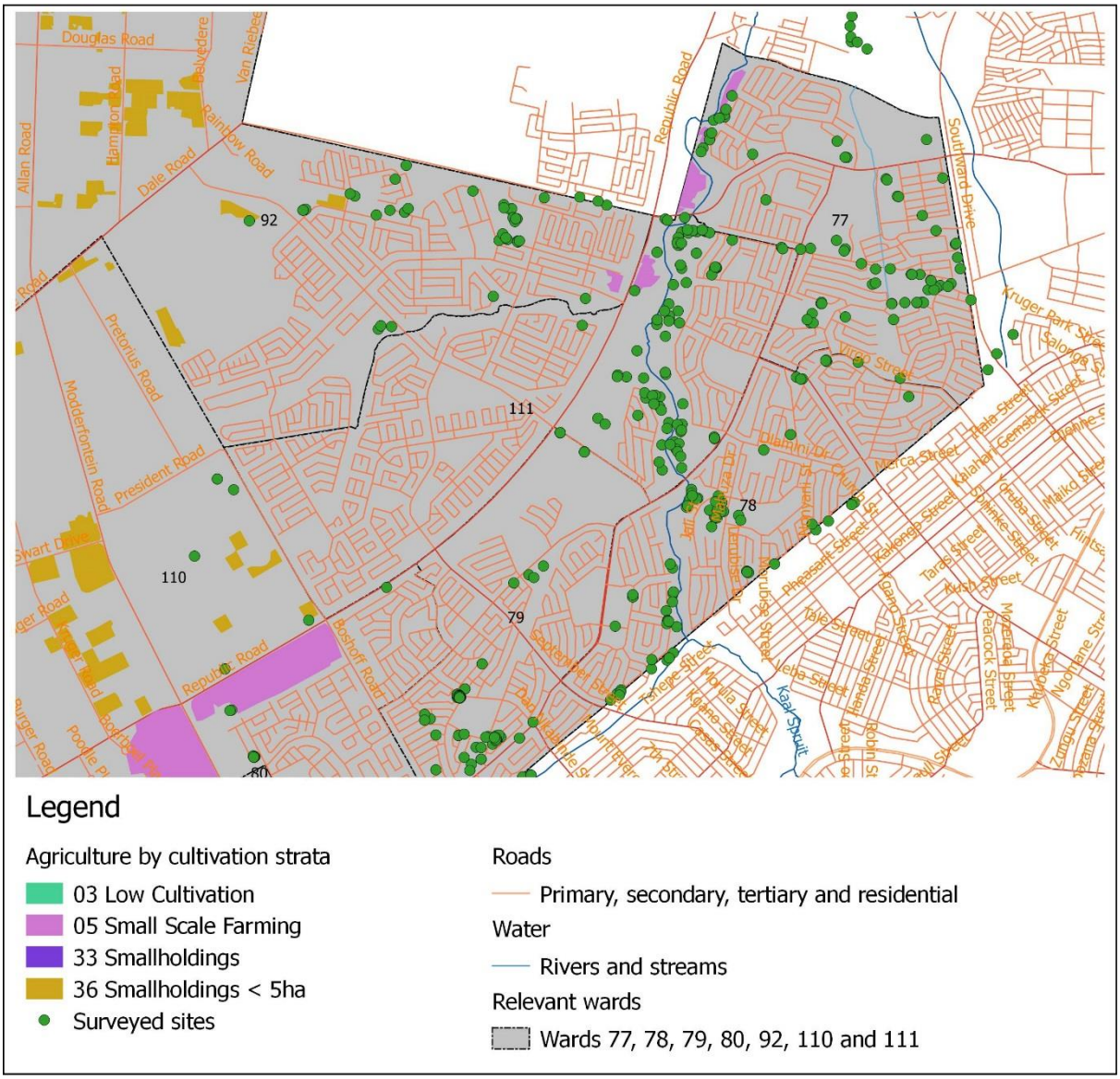


Figure 18: Map of agriculture in Ivory Park classified by cultivation strata in addition to agricultural sites surveyed in the area

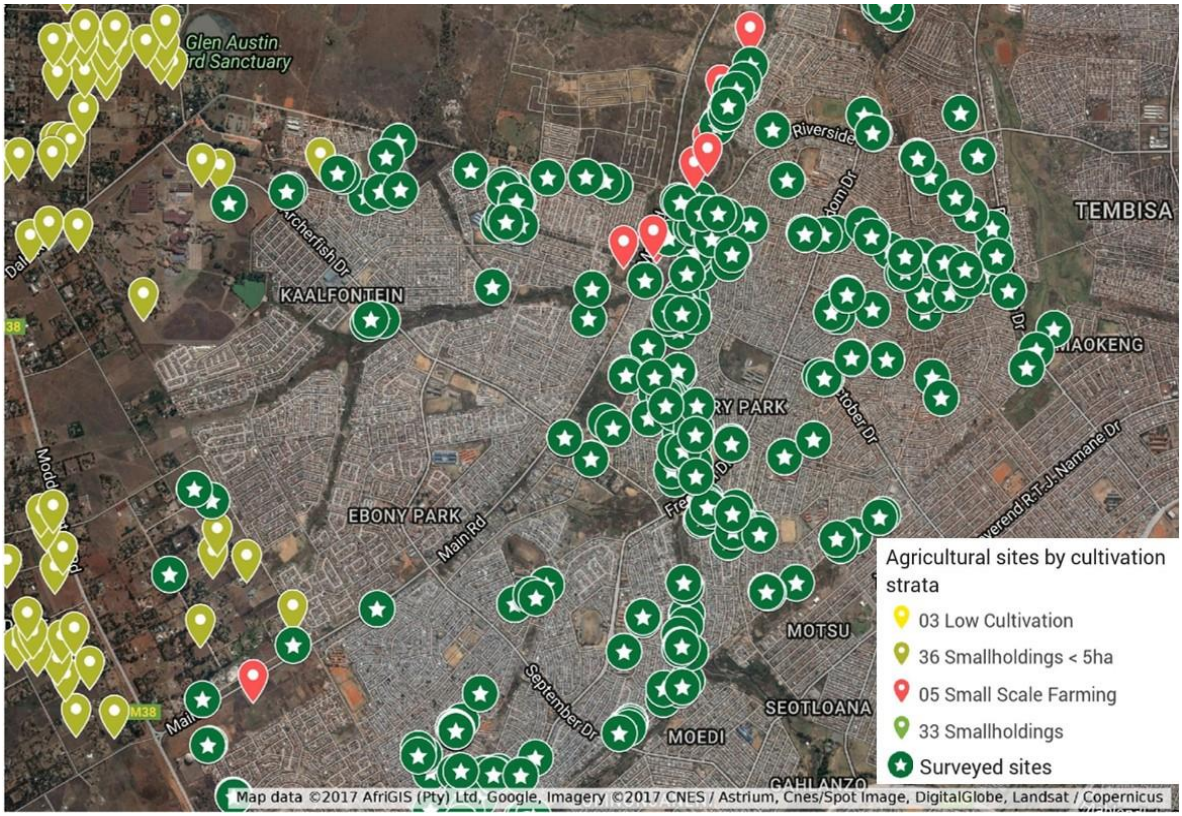


Figure 19: Satellite image depicting agricultural sites in Ivory Park classified by cultivation strata in addition to agricultural sites surveyed in the area

In terms of area, the previous chapter identified about 21.5ha of farmland in Ivory Park itself. In the survey and the interview, respondents were asked the area of their farms and all but nine gave a value, ranging from 2 square metres to 30000 square meters, or 30ha. Combining these values, the researched farms in Ivory Park represented about 41.7ha of farmland.

The spatial data which informed the analysis of the previous chapter was provided by the Gauteng Department of Agriculture and Rural Development and was based on the visual identification and classification of farmland from satellite imagery taken in 2011 (corresponding with the poverty data used which was collected through the national census in the same year). The survey researchers on the other hand were in the field for a number of months ending in December 2016, identifying any agricultural sites they could find there. Although the survey and interviews took place five years after the satellite images were taken, the apparent discrepancy in number and area of farms in Ivory Park probably has more to do with the different data collection methods than any change in agriculture over that time.

The survey was better able to recognise unique farms, even very small plots within dense residential areas, whilst the satellite data gave a very accurate measure of area under agriculture but could not distinguish discrete farms and missed the smaller areas of farmland. In Ivory Park, the analysis of

satellite data only picked up sites in open green areas along the river, not within the residential areas, the smallest site identified being a small-scale pasture plot of just over a hectare. In other parts of the City, even in wards 92 and 110 adjacent to Ivory Park, the data did include sites within residential areas, some as small as about 260 square metres. But these were located in less dense areas in which it would be easier for the analyst to identify agricultural land use within the large residential properties, such as the smallholdings identified in Austin View or President Park. In Ivory Park, many of the surveyed sites are located within the boundaries of very small residential properties that are densely packed, as is typical in a township development. It would be extremely difficult to identify these visually from satellite imagery, but when moving through the area on foot these sites would be easier to spot, even within people's properties, as one can usually see over or through the boundary fences where these exist. In addition, for the survey, the researchers pursued a snowball sampling technique by asking farmers whom they had surveyed if they could direct them to others, and they also enquired other locals on the streets, so they were able to identify many more sites in the area. The survey included some large farms in open areas, but these made up the minority of the respondents – the average farm size from the survey being about 33 square metres whilst that of the previous chapter was about 1800 square metres. The survey also distinguished the number of discrete farms made up by a particular area of agriculture, whilst for the satellite data a number of plots mapped could make up one farm in reality, or a single plot mapped could be divided into multiple farms in reality. One sees on the map of figure 13 for instance that a number of surveys were recorded around a single small-scale farming plot identified by the satellite data, which in reality is perhaps made up of a number of smaller adjacent farms which each completed a survey.

If it is true that the analysis of satellite data has failed to identify some of the smaller agricultural sites in residential areas, especially where properties are small and densely packed such as they are in townships, it is quite possible that the amount of agriculture taking place in areas of high poverty density has been seriously underestimated. This is borne out not only by the identification of many more agricultural sites in Ivory Park than those mentioned in the previous chapter, but also by the identification of agricultural sites in the area of Alexandra or the ward 95 of Diepsloot, which contain no agriculture according to the analysis of satellite data. The implication is that there are likely to be many more farms located in this type of poor area; farms which represent new potential to provide poor consumers with access to locally grown fresh produce. Of course, this does not invalidate the potential already recognised in particular areas by the previous chapter, such as in the area of Ivory Park and its surrounds, rather it enhances or adds to it.

Agricultural classifications

In the previous chapter, farmland was mapped according to crop type and cultivation strata. Ivory Park was found to contain small-scale farming and maize, with the surrounding wards containing low cultivation, small-scale farming, and smallholdings cultivation strata, and maize, pasture and soya beans crop type. Ward 113 of Dieplsoot was found to contain high, medium and low cultivation strata, and pasture, maize, soyabeans and horticulture crop types. No agriculture was found in Alexandra. Cultivation strata is a measure of the level of cultivation and so refers to the physical form of production as well as the scale and intensity. Most of the farms surveyed or interviewed would probably fall under the smallholding or small-scale farming classification. As expected in the analysis of the previous chapter, many were presenting alternatives in terms of their nature of production, often avoiding chemical inputs and replacing them with methods that enhance soil health, promote biodiversity, reduce waste, and limit pollution and emissions. The farms that irrigate using municipal water seldom use more than the free basic allowance from the municipality, make use of simple more water efficient irrigation techniques and practice water harvesting. Many of these realities could be attributed to lack of resources. A substantial number of the farms were practicing organic agriculture, which in addition to the sustainability benefits mentioned, is also believed to provide health benefits for consumers.

As predicted, the smaller scale of production linked well with smaller, more informal distribution channels, which are more empowering and accessible to poor consumers and do not compromise the benefits of a local food system by relocating produce. Comparing the scale of production and the distribution channels used confirmed that larger farms are generally more likely to supply the formal sector, however they were not more or less likely to make use of a conventional nature of production. It was found that larger more profitable farms were more likely to be cultivating in monoculture, although there were exceptions. Many of the larger surveyed or interviewed farms would still be considered small-scale, but a handful could possibly be classified differently, at least in terms of size. For instance, the largest interviewee, Luxting Pty, was larger in size than all but one of the farms mapped in ward 113, which were classified as low, medium and high cultivation. Whilst this farm did indeed supply to the formal sector, it also made produce available to local informal traders and directly to consumers. In terms of nature of production, the farm employed strictly agro-ecological methods, quite the opposite to the commercial nature of production preferred by the corporate food regime, even in its ideology. If this farm could be classified as low, medium or even high cultivation, speaking to the producer demonstrates how there is still the potential for food system alternatives amongst these agricultural classifications.

The only crop type classifications mapped in the study areas were pasture, maize, soya beans, horticulture and fallow. The surveys and interviews found that almost all of the farms grew vegetables

but the vegetable crop type was not recorded by the satellite data in these areas. Again, this suggests that this type of agriculture has been underestimated by the satellite data. As anticipated, there was little evidence of processing and most of the vegetables reached consumers as fresh produce, providing a good source of fibre, vitamins, minerals and other nutrients. Having excluded pasture and fallow, the most common food crop type mapped in the study areas was maize. 154 of the farms surveyed or interviewed were indeed cultivating maize. Because much of the maize grown in South Africa is milled into mealie meal, the country's staple starch, it was considered likely that this crop type could be processed, losing much of its nutritional value and creating the possibility that it would leave the area and lose the benefits of a local food system. There was evidence that exactly that had taken place in the past, but the distance to the nearest mill and the demand for unprocessed green mealies suggest that this form of foodstuff is preferable to farmers. It is also healthy for consumers, who obtain far more nutrition than from processed maize. There was no clear evidence from the survey or interviews that soya beans were being cultivated in the study area, although green beans and peanuts were being grown, with their associated benefits as legumes for the soil and the consumer.

Diepsloot, and Ivory Park and the surrounding areas, showed promising elements when mapping the potential for food system alternatives. In some ways, the reality exceeded these expectations. In Ivory Park there were many more farms than had been suggested by the satellite data used to map agricultural land. Combined with the identification of farms in other high poverty density areas like Alexandra, where no agriculture had been located in the previous chapter, this suggests that the satellite data has underestimated the amount of agriculture, especially where farms are small and located in densely populated residential areas. Speaking to producers confirmed that local food networks existed in the study areas, with their benefits to poor consumers in terms of accessibility, empowerment, sustainability and health. The types of agriculture taking place in reality, showed still greater potential for food system alternatives than what had been mapped previously, and the interviews and surveys demonstrated that this potential is being realised.

Conclusion

The areas studied for this chapter had the basic ingredients for a local food system that serves and benefits the urban poor – the occurrence of both agriculture and a high density of poverty. The benefits of being local, in terms of accessibility, empowerment, sustainability and health, could be compromised or enhanced by other characteristics of the food system. By engaging farmers in these areas, this study not only confirmed that such a local food system existed but also that the foodstuffs produced, the nature of production and the modes of distribution which characterised the system generally supported these benefits and added to them.

The researched farms represented a substantial amount of farmland and virtually all farms were productive. Estimates of production, based on the agricultural area and average yield rates, or based on income generated by farms selling their produce, correspond to large volumes of fresh produce being locally grown, most of which was expected to remain in the local food system as a result of the modes of distribution chosen. Almost all of the researched farms were retaining at least some of their produce for their own consumption, many of which didn't appear to be using other modes of distribution, especially many of the smaller farms. Of the purely subsistence farms, more than a quarter are under 20 square metres in area and more than half are under 50 square metres. Whilst subsistence is thus unlikely to be providing so much fresh produce, and only for those households involved in the researched farms (who do not represent the majority of consumers in the study areas), this mode of distribution has numerous benefits associated with it, especially in terms of empowerment and accessibility. There was also evidence that a number of farms were donating some or all of their produce to community projects or other worthy causes. Some farms were channelling all of their surplus production into initiatives in the community such as orphanages or school feeding schemes, whilst others were donating at least part of what they grew.

Many of the farms were selling some produce, and based on their much larger area, food entering the food system in exchange for money made up much of what was being grown locally, and the income generated by these farms suggests that it represents a substantial amount of food. The local community was being reached by most of the farms selling some or all of their produce. Almost all of these farms in the survey included 'local community' if they listed their outlets. All of the productive farms interviewed supplied fresh produce into the food system of the local community, even those which also supply to informal traders from elsewhere or to formal retail chains that would potentially take the produce through a longer distribution channel. By making it available in their area, directly or through vendors and hawkers, many of the researched farms were providing poor consumers with good access to food, with all the associated environmental, social and health benefits of locally grown fresh produce. Both informal traders and the farmers themselves were offering the produce from nearby locations and in small, affordable quantities which wouldn't require the consumer to get transport and which are particularly suited to the ways in which the urban poor source food. Operating at a small, local scale in terms of restocking and reselling, means the produce was likely to be relatively fresh considering the absence of refrigeration. In addition to these benefits, direct sale from the farm means that the produce can be sold fresh from the ground, and that the consumer encounters the production site and process, and engages with the people involved, discouraging the social and environmental externalisation of costs, empowering the consumer in their choice and establishing important and valuable relationships.

Most farms were making use of a variety of agricultural methods which improved their impact on the natural environment and may even have enhanced the nutritional value of their produce. Many farmers were practicing organic agriculture, refraining from the use of chemical pesticides and fertilizers and using alternative techniques such as composting and mulching, cultivating a variety of crops and combining them spatially and temporally through intercropping and crop rotation, limiting their irrigation and practicing water harvesting, and generally optimising on available resources rather than relying on external inputs. By doing so, these farmers were not only controlling pests and improving soil health, they were also protecting and enhancing biodiversity, limiting pollution and emissions, reducing water inefficiency and promoting circular resource use. Nature of production was highly varied from farm to farm, but almost all of those researched were practicing some combination of the sustainability measures enquired about.

Over 94% of the researched farms grew a variety of crops, almost all of which were vegetables, but there were also some fruits, legumes and other crops being cultivated. None of the crops required processing, and most were probably sold to consumers as fresh produce that had perhaps undergone minor processing locally, such as being divided or at most pickled or cooked. The only evidence of substantial processing was of maize, which had left the area from one farm in the past to be milled into meal. Although maize meal is staple in South Africa, the market for unprocessed green mealies and the necessity of transport to get to the mill was enough of a disincentive for the farm to have ceased having its maize processed – conditions which would also apply to the other 156 farms which grew this crop. As such, the crop type and foodstuff were unlikely to compromise the benefits of the local food system of the farms in the study areas, and by providing unprocessed fresh produce were enhancing the benefits in terms of health for urban poor consumers.

In summary, urban farms in the study areas were indeed realising the potential for food system alternatives which had been identified in the previous chapter. Not only was there much more production taking place, in terms of the number of farms and area of farmland, than had been expected, but the modes of distribution and the scarceness of processing meant that much of this substantial amount of food was being made locally available for poor consumers in the areas. The map of farmland found agricultural types which were very likely to be associated with more alternative forms of production and distribution in Ivory Park and the surrounding wards, slightly less likely in Dieplsoot's ward 113, and impossible in Alexandra, where no agriculture was found. Engaging with farmers revealed that the foodstuff, nature of production and modes of distribution which characterised the food systems of the researched farms in these areas demonstrated the realisation of this potential and more. The urban agriculture in these areas included a multitude of food system alternatives that would better serve and benefit the urban poor.

CHAPTER SIX:
CONCLUSION

In order to determine if and where there was potential in the City of Johannesburg for food systems to exist in which urban farms are serving and benefiting urban poor, the occurrence of poverty was mapped against the occurrence of different classifications of agriculture in the municipality. Much of the farmland in the City was located in areas which had high levels of poverty according to three ward-level measures, representing varying possibilities that these farms could be supplying locally grown produce to the many poor consumers living nearby. The associated benefits of a local food system in terms of accessibility, empowerment, sustainability and health, could be compromised or enhanced by other food system characteristics typically associated with the various crop type and cultivation strata classifications of the farmland. Having constructed a fairly complete picture of the potential across the City using this information, the research then explored the reality in a number of study areas.

There are areas of the City of Johannesburg where the types of agriculture taking place alongside much poverty, present an opportunity for consumers there to engage in an alternative food system which opposes some of the burdens of the corporate food regime. By engaging people involved in farms in Ivory Park and the surrounding areas, some in Diepsloot, as well as a handful in Alexandra, we could confirm whether their produce is being accessed by local consumers from the same poor area. We could also obtain direct evidence about the characteristics of these food systems, such as the foodstuffs produced, nature of production and modes of distribution employed. We can conclude that many farms in the study areas were presenting food system alternatives, meaning that their produce is indeed being made available to the local community in ways that will benefit them. The farms represent a substantial amount of healthy fresh produce, which is locally grown, and often produced in an environmentally friendly way. In addition to that produced for subsistence and donation, what is sold from most of these farms also enters the local food system. Not only is it made accessible in small, affordable quantities – where consumers are buying directly from the farm they are also escaping some of the disempowerment that comes with being distanced from one's food.

The farms analysed in the study areas made up about 65ha of agricultural land. This is equivalent to only 1% of the 6500ha of farmland mapped in the City of Johannesburg[28]. Comparing the types of agriculture in the study areas with that mapped in other parts of the municipality suggests that there

[28] Many of the researched farms did not seem to have been recognized by the satellite data, so their area does not strictly form part of the farmland which was mapped in the City

was already a relatively high potential for the farms in the study areas to be presenting food system alternatives. However, engaging with these farmers did not only confirm that farms in the study areas were indeed serving and benefiting the local urban poor, it also generated findings that relate back to the map of farmland across the municipality, and to urban agriculture in general. The following sections will draw together the conclusions about whether urban agriculture in the City of Johannesburg is providing access to fresh produce for the urban poor and whether the food systems which they influence benefit these consumers in terms of accessibility, empowerment, sustainability and health. The study then concludes by considering structure and agency in urban farmers' choices and suggesting some opportunities for further research.

Accessibility

The corporate food regime has failed to address hunger and, despite there being more than sufficient production, almost 800 million people around the world suffer from inadequate access to food (FAO, 2015). In a climate of rising social inequalities, food insecurity is rife and concentrated in low income areas of cities. Volatility in food prices hit the urban poor directly, via agribusiness and formal retail which are increasingly globalised. The market caters to consumers based on their spending power, and the food system is shaped accordingly the more it assumes the same logic, evident for example in the spatial and temporal neglect of the poor by supermarket retail. By operating in local food systems and making use of alternative modes of distribution, urban farmers in Johannesburg make food available in ways that are much more accessible to poor consumers.

Interviews were conducted with 18 urban farmers, and a survey with 454, all representing farms located in poor areas of the City. Of the 12 purely commercial surveyed farms, only one responded regarding the outlets for selling their produce and did not include 'local community' (five did not respond). Aside from that, all of the productive farms were supplying into a local food system by retaining produce for subsistence, donating to a local cause or selling to the local community. All of the interviewed farms that were producing food were supplying into local food systems. As a result of their location, these local food systems were all accessible by many poor consumers, as would be the case for much of the urban agriculture in the City of Johannesburg if it was to supply locally. Almost three quarters of the farmland in the City of Johannesburg was located in wards where nearby consumers were likely to be poor. This likelihood increases from the high absolute poverty wards, which contained about 40% of the City's agricultural land, to the high relative poverty wards, which accounted for over 30%, to the wards representing some of the worst concentrations of poverty in Johannesburg, which contained about 3% of the City's farmland. The latter high poverty density areas undoubtedly accommodate more agriculture than this data suggested, based on the evidence of the amount of agriculture in the study areas of Ivory Park, Diepsloot and Alexandra. Thus findings

regarding the amount and location of urban agriculture in Johannesburg indicate that it promotes food accessibility for the urban poor, if its produce is made available locally.

The combined area of farmland represented by the researched farms indicates that a substantial amount of food was being produced in the study areas, much of which was becoming accessible to the local poor consumer through various modes and channels of distribution. Farms which were selling part of their produce made up the greater proportion of this farmland and were producing an estimated minimum of R30000 worth of fresh produce each week. Not all of this was being made available locally. Although the vast majority of the farms in the study areas were supplying food into local food systems through one or more modes of distribution, a few farmers who were selling produce were choosing distribution channels that could relocate some of their produce. Adding the cost of transport to the price of the food is one way in which the accessibility benefits associated with local food systems would be compromised. Another concern with produce leaving these areas is that the food may become available in an area where consumers are not likely to be poor. Three interviewees supplied produce to informal traders from elsewhere. Although production would then not be as close to consumption, this form of distribution is typical of poor areas and is highly accessible to poor consumers, as described below.

Only the three largest farms interviewed sold to formal retailers, risking that this portion of their produce would be removed from the area and would be made available to consumers in ways that are not as well-suited to the needs of the urban poor. Looking beyond the study areas, many of the farms in the City are large in size and operate at scales that make this form of distribution more likely. There is hope in the increasing trend for supermarket branches to source locally instead of relocating produce to a centralised pack house for redistribution. On top of this, of the farms that sold some of their produce to formal chains, that may relocate it, all of them also retained or donated some and sold some locally. Two of the farms produced other crops just for the local market, whilst one growing only spinach sold about 25% of its harvest to local informal traders. Many other large farms in the municipality are located in poor areas where these alternative forms of distribution would be viable, even if in combination with more conventional value chains. Of the 15 productive farms interviewed, 11 sold to local informal traders and ten sold directly to consumers, eight of which sold directly from their farm.

These types of retail are readily accessible to the urban poor. They are conveniently located, thus saving money on transport, and make produce available in small affordable quantities, often with a discount or loan in times of need. Whilst they are options for farms of any size, these distribution channels are associated with smaller scales of production. About 13% of Johannesburg's farmland was classified as smallholdings or small-scale farming. Just under half of the smallholdings farmland

was in high absolute poverty wards, and 99% of the small-scale farming was in wards with high rates of poverty, many having high poverty density. In addition, the discrepancy between the satellite data and survey data suggest that many farms of these types were not identified in the mapping. Many smaller farms were retaining all their produce for subsistence. This may not constitute as much produce but this mode of distribution has numerous consumer benefits in terms of accessibility. The location is usually at or near the consumer's residence, the quantity is as desired, and there is usually no exchange of money, making this form of food provisioning a critical resilience strategy against the crises of the corporate food regime. There were a handful of farms which did not retain or sell any produce, but donated it all to a local cause. There were also farms which likewise grew food primarily as part of a non-profit project but sold some produce to support the project's other needs, and sites which sold their produce for profit but also donated some of it to needy initiatives or institutions in the local community. The donation of produce was not always easy to distinguish in the survey, making it a challenge to assess how many farms in the study area were donating produce and therefore difficult to infer about this mode of distribution in other parts of the City. But some respondents did provide specifics and, along with the evidence provided by the interviews, it is clear that donation of produce was one way in which food from the farms in these poor areas reached the local community with the associated accessibility benefits, and could be discovered in other areas where urban agriculture overlaps with poverty.

Empowerment

The concentration and consolidation of ownership and control in the corporate food regime has created massive power imbalances, such that decision-making about food has been increasingly confiscated from the hands of people by 'middle space players' (Clapp, 2013). By increasing the geographical distance between them, production and producers have been conceptually separated from consumption and consumers, and the human relationships that gave food its meaning have been replaced by successions of "faceless intermediaries" (Allen et al., 2003, p. 64) down elongated value chains, culminating in the commodification of food. Again, urban farmers in Johannesburg are choosing to supply locally and through alternative distribution systems, which destroy the veil between producer and consumer and re-establish accountability and personal relationships, translating into empowerment benefits for urban poor consumers.

As described in the previous section, most of the researched farms were realising the potential for local food systems that make produce available for the poor consumer living in the study areas. Where production occurs locally, the consumer is inherently more informed and familiar with the people and processes involved, meaning that social and environmental costs are less likely to be externalised and exchanges more likely to have relational value. The location of so much urban agriculture in the City

alongside high poverty rates, and the evidence that smaller farms in high poverty density areas has been underestimated, indicates that many urban farmers could be making produce available in ways that are more empowering, if they are supplying their local community. As with accessibility, this can be compromised by the choice of more conventional distribution channels, which may relocate produce so that it is no longer locally available to urban poor consumers, and in ways that are appropriate for their food provisioning practices. Distribution channels like supermarket chains are associated with larger scales of production, but even the largest interviewed farms also supplied produce into local food systems through subsistence, donation and sale to informal retailers or consumers themselves. The vast number of larger farms mapped in poor areas of Johannesburg may also be employing a combination of conventional and alternative forms of distribution like those in the study areas. Furthermore, the smaller farms in the City, many of which were probably not identified on the map of farmland, are almost certainly distributing their produce locally and via modes and channels that serve and benefit the urban poor in terms of empowerment.

In addition to the accessibility benefits of smaller, more informal retail, the exchanges these entail are often face-to-face, between people who come to know one another, enhancing both accountability and trust. The more direct the contact with the producer, the more informed the consumer is. Even closer than visiting the farm and seeing the produce being harvested, in the subsistence mode of distribution, the consumer *is* the farmer by definition. The consumer benefit of accessing produce without the need of money is definitely related to empowerment as well as accessibility. Very few of the productive researched farmers (only one interview and 17 survey respondents) were not retaining some produce for subsistence. Some of these non-subsistence farms were large scale, but some purely subsistence farms were also relatively large and others that combined subsistence with other modes were amongst the largest researched farms. Thus, for all scales of production, subsistence cannot be ignored as a possible food system alternative in the rest of the municipality, by which urban farmers make food available, albeit to their own households, with all the associated empowerment benefits of this mode of distribution, in addition to those of a local food system. Judging by the larger combined area and the estimated earnings of farms selling produce in the study areas, sale of produce would extend the reach of farms in the City to many other households, accompanied by various empowerment benefits wherever more alternative distribution channels are chosen in favour of or in combination with more conventional ones.

Sustainability

South Africa has been an arid country with relatively poor soils ever since agriculture began, but water pollution, erosion, climate change, and numerous other forms of environmental destruction, are further threatening this limited agricultural resource base. Our naturally high biodiversity is also in

peril. The nature of production which characterises the corporate food regime is a major contributor to this danger. Chemical fertilizers, pesticides and herbicides run off into fresh water and decimate beneficial life, eventually resulting in reliance on piped irrigation and synthetic inputs as the soil, water and agro-ecology are no longer heathy enough to support food production naturally. Genetically modified seeds accelerate this cycle of dependence and support the extension of entire landscapes of monocultures. Aside from jeopardizing resilience, the farmer's self-reliance is whittled away. Greenhouse gases emitted as a result of on-farm fossil fuel consumption and other inappropriate agricultural practices, add to the emissions of the transport and cold chain infrastructure which support ever-lengthening food distribution chains. The poor are most vulnerable and least able to adapt, as the variety, availability and affordability of food is compromised, now and in the future. Johannesburg's urban farmers are reducing the distance which food must travel and are adopting agricultural methods and practices that limit environmental damage and even enhance the local ecology, making for more sustainable food systems.

As anticipated, many of the small researched farms were associated with food system alternatives in their nature of production, but so were many of the large researched farms. Nine of the 15 productive farms interviewed stated that they practiced organic agriculture, as did two thirds of the survey respondents. This included farms of all sizes. Similarly, when enquired in the survey regarding the independent use of particular methods and techniques for sustainability, almost all farms reported making use of some combination of these. The most common was the use of compost (nearly 80% of respondents), followed by crop rotation (over 70%), never using chemical fertilizer (two thirds of respondents), intercropping (over 60% of respondents), never using chemical pesticides (over half), mulching the soil (just over half), and then harvesting water (over a third). About two thirds of the survey respondents irrigate with municipal water but most use less than the free basic allowance of 6 kilolitres – only 85 farms pay for water (from R50 upwards). Many of these practices improve efficiency and follow nature to make optimal use of what is available, making them good options for resource poor farmers. Assuming that this is related to their location in poor areas, this would thus be the case for farms located in other poor areas as well.

Whilst the vegetables crop type had no theoretical influence on the nature of production, in the classification of mapped agriculture, it overlapped predominantly with high cultivation and pivot irrigation cultivation strata. Almost all of the researched farms were growing vegetables. This implies that this crop type is probably even more abundant than the map of farmland suggests. It is possible that many of the small-scale farming and smallholdings for which the crop type was unidentified or 'unclassified' could be vegetables. This constitutes about 184ha or 21% of these cultivation strata. It is also probable that the farmland not recognized by the satellite data, expected to be mostly small farms in high poverty density areas, would be producing vegetables. These three characteristics of

these (additional) farms would translate into sustainability benefits as a result of the associated nature of production and the likelihood of being locally situated for urban poor consumers.

On the other hand, the maize and soya beans crop types were associated with nature of production in two ways: by definition, farmland classified as either of these was assumed to be growing in monoculture, and, these two crop types were very likely to be genetically modified, since most of their production in South Africa is. Soya beans were not being grown by the researched farms. Of the 154 surveyed farms growing maize, only three were cultivating in monoculture and all of these were small (16, 50 and 168 square metres respectively) and retaining their produce for subsistence. Maize farms surveyed or interviewed in the study areas thus differed from what was expected from those mapped across the municipality, and even mapped in the study areas The largest (by definition, monoculture) maize farm recognised by the satellite data was located in ward 110, just outside Ivory Park. Not many of the researched farms were cultivating in monoculture (one interviewee and 23 survey respondents) and whilst they differed in size and mode of distribution, a disproportionate number were large commercial farms. That being said, even these farms employed many food system alternatives around their nature of production, often in diverse combinations. The largest researched farm, cultivating a monoculture for purely commercial distribution, employed strictly agro-ecological methods, which are completely inimical to those characteristic of the corporate food regime. The survey didn't enquire about genetically modified seed, but 70% of the farms growing maize were practicing organic agriculture, which would preclude its use. These findings suggest that neither larger scale cultivation strata classifications nor the vast amount of farmland classified as maize in the City can be assumed to be unsustainable in their nature of production by virtue of these classifications alone.

As with the sections above, the sustainability benefits of local food systems, connected in this case to the reduced need for transport for instance, are anticipated for urban agriculture in poor areas across the City, wherever it is supplying the local community. The findings from the study area confirm the hypothesis that this is especially likely where the vegetables crop type and the small-scale farming and smallholdings cultivation strata occurred. However, as above, the results also indicate that the other classifications of farmland could provide sustainability benefits as well.

Health

The dominance of Big Food in the corporate food regime means that highly refined, nutrient-poor, calorie-rich, fatty foods, commercially packaged by industrial food processing giants, fill the shelves of massive supermarket chains, representing the cheapest, most accessible energy option for poor consumers. The slanted distribution of formal retail in favour of higher income areas makes poor

consumers rely on supermarkets less regularly. This reinforces these unhealthy food choices, in spite of the variety on offer in some cases, because these products are not as perishable, which becomes important when purchases are less frequent and require transport, combined with a lack of storage and refrigeration. The resulting diets lead some members of the same household to suffer from undernutrition, causing high mortality and stunted physical and mental development in children, whilst others suffer from overnutrition, causing obesity and other non-communicable diseases. In addition, the low dietary diversity and insufficiency of fruits and vegetables is resulting in widespread deficiencies in essential nutrients such as fibre, protein, vitamins and minerals. Urban agriculture in Johannesburg is supplying foodstuffs that resist the nutrition transition of the corporate food regime. By making fresh produce available locally, urban farmers not only reduce the economic, social/societal and environmental costs detailed above, the time since harvest is also typically reduced, meaning foods are more likely to be fresher and retain its nutritional value. These farmers retain the health benefits associated with local food systems and fresh foodstuffs when their produce does not leave the area to be processed. Even choosing food system alternatives related to nature of production is argued to translate into consumer benefits for the urban poor in terms of health.

Almost all of the researched farms in the study area were growing vegetables and the vast majority of these were making them available locally and unprocessed. As detailed in the previous section, the results of the surveys and interviews suggest that the amount of farmland producing vegetables had been underestimated in the map of agriculture in Johannesburg. Vegetables already represented a vast amount of agricultural land in the City, but much of this was associated with large scale cultivation strata. The additional vegetable farms could include farmland that was identified on the map but not classified by crop type as well as formerly unrecognized farms, and would probably be mostly small in scale. Whilst it may not combine to be as much as the 1075ha of farmland already classified vegetables, much of which is pivot irrigation and high cultivation, these additional vegetable farms should not be assumed to represent an insignificant volume of production. Extrapolating the amount of vegetable farming taking place in the study areas, in which no vegetable farming had been mapped at all previously, suggests that the City of Johannesburg accommodates a vast amount more vegetable production in poor areas.

Findings from the study areas indicate that the farming throughout the municipality which wasn't identified by the satellite data would probably small in scale, located in high poverty density areas and growing vegetables. These three characteristics would make healthy fresh produce more likely to be accessible locally for poor consumers and more likely to remain local as a result of the modes of distribution associated with smaller scale production. These food systems would thus provide, as a result of being local, the health benefit that the food would be fresher the closer consumption came to production – which could be as close as direct-from-farm or even subsistence, in which case produce

could be fresh from the ground. The food systems would also provide the health benefit of nutrient rich vegetable foodstuffs.

The interviews suggest that such farms are unlikely to remove the produce from the area to be processed if they are vegetables, although there was evidence that this had occurred for maize in the past. The farm which had sent maize out of its local area to be milled had ceased doing so because the distance was a disincentive and there was sufficient demand for green mealies to sell their maize unprocessed instead. Like with the nature of production associated with maize, the findings from the study areas support the conclusion that all the maize farming in poor areas of Johannesburg cannot be assumed to be producing mealie meal as a foodstuff, despite its importance as a staple food. Rather, the nature of local production in poor areas of the City favours unprocessed green mealies, and thus the subsequent health benefits associated with this food system alternative.

In summary, whilst the map of agriculture and poverty in the City of Johannesburg located a number of areas with potential for food system alternatives that would serve and benefit the urban poor, engaging with food producers in the study areas confirmed that this potential is being realised by urban farmers. The various crop type and cultivation strata were associated with food system characteristics that differed in their likelihood to result in the four types of benefits for the urban poor. The study areas were selected because of their high poverty density and because they contained types of agriculture that had the highest probability for food system alternatives. In reality, they were dominated by smaller scale farms growing vegetables, which the survey and interviews demonstrated as providing numerous consumer benefits for the local urban poor. The results also suggest that the municipality contains many more farms like these which were not recognized by the satellite data. But the study areas also included some larger farms, and some producing other crops such as maize. Findings from these researched farms indicated that the potential for other classifications of urban agriculture to generate food system alternatives should not be ignored, especially those located in other poor areas of the City. Although issues of land size, for instance, had an impact on food system characteristics, in the end some farmers chose alternative options, in spite of what could be expected. The choice to engage in urban agriculture, the choice of what to grow, the choice to employ a particular agricultural approach, the choice to retain what is grown for subsistence, or the choice to sell it and what channels of distribution to employ, are all the complex results of structure and agency

Structure and agency

Substantiating what the literature proposes, engaging with farmers in the study areas made clear that the complexity of the food system presents numerous opportunities for the people involved to do things differently, in this case for urban farmers to make choices about the foodstuffs, nature of

production and modes of distribution which characterise the food systems they operate in. These choices result from the reciprocal influence of structure and agency. "In one sense the very notion of a 'farmer', as an individual actor, an agri-culturalist, implies agency, implies spatially and socially differentiated action and activity" (Winter, 2005, p. 613). The proof of agency in the context of the corporate food regime's powerful normalising forces, is the proliferation of difference (Ilbery & Maye, 2005). By demonstrating the incredible variety in combinations of food system alternatives occurring in the study areas as a result of the urban agriculture taking place there, this research shows how the agency of urban farmers, shaped by structure, can be at the root of relieving the urban poor from some of the impacts of the corporate food regime in terms of accessibility, empowerment, sustainability and health.

Throughout the research, the notion was reiterated that food system alternatives result from the combined expression of structure and agency. There was evidence of some of the factors that play a role in the decisions of the farmers. For example, the size of the land influenced the modes of distribution which a farm made use of, with farms selling all or part of their produce generally being larger than those retaining everything for subsistence. Or again, the scale of production influences their ability to supply to the formal retail sector. However, the complexity of combinations of food system characteristics shows that there are many considerations behind the farmer's decisions about what to produce and how, and in what ways to make it available. This research was careful to emphasise that the motivations of those involved in a food system alternative need not be alternative, and that choosing an unconventional option may even be out of necessity. Further research could qualitatively explore the constraints and limitations and other factors which result in the farmer's pursuit of the alternative over the conventional.

A study which looked into the motivations of urban farmers in Johannesburg involved in food system alternatives would need to take similar cognizance of both structure and agency, factors limiting choice and factors enabling choice. We know that there are a number of structural factors, which impact farmers' choices. And many of these are considered unjust and are at the heart of struggles against the corporate food regime. Protecting the farmer's freedom and independence to choose is a key principle in the food sovereignty movement, for instance, which therefore campaigns around issues like access to land and inputs, democratic control of food policy and freedom from dependency (Cherry, 2016). Exposure to such campaigning and awareness raising about structural limitations and exogenous restrictions to farmer choice can in turn have an impact on some of the more endogenous factors. The motivations behind a farmer's decision to use a low input nature of production, for instance, may turn from economic to more ideological. Although the choice is the same, the primary reason behind it may now be that the farmer identifies as an activist, rather than the price of chemical inputs. The very same symptoms of the corporate food regime may be what is pushing urban farmers

to adopt alternative ways of producing and distributing, both out of necessity and out of explicit rejection of the status quo. On one hand, the consolidation and concentration of the food system into global market agribusiness and supermarket retail has excluded urban farmers that are not big enough to fit in, forcing local food producers with less access to resources to make use of a low input nature of production and smaller more informal distribution channels. On the other hand, the injustice of the current system could foster the farmer's political and ideological desire to initiate a more socially, economically and environmentally just food system in critical opposition to the corporate food regime.

Writing about urban agriculture in the City of Johannesburg, Greenberg connects the vital "fighting for an alternative" to "human agency" in the following quote:
"*It is clear that, whatever the revolutionary aspirations, the majority of the South African and African population are struggling for survival without a clearly formulated collective political project to escape from this situation. A sustained collective project is most likely to emerge from the harsh, unbeautiful, but also creative and beautiful, ways that people find to survive and to resist, in the positive sense of fighting for an alternative, however unclearly visualised. There is a dialectical relationship: resistance creates the conditions for the expansion of human agency/creativity.*" (2006, p. 28)

Such a study of what motivates farmers' choices would hopefully gain from this research, which looked into the choices themselves, made by farmers, and their implications for food system alternatives. By highlighting the dynamic and diverse examples of urban farmers acting within the food system, this research demonstrates how, regardless of motivation, the corporate food regime is being opposed. Many frame urban agriculture in such a way that farmers appear to have no agency, seeing local production either as "a stepping-stone to commercial production at an ever-increasing scale," (Greenberg, 2006, p. 20) "premised on a mainstream commercialisation model for urban farmers" (Malan, 2015, p. 65), or as "a last resort for poor households, rather than a choice" (McLachlan & Thorne, 2009, p. 11). Instead, this research has replanted urban agriculture in the complex environment of food systems. By unearthing the farms at the roots, and tracing these to some of the features of these food systems that stem from them, we see the flourishing of forms that differ from the conventional. Whilst the external conditions influence the growth of these food system alternatives, the farmer has an essential role in cultivating them. And so, in what seemed to be an unbroken monoculture landscape dominated by the characteristics of the corporate food regime, we see the sprouting of difference, yielding benefits to urban poor consumers in terms of accessibility, empowerment, sustainability and health, and perhaps spreading the seeds of a more robust and radical food system transformation.

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APPENDICES

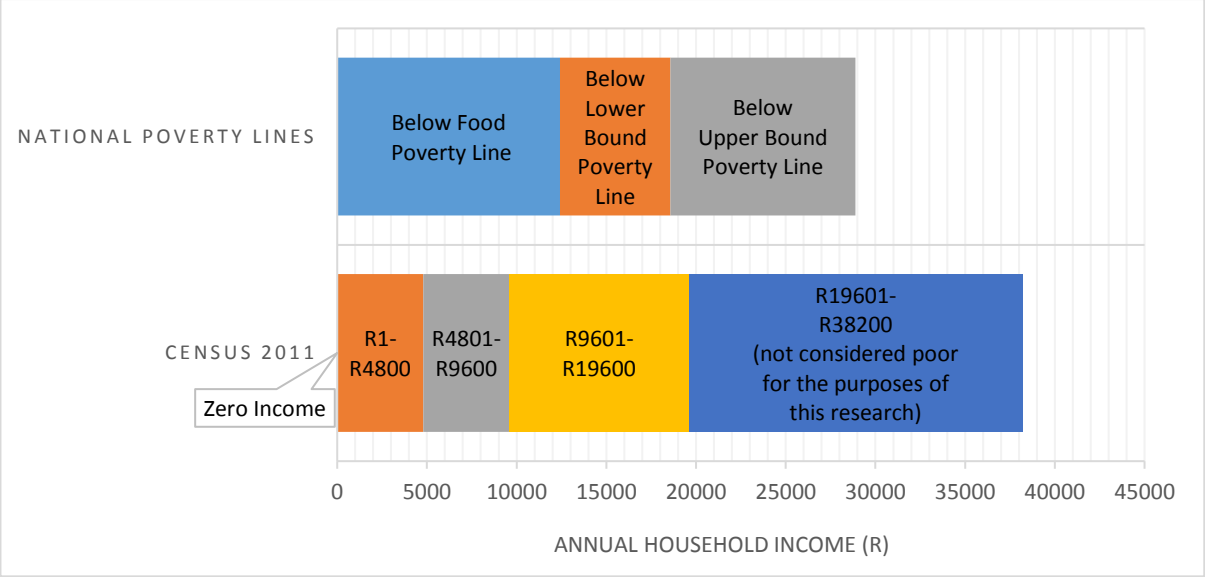
Appendix A: Definition of a poor household used in the research in comparison to national poverty lines

The definition of a 'poor household' used by this research aligns with that suggested by a 2015 review of poverty and income based on Census 2011 (Statistics South Africa, 2015a) and corresponds with that used by other studies (City of Johannesburg, 2004; and De Wet et al., 2008). As detailed in the chapter on methods, the definition makes use of the income bands reported in the census and these not based on a specific poverty line, so it is illustrative to see how these bands compare to the official national poverty lines. Many monetary measures of poverty make use of poverty lines. Relative poverty lines support a shift away from a purely economistic idea of poverty, towards one in which poverty is understood as exclusion from the general level of welfare and standard of living in one's society. But in a country such as South Africa, where much of the population are not meeting their basic needs, the standard is set too low and an absolute poverty line is generally more useful (Department of Social Development, 2007). In this case, a poverty line is a calculation of the minimum amount of money you need to survive, such that those who fall below that line can be said to be living in poverty.

In 2015, Statistics South Africa rebased the national poverty lines on a cost-of-basic-needs approach (Statistics South Africa, 2015c) by updating and reweighing a basket of goods and services, including both food and non-food, based on the Income Expenditure Survey from 2010/11. By using observed expenditures, such as those on food, this 'semi-normative approach' tries to acknowledge the types of lives and diets customary to the society, from which the poor are excluded (Department of Social Development, 2007). In terms of 2011 prices, this set the Food Poverty Line (FPL) at R335 per capita per month, below which one can't afford enough of the food typically purchased by South Africans to meet a minimum energy intake of 2100 kilocalories. The upper and lower bound poverty lines include the consumption of non-food basic necessities such as clothing, shelter, transportation, education, etc. In terms of the consumption of non-food basic needs, there is no universal standard such as the minimum energy intake for food, so lower and upper bound poverty lines are determined to represent the lower and upper bounds of the additional non-food component (Statistics South Africa, 2015c). The Upper Bound Poverty Line (UBPL) was rebased at R779 per capita per month, below which someone is unable to meet their basic needs and can be considered poor. The Lower Bound Poverty Line (LBPL) was rebased at R501, using reference households whose expenditure on food was below the FPL, indicating that some basic food-needs are being sacrificed in order to meet their non-food requirements. The per-capita per-month poverty lines described above were derived by considering

the size of the household, with adults and children eventually being considered equal members (although this is not always the case in the methods of other countries) (Department of Social Development, 2007). As such, to calculate the poverty lines in rands per-household per-year one should multiply the current figures by the average household size in the City in 2011 (3.09 people per household (South African Cities Network, 2016)) and by 12 months. This puts the food poverty line at R12 422 per household per annum, and the lower and upper bound poverty lines at R18 577 and R28 885 per household per year respectively.

Graph 1 below plots both the income bands used by the Census, and the national poverty lines, in terms of average annual household income. This comparison reveals that the zero income households and all of those in the bands of annual household incomes from R1-R9601 would be considered unable to meet their basic food needs. In the R9 601-R19 600 annual household income band, some are below the food poverty line, whilst others would be between the food poverty line and the lower bound poverty line and therefore unable to simultaneously meet both their basic food and non-food needs, having to spend some money required for food to meet their non-food requirements. Still within this R9 601-R19 600 band, households with an annual income above R18577 would be between the lower and upper bound poverty lines, in which case they would be able to meet their basic food needs, but would not be able to meet all their basic non-food needs. However, households reporting annual incomes above R19601 and therefore not defined as poor households for the purposes of this research, would still be below the upper bound poverty line if their annual household income doesn't exceed R28885. In order to incorporate these households into the definition of poor, whilst still making use of Census 2011 data, this research would need to include the R19 601–R38 200 annual household income band. This R19 601–R38 200 income band contains the largest proportion of households at the city level at 16.78% (the zero income band contains 16.74% of households), and the same is true at the level of many of the individual wards. Since all of these households would be able to meet their basic household food needs, and many are not considered to be in poverty at all according to the R28 885 upper bound poverty line, for the purposes of this study households in the R19 601-R38 200 income band will not be defined as poor.



Graph 7: Horizontal bar graph comparing the national poverty lines to the average annual income categories of the Census which were used to define a poor household and so formed the basis of the mapping of poverty

This is in line with the Statistics South Africa 2015 review of income and poverty quoted above (Statistics South Africa, 2015a), but should be seen as quite strict in its definition of poverty, considering that 'poor households' include those below the food poverty line, those below the lower bound poverty line and only the poorest (not all) of those between the lower and upper bound poverty lines. A less restricted definition of poor households based on annual household incomes, for example, is used by the Council for Scientific and Industrial Research (CSIR), based on a classification developed in 2013 by the Bureau of Market Research at the University of South Africa (UNISA), which includes all households reporting annual incomes from R0 to R54 344 in 2011 (CSIR, 2015). Thus, in reading the results of this research, one should bear in mind that all 'poor households' are experiencing real poverty and are considered unable to meet their basic needs, including some who cannot even afford enough food from day to day.

Appendix B: Farmer Survey

Member registration survey

Member's ID	Automatically generated
Consent Form ID	Completed by researcher
Member's name	What is your name?
Member date of birth	What is your date of birth?
Member gender	Are you male or female?
Member marital status	Are you single, married or widowed?
Member race	What is your race?

Baseline survey

Baseline survey ID	Automatically generated
Member ID	Selected by researcher
Garden ID	Linked to member ID
Consent Form ID	Linked to member ID
Garden Size	Size of the garden in square meters – measured by researcher
Fencing	Describe the fencing around your garden. No Fencing Poor Good Very Good
Gardening Benefits	What benefits do you get from your garden? Self Employment Feed your family Income Other
Gardening days	How many days per week do you work in your garden?
Dependants	How many household dependants do you feed? Less_than_5 5_to_10 more_than_10
Garden Helpers	How many family members or friends help you in your garden? none 2_to_5 6_to_8 More_than_8
Equipment	What farming equipment do you have access to?
Wet season Crops	What crops do you grow during summer? Amadumbe Beetroot Brinjal Butternut Cabbage Carrot Chilli Chomolia Crops Kale Lettuce Maize

	Mint Onion Onion_Red Onion_Spring Peanuts Pepper_Green Potato Pumpkin Spinach_Broadleaf Spinach_China Sweet_Potato Tomato Other
Dry season Crops	What crops do you grow during winter? Options as above
Water Source	What is your source of water?
Pay For Water	Do you pay for water?
Chemical Fertilizer	Do you use chemical fertilizer in your garden? Never Sometimes Always
Chemical Pesticide	Do you use chemical pesticide in your garden? Never Sometimes Always
Composting	Do you use compost or manure in your garden? Yes No
Know Organic Farming	Do you know what organic farming is? Yes No
Practice Organic Farming	Do you practice organic farming? I_would_like_to_learn Yes No
Crop Rotation	How do you practice crop rotation? Planting_different_crops_each_year Planting_crops_in_rows Dont_know
Intercropping	How do you practice intercropping? Do_not_know Growing_different_crops_in_different_fields Growing_different_crops_in_the_same_field
Water Harvesting	How do you practice water harvesting? Collecting_and_storing_Rainwater Water_Treatment Do_not_know
Mulching	How do you practice mulching? Covering_Ground_of_crops Harvesting_Mature_Crops Do_not_know
Keep Records	Do you keep records of your farming activities? Yes No

Record Types	What information do you keep records for? Amount Harvested Area planted Crops Expenditure Harvest Dates Compost / Manure volumes Pest or Disease controls used Planting Dates Sales Weeding time Other
Sell Produce	Do you sell your produce? Yes No
Earnings From Produce	How much do you earn per week from selling your produce? None Less_than_R50 R50_to_R100 R100_to_R200 More_than_R200 More_than_R4000
Photographs	Photograph of member, garden and crop captured by researcher
GPS Location	Recorded by researcher

Outputs survey

Member ID	Selected by researcher
Garden ID	Linked to member ID
Consent Form ID	Linked to member ID
Production Type	What type of production takes place on the farm? Not_Productive Subsistence Semi-commercial Commercial
Selling Products	Are you selling what the farm produces? Yes No
Outlets	What are the outlets for your produce? Local_community Local_market School_or_creche Agrihub Other
Current Products	What are you current products? Non-organic_fruit Non-organic_veg Organic_fruit Organic_veg Traditional_crops Medicinal_herbs Other

Appendix C: Interview schedule

The farm

What is your involvement with the urban farm?

How large is the site?

Where is it located?

Nature of production

What type of agriculture is practised there?

How many people are involved in the farm and in what capacity?

The produce

What is produced on the farm?

More or less how much is produced of each item at the height of the season?

Mode of distribution

What happens to what is produced - to whom is produce made available?

Are the people involved in the farm the only ones who receive produce from the site or does some produce go to others, through sale or other channels?

How is it made available – given away, in exchange for labour, sold for cash?

In what quantities and at what prices is it made available?

Appendix D: Ethics clearance certificate

school of SOCIAL SCIENCES

SOSS Human Research Ethics Committee

Clearance Certificate

Protocol Number:	DEV16/06/03
Project Title:	Does non-subsistence urban agriculture in Johannesburg provide urban poor with access to fresh produce?
Investigator's Name:	Stacey Hope-Bailie
Department:	Development Studies
Date Reviewed:	3 June 2016
Decision of Committee:	Approved / Unconditionally
Expiry Date:	3 June 2018
Date:	2 August 2016
Head of School	Professor Shahid Vawda
CC supervisor:	Prof Michelle Williams

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Declaration of Investigator

To be completed in duplicate and one copy to be returned to Ms. Rita Kruger in the School of Social Sciences, Room CB 152.

I fully understand the conditions under which I am authorised to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. If any departure from the research procedure as approved, I undertake to resubmit the protocol to the committee.

Student Signature

Date