

Urban Agriculture

A case study of Quito, Ecuador

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This is for my grandmother, a force of nature, if there was ever one.

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#letsunpackthis

Abstract

Urban agriculture can be one of the many solutions that a city employs as a part of its larger sustainability strategy. It can have many advantages: food security, employment, better utilisation of public spaces, safer and better food production and economic empowerment of disadvantaged groups. But in the context of nature-based solutions (NBS), urban agriculture needs more evidence to support it as a viable solution. This thesis is a case study of the city of Quito, Ecuador. It elaborates upon the programme by responding to two questions: firstly, what were the reasons that led to the setting up of the programme and what difficulties it faces or has faced over time, and secondly, what impacts has the programme had on the sustainability of the city.

This thesis uses the EKLIPSE framework to evaluate the outcomes of the urban agriculture programme and to put them in the context of NBS. Several factors played a pivotal role in shaping the programme, starting with the petroleum-fuelled economic boom of the 1970s. Flawed agricultural policies from around the same era, coupled with an economic crisis in the late 1990s also helped play a role in accelerating the scaling up of the programme. The programme has aimed to be an inclusive one since its inception and it has continued to address socially vulnerable groups till today. A multi-stakeholder approach has given the programme wide acceptance among various groups within society and it has thus ensured its own continuity among various political regimes.

Policy level inclusion of the programme has just begun to take place and the city is planning to come out with a food policy that gives urban agriculture a role in the city's food system. In terms of key outcomes, the economic benefits have been considerable in that a significant number of people are directly or indirectly dependent on urban farms. It has also resulted in reduction in expenditure on food for families. Communities can come together as farms create social spaces and opportunities for interaction. Environmentally, it has reduced the distance travelled by food to get to the city and helped preserve biodiversity by encouraging a wide diversity of crops as well as animal husbandry.

Keywords: urban agriculture, Quito, South America, Ecuador, sustainability, nature-based solutions

Executive Summary

This thesis addresses a few issues surrounding urban agriculture: specifically, why does a city implement urban agriculture as one of its sustainability strategies and what can the results of such a programme be. These two themes are explored in the context of Quito, Ecuador, a city of 2.5 million residents in South America. This city was chosen as it has one of the demonstrably successful urban agriculture (known as AGRUPAR) programmes in the world and can hold important lessons for other cities in the world in terms of how a successful programme should be conceived, planned, implemented and measured. The thesis responds to the following two questions to achieve its main objectives:

1. What are the drivers, obstacles and benefits of urban agriculture in Quito?
2. What are the outcomes of the urban agriculture model in Quito with respect to the three pillars of sustainability?

Both questions for thesis are explored through the lens of Nature Based Solutions (NBS), which uses ideas and concepts from nature to solve various problems such as air pollution, flooding, climate control etc., in an urban setting. The first question explores why the city implemented urban agriculture, in terms of the social, political and economic situation of the city at that point in time. Then it identifies the obstacles it faced before, during and after the implementation of the programme as well as those it faces currently. The second question addresses the actual outcomes of the programme considering the three pillars of sustainability: economic, environmental and social. For future research that looks at the transferability of such programmes, this question might be of importance as it addresses outcomes of the programmes considering the set of conditions which resulted in it taking a certain shape.

The thesis follows two research methodologies towards its intended outcome: a literature review and field interviews. The purpose of the literature review is to synthesise and analyse existing knowledge in the field, as urban agriculture has been well researched over the past three decades and more. Gaps in the literature have been filled in using interviews and data collection in Quito in person. Several stakeholder groups were interviewed during the research including farmers, NGOs and city government (both current and past) officials. Citizens were not interviewed as it was difficult to obtain a meaningful sample size during the one month field research in Quito. Language was a challenge for the research, in the sense that while a good quantity of data was gathered, a translator was required for many interviews.

Around the year 2000, Quito was going through a unique situation, economically as well as socially. Socially, decades of petroleum-fuelled economic expansion had greatly increased GDP growth rates and brought in a lot of foreign currency. The increased growth rates manifested itself in certain sectors like real estate in cities, which in turn created a demand for jobs; consequently, large scale migration happened and the city's population more than doubled during this time. Land reform policies, starting in the mid-1960s also exacerbated migration into urban areas as they were not properly implemented causing rural populations to leave in search of better opportunities. The third reason behind the migration was the policy of import-substitution industrialisation which caused a build-up of industry, mostly in and around major cities in Ecuador including Quito. This created jobs as well and contributed to migration into Quito from the countryside.

Economically, the country was facing a crisis and the currency was replaced by the US Dollar, also known as dollarization. This move, combined with several other factors caused a

contraction in the GDP of the country and many industries/businesses had to close, which led to an unemployment level as high as 45 percent in Quito. It was at this time that the city started exploring avenues to be able to put its citizens back to work. Several programmes were started which were aimed at the vulnerable communities within cities, like women and Andean migrants. One of the programmes was the urban agriculture programme, which was going on already on a trial basis, which the city government decided to upgrade to a pilot programme.

Unemployment was the major economic driver that led to the institutionalisation of the urban agriculture programme. The programme, which was initially being run on a trial basis by several international aid agencies gained support in the mayor's office as it had potential to create jobs as well as feed families to a certain extent, especially those with very low incomes. This presented a lot of barriers as well, since the idea was to ensure that farmers were the only ones that benefitted from the sale of their produce, and not middlemen as has historically been the case. Currently, there is a perception among citizens that food produced within the city (which is organic) is much more expensive as compared to food at the supermarkets. This research has produced anecdotal evidence that it is not so. Lack of education among consumers, both in terms of advantages of organic food as well as knowledge of where to procure it, has hindered demand from the consumer end.

Socially, the city government set out to make the programme as inclusive as possible. It did so by reaching out to the thousands of already present community-based organisations and clubs. This offered two advantages: reaching a large section of the population and reaching across economic divides among the population. The development agencies involved like the UNDP also conducted city consultations which included a wide variety of stakeholder groups to get feedback as well as to promote inclusiveness. A combination of other factors worked towards urban agriculture's advantage as well: availability of land within city limits, people's prior knowledge and acquaintance with agriculture and the enthusiasm of stakeholder groups. It is this popularity that has helped the programme to continue even under different political regimes as it has wide popular support. In terms of barriers, growing popularity of supermarkets among the people is a major one, especially as these supermarkets are one-stop shops for multiple goods, including food. As mentioned earlier, customer demand is something that is another barrier, but one that can be overcome using education.

Institutionally, the city's government put its resources, both monetary and human, behind the programme. The programme had support from the mayor's office as well. One of the key aspects of the programme was that the city was in charge of conceptualising and running the programme entirely, with technical and knowledge support being provided by outside institutions. This possibly led to the city being more invested in this programme as compared to other examples. For the first time, the city experimented with temporary land use permits that allowed cultivation on land that was lying fallow. A barrier from the private sector has been the reluctance of supermarkets to source products from small producers. Logistical issues, such as those faced by farmers who cannot afford to transport their produce to the marketplaces, present a barrier that is yet to be overcome.

In terms of economic benefits, the programme is associated with more than 1,300 urban farms in Quito and it has trained about 16,000 people since its inception. In addition to crop farming, diversification in production is encouraged, with many farmers branching out into activities like beekeeping, small animal and poultry production as well as food processing like jams and preserves. Thanks to technological inputs, farmers are also able to grow high-return crops such as tomatoes in Quito, which is usually difficult as the city is at a high altitude. AGRUPAR has also started weekly fairs or 'Bioferias' so that farmers have an outlet to sell produce to the citizens. After starting farms, farmers have reported monthly savings in food

expenditure between 30-80 percent depending on farm and family size. Some who have scaled up production also report significant incomes from the farms.

The environmental outcomes for the programme have also been significant. Most surveyed participants held the view that personal environmental awareness had increased significantly because of their participation in the programme. The programme also contributes to maintaining local food and biodiversity by encouraging the cultivation of more than 70 different types of crops in farms. Bug/pest control is also carried out using organic-friendly methods. Composting is another aspect with significant environmental advantages. Farms under the programme are composing about 3,120 tonnes of organic waste every year. There are also definite reductions in food-miles travelled since locally grown food substitutes food coming from outside the city, but that has not been quantified in any study so far.

Several social outcomes were also reported during research by participants. The first was that community gardens provide citizens with a sense of space to socialise in. This led to more interactions between members of the neighbourhoods where the farms are located. In another group of farmers, the reported outcomes were a significant improvement in health in both adults and children. Senior citizens, especially, found such farms to be space for exercise and recreation. As women are the driving force behind these farms, they also stated it helps with empowerment and skill development. Resilience is another outcome as stated by city officials. It is an activity that helps with post-disaster rebuilding efforts as vulnerable populations have an economic activity to help them get back on their feet as Quito is prone to natural disasters.

Overall, this thesis has found the urban agriculture programme in Quito to be one that is delivering multiple benefits to the city's residents, especially the socially and economically vulnerable ones. Although the programme was set up fifteen years ago to help solve a specific set of problems, the programme now continues to address those as well as new ones that have come up over the course of time. In terms of outcomes, it is a programme that contributes to the three pillars of sustainability, in a cost-effective way. Barriers do exist within the programme and need to be overcome, but these also present a new opportunity and reason to expand the programme beyond its current scope.

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1 Introduction

Urbanization has been a persistent and growing trend in the recent past: much of it has occurred over the past sixty years. 2007 was the first time in history that the number of people living in urban areas exceeded those living in rural areas. This phenomenon has since endured and by 2014, 54 percent of the world's population lived in urban areas. It is expected that about 66 percent of the world's population will be urban and the rest rural by 2050. This is a roughly a reversal of distribution as compared to the 1950's, and it is occurring within a short span of 100 years (Department of Economic and Social Affairs, Population Division, 2014).

The rapid rate of urbanization has many consequences, both good and bad. Cities are a hotbed for productivity, commerce and innovation. Urban areas provide opportunity and employment in the formal as well as informal sectors, attracting talent from non-urban areas. Thus, they have also been a vehicle for lifting millions out of poverty. Cities like Paris and Kinshasa account for 16 percent and 13 percent of the population of France and the Democratic Republic of Congo respectively, but contribute 27 percent and 85 percent of the Gross Domestic Product (GDP) of their respective countries (UN Habitat, 2016). On the other hand, this very rapid rise in urbanization has also brought about complex environmental, social and economic problems, that are often a cause or an effect of each other. Cities have also turned into hotbeds of pollution, resource consumption and drivers of climate change. The resource-intensive aspect of cities is especially true as most of the major inputs required for survival such as energy, food and water are often sourced from outside cities. It is also often the case that municipal waste is disposed of in landfills outside the city out-of-sight from city dwellers.

It is estimated that 60-80 percent of global energy usage occurs in cities. This energy usage along with the fossil fuels used for transportation account for about 70 percent of the total anthropogenic greenhouse gas (GHG) emissions. A widening income gap has also been observed in areas of rapid urbanization in recent years. There has also been an upsurge in involuntary migration. The Syrian conflict has resulted in the biggest migration of people in recent times with Europe witnessing an influx of more than a million migrants and refugees in 2015 alone. Countries such as Lebanon and Jordan have also had to deal with a massive influx of migrants during the same period (UN Habitat, 2016). This puts additional pressure on cities to find avenues for employment for the new arrivals as well as to ensure that distribution of wealth is not skewed among members of society.

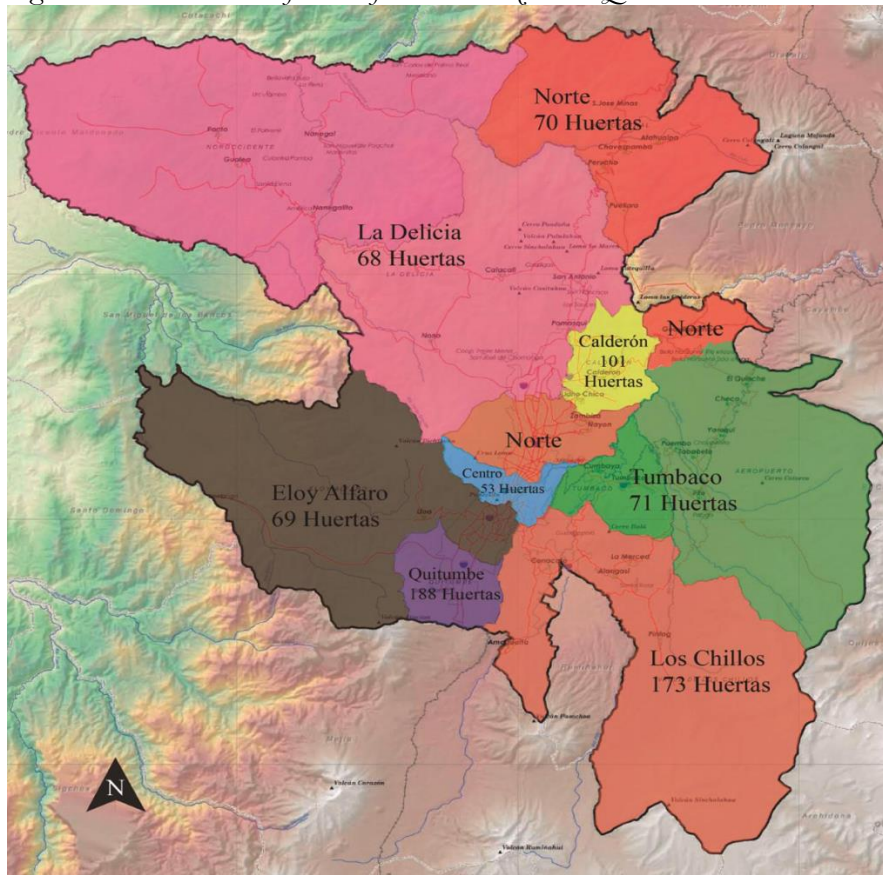
1.1 Quito: An introduction

Quito is the capital of Ecuador, a country of about 16 million people and is in the North of the country in the Pichincha province. It is the second largest city in Ecuador after Guayaquil in terms of population, and has about 2.6 million citizens (Pichincha's total population is 2.8 million). Even though it accounts for about 45 percent of the province's total land area, it has more than 93 percent of its population, highlighting its importance. In 1993, the city was transformed from a capital city to a Metropolitan District (DMQ in Spanish). This meant a devolution of powers to the city and it had to assume new powers to manage a wider range of issues such as transport, sustainable development and urban planning.

The DMQ is subdivided into 8 zonal administrations (Administraciones Zonales in Spanish), each managed by an administrator who reports to the Mayor. The zonal administrations consist of 65 parishes (32 urban and 33 sub-urban) (Arrazola, Alvaro, Renckens, Ballesteros, & Hollenstein, 2016). Urban agriculture is practiced in each of the zonal administrations, with the southern zones leading in the total number of farms (see Figure 1-1); The farmers interviewed for this research were all from the Quitumbe zone, as it has the maximum number

of farms. This zone is in the south of the city and happens to be the area with several disadvantaged communities, which makes it ideal for this research.

Figure 1-1: Distribution of urban farms across zones in Quito



Source: CLAVIJO, 2013

1.2 Problem definition

In the past, each of these problem areas: environmental, social and economic have been dealt with using technocratic solutions that are very targeted, but fail to account for their negative impacts. For example, sea-walls are built to control flooding, without considering the destruction of the flood-plains/mangroves that they are built on that might lead to a loss in biodiversity. The cross-disciplinary and interconnected nature of such problems means that a more holistic, systems-based approach is required to mitigate impacts of any solutions that we may want to use. This is where the concept of nature-based solutions (NBS) is of relevance. NBS have been defined as actions that are inspired by, supported by or copied from nature, whose aim is to help societies address a variety of environmental, economic and social challenges in sustainable ways (European Commission, 2015). These can include both the usage of existing natural solutions or through the usage of bio-mimicry which copies the processes found in nature and adapts it for human use. NBS also tend to offer economic advantages over traditional solutions both in the initial as well as operational stages. The European Commission (EC) has identified four key goals for its NBS programme (European Commission, 2015):

1. Enhancing sustainable urbanization
2. Restoring degraded ecosystems
3. Developing climate change adaptation and mitigation
4. Improving risk management and resilience

Any adopted solution may contribute to a specific goal under the NBS umbrella or may contribute towards multiple goals simultaneously. Urban agriculture is one of the many such proposed solutions under the NBS umbrella. It could supply food to urban areas at a lower cost, absorb organic waste from cities thus reducing the waste management load, reduce transport distances for food being supplied from outside the city helping reduce GHG emissions and fuel consumption. These are just a few of the potential benefits; these and others will be presented and expanded upon in other parts of this thesis report. Therefore, it is a solution that could help meet multiple goals under the NBS umbrella.

1.3 Scope and limitations

Agriculture, including urban agriculture is dependent on factors including geography, resource availability, climate and many other localised phenomena. To limit the scope of this study, the research will focus on urban agriculture in the context of urban and peri-urban areas of Quito, Ecuador and the circumstances that are associated with these areas.

Quito was chosen as the focus region for this research due to its well-developed urban agriculture program. Since 2002, the municipality of Quito has been running the Agricultura Urbana Participativa (AGRUPAR, participatory urban agriculture programme in English) programme under the guidance of the municipality's CONQUITO (Corporación de Promoción Económica— economic promotion corporation). Since then, the programme has grown to include over 2,500 orchards and involves more than 16,000 citizens living in and around the city (“AGRUPAR,” n.d.).

Under, the programme, its participants earn a living income each month through sale of produce/products; employment has also been generated while simultaneously meeting a part of the food demands of the city. Given these characteristics, Quito makes for an ideal case study to study and document evidence for benefits that urban agriculture can provide to a city's overall sustainability strategy.

The key limitations of this research were: limited time availability to spend in Quito, Ecuador due to financial and time constraints and not being fluent in Spanish. The results obtained from areas in and around Quito will most probably vary when compared against cities within and outside Ecuador. Agriculture is a highly-localised activity and very much context-dependent, but the intention of this research is to study the outcomes of a well-implemented scheme and the possibility of transferability of certain aspects between cities. This research does not intend to suggest complete transferability or even validity in other contexts.

1.4 Research questions and objectives

To fulfil its purpose, the thesis intends to ask the following research questions:

3. What are the drivers and barriers of urban agriculture in Quito?
4. What are the outcomes of the urban agriculture model in Quito with respect to the three pillars of sustainability?

The first question of the thesis will be an exercise in defining urban agriculture within the context of NBS, followed by a close examination of what exactly the reasons were that enabled the success of the urban agriculture programme in Quito. This is important to understand what exactly the concept has come to mean in the past few decades, and the contributions it can make towards sustainable urbanisation. The next part of the question tries to identify the barriers that the programme faced in the past as well as those it is facing

currently.

The second question will try and measure actual outcomes of the urban agriculture programme implemented in Quito. This question will be answered through a combination of data collection on the ground as well as surveying existing literature. It will be answered in the context of what influence urban agriculture has had on the three pillars of sustainability within the city. This question becomes important as it can potentially address the issue of transferability to some extent in terms of what the context in Quito was at the time of implementation as well as what lessons could potentially be drawn.

1.5 Audience

This study is primarily directed towards researchers and policymakers working in the field of urban agriculture, especially within the EU's Horizon-2020 programme. It is also intended that advocacy bodies such as non-governmental organizations can find results and learnings that are useful for them within this study. Finally, it is also intended for practitioners, supporters and detractors of urban agriculture.

1.6 Disposition

This research has been structured in the following way:

Chapter 1: It introduces the topic, research questions and objectives, identifying the scope and limitations of the study, and finally defining the target audience for the study.

Chapter 2: It contains the literature review, containing the definitions of urban agriculture, nature based solutions and other frequently used concepts from existing literature and the impacts and expected outcomes of urban agriculture on cities and urban areas. It also explores the relationship between urban agriculture and nature based solutions.

Chapter 3: It puts forth the analytical framework, evaluation framework and general methodology including rationale for using a case study design. Limitations of the study are described as well.

Chapter 4: It presents the results and findings combined with a discussion at necessary points. It also addresses the results of the research questions in terms of drivers, barriers and outcomes of urban agriculture in Quito from the perspective of three types of stakeholders interviewed during the course of research: government officials, NGOs and farmers.

Chapter 5: It presents the conclusions from the study, and puts forth key aspects of the urban agriculture program in light of the research questions asked. The final section of the chapter identifies potentially useful and interesting research that could be conducted in the aftermath of this study.

2 Literature review

This section of the thesis presents a review of the existing literature of the main themes being explored: urban agriculture and Nature-based solutions (NBS) as the concept applies to urban agriculture. This section will try and establish the validity of urban agriculture as an NBS. Lastly, it is important to note that urban agriculture has been written about much more and for much longer as it has been of interest to researchers for much longer, as compared to NBS. The literature used in this section was scoped out using keywords related to both themes. Once an initial list of relevant literatures was compiled, the bibliographies referenced in the initial list were used to create a second list of relevant literatures.

2.1 What is Urban Agriculture?

To understand the nature and effects of urban agriculture, the first step is to try and define urban agriculture. Defining it also helps with better defining the scope of research that will be conducted in this thesis report. Over the years, many definitions have been offered. The Food and Agriculture Organization (FAO) (1996) defined it as ‘food production that occurs within the confines of cities’. Within the confines of cities, however, this definition did include non-commercial production on rooftops, backyards, community gardens etc. as well as a more commercial scale production in greenhouses and open plots of land as well. The focus, however, remained on small-scale operations. This excludes peri-urban areas from the scope of the definition as well as associated activities like animal husbandry and poultry keeping. Ellis et al. (1998), in contrast, used a definition of urban areas that included both urban as well as peri-urban areas. It also included poultry and fish farming within its scope and includes small and large scale operations. Other studies have considered UA to be agriculture that is practiced by urban residents with the definition of the term ‘urban’ varying per the context or setting in which it is being studied (Zezza & Tasciotti, 2010).

Urban agriculture can be defined as the growing of plants and the raising of animals for food and other uses within and around cities and towns, and related activities such as the production and delivery of inputs, and the processing and marketing of products. Urban agriculture is located within or on the fringe of a city and comprises of a variety of production systems, ranging from subsistence production and processing at household level to fully commercialised agriculture (van Veenhuizen, 2006).

This study shall use a combination of definitions offered in previous literature. Thus, urban agriculture shall be considered as growing of crops or raising of animals for food or other uses practiced by urban or peri-urban dwellers in the city under study. This will include conventional growing of crops as well as poultry and fish farming and includes small and large-scale commercial and non-commercial farming.

2.2 Rationale for urban agriculture

Urban agriculture can be found across almost all cities throughout the world, be it in the form of community gardens, rooftop cultivation, full scale farms or high-tech hydroponic grow operations. There are however, key differences between practices within urban agriculture found in the global North as compared to the global South. Given that cities in the global North started the process of urbanization much earlier in time, the rates of urbanization in Europe are already at 73 percent, and are projected to increase to 82 percent by 2050 (European Commission, 2015). In contrast, the percentage of urban population in Africa and Asia was close to 40 percent and 50 percent respectively. Africa and Asia, however, are experiencing explosive rates of urbanisation (Department of Economic and Social Affairs, Population Division, 2014). There are also key differences in the ways that agriculture is

practiced, both urban and rural. Whereas in Europe, it is a highly-mechanised operation with extensive government support, subsidies, and access to market systems, it is a far less techno-centric and is much more of a cultural and politically important aspect of urbanism in Africa (Page, 2002).

Agriculture remains one of the most significant sources of employment and income for people living in the global South, both in villages and to a lesser extent, in cities. Food production centres (farms) are often located much closer to cities in both Africa and Asia. Leafy vegetables, for examples are supplied to urban centres often from distances of 30 kilometres or less (Moustier, Vagneron, Bui Thi Thai, 2004). The definition of what constitutes an urban area and a rural area vary by region or country, and is beyond the scope of this study. However, there are certain clear characteristics that can be observed in urban and rural agriculture that can help differentiate between the two, at least for developing countries, and has been presented in table 2-1.

Table 2-1: Characteristics of urban and rural agriculture

Feature	Urban agriculture	Rural agriculture
Employment	Agricultural labour is low relative to non-farm employment	Agriculture is the main source of employment
Farmers' income	Agriculture is sometimes a temporary/partial source of income	Agriculture is the main source of income
Farm profile	Informal/often illegal use of land	Traditional access to land
Market supply	Intended for urban markets as well as self-consumption	Intended for self-consumption, urban & rural markets as well as exports
Product types	High value, perishable products	All types, mainly staple food
Commodity chain	Short marketing chain	Long marketing chains
Multi-functionality	High	Low
Access to inputs	Close to sellers	Can be close or far to sellers
Food safety risks	Risky—polluted inputs and environment	Lower risk
Access to natural resources	Strong competition with other urban economic activities	Low competition
Public policy	Usually ambiguous/non-supportive, in favour of other activities and land uses	Priority area for policy makers responsible for rural areas

Source: Bon, Parrot, & Moustier, 2010

In the absence of official policies or government support, people still do undertake agriculture in cities. In the African context for example, urban agriculture is undertaken for a variety of reasons, some of which are listed below:

1. As a strategy for sustenance. Some of the poorest sections of society undertake agriculture simply to survive often on land which is not owned by them to survive. This group of people are also prone to harassment from the authorities for doing so (Sanyal, 1985).
2. As a commercial activity to be able to sell high value goods in the marketplace and generate revenue for households (Memon & Lee-Smith, 1993).
3. As an alternative to using cash: expensive food items like eggs, meat, vegetables are produced on the farm so that cash can be used for other purposes (Jamal & Weeks, 1988).
4. As a strategy by women to secure food supply and possibly additional income for the household, if needed (Maxwell, 1995).

The above listed reasons are also applicable to other countries in the world, and do not deal with institutional level involvement in urban agriculture; They deal with a personal level reasons only. There can be many more reasons for undertaking urban agriculture apart from those listed above.

2.3 Impacts of urban agriculture

Existing literature was surveyed to assess the potential impacts of urban agriculture. The impacts described in this section have been presented through the lens of nature based solutions to examine various outcomes from the practice through an environmental, economic and social lens. This section presents only the positive impacts of urban agriculture. Its criticisms are presented in the subsequent section (See Section 2.4).

2.3.1 Social impacts

The social impacts of urban agriculture have been documented extensively, and they show how it affects the way in which communities around farms interact with each other as well as with their neighbourhoods. A few of the impacts have been elaborated upon below.

Urban agriculture as a neighbourhood building tool: Urban agriculture can play an important role in bringing neighbourhoods together. The spaces put to such use have been reported to act as places where people from varied backgrounds can connect with each other and build trust and reciprocity with each other. Activities within urban gardens and farms foster the development of social ties within communities (Teig et al., 2009). Urban farms provide an area where workers/employees can find ways to attach value to their work. Such areas help build trust, pride and induce a sense of ownership of the area as well as the neighbourhood among the workers. This build-up of a sense of ownership among the community through providing jobs also helps in preventing crimes and reduction in violence in certain neighbourhoods (Bradley & Galt, 2013).

Food access and security: Of the various measures that can be taken to improve food security in communities, it has been found that local grown produce in community gardens may be one of the most practicable ways of achieving it, especially in low-income communities (Gottlieb & Fisher, 1996). Along with food security, they also provide a sense of ownership to the community as mentioned above, since the urban farmers are direct beneficiaries of the produce grown on such farms. As the production is local and the beneficiaries are in the immediate vicinity of production, it cuts out the various stages of the distribution process and

makes food cheaper, which is especially important for poorer communities (Teig et al., 2009). Excess produce that cannot be stored or used is often donated to either food banks or the needy, thus helping extend the food security net (Corrigan, 2011).

Physical and mental health: Apart from increasing self-reliance, participants in urban farming/gardening have also reported deriving personal satisfaction (Patel, 1991). They provide spaces where residents of surrounding communities can indulge in physical activity or simply relax (Twiss et al., 2011). Studies have also found that residents around such farms also report a betterment in general health as well as therapeutic effects of being around plants (Saldivar-Tanaka & Krasny, 2004).

Cultural assimilation: Urban farms also provide a space where people of all ages and cultures can come together and interact. One of the projects implemented in Canada to integrate immigrants into the local community, depended on the fact that many immigrants have skills in agriculture which could be used to increase food security as well as access to communities. Towards the end of the project, it was found that immigrants belonging to different cultures had different preferences for fruits and vegetables and this meant that they learned more about other cultures as well as shared their produce with local markets. Thus, this helped foster interactions between immigrants as well as between immigrants and local communities (Beckie & Bogdan, 2010).

Better diet: The presence of urban farms can result in better diets for those involved in farming as well the community surrounding the farms, in terms of increased consumption of fruits and vegetables. As excess produce is sold in farmers markets or community markets, an increase in healthy food consumption was observed in neighbourhoods with low-incomes (McCormack, Laska, Larson, & Story, 2010). One study also found an increased involvement and improved knowledge of fruit and vegetables among youth, which also led to their increased consumption as opposed to junk food (Ober Allen, Alaimo, Elam, & Perry, 2008). An increased likelihood of consumption of fruit and vegetables (at least 5 times per day) of up to 3.5 times was found among participants in urban gardening as compared to community members who did not participate (Alaimo, Packnett, Miles, & Kruger, 2008).

2.3.2 Economic impacts

Skill dissemination, job training, employment and entrepreneurship: When youth get involved in urban agriculture, it results in the development of their skillsets and helps them achieve some degree of freedom to generate their own source of employment and revenue (Metcalf & Widener, 2011). Agriculture projects located in neighbourhoods with high levels of crime and unemployment helped communities rebuild by providing opportunities for employment and entrepreneurship (Bradley & Galt, 2013). Participants in urban farming also responded saying that skills pertinent to jobs that were developed on farms were one of the most significant outcomes of their participation (Holland, 2004). A study conducted among community farming projects funded/partially-funded by the US Department of Agriculture (USDA), about 35,000 farmers received training in farming, sustainable agriculture, business and management. It also resulted in the creation of 2,300 jobs and 3,600 micro-businesses (Kobayashi, Tyson, & Abi-Nader, 2010).

Increased market access for farmers: Farmer's markets that are organized in communities to sell produce are usually done by the farmers themselves. When these markets are organised in cooperation with city-based producers, they have the potential to increase market access for these farmers. Such markets have been shown to attract customers from a much larger geographical spread as compared to conventional supermarkets (Gale, 1997). While the difficulty of getting into metropolitan markets has been acknowledged, they still provide the

highest gross sales to sellers and have had the greatest increase in demand for value-added products (Feenstra & Lewis, 1999). Farmers can capitalise on such advantages and explore opportunities for making more money. It is also often a good diversification strategy to offer value added or other products to reduce dependence on food products alone.

Reduction in food expenditure: Since produce is also often consumed by the farmers and their families, it represents a significant saving in economic terms for these families. The return on investment for such farms was found to be quite high, especially for vegetables or fruits that are very expensive at the supermarket, and with better quality (Patel, 1991).

Increase in real-estate prices: Apart from neighbourhood revitalisation, the presence of urban garden/farms have been shown to result in increased real-estate prices in neighbourhoods. The spill-over effects of such an increase in real-estate value in an increased collection in tax by municipal authorities, which could lead to an increased provision of services for the overall community (Voicu & Been, 2008). The presence of urban gardens has also been shown to attract younger people who are of a working age, which could further result in an increased collection of taxes, but this is often a double-edged sword as it leads to gentrification of neighbourhoods and long-time residents get driven out (McClintock, 2013).

2.3.3 Environmental impacts

Closing resource/waste loops: Urban farming/agriculture, carried out using organic waste from kitchens as well as waste water. Cities are big consumers of raw resources, and consequently generate proportionally huge quantities of waste as well. If a portion of the waste stream can be diverted towards agriculture, it can also help cities cope with reducing quantities of waste entering the waste stream and problems associated with dealing with it. Cities, especially those in the global south do not have efficient segregation systems for municipal solid waste and such waste is often sent to one central facility such as a landfill or a treatment plant. If such waste can be captured at source in neighbourhoods surrounding farms and turned into compost, it can reduce the environmental impact of individual neighbourhoods (Smit & Nasr, 1992).

Similarly, waste water can also be reused within cities to irrigate lands and reduce the consumption of raw water for such purposes. Obviously, using waste water for food crops brings up sanitary issues with pathogens as well as cultural issues surrounding the usage of 'soiled' water for raising crops. Both issues can be overcome by using appropriate treatment methods and perhaps using such water to raise crops for livestock consumption. The wastewater-fed aquaculture farms of Kolkata in India are a good example of this, where industrial and municipal wastewater is diverted to fish farms. It is first treated with appropriate methods to remove pathogens, heavy metals and reduce its Biological Oxygen Demand (BOD) and then pumped into fish holding ponds where species like carp and tilapia are grown (Jana, 1998).

Regulation of air quality/local climate/storm water: Urban agriculture, as a component of Green Infrastructure (GI) in cities, has the potential to regulate local air quality and climate. It also has the potential to reduce heat island effect, by increasing the rate of evapotranspiration as well as reducing the rate of storm-water flow into drains, thus reducing stress on city sewage systems. The level of benefits derived, of course depends on factors such as environmental conditions, placement of green spaces and the characteristics of the surrounding landscape. It is also important to note that trees and other plants with a higher Leaf Area Index (LAI) have a higher potential for reduction in temperatures and other effects (Coutts, Tapper, Beringer, Loughnan, & Demuzere, 2013). Although, a recent study found that vegetable covered green roofs had a similar water retention capacity as compared

to traditional species that are normally used for green roofs (Whittinghill, Rowe, Andresen, & Cregg, 2015).

Climate change resilience: Urban agriculture also has the potential to contribute towards climate change resilience as well as facilitate urban transitions towards lower carbon intensity. The ability of plants, including agricultural plants to capture and store carbon has also been discussed widely across literature, but exact quantification studies on a large scale have not been carried out yet (Santo, Palmer, & Kim, 2016). One such study carried out near Sutton, England, found that food production near the town had the potential to reduce diet related emissions by 0.4%. This may not seem like a significant amount, but it is more than the carbon sequestration rates found in conventional GI projects like parks and forests (Kulak, Graves, & Chatterton, 2013). A paper by Barthel et al. (2013) postulates that urban agriculture helps to maintain the collective memory of food production, which further helps increase resilience of cities in the event of natural disasters induced by climate change or environmental crises.

2.4 Criticisms of urban agriculture

While taking note of the positive impacts that urban agriculture can have on cities and on their transitions towards sustainability, researchers in the domain have also identified criticisms of the concept and its implementation. For this thesis, it becomes important to highlight such criticisms to identify/verify them during the field research stage.

In his essay entitled 'Poverty and Famines' as well as others, Sen (1981) points out that a rise in food production does not necessarily translate into meeting the food or nutritional requirements of those who are most vulnerable. In their seminal work on the subject, Ellis et al. (1998) raise several other issues with urban agriculture. The first issue is that of extreme urban poverty often being associated with parts of the city where the chances of conducive conditions for self-production of food are often small or negligible. This factor, of course, varies from city to city, both in the global south as well as the global north. The second issue they raise is that of methodology of calculation of food security. This arises when the potential for urban farming to solve food security issues is derived for an entire city using characteristics of a subset of the population engaged in farming. The same characteristics may or may not be applicable to the entire population set and can such an extrapolation can produce false inferences. The third point that they raise is regarding the drawbacks that production of food in urban areas can face. These drawbacks can be in the form of overstretching city supplies such as water and land in densely populated parts of the city, which are otherwise meant for domestic uses. If animals are being raised, they introduce an additional set of issues such as odour, disease and waste. Thus, urban agriculture might not always be viable and a cost-benefit analysis can help determine if it can indeed be applicable to certain areas of the city.

The expansion of cities is almost always associated with the pushing of farmlands further away from urban fringes. This is mostly due to economic reasons as it is more sensible to divert land to uses that brings maximum amount of economic value, and agriculture is certainly not a top earner. This requires political intervention to tilt the scales in favour of agriculture and is not always desired or feasible (Bon et al., 2010).

Regarding the usage of municipal solid waste (MSW) by composting it and turning it into fertiliser, the idea has been criticised as separate collection of waste is not very common, especially in developing countries. Often, municipalities in such countries lack even basic garbage collection infrastructure, and planned composting based on incoming-outgoing garbage ratio is almost non-existent (Drechsel & Kunze, 2001). Perhaps one of the few successful examples of composting in the developing world has been Cuba, which has made

tangible progress towards recycling organic MSW, but this is due to the prevailing political conditions that have made it an imperative (Cruz & Medina, 2003).

Hoornweg et al. (1999) also list challenges to urban agriculture with respect to financing issues involving composting as well as the necessity to tackle the problem of contamination by heavy metals, in case they enter the waste cycle. This means having to keep a tight control on the raw material that goes into making the compost.

2.5 What are nature-based solutions?

As stated in the previous chapter, the EU defines nature based solutions as actions inspired by, supported by or copied from nature which intend to address a variety of societal problems in the environmental, economic and social sphere in a sustainable manner. Balian et al. (2014), in a BiodivERsA workshop report, provides a more extensive definition of nature based solutions as those that use nature in tackling challenges such as climate change, food security, water resources, or disaster risk management, encompassing a wider definition of how to conserve and use biodiversity in a sustainable manner, which also manage to account for societal factors such as poverty alleviation, socio-economic development and efficient governance principles.

The International Union for Conservation of Nature (IUCN) defines nature based solutions as actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits (Cohen-Shacham, Walters, & Janzen, 2016). These solutions use ecosystems and the services they provide to address societal challenges such as climate change, food security or natural disasters.

The term ‘nature based solutions’ is meant to encompass concepts such as ‘ecosystem services’ and ‘natural capital’, there is not one universally agreed upon definition yet, and different definitions place emphasis on different components or aims of the concept. Potschin et al. (2016) pose questions about the concept itself. In addition, they ask what ‘nature based solutions’ brings to the table in addition to existing concepts like ecosystem services and biodiversity in various respects such as approaches to policy, implementation and management. The EC claims that nature based solutions ‘builds on and supports closely related concepts such as ecosystem approach, ecosystem services, ecosystem-based adaptation/mitigation, and green and blue infrastructure (European Commission, 2015).

This open-ended definition of the concept can be its strength. Potschin et al. (2016) suggest that as the concept can be interpreted in different ways, it might motivate different stakeholders to participate in dialogue surrounding specific solutions. The authors also state the need to understand each term individually to operationalise it, and offer the following definitions:

1. Nature: relates to biodiversity in aggregate, individual elements of biodiversity (individual species, habitats, ecosystems), and/or ecosystem services
2. Nature-based: refers to ecosystem approaches, ecosystem-based approaches, biomimicry, or direct utilisation of elements of biodiversity
3. Solutions: refers to a specific problem or challenge, for which recognisable solutions or more beneficial outcome exists.

In addition to the above definitions, the concept has been unpacked further by Balian et al. (2014), where they propose a typology for nature based solutions:

- Type 1: Solutions that consist of better using existing natural or weakly managed ecosystems, where the intention is to use such systems in a better fashion so that they can still deliver the same range of ecosystem services, while minimizing the intrusion on the system itself.
- Type 2: These solutions relate to defining management rules such that sustainable and multifunctional ecosystems are developed, which may or may not be intensively managed, such that they better deliver selected ecosystem services.
- Type 3: Solutions that approach ecosystem management in very intrusive ways, even to the extent that completely new ecosystems are created.

This proposed typology gives us a good starting reference point, although it cannot possibly include all examples of nature based solutions. As the concept evolves, it is expected that the typology will also expand to include more examples and solutions. The EC's existing research and innovation agenda for nature based solutions requires them to meet four goals. These four goals can be taken as a good starting point to assess a solution for effectiveness. The goals, listed in section 1, and what they intend to address are elaborated below (European Commission, 2015):

1. Enhancing sustainable urbanization: The goal recognises the reality that most of Europe as well as the world's population will live in urban areas and cities by 2050. The unprecedented rates of urbanisation pose a risk to urban environments, but also presents an opportunity for businesses in terms of meeting the demands on requirement for new living spaces and housing and associated facilities. These new urban areas are dependent on the availability of resources such as water and clean air for their growth and development and nature based solutions help in providing these vital ecosystem services as well as co-benefits such as resilience towards climate change and increased opportunities for recreation.
2. Improving degraded ecosystems: Urban expansion eats into the countryside resulting in degradation of large areas of ecosystems. This affects the function of such ecosystems in their ability to deliver services such as water purification, soil erosion protection, flood control, carbon sequestration etc. and often results in losses to the tune of 450 billion EUR to the EU alone. The restoration of at least 15% of such degraded ecosystems is now a European as well as a global goal.
3. Developing climate change adaptation and mitigation: As climate change is one of the primary reasons for ecosystem degradation, there is a need for developing nature based solutions that deal with both adaptation as well as mitigation that are applicable for multiple challenges.
4. Improving risk management and resilience: Natural disasters such flooding, storms and droughts cause economic as well as social harm across Europe and the rest of the world, and are exacerbated by the effects of climate change. These can be mitigated with adaptation and prevention policies which are nature based, but can also be technological solutions that work in tandem with nature based solutions. Nature based solutions offer multiple synergies and have benefits across problem areas, thereby reducing the overall cost of dealing with them.

2.5.1 Nature based solutions in the global context

In Europe, The Covenant of Mayors for Climate and Energy was launched in 2008 to bring together local and regional authorities within the European Union which have voluntarily committed to implement the EU's climate and energy objectives within their jurisdictions. Similarly, the Compact of Mayors was launched at the 2014 United Nations (UN) climate summit by Michael Bloomberg, UN Special Envoy for Cities and Climate Change and other

UN bodies and NGOs. The Compact is a global alliance of mayors and city officials, who are committing to reduce their GHG emissions, increase climate change resilience and make their citizens aware of their progress (Compact of Mayors, 2015).

Six months after the Paris climate accord, these two alliances merged to form the Global Covenant of Mayors for Climate & Energy, which is the single largest global coalition of cities committed to fighting climate change. In February 2017, the EC announced that several big and small cities from India will be signing up to the covenant as well bringing the country with the world's fastest rates of urbanisation under its ambit (Koekoek, 2017). It only demonstrates that in the future, more cities will be collaborating with each other in their journey towards sustainability irrespective of their location in the global North or the global South. This is also the reason why Quito was chosen as the geographic area under study for this thesis as it could potentially hold learnings for cities across the world.

2.5.2 Urban agriculture and nature based solutions

The concept of ecosystem services is perceived in the sense that nature is rendering 'services' towards human development and prosperity, with an explicit anthropocentric focus. Nature based solutions on the other hand, is different, as it addresses the well-being of humans with actions or processes found in the environment. It also integrates social factors into the mix and takes a systems approach. Urban agriculture, which will be defined in the next section of this chapter, when practiced in the sense of natural systems agriculture, meets the criteria that nature based solutions demand (Eggermont et al., 2015). If urban agriculture is examined through the lens of the IUCN's definition, then it does not strictly fit the bill. But under the proposed typology presented in the previous section, it could be categorised under Type 2, which relates to moderately managed ecosystems. Eggermont et al. (2015) also call for retention of traditional knowledge concerning agriculture to be preserved and integrated into the modern concept of nature based solutions. Further, if elements of biodiversity conservation are included, then the definition of urban agriculture begins to approach the one proposed by the IUCN.

Under the EC's definition however, urban agriculture does qualify as a nature based solution. The EC's definition is the one that this study will be using and will examine the EC's requirements or criteria of nature based solutions that can be met using urban agriculture; These criteria include the development of solutions that maximise cost-effectiveness and co-benefits that improve human health, are resource-efficient and economically inclusive. In this context, the EC has called for the scaling up of such solutions by first collecting evidence of their effectiveness, and then developing new business models and institutional frameworks to ensure good implementation and outcomes (European Commission, 2015).

Nesshöver et al. (2017) bring forth a pertinent argument about the role of human manipulation or engineering in NBS. While existing typologies do recognise and classify different solutions based on the level of manipulation involved, for an umbrella concept like NBS, there is no consensus on an acceptable level of human intervention that still allow for a solution to be included under the umbrella. For example, genetic engineering of organisms to fulfil a specific purpose is one that raises many questions of ethics and is highly contentious. The EC's definition does not allow for genetic modification, but an argument could be made to include them as well. In the context of urban agriculture, if provision of food is regarded as an ecosystem service, then farming in sustainable ways that do not 'artificially' alter nature (non-usage of chemical fertilisers for example) can surely be termed as a nature-based solution.

3 Methodology

One of the main purposes of this thesis is to contribute towards building an evidence base for nature based solutions, and will be exploratory in nature. The first research question (RQ) will be answered using an extensive literature review. A literature review has been deemed appropriate for answering this question as urban agriculture has been written about extensively and a sizeable body of literature exists. The body of literature on nature based solutions is comparatively small but rapidly expanding, and is sufficient to answer the question. Any remaining gaps will be filled in using field research, if applicable, or expert interviews.

For the second RQ, a different methodology needs to be followed. Using Quito as the region under study, the urban agriculture programme implemented there will be documented for the various outcomes it has had on the city in terms of the three pillars of sustainability. Hence, the research is a study of the outcomes of the program that measure its progress against the requirements under the nature based solutions umbrella. A mixed methodology approach, involving a case study approach, enriched with interviews and data collection from the field will be used to answer this question.

3.1 Analytical framework

The term NBS picked up traction within the scientific community in the early 2000's when it was first used in the context of agriculture to address problems such as integrated pest management, farm run-off treatment etc. (Potschin et al., 2016). As the usage of the term grew, it gradually incorporated many other potential solutions that borrowed their processes from nature or depended on natural systems. The use of such ecosystem services to provide multi-faceted solutions to environmental, economic and social problems is being investigated under the European Union's Horizon 2020 programme. The programme intends to investigate the effects of large-scale pilots and demonstration projects, which offer these multiple benefits (Maes & Jacobs, 2015).

Evidence regarding the effectiveness of NBS as a tool for achieving sustainable urbanisation varies across the spectrum. While some solutions such as green roofs and urban green spaces have had ongoing research to quantify their benefits, the evidence base is not uniformly level for all solutions. While knowledge on specific benefits of certain solutions exists, attention needs to be paid to investigate the potential for generation of co-benefits by NBS. In places around the world where such solutions have already been implemented, these serve as living labs for experimentation and innovation, and can provide spaces for the testing of such solutions that can provide a maximum extent of environmental, economic and social co-benefits, which will help build an evidence base to demonstrate the effectiveness of such solutions (European Commission, 2015).

Following a workshop on nature-based solutions to climate change mitigation and adaptation in urban areas, which was hosted at the International Academy for Nature Conservation in Germany in March 2015, Kabisch et al. (2016) presented four important knowledge gaps that were identified by the participants of the workshop:

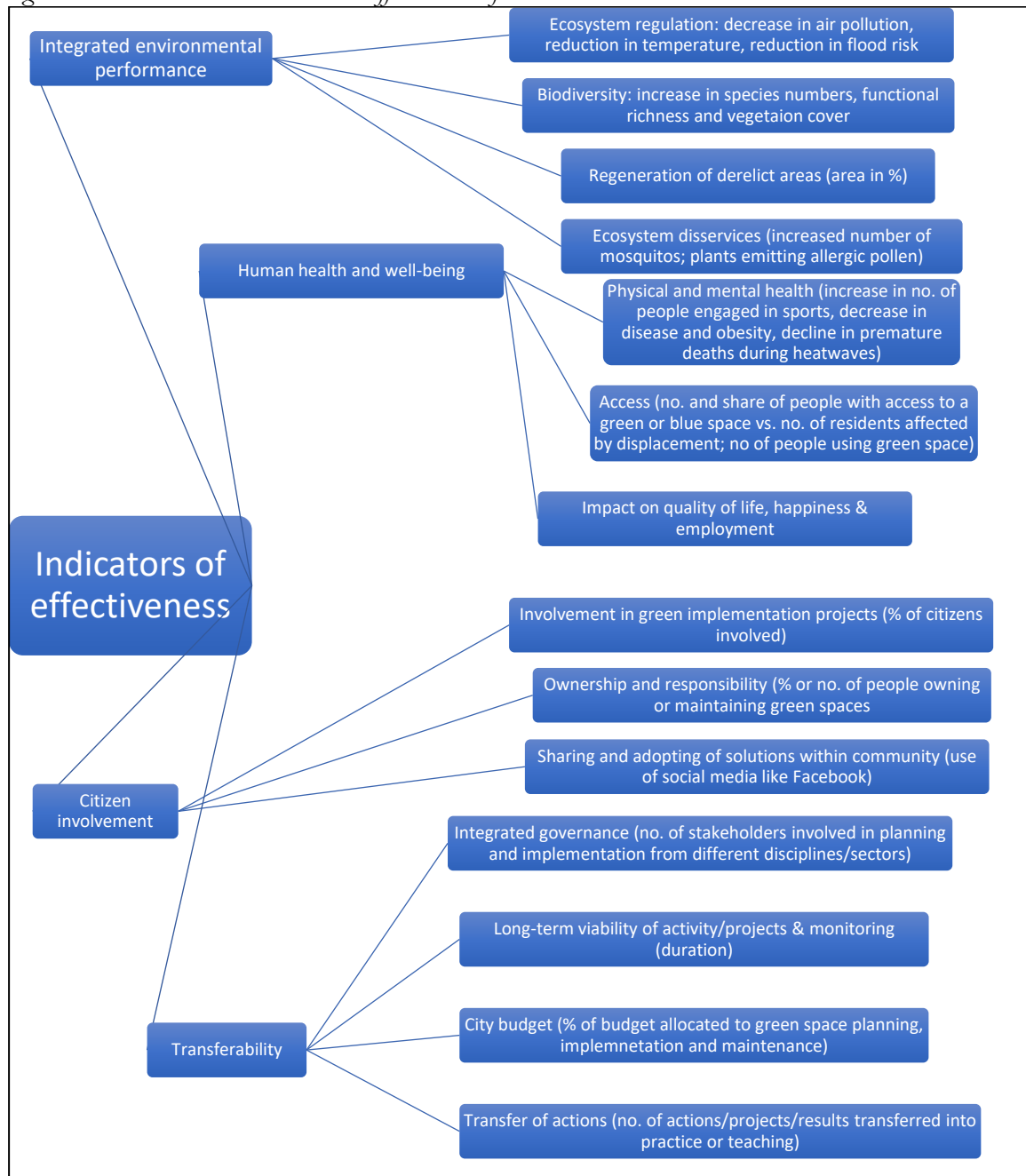
1. The effectiveness of NBS
2. Relationship between NBS and society
3. Design of NBS
4. Implementation aspects

These four knowledge gaps can be analysed and further broken down to specific indicators that can be used to measure and quantify the impacts of NBS. This study intends to examine

the case of urban agriculture specifically as an NBS, and therefore try to close the knowledge gaps by building a better evidence base. The validity of urban agriculture as an NBS will be investigated through analysing the roles and impacts of various actors that are involved at different capacities such as governments, NGOs, farmers and citizens.

As the use of ‘nature based solutions’ as an umbrella term is relatively recent, efforts towards evolution of a framework for evaluation of such solutions is also quite recent. The first steps towards this were taken at the workshop described in section 3.1 in Germany. The workshop yielded a range of indicators which could be categorised under four broad themes: (1) Indicators for integrated environmental performance (2) indicators of human health and well-being (3) indicators for citizen involvement (4) indicators of transferability. The indicators identified under each of the theme areas are presented in Figure 3-1.

Figure 3-1: Indicators used to measure effectiveness of NBS



Source: Developed from Kabisch et al., 2016

Building upon this work, the EKLIPSE mechanism¹ was asked by the EC to prepare a framework for the evaluation of projects under the nature based solution umbrella. Responding to this request, the EKLIPSE project came out with a holistic framework for the evaluation of such projects, the first one of its kind.

Figure 3-2: Key challenges under the NBS umbrella



Source: Developed from Raymond et al., 2017

The framework could identify 10 challenges pertinent to the evaluation of nature based solutions from existing literature (See figure 3-2). The working group of the EKLIPSE project that prepared the framework concluded that a nature based solution that helped solve any of the ten challenges would also be instrumental in supporting climate resilience in urban areas. The group also acknowledged that different responses or solutions or responses could be taken up at three different scales as put forth by Hein et al. (2006); The three scales are the macroscale which corresponds to a global level, the mesoscale which corresponds to an ecosystem level and the microscale which can be as small as a plot of land or a single building. This particular framework is applicable only to the meso and the microscale, and the indicators suggested for use by it are applicable only to these scales (Raymond et al., 2017).

3.2 Case study approach

As stated earlier, this thesis work is exploratory in nature and is focused on the city of Quito, Ecuador. A case study approach has been chosen as the methodology. The reason for this is that, at the simplest level, case studies provide a descriptive account of one or more

¹ The EKLIPSE mechanism is an EU funded project that brings together stakeholders to create a mechanism that aids in evidence-based decision making in issues concerning biodiversity and ecosystem services.

subjects/cases under study. When used in a manner that is academically thorough and focused on a subject to achieve isolation of factors under investigation, they offer the advantages of experimental research within real-life settings/contexts (Hakim, 2000). As case studies allow for the usage of a variety of data collection techniques and methods, they offer one of the most holistic picture compared to other research methodologies. This research, as stated earlier, will combine literature review and analysis with data collection involving interviews and appropriate city documents.

Quito presents an ideal example of a city with a demonstrably successful example of an urban agriculture program that has been implemented successfully for more than a decade now. It is important to note that the program was not implemented or designed under the nature based solutions umbrella. It was instead born out of the need for the city to solve food security issues in the poorest parts of the city ("Local Urban Food Policies in the Global Food Sovereignty Debate," 2015). Naturally, a question may arise over why this program is being evaluated under the same concept. The idea of evaluating this program using the lens of nature based solutions is so that it contributes to building up the evidence base. Even though it was never explicitly implemented to have co-benefits, it is expected that the programme will inherently have these benefits nonetheless. Hence, it becomes worthwhile to investigate these benefits and wean all possible learnings from it.

3.3 Questionnaires/interviews and participant observation

To gather information about the outcomes of the urban agriculture programme in Quito, questionnaires were devised based on the indicators that can be used to measure outcomes of the programme. Multiple questionnaires were devised for each of the identified stakeholder group to gather data from as many stakeholder groups as possible.

The questionnaires are semi-structured in nature and contain multiple questions each. Some of the questions are open-ended while some required structured responses. These questionnaires form the basis for interviews. The interview method was chosen as it has advantages required for this research. First, it yields a high quantity of data quickly. Second, as opposed to a survey, instant follow-up and clarification are possible. Third, since data gathering and interviews take place in the field, it can be combined with participant observation and context to derive a deeper meaning to the results (Marshall & Rossman, 2006).

Some of the questions in the questionnaire require quantitative data to answer them. As the first step, personnel with this information will be identified through internet searches and telephonic enquiries. If data cannot be gathered through these two methods due to a lack of authorisation on the interviewee's part or language barriers, I will try and remediate it through conversations and requests in person while in Quito. The questionnaire was not sent out in an Internet Mediated Research (IMR) format as the internet penetration in Ecuador is low at about 48 percent of the total population (CIA World Factbook, 2006) and could result in either poor or biased results, especially among target groups like poorer farmers.

During the research period, I conducted 23 interviews in total, the majority of them in person with the interviewee, and the rest over Skype. The interviewees included both individual as well as community farmers, members of NGOs working in the area and finally government officials involved directly in the city's urban agriculture programme as well as those from affiliated ministries like the environment ministry. The full details of the interviewees can be found in the annex.

The basic framework of each interview has been presented in the form of an annex at the end of this document. However, the questions formed only the backbone of the full interview; the

entire interview was held in a conversational style involving participant observation. The respondents were free to explore topics that they felt were necessary around a central theme/question.

3.4 Research ethics

While ethical considerations are important at all stages of research, from initial preparation to report writing, they become more important during the interview stage. This is because responses from interviewees are often a window into their private lives, and publication of obtained information means placing that information in a public domain (Miller, 2012). There are ethical issues at other stages of research as well, and the following is an excellent summary provided by Kvale and Brinkmann (2009):

1. Thematising: Apart from conducting the study for the sake of scientific value, the purpose of a study must also be evaluated with respect to the human situation under investigation.
2. Designing: Informed consent of subjects under study must be obtained prior to conducting the study and consequences of publishing the study on the subjects must also be considered.
3. Interview situation: Evaluation of interview situation and its consequences on both the subject such as stress and changes in self-understanding must be taken into consideration.
4. Transcription: In case confidentiality is requested by subjects/interviewees, it must be respected. The transcription must stay as true as possible to the interviewees' statements and intentions.
5. Analysis: The depth of analysis of gathered data/statements should be consciously considered, and the subjects should be allowed to verify the outcomes of the analysis for correctness.
6. Verification: One of the researchers' main responsibilities is to ensure verification of collected data before reporting it.
7. Reporting: This stage again concerns issues surrounding confidentiality as well as consequences of reporting on the interviewees.

The above seven concerns have been kept in mind at all relevant stages of the thesis. My personal contact details and credentials to verify affiliation will be provided at all stages to everyone involved in this research.

3.5 Validation and limitations

The first obvious limitation is that of language. A translator was employed, but some content is bound to be lost in translation, or the essence diluted. Since some of the interviewees were direct practitioners of the urban agriculture programme in Quito, there is bound to be bias in their responses. Efforts were made to reduce this bias by cross-checking responses with other interviewees.

The second limitation was that interviews of citizens of Quito could not be conducted as the actual research period spent in Quito was one month and it was not enough to gather data from a meaningful sample size in a city where the population is more than 2.5 million. The views of citizens would have added valuable insights to the research but could not be included within its scope.

4 Analysis and discussion

This chapter presents the results obtained considering the research questions, through a combination of data collected during field work, interviews as well as data from available literature. Analysis of obtained data, wherever required, is also presented.

4.1 Drivers and barriers for urban agriculture

4.1.1 Background

Before trying to understand why the city decided to implement and support urban agriculture, it is important to understand the series of events that preceded it. The demographic characteristics of the country changed rapidly between the years 1980-2000. There was a mass internal migration of people from rural areas into the cities, which can be seen clearly in table 1.

Table 4-1: Population in urban and rural areas, Ecuador

	1982	1990	2001
Total population	8,060,712	9,622,608	12,090,804
Urban population	3,968,362	5,305,911	7,372,528
Rural population	4,092,350	4,316,697	4,718,276
Quito population	866,472	1,104,958	1,413,694

Source: Carrion, Vasconez, & Bermudez, 2003; Instituto Nacional de Estadística y censos, Ecuador; Metropolitan Studies, Quito Town Hall Planning Office

Rural areas, which were more populated in the early 1980's, started to witness a stagnation in population growth. Simultaneously, urban populations began to experience a massive growth thanks to migration from rural areas. By the end of the millennium, more than 60 percent of the country was living in urban areas. Quito was one of the urban centres that experienced this explosive growth. The city's population doubled from 780,000 in 1980 to about 1.4 million by 2000 due to an influx of indigenous Andean migrants (FAO, 2014).

This doubling of the urban population was caused by three main reasons (N. Reyes, personal communication, 25th April 2017):

1. The petroleum boom started in 1972 in Ecuador, which propelled GDP growth rates to close to 9 percent throughout the 1970's (Commander & Peek, 1986) and the GDP per capita increased by 70 percent during this period (Offerdal et al., 2000). Oil exports brought a windfall of foreign exchange to the country. This new money manifested itself in the form of increased construction activity mainly in cities. This increased construction activity created jobs and attracted unskilled labour from the countryside to the cities like Quito (Commander & Peek, 1986).
2. The policy of land reform, starting in 1964, also had a significant effect on migration. Much of the fertile cultivable land was concentrated near the coastal regions, while lands in the Sierra (highland) region were not as fertile. Before the land reform law was passed, small parcels of large farms were worked by peasants for no wages, but remained under the ownership of landowners. The land reform law intended to distribute idle land did manage to distribute about 700,000 hectares between 79,000 peasants, but it resulted in the fragmentation of land. By 1982, only 20 percent of farms were larger than 10 hectares, but these were accounted for about 85 percent of

the total farm land whereas the remaining 80 percent accounted for less than 15 percent. Only 5 percent of the farms were larger than 50 hectares in size, but they made up for more than 55 percent of the land under cultivation. Redistributed land was also often the poorer quality land; the large land owners preferred to keep the fertile valley lands to themselves. Government assistance to make this poor-quality land productive was also absent, and combined with its small size, made it a liability to its new owners. This meant that the peasants migrated to cities in search of better jobs (Hanratty, 1991).

3. Import substitution industrialisation was another reason why population increased in Quito. Manufacturing as a sector began to develop and grow in the mid-1960s, and received a boost in the 1970s due to increased petroleum revenues. Guayaquil and Quito, the two largest cities in Ecuador, accounted for about 66 percent of all employment in industry in Ecuador (Whitaker, Colyer, & Alzamora, 1990; Hanratty 1991).

The dependence of the Ecuadorian economy on oil had increased significantly since exports started in 1972 and by the 1987, petroleum alone accounted for 14 percent of the GDP (Hanratty, 1991) and by 2000, it alone constituted 50 percent of exports. Starting in the '90's however, the economy started to flounder as it was a decade of low oil prices. The latter half of the decade also saw a war with Peru, which was followed by the devastating effects of the El Niño phenomenon, which crippled manufacturing/production along the coasts. By the end of 1999, a combination of these and other external factors caused an economic crisis and the country decided to switch to the US Dollar as the official currency, which came to be known as 'Dollarisation' (The World Bank, 2010). By this time, the country was reeling under unemployment. Reyes reports that the city of Quito itself was facing unemployment levels of 21 percent and underemployment levels of 45 percent.

4.1.2 Economic

At the turn of the century during the economic crisis, among the cities in the country, Quito was one of the most affected, given that it was an industrial and economic hub. The section of the population that were affected the most during this time were young people and women as they lost their employment. The size of the government, which had increased during the oil boom period, also reduced considerably and many people lost employment. This period also saw a lot of migration from the country to Europe and the US. Basically, anyone who could afford a ticket out of the country left and the ones that remained behind were the poorest members of society (N. Reyes, personal communication, 25th April 2017).

It was in this time of crisis that the city began to experiment with various ideas to bring employment, jobs and opportunities for entrepreneurship to its citizens, especially the poorest ones that were hit hardest by the crisis, particularly youth and women. Urban agriculture started as a small-scale experiment in the city around the year 1994-95 under the United Nations Development Programme's (UNDP) Urban Management Programme for Latin America and the Caribbean. A couple of other international agencies like Canada's International Development Research Centre (IDRC) were also instrumental in running the programme. In the year 2000, after a presentation was made to the then mayor Paco Moncayo Gallegos, it was decided to run the programme on a pilot scale on a hill called El Panecillo in the centre of Quito. At that point in time during the crisis, the municipality did not have too many social development or economic development initiatives under implementation, and when the program was pitched to the mayor, it caught his attention mostly because it was proposed primarily as an economic programme to generate employment and then as an environmental one (D. Carrion, personal communication, 24th April 2017; N. Reyes, personal communication, 25th April 2017).

A prominent barrier that was faced during the initial phases of the programme was that of establishing a constant supply. Production in the beginning was intermittent and in small quantities, which then becomes difficult to sell. The programme was then criticised for producing some of the ‘most expensive cabbages and carrots’, as it was just building up and a lot of resources went into building up AGRUPAR, staffing and training it. Then the programme asked farmers to gather produce from other farmers and sell consolidated quantities instead of small unprofitable quantities. It was also recognised that till then it was only the middlemen who were making most of the sales as well as the profits from sale of produce in the city. AGRUPAR had to figure out a way to remove these middlemen and make sure that the producers were the ones profiting from their own produce. Various forms of sale were also experimented with to establish different channels of sale: weekly market fairs (called Bioferias), neighbourhood selling, sale pre-packaged baskets of produce according to advance orders among others. Cues were also taken from established programmes in Havana, Cuba and adapted to Quito’s conditions to make them viable (D. Carrion, personal communication, 24th April 2017).

Another one of the economic barriers or drawbacks that can be observed is the dependency that develops among farmers on AGRUPAR for equipment and infrastructure. This was echoed by at least half of the farmers that participated in the interviews who felt that AGRUPAR should continue to support them in terms of providing material support to build greenhouses. Partial material support was provided by the programme in the first instance that greenhouses were built (A. Darquea, personal communication, 4th May 2017).

Officials from NGOs stated that prices of products at organic fairs or Bioferias pose a limitation to a lot of the poorer consumers and face a lot of resistance if prices are higher than those at supermarkets. However, officials from the city government stated that prices found in Bioferias are very low as compared to the prices of similar organic products in supermarkets (N. Pinto, personal communication, 11th April 2017; A. Rodriguez, personal communication, 4th April 2017). To analyse price differences, a price comparison of products/produce found in Bioferias against those found in SuperMaxi, a prominent supermarket chain found throughout the city was carried out. The results are presented in Table 4-2.

Table 4-2: Price comparison between Bioferias and supermarkets

Name	SuperMaxi non-organic price (USD/kg, unless mentioned otherwise)	AGRUPAR price at Bioferias (USD/kg, unless mentioned otherwise) (Organic)	SuperMaxi (Organic) price (USD)/kg
Green peppers	2.1	2.0	NA
Culantro (Cilantro)	0.67	2.0	0.83
Nabo Chino (Chinese Turnip)	0.97/stalk	0.50 (Depends on size)	NA
Spinach	0.93	2.0	NA
Broccoli	0.79	0.5-0.7	NA
Cabbage	0.64	0.3-0.5	NA
Red cabbage	0.65	NA	NA

Leeks	1.56	2.0	NA
Zucchini	0.77	1	NA
Eggplant	1.12	NA	NA
Tomato	1.78	NA	NA
Avocado	3.01	1.53	NA
Lechuga (Lettuce)	NA	0.3-0.5	1.05/200g
Cebollino (Chive)	NA	0.1/25g	1.19/25g
Carrots	NA	2.9	1
Acelga (Chard)	NA	0.8/stalk	1
Roman lechuga (Roman lettuce)	NA	2.32/100g	NA
Beetroot	NA	0.58/500g	0.5/500g
Tomato	NA	2.61	1.75

Source: Alexandra Rodriguez pers comm., AGRUPAR; prices from SuperMaxi as of 26th April, 2017

Note: For full price list of products available in Bioferias, please refer the appendix; NA=Not available

From Table 4-2 above presents a price comparison of 19 different varieties of fruit and vegetables. Although more than 70 different types of fruit, vegetables, grains and staples are under production as a part of the AGRUPAR project, the above table presents a price comparison for the products that were on sale at SuperMaxi, one of the prominent supermarket chains in Quito. In most instances, prices at Bioferias held by AGRUPAR were significantly lower as compared to the prices found in the supermarket. This applies to both organic as well as non-organic products. However, the data presented above is a snapshot of the prices on the day of the visit to the supermarket. Prices at the supermarket as well as those found in the Bioferia fluctuate according to season.

4.1.3 Social and political

To create a broad social base and acceptance for the economic development programs, it was recognised early on by the city government that community outreach activities were important. First, it was identified that the target groups were Andeans (indigenous) and Ecuadorians of African descent that were most at risk. Many members of these communities were working in the construction industry as unskilled labour. They lived in the historic central part of the city in deteriorated housing as well as housing facilities provided by the church. Quito also has had a long history of community based organisations (CBOs) since the 1970s. These CBOs undertake social initiatives such as programs to fight poverty, programs to deal with housing issues and programs to improve neighbourhoods, with almost each neighbourhood in the city having some form of such an organisation (Carrion et al., 2003). There were also several Non-Governmental Organisations (NGOs) as well to help and coordinate the efforts of the CBOs. At the time, the city also had several guilds which were organised according to professions, such as carpenters' guilds, tailors' guilds, skilled workers' guilds etc. From a survey that was carried out at the time, it was found that there were about 11,000 such organisations (N. Reyes, personal communication, 25th April 2017).

Perhaps the most important and instrumental form of community organisations of all were the sporting clubs and organisations in the city, as they were one of the most organised,

recognised and well distributed. 1600 leagues were identified throughout the city. Each league had anywhere between 4 to 10 clubs. And each club had at least 22 members in it. So roughly, these clubs had a combined membership of anywhere between 104,800 to about 352,000. The latter figure represents about a quarter of the city's population at the time. Indirectly, the reach of these clubs was significantly more if the families of the club members are accounted for. Such clubs at the time were on city government land with little oversight. The city government then realised that this could be leveraged to their advantage. They stipulated that if there were to continue, they had to open membership to women as well, which the clubs complied with. The city appointed a secretary exclusively to look after the affairs of both these communities. All these organisations played a big part in the city's outreach activities and spreading word of the urban agriculture programme (N. Reyes, personal communication, 25th April 2017).

The UNDP's UMP programme which had already conducted several city consultations on issues like participatory budgeting, gender etc. then decided to conduct one on urban agriculture to gauge the city's perception of such a programme and get citizens' feedback. What struck the organisers of this consultation was the diversity and range of stakeholders that it brought together and the level of positive response. This forum that was held in Quito was described as a watershed moment for the entire region. It even had transfer effects from Latin America to Sub Saharan Africa; the network created in Latin America led to the creation of a series of policy briefs for city authorities which helped policymakers in these other cities improve implementation of such programmes (L. Mougeot, personal communication, 24th March 2017).

The local government was interested and they mobilised people to come forward without which the city consultation would not have succeeded. And there were people who remembered the UMP from earlier and knew about their work. And for every project that the UMP undertook, they had conducted city consultations previously and were established in institutional memory. The group of El Panecillo women involved in the pilot project were present at the city consultation and narrated their experiences from the farming that they were doing, which was quite important. The UMP was also working with universities, but universities were not key players in this consultation. The UMP also wanted to have the private sector, supermarkets for example, to sell products from the farmer groups at their stores. But they didn't turn up to the consultation, even though they professed interest in it. Their opinion was still taken into consideration. But almost all stakeholders were represented like ministry of health, agriculture etc. So, it followed a multi stakeholder approach and the fact that it was that it was multi-sectoral and multi-stakeholder from the very beginning is possibly one of the key drivers for success.

At the time, it was observed that the area under the Metropolitan District of Quito (DMQ in Spanish) was huge, but the urbanised area as a proportion was very small. It is one of the smallest in all Latin America in relation to the overall size of the region. This is quite unique. This is one of the key drivers because land is available in plenty under the realm of the mayor and the land is rural as well as urban. We also had local champions who backed the programme and helped us popularise it. Because it is urban, peri-urban and rural, it was easier to scale across the DMQ because of availability of land, traditions of people etc. And it helped that we already had successful demonstration projects which made it easier to get political approval (Y. Cabannes, personal communication, 11th May 2017).

One of the target groups that the programme was aimed at were women. Due to the prevalent social structures, women were also the ones responsible for most of the household chores as well as raising children. Since agriculture was going to be an added responsibility on top of that, and it was found that the men of the household were not too cooperative, it was

recognised that asking them to participate in agriculture was not a fair proposition. Special programmes were started to provide emotional and handholding support to these women through the initial phases (D. Carrion, personal communication, 24th April 2017).

This is one of the few programmes that has been implemented continuously by the municipality for the past fifteen years and has survived three mayoral terms due to the broad popular support that it enjoys. Usually what is observed is that programmes started by one mayor get axed in the next term due to a lack of political support. It is also one of the programmes that has gained international recognition such as a special mention at the 2016 Milan Urban Food Policy Pact and the Dubai International Award for Best practices in 2014 (A. Darquea, personal communication, 4th May 2017; D. Carrion, personal communication, 24th April 2017).

Among the social factors hindering the development of urban agriculture is the rise of supermarkets. Traditionally, people shopped at municipal markets (*Mercado* in Spanish) for food and produce. However, investments into such markets has gone down in the recent past. Supermarket chains have crept up and are customising themselves to the needs of each neighbourhood. People are going to the supermarket due to multiple reasons, one of them being convenience. Other factors like brightly lit presentation also helps. They serve as one-stop-shops for everything ranging from groceries to household needs. If you look at national statistics as well, the average time dedicated to food purchases has gone down which has also meant the rise of processed foods (N. Pinto, personal communication, 11th April 2017).

There is a false perception among people that organically grown food is necessarily more expensive as compared to non-organic food. When we were selling produce from our farms, we priced it competitively after checking prices at supermarkets so that people are more inclined to buy from us. But a big supermarket opened right next door and our own sales crashed after that. People prefer shiny, clean looking products as compared to what is natural (M. Morales, personal communication, 3rd April 2017).

A pull from consumers' end is also something that is required. However, there aren't too many consumer organisations now that are engaged in creating consumer awareness and increasing consumer demand for healthy, local, organic food. One of the initiatives that is prominent is called '250,000 families' which is engaged in identifying and recruiting families in solidarity with food sovereignty. We realise that industry is pushed by client demand and having critical mass at that end is important. For example, right now, distributors reject carrots bent out of shape even if they are perfectly fine to eat; Consumer, as well as retailer education is required to make people realise that the food is still fine (N. Pinto, personal communication, 11th April 2017).

4.1.4 Institutional and informational

Urban agriculture in Quito was started by the UNDP as a small-scale experiment. When other international institutions like the IDRC started to participate in the project, it began to gain momentum as well as recognition within the city government. One of the big institutional drivers at the time was the Quito Declaration of 2000, signed by the representatives of municipalities of 27 cities across Latin America. It was a workshop on 'Urban Agriculture in 21st Century Cities'. The Declaration itself was not a planned event, but emerged due to the dynamics of the forum. Some of the cities present brought forward questions and deficiencies in their own programs which resulted in a needs assessment in terms of what they would like to see coming their way in terms of assistance. The Declaration served as a way for these governments to make the topic visible and commit themselves publicly to the issue (L. Mougeot, personal communication, 24th March 2017).

At a subsequent regional training course, about 10-11 cities participated and brought forth their own proposals for urban agriculture programmes, including topics like financing, participatory planning, waste recycling and health issues. Some of the best proposals were allocated funds to kick-start programmes in their own city. Further, due to the scale of problems that the city of Quito was facing at the time, the city's Director of Physical Planning at the time, Diego Carrion, stated that the city didn't just want a pilot show-case project, but something that could be scaled up successfully to benefit the entire city.

Subsequently, the municipal programme for urban agriculture was launched in 2002 as the Participatory Urban Agriculture Project (AGRUPAR in Spanish) under the jurisdiction of the city's Directorate for Sustainable Human Development. In 2005, it was brought under the municipality's economic development agency (called CONQUITO), where it runs till today with its own independent budget (FAO, 2014).

AGRUPAR was the continuation of various experiments in urban agriculture in Quito. It took years to put it together and process was put together slowly and that was the key for success. Another element is that the UMP approach had institutional anchoring with Latin American institutions, but at the same time, UMP never financed programmes like international aid agencies and foundations. The focus was never on projects but on processes. The support for processes is very crucial: shifting from a project approach to a process approach. Because a process is something led by local partners. We only stepped in when they required us to do a study or arrange for exchange partners and expertise. This I think was an element which was important. AGRUPAR took fifteen years to fully pan out, and projects are typically much shorter, and by intervening in processes and not indulging in projects, it followed a different path and was successful. Instead of trying to push money onto governments, they had to compete to show that they were committed. and that they had to sign a letter of understanding with grassroots organisations and universities etc. (Y. Cabannes, personal communication, 11th May 2017).

This is one of the key elements for the programme in Quito, in that it was never a programme that was started by international organisations and implemented by them. The ideas and support were supplied by them, but it was ultimately the people and the local government that put those ideas into action and came up with solutions to problems which helped it become successful.

It is also important to note that when the mayor at the time, Paco Moncayo Gallegos, heard about the project, and decided to invest the city's financial and institutional resources into the project to support it and help it expand. The fact that cities in the Sierra like Ambato, Cuenca, Latacunga and Quito have always had traditions of farming and agriculture even before the start of the programme. For example, in the 1950s and the 1960s, peripheral neighbourhoods always had agricultural lands or small garden plots attached to them and farming was second nature to the people. Secondly, people who migrated into the city also brought their farming traditions and small scale agricultural activities like pig farming along with them when they migrated into the city. When the city formally started the agriculture programme, it wasn't something that had to be started from absolute scratch (N. Reyes, personal communication, 25th April 2017).

Even though agriculture was not something new to the people of Quito before the city government's programme was launched, was viewed by city dwellers as well as government officials as something that was purely rural. New rationales and arguments had to be brought forward to convince city government officials of the multi-functional nature of agriculture and

how it can help address other issues that the city faces, for e.g. organic waste management. The risk averse nature of politicians was something that had to be overcome as well as it was found that they prefer to experiment on a smaller scale before investing fully in an idea. In terms of planning, the real challenge was to move from an agriculture that is opportunistic to one that is more deliberate, in terms of being allocated resources like land. Trying to allocate large plots of land within city limits to single use for a single crop was not acceptable. So, experiments with mixed use like animal husbandry, temporary use of fallow land, temporary occupancy permits etc. were experimented with (L. Mougeot, personal communication, 24th March 2017).

Many of the farmers interviewed during the research stated the difficulty in getting their products to market as a key barrier to the growth of their farms and enterprises. As most of the entrepreneurs/farmers are from the lower income groups in society, they often live on the outer fringes of the city and on hillsides. Their production volumes are not large enough to justify investment in modes/means of transport exclusively for themselves. On the other hand, large corporations/supermarkets face difficulties in dealing with many small suppliers and prefer dealing with fewer suppliers to reduce costs and logistical issues. They also recognise that small producers/suppliers do not have the logistical and financial wherewithal to supply directly to the supermarkets and need to sell to a third party instead who can organise the logistics. One of the big supermarket chains, Mega Santa Maria (MSM), has continued to source from small and medium enterprises (SMEs). There is also a legal mandate in the form of 'Good Commercial Practices Manual for Supermarkets' (Manual de Buenas Prácticas Comerciales para los Supermercados in Spanish), which requires supermarkets to procure 11 percent of their total purchases come from SMEs and artisanal producers. There is dual purpose to this law, in that apart from supporting small scale producers, it also intends to encourage a wider marketplace with many suppliers instead of a conglomeration of big ones (Arrazola et al., 2016).

4.1.5 Financial and legal

Institutions that provide credit such as banks are usually reluctant to provide help to urban farmers due to a variety of reasons, and such institutions perceive urban agriculture as risky (Cabannes, 2012). This is where the city government of Quito stepped in to provide credit facilities for its citizens. The city created a fund called 'Pro-Quito' Economic and Social Inclusion Development Fund Programme to disseminate funds to individuals and cooperatives. The city government put in the required money for the fund, which was managed by a trust; The city government had representation on its board along with representatives from the cooperative organisations and communities. The fund's main objective was to provide investment support towards activities that generated employment or towards the setting up of micro enterprises. This fund designed special credit lines for urban agriculture to enable repayment terms and provision of credit according to the production and harvesting schedules (Avila, 2002) (N. Reyes, personal communication, 25th April 2017).

After 2009, credit is being disbursed through what are known as 'Sociedades Populares de Inversión' (SPIs), or popular investment societies. There are currently 35 such operating societies, which are self-managed, in Quito and the criteria to join one of them is to make an initial contribution, which can be as little as 10 or 20 USD, depending on financial situation of the member who wants to join (Duenas, 2011).

The regulatory landscape for urban agriculture in Quito was also unclear in the beginning, especially with issues like raising of small animals within city limits that might lead to public health issues. Thus, it becomes important for land use plans to incorporate and recognise urban agriculture as a legitimate use of space and the city's resources. In Quito, urban agriculture was included under the category of 'use of urban soil' through a consultative

process under the General Plan for Municipal Land Development 2000-2010, thus legitimising it as an activity within city limits (Cabannes & Dubbeling, 2003).

There was a lot of learning that was happening from other cities, in this case from Rosario, Argentina. A major development was the introduction of non-permanent lease on land for urban agriculture which was very new. And this started from the pilot project in El Panecillo. This was a major shift for the local government. It gave confidence to women who started these projects that the land was guaranteed to them for a fixed period. We had to know precisely the land details in the city, in terms of land use before starting out. What took a little more time than expected was the institutionalisation of AGRUPAR as a programme, and this is when the UMP stopped, but the work continued (Y. Cabannes, personal communication, 11th May 2017).

One of the barriers that citizens involved in urban agriculture face is that of legality of land. Many of the migrants who came into the city started buying land on the city's outer limits. This land, at the time, was owned by large landowners who sold sub-plots to middlemen who in-turn sold these sub plots to their new buyers. At the time, however, it was not legally valid to break up these large landholdings into sub-plots. For a long time, the municipality and the city government turned a blind eye towards this phenomenon and the ownership of the plots was stuck in a grey-zone as the new owners did have papers to prove that they bought the land, but they were not recognised. Hence, the new owners remained in limbo for a long time till the municipality moved ahead to legalise the plots (D. Carrion, personal communication, 24th April 2017).

About half of the farmers interviewed during the research period said that they were still in the process of legalisation and the municipality was cooperative and moving fast to help them get title deeds for their property. However, until the time that complete legalisation happens, the neighbourhood is not able to receive the full range of civic services. Another theme that was raised by more than half of the urban farmers interviewed was that they were sharing a water connection since they could not get individual connections for their farms. This led to conflict during payment of bills as there was no system to account for who was consuming how much among the farmers. But they view this as a short-term hurdle till property papers are delivered.

4.2 Outcomes of urban agriculture

4.2.1 Overview

Urban agriculture started as a pilot project on a hill called El Panecillo in the city centre in the year 2000 as one of the strategies that the city was employing to improve employment and livelihoods. It was in the year 2002 that the programme was formalised into AGRUPAR managed by the Directorate of Sustainable Human Development. In 2005, it was transferred to the Corporación de Promoción Económica (CONQUITO) (translates to Economic Promotion Corporation). Since 2010, the programme has evolved into a multi-stakeholder entity and has been allocated an independent budget within CONQUITO (See Figure 4-1) (GIZ, 2016).

Figure 4-1: Stakeholders involved in the AGRUPAR project



Source: Duenas & Rivera, 2016

The stated objectives of the programme include (Dirección General de Arquitectura Ministerio de Fomento, 2015):

1. Technical capacity building for farmers in urban and peri-urban areas

2. To increase agricultural production in a safe and sustainable manner and agribusinesses with a focus on micro-enterprise management
3. To connect production with differentiated markets
4. To contribute to community building and solidarity networks
5. To promote the creation of cooperative saving societies and credit funds
6. To contribute to public policy

The municipality of Quito has been the main contributor to the budget of AGRUPAR. Over time, it has also had international development agencies as partners that have contributed to some specific objectives of the programme, but the municipality has remained the largest contributor. The department's budget over the years is presented below in Table 4-3.

Table 4-3: AGRUPARs budget over the years

	2009	2010	2011	2012	2013	2014	2015	2016
Budget (USD)	268,631	267,020	279,000	314,900	317,726	NA	NA	360,000

Source: Dirección General de Arquitectura Ministerio de Fomento, 2015; GIZ, 2016;

NA: Not Available

4.2.2 Economic outcomes

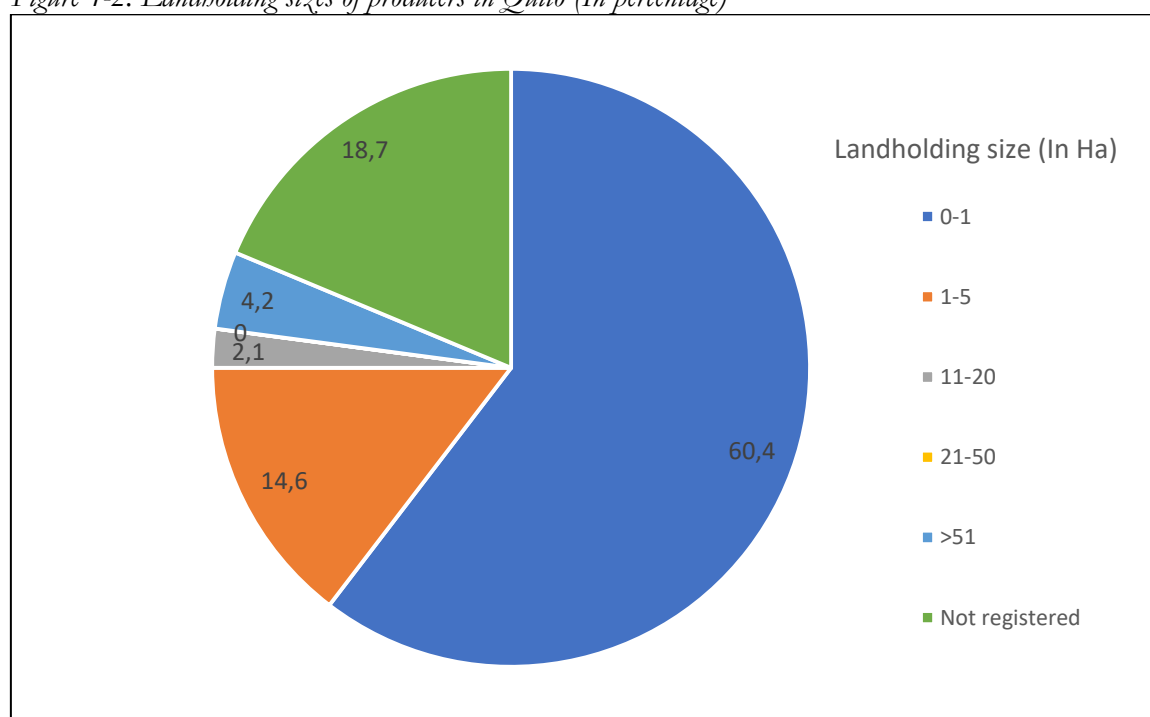
AGRUPAR has trained about 16,000 people in organic cultivation methods since the programme has started (GIZ, 2016). Enterprise creation is also one of the focus areas for the programme, based on activities like food processing, and there are more than 200 enterprises now that have been formed under the programme. Each of these enterprises is providing direct full-time employment to at least 4 people each. There are also about 300-400 part-time jobs that have been created on farms putting the total employment numbers at more than 800. Currently, there are more than 1300 urban farms in Quito, providing employment to at least as many people. The small-scale producers in Quito are mostly from the lower income brackets of society and about 85 percent of them are in the lowest income bracket (See Table 4-4) and most of them have very small landholdings of less than 1 hectare (See Figure 4-2). The producers falling into this bracket make less than the minimum wage, and it is this and other sections of vulnerable people that AGRUPAR targets (A. Rodriguez, personal communication, 4th April 2017).

Table 4-4: Income distribution of producers in Quito

Income bracket (In USD)	Percentage
1-365	85.4
366-500	4.2
1000-2000	4.2
>2000	6.3
Total	100

Source: Boada & Torres, 2015

Figure 4-2: Landholding sizes of producers in Quito (In percentage)



Source: Boada & Torres, 2015

Apart from farming crops, the programme also encourages diversification of activities such as rearing of guinea pigs, bee-keeping, and poultry production, examples of which can be seen in Figure 4-3. There existed a total of 314 livestock production entities as of January 2016. A minimum of 600 USD/month is required to feed a household in Quito; The monthly average income of households joining the programme is about 350 USD/month (GIZ, 2016). It is important to target lower income groups as these groups are the ones with the highest proportion of spending on food in proportion to total expenditure per month, and hence most vulnerable to changes in food prices or shocks. Such groups (Groups 1-5) are seen to spend 30 percent and above of total expenditure per month on food alone (See Table 4-5).

Table 4-5: Expenditure on food by different income classes

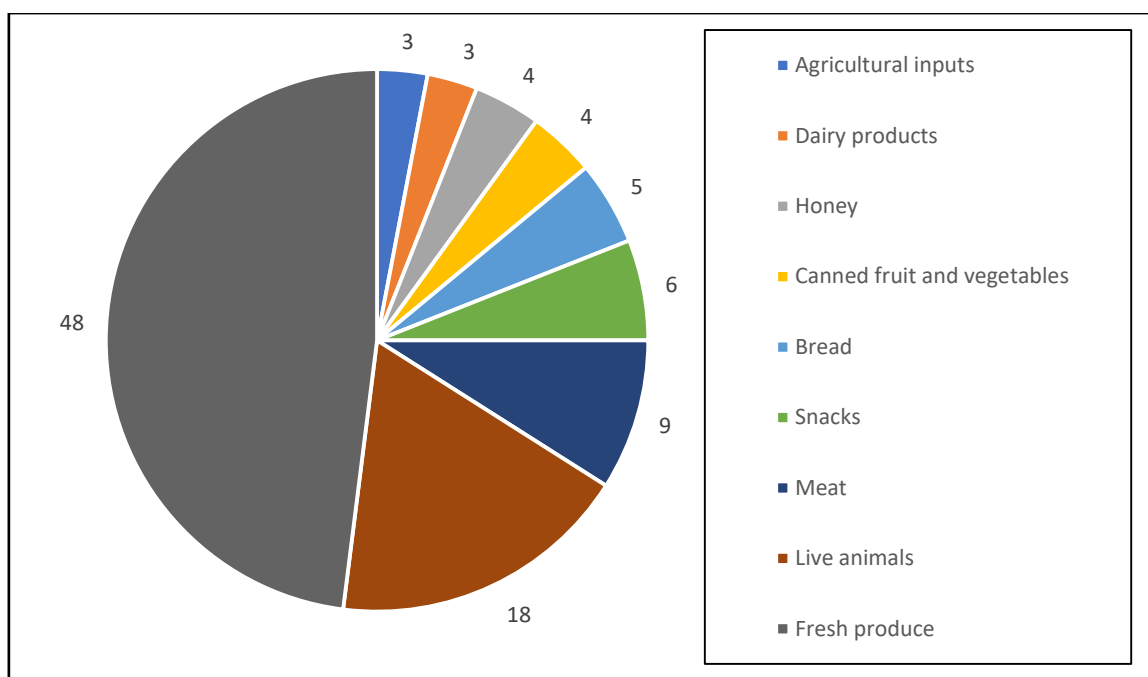
Population segment	Total expenditure	Expenditure on	Food expenditure
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(from lowest to highest income)	(USD/month)	food (USD/month)	(% of total)
1	250.7	109.5	42.3
2	333.8	137.2	40.5
3	393.0	151.5	38.1
4	439.6	153.4	34.6
5	496.2	158.2	31.6
6	545.2	158.3	28.7
7	620.8	162.3	25.8
8	705.2	158.3	22.0
9	879.8	159.3	17.8
10	1,439.8	165.8	11.3
Mean	610.5	151.4	24.4

Source: Hollenstein, 2015

The average earning from each garden under the AGRUPAR programme is about 175 USD/month, including self-consumption as well as sales. This is three times greater than the monthly average support money paid out by the government to people below the poverty line (It is known as the human development voucher and is 50 USD/month). 17 percent of the participants in the programme are actually able to make more than 300 USD/month (Duenas & Rivera, 2016). CONQUITO also has about 48 SPIs registered which function to provide credit just to urban agriculture programmes (A. Rodriguez, personal communication, 4th April 2017). All the farmers engaged in farming on an individual basis also reported that they did not need to borrow money to finance expansion or buying infrastructure for the farm; They were either self-sufficient or reported enough savings from their own farms to be able to save for future investments. Of the total turnover from all activities under the AGRUPAR programme, fresh produce still contributes the most towards incomes (see Figure 4-3), indicating the higher potential that micro-enterprises and food processing initiatives have in the future.

Figure 4-3: Percentage contribution of activities to total turnover under AGRUPAR programme



Source: Duenas & Rivera, 2016

Figure 4-4: Rearing of guinea pigs and bee-keeping on urban farms in Quito



Source: Author

Figure 4-5: Tomatoes being grown in greenhouses in Quito



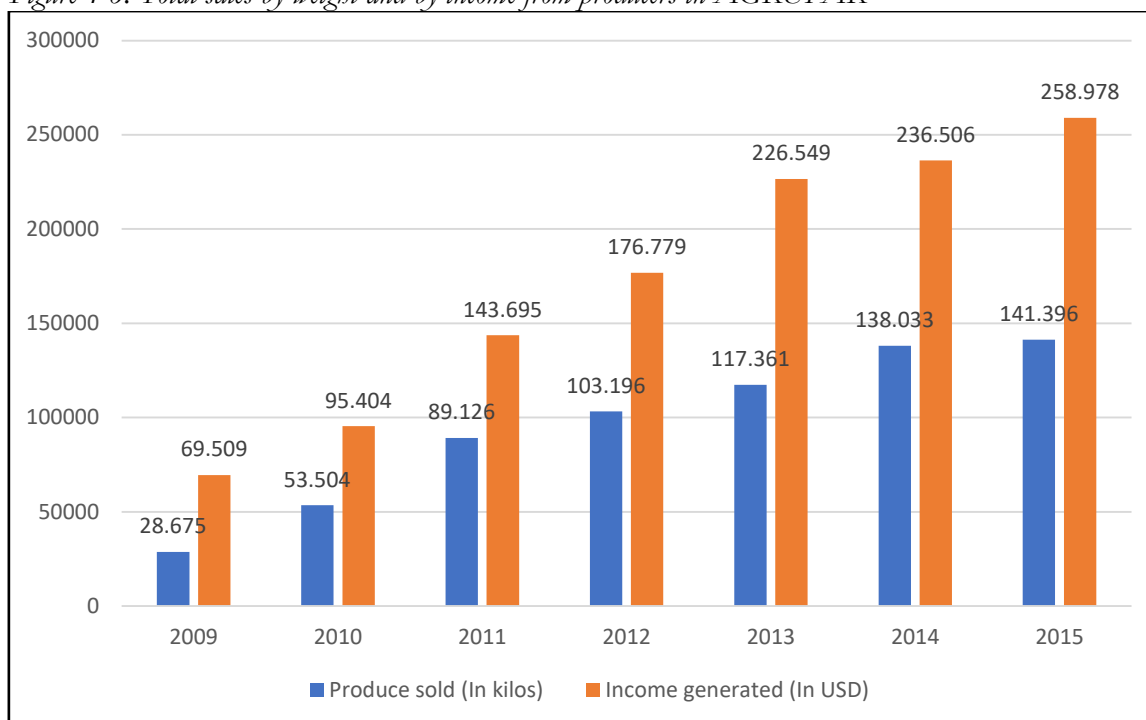
Source: Author

All the farmers interviewed during the research period stated that AGRUPAR does not dictate what the farmers should grow. However, they indicated that thanks to the training received from the programme, they now grow crops that have shorter lead times to market such as chard, cucumber, lettuce etc. as compared to earlier when they were growing crops such as potatoes and corn that have much longer growth cycle, enabling them to make more money. All the farmers interviewed during research (who were involved in farming prior to their collaboration with AGRUPAR) also stated that their crop of choice was mostly corn, but thanks to AGRUPAR's help, they have diversified into more commercially viable crops.

Another aspect is the technical training and infrastructure support that the programme provides to its participants. Due to help provided in setting up greenhouses, farmers can cultivate tomatoes in Quito, which is quite hard to do as it is situated at a height of 2,800 metres (See Figure 4-5). Drip irrigation which is used by all farmers, is an efficient way of supplying water to crops in the city and increases water availability for other uses. AGRUPAR also holds market fairs also known as 'Bioferias' in 17 different locations across the city, either weekly or bi-weekly according to location, where farmers can come together and sell their produce. Farmers who disclosed figures regarding income and savings during the research, reported a minimum of a 30 percent decrease in monthly expenditure on food². Some farmers reported as much as an 80 percent decrease in expenses (variable according to farm size and family size). The programme's outputs have been growing consistently over the last few years, both in terms of total tonnes of output sold at the Bioferias as well as the total income generated for farmers (see Figure 4-6).

² It is important to note here that reduction in expenses were reported mostly on items like fruit and vegetables that the farmers grow. Staples like rice and corn are still purchased from the market.

Figure 4-6: Total sales by weight and by income from producers in AGRUPAR



Source: Duenas & Rivera, 2016

4.2.3 Environmental outcomes

Since food cultivated in the city is being consumed within the city itself, there has been a reduction in the quantity of food coming into the city, reducing transport related emissions. However, currently, there are no studies that have quantified this, and exact numbers aren't available.

According to a study conducted during February-July 2015 with 192 randomly selected participants, 12 percent held the perception that environmental awareness and protection was one of the main motivations for them to be engaged in agriculture. 98 percent of all respondents of the survey stated that issues related to the environment were very important to them. 92 percent of them also stated that they care more for the environment as a result of their participation in the programme (Oviatt, 2016).

To be eligible to be included under AGRUPARs scheme of production, farmers must comply with the programme's organic methods of cultivation. This includes concepts like avoiding mono-cropping, biodiversity preservation including no GMO cultivation, use of natural methods for pest control and the use of organic-approved pesticides and fungicides which can be seen in Figure 4-7. Traditional Andean crops are also grown as a part of the programme by the farmers which contribute to the preservation of cultural heritage. These are mostly grown by the farmers for self-consumption and not usually seen in marketplaces. Due to the stress on biodiversity, about 75 different varieties of food crops (fruit and vegetables) are being cultivated under the programme (A. Rodriguez, personal communication, 4th April 2017).

Figure 4-7: Bug control using sugar water and bird control using shiny objects in urban farms



Source: Author

Inorganic fertiliser and manure are also not used on farms. Instead the farmers are educated on preparing manure using kitchen and organic household waste (not including toilet waste). All farmers who practised poultry keeping and small scale animal husbandry were also using animal waste and droppings to prepare manure (See figure 4-8). Composting is being done on site at farms; This means about 20 kilos of waste per household per week is being composted, which adds up to 3,120 tonnes of waste is being recycled as a part of the programme every year. The total area under production in the city (including urban and peri-urban areas) is about 29 hectares of land which was previously unused or fallow, or was not being farmed using organic methods. Because of the local nature of the food supply, energy is being saved on cold storage and processing as well, but there are no studies yet which quantify these savings.

Figure 4-8: Composting being done on site at farms



Source: Author

4.2.4 Social outcomes

Integration and assimilation between various groups of people, especially the vulnerable, within the city is one of the objectives of the urban agriculture programme in Quito. Mougeot (2006) argues that it is mostly women and children who tend to be some of the most vulnerable, in that in developing countries (usually), they are most likely to face obstacles in accessing resources like land, finance, water etc. Urban agriculture, hence, poses an easy solution for them in the sense that they can participate in the activity while still being at home and generate income/nutrition for the household. It is no surprise then that women are seen to be the dominant group in terms of participation comprising and running 84 percent of all the orchards/farms in Quito, thus allowing them to become entrepreneurs. The remaining 16 percent of the participants are men (Duenas & Rivera, 2016).

About 50 percent of the farmers interviewed during the research period were involved in community farming, i.e., communal farming on a single plot of land or on individual plots but involving sharing of knowledge, expertise and labour. There are interesting sets of findings from both groups.

The first group was a set of senior citizens (about 20 in total, all women) working on a common piece of land³, with divided sub-plots (See figures 4-9, 4-10). The plot of land is attached to a community health centre and is owned by the municipality. What is interesting about this collective is that a doctor at the health centre contacted AGRUPAR and arranged for a technician to train the senior citizens involved farming the land.

The main motivation described was that all the citizens involved were suffering from ailments such as obesity and arthritis and the garden was a way for them to indulge in physical activity and to learn about healthier food. There were various outcomes of the farming that the group described as positive. They stated that they learnt about the effects of pesticides on health and the benefits of eating organic. They also stated that since they started working on the garden, they have been able to meet more members of the community and increased social cohesion. They also reported an increased sense of ownership of the neighbourhood since the start of

³ The interview was conducted only with the leader of the group, not all members of the group.

the farm. Since the farm is quite visible from the road, it attracts many onlookers who are interested in what the participants are doing. It has also managed to attract customers who want to buy produce from the farm. They feel that the garden is a space where they come together, work and play together. They also stated that the team that works on the garden comprises of all classes of society. And in case one of the members is unable to contribute monetary resources towards the garden, they can make up for it in terms of their time and effort.

Lastly, they also noticed a considerable effect on health and noted that farming as an activity helps them remain mobile and stay fit as compared to earlier. They now refer to farming as ‘crop therapy’.

Figure 4-9: Senior citizens working on a communal plot of land (with sub-divided plots)



Source: Author; Laura Zuñiga

Figure 4-10: Members of the collective on a visit from AGRUPARs engineer



Source: Laura Zuñiga

The second group consisted of seven farmers, making up of 50 percent of the sample, which was farming in a low-income cluster called ‘Once de Mayo’ in the Turubamba Bajo neighbourhood of Southern Quito. They farmed together as a group, but on individual plots that belonged to their respective families. This group consisted entirely of women as well (see figure 4-11). This group reported that they gained recognition after being featured on local television about their efforts towards organic farming, which brought in more customers that wanted to buy their products. They reported an increase in self-esteem and self-belief among the women in the community after starting farming. They also reported skill development due to extensive training from AGRUPAR as one of the main outcomes of farming here.

Additionally, they stated that their health has improved much since they started consuming their own produce. A positive change in the health of the children within the community was also noticed in terms of activeness and improvement in learning at school after the switch from market-bought produce. As stated earlier, communities that settled around Quito struggled to gain ownership status of their land due to improper sale and lack of recognised title deeds. This is one of the communities that is still affected by the issue. They are actively mediating with the municipality for recognition and farming is one of the activities they say gives the community legitimacy and brings them together as a community in their fight for legalisation.

Figure 4-11: Community members from Once de Mayo on their farms



Source: Author

Oviatt (2016), from a study of 192 farmers also reports similar findings. 95 percent of participants reported that they switched to healthier diets after the start of the programme and 83 percent reported that they now eat new types of food that they did not eat earlier: 91 percent say that they eat more vegetables and 56 percent say that they eat more fruit. Almost all participants agreed that the family's health improved since they started farming.

In terms of climate resilience, also mentions that most of Quito's food supply is not produced in Quito, but comes from outside the city. And the poorest and most vulnerable sections of society may not always have economic access to this food. Quito is also a city which is quite prone to natural phenomenon like floods, drought and volcanic activity. During natural disasters, urban farming offers a steady supply of food to the disadvantaged, and is an activity that helps shore up the city's resilience. It is also a good post-disaster rebuilding activity, one that provides a source of income or becomes a subsistence activity in the aftermath (A. Rodriguez, personal communication, 4th April 2017).

5 Conclusions

5.1 Principal findings

5.1.1 Importance of context

The drivers and barriers that the urban agriculture programme in Quito faced shaped the outcomes of the programme and where it experienced limited or wide ranging success. One of the key conclusions that the research brought up was the importance of context in relation to this programme, and broadly applicable to any other environmental/social programme. Starting in the early 2000's, born during a crisis, the programme was aimed at enabling people to economically empower themselves. It was one where the government played a hand-holding role till the people could support themselves. But it was never done to the extent that a dependency on government help developed. The fact that agriculture was not a new concept to the city probably made the learning curve less steep. The role played by international agencies was also quite important, in that they were the ones who began implementing agriculture projects within city limits on a small scale before the city government took notice of it. But when the city government did take over, they stepped back at the right moment and let the government take control, while simultaneously providing support in areas where competencies were lacking, in areas like technical processes and institutional setups for example. This probably was one of the key drivers of the programme which made sure that it was the city which was invested in making a success of the programme, instead of the international partners who might have taken a more project-based approach.

5.1.2 Institutional support

Another stand-out feature is that AGRUPAR has been under the umbrella of CONQUITO, the city's economic promotion agency, for most of its lifetime. Yves Cabannes, former director of the UMP for Latin America and the Caribbean, was of the view that the extent of success of such programmes depends on the placement of such programmes. Other cities that position such programmes as purely social programmes often face limited success in the outcomes. However, cities that link outcomes of such programmes with economic, social and environmental outcomes are more likely to see a much higher chance of success as a wider range of stakeholders are automatically involved and remain engaged.

Of course, policy support is the other side of the coin, in that such programmes will not be successful without support from the government. The programme in Quito is quite successful from a cost-benefit point of view; it provides employment, both direct and indirect, and incomes as well as helps people become entrepreneurs. These can be quantified monetarily and be measured. However, it also plays an important role in the uplifting of people from vulnerable sections of society, increases social cohesion and helps maintain biodiversity, all of which cannot be quantified in monetary terms. It is doing all this while accounting for just 0.2 percent of the total budget of the DMQ. It can surely reach out to a much larger section of society if the government decides to increase the programme, both institutionally and financially.

5.1.3 Policy and people

One of the hurdles to the programme is that consumer demand for organic produce did not really exist. This is probably due to the lack of consumer education. Many stakeholders from NGOs stated that those who do know about locally produced food in the city perceive it as being too expensive. While acknowledging the limited budget that AGRUPAR has, I believe that it should focus more on issues at the consumer end as well expanding the programme

beyond vulnerable communities. This will serve to accomplish two things: (1) Increase visibility of the programme to the middle class (2) Create consumer pull from all sections of society. Informal conversations within the city suggested that many people did not know about the food being produced within Quito. The other thing that must be ensured by AGRUPAR is that the food being produced does not become a niche commodity. Alexandra Rodriguez, AGRUPAR's chief, told me during our interview that the programme approaches food production as a societal leveller, in that everyone pays the same amount for food, with an emphasis on maintaining a fair price for the producer.

Policy support from the government is another area that could be improved. While the government has proved to be a great collaborator thus far both in terms of institutional as well as financial support, more could be done in terms of encouraging consumption of local organic produce. One of the examples that was quoted earlier was about mandatory procurement of products from small and medium enterprises which could be expanded to include locally produced food, especially for government run programmes and institutions. Policies to include mandatory sourcing of locally produced food could also be instituted to further increase demand for such products. Nataly Pinto, Food Smart Cities Cluster Coordinator at VECO Andino, an NGO, told me during our interview that AGRUPAR was working with them and other NGOs, government bodies, farmers, citizens and other concerned stakeholders to come up with a comprehensive food policy for the city, which could include such elements, but the process is in very early stages of development and I cannot comment on it any further.

Many small farmers during interviews stated that bringing their produce to markets (Bioferias) was a problem since they were not able to arrange the logistics. They are still able to sell their produce mostly through neighbourhood selling. But, this remains a dual edged problem and has two possible costs associated with it for the producer: (1) Time cost, as it falls the producer to spend time walking around the neighbourhoods, announce the product(s), find buyers and make a sale (2) Opportunity cost, as it is possible to discover higher prices for products at the marketplace instead of neighbourhoods. Again, since marketplaces take place on fixed days of the week, it becomes easier for the producer to make growing schedules and time crops properly. Another disadvantage that could be faced with neighbourhood selling is that producers may have to resort to lowering prices to finish stock that cannot be stored due to a lack of refrigeration/storage facilities, causing losses to the producer. Supermarket chains also identified this as a problem while procuring products from SMEs, as many of them could not organise the logistics to bring their products to supermarkets. And dealing with many SMEs could increase the overhead costs for supermarkets. A possible solution to this could be the formation of a logistics cooperative between the farmers of the city which arranges solutions for farmers who cannot afford it themselves. Such a cooperative should ideally operate at a not-for-profit basis to avoid the tag of a 'middleman'.

5.1.4 Precautions and limitations

Ellis & Sumberg (1998) bring forth very pertinent criticisms and cautions surrounding urban agriculture. Firstly, policy issues are very important. Before advocating or formulating policies surrounding urban agriculture, it is important to remember what policies failed in the past and to carefully avoid prescribing the same in the future. It is also important to keep in mind the kind of power that municipalities or local bodies possess before formulating policies. Many city governments around the world simply do not have the decision-making power in terms of land use planning or sustainable development. Trying to enforce a policy without taking this into consideration might just result in an outcome where little progress is achieved due to the need for coordinating bureaucracies at various levels, if they are willing to cooperate in the first place. Second, they point out the case of sub-Saharan African countries where previous

agricultural policies around credit, finance, marketing and farm support are still slowly being dismantled as they are ineffective and inefficient. For policies that are effective such as research and development, they should not be burdened additionally with urban agriculture as well. However, thankfully in the case of Quito, neither has been the case and policymakers should ensure that this remains so. Third, and perhaps the most important, they state that agricultural services such as advice, marketing services knowledge inputs are likely to be hijacked by those who are better informed and richer than vulnerable sections of society. This is something that needs to be kept in mind especially if/when the programme is going to be expanded to reach all sections of society, so that the vulnerable ones do not get edged out.

Finally, the concept of urban agriculture and NBS itself should not be oversold. It is still important to remember that given the resources and time, the programme supplies about 1 percent of the city's food needs. This is not to say that it is ineffective. But even after scaling up, it can produce non-discretionary food like greens, poultry, vegetables and fruit but probably cannot support staples like corn or wheat, which require much more land and resources. Still, it could possible supply a large extent of the city's needs in terms of non-staples and help it achieve multiple other objectives simultaneously. This is where communication of what is possible and what is not becomes important, so that expectations remain realistic from all stakeholders involved and not overly-optimistic.

5.2 Further research

One of the stakeholder groups that I could not interact with due to both time and language constraints was that of consumers and citizens. I did not also come across much research on consumer preferences in Quito, especially for local organic produce. This is something that could help bolster the case for expansion of the programme to help it achieve a wider breadth and reach. Consumer preferences, in terms of what they want to eat and the level of involvement that they are willing to put into the programme could also be mapped to gauge the potential for expansion.

Finally, the actual environmental outcomes of urban agriculture need to be mapped out, as data simply does not exist on these indicators. As the programme is contributing more than 400,000 tonnes of food annually from 29 hectares of farmland within the city, it is contributing to a reduction in transport emissions. It may also be contributing to reduction in runoff into the city's sewage system by retaining water on hillsides. This could be potentially very beneficial since the city faces flooding of roads frequently due to poor infrastructure that cannot handle cloudbursts. Finally, contribution in terms of better air, local temperature quality of life could also be mapped.

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Appendix 1: Interviewee list

Note: Permission to include names was taken from each interviewee before the start of interview

S.no.	Name	Designation	Date of interview
1	Alexandra Rodriguez	Head, AGRUPAR project, CONQUITO	4 th April, 2017
2	Natacha Reyes	Former Executive Director, CONQUITO	25 th April, 2017
3	Diego Carrion	Former General Director of Planning and Secretary of Territorial Development of the Municipality of the Metropolitan District of Quito	24 th April, 2017
4	Agustin Darquea	Engineer in Environment and Natural Resources and Good Environmental Practices, Ministry of Environment of the Municipality of Quito	4 th May, 2017
5	Yves Cabannes	Former Regional Coordinator, UN Habitat/UNDP Urban Management Program for Latin America	11 th May, 2017
6	Nataly Pinto	Food Smart Cities Cluster Coordinator, VECO Andino	11 th April, 2017
7	Markos Morales	Executive Director, TINKU permaculture centre	3 rd April, 2017
8	Luc Mougeot	Senior Program Specialist, IDRC Canada	24 th March, 2017
9	Laura Zuñiga	Farmer	10 th April, 2017
10	Delia Guasumba	Farmer	11 th April, 2017
11	Luis Alfonso Monoli6n	Farmer	12 th April, 2017
12	Juanita Inlasaca	Farmer	12 th April, 2017
13	Enrique Cabascango	Farmer	12 th April, 2017
14	Elsa Naranjo	Farmer	12 th April, 2017
15	Blanca Rocha	Farmer	12 th April, 2017
16	Jesus Endara	Farmer	12 th April, 2017
17	Alba Vallejo	Farmer	13 th April, 2017
18	Margarita Soledispa	Farmer	13 th April, 2017
19	Silvia Molina	Farmer	13 th April, 2017
20	Hiralda Aguilar	Farmer	13 th April, 2017
21	Bolivar Jim6nez	Farmer	13 th April, 2017
22	Sonia Ruiz	Farmer	13 th April, 2017
23	Jazmin Encalada	Farmer	13 th April, 2017

Appendix 2: Questionnaires

Note: Some follow-up questions were asked wherever necessary, but have not been included in this list.

1. Farmers:

- Are certain products/crops encouraged over others in order to earn more profit within the city/in proportion to their relative value? How long have you been practising urban agriculture?
- What is the premium that organic products command over non-organic products?
- What is the proportion of market sellers in relation to growers? Are the growers selling themselves or are there middlemen as well?
- How was the question of land allocation addressed? Was idle public land given out, or was it left to urban farmers to find land? Were land issues dealt with at all?
- Has the food security situation improved within the household? Has it improved in terms of food availability within the household or in terms of reduction in purchases that needs to be made outside the household? If so, by how much have purchases declined?
- Does the municipality provide training, advice and provision for educational activities? Is it adequate? Any new skillsets learned?
- Has there been an allocation of land rights to urban farmers? If not, what is the system that is being followed?
- Do you participate in UA activities regularly/occasionally? In case you do, do you feel an increased sense of ownership towards the area/neighbourhood after the introduction of the UA program? Do you use these spaces to socialise?
- What improvements would you like to see in the programme?

2. NGOs:

- What were the drivers, barriers and benefits to Quito's UA program?
- Since the program has started, has there been a noticeable stabilisation or drop in prices/improvement in supply of fruit/vegetables?
- Has the food security situation improved within the household? Has it improved in terms of food availability within the household or in terms of reduction in purchases that needs to be made outside the household? If so, by how much have purchases declined?
- Has there been an allocation of land rights to urban farmers? If not, what is the system that is being followed?
- What improvements do you think can be made to the program?

3. City government officials:

- What were the drivers, barriers and benefits to Quito's urban agriculture programme?
- Are certain products/crops encouraged over others to earn more profit within the city/in proportion to their relative value?
- What was done in terms of the legal regime to encourage urban agriculture?
- Has there been a concerted effort to close waste loops by diverting composting products towards UA? Is there an effort towards composting at all? Do farmers compost by themselves separately?
- Has there been a net addition in jobs after the introduction of the UA programme? If yes, how many?
- Has the net income of urban farmers been measured? If yes, what is the average earning

- per month/year as compared to the national average and minimum wage?
- Are there any tax subsidies or fiscal incentives provided to urban farmers by the municipality/government?
 - What is the proportion of food that is produced within the city as opposed to the food that is coming from outside the city?

Appendix 3: Price list of food items at Bioferias managed by AGRUPAR

S. no	Name	Weight (grams)	Price (USD)
1	Acelga	500	0.5
2	Alfafa	200	0.5
3	Apio	250	0.5
4	Arveja tierna	500	1.5
5	Brócoli	450	0.5 – 0.7
6	Cebolla blanca de rama	700 with leaves	1
7	Cebolla paitaña	500	0.75
8	Cebolla perla	500	0.75
9	Cebolla puerro	500 without leaves	1
10	Cebollín	100	0.5
11	Cilantro	250	0,5
12	Col blanca	NA	0.3 a 1
13	Col brusela	250	1
14	Col milán	Depends on the size	0.3 a 1
15	Col morada	Depends on the size	0.3 a 1
16	Coliflor	450	0,5 - 0,7
17	Espinaca	250	0.5
18	fréjol tierno	500	1.5
19	lechuga hoja	Depends on the size	0.3 a 0.5
20	Lechuga repollo	Depends on the size	0.3 a 0.5
21	Nabo chino	Depends on the size	0.5 a 1
22	Papa	1000	1
23	Papanabo	500	0.5
24	Pepinillo	500	1
25	Perejil liso y crespo	250	0.5
26	Pimiento amarillo	250	1
27	Pimiento	250	0.5
28	Rábano	500 without leaves	0.5
29	Remolacha	500 without leaves	0.5
30	Rúcula	250	0.5
31	romanesco	500	1
32	Sambo	1000	1
33	Tomate riñón	1000	1.75
34	Tomate cherry	250	1.25
35	Tomatillo	300	1
36	Vainita	250	0.5
37	Zanahoria	500	0.5
38	Zapallo	1000	1
39	Zucchini amarillo	500	1

40	Zucchini verde	500	0.5
41	Alcachofas	500	1
42	Achogchas	500	1
43	Berenjena	NA	NA
44	Zanahoria blanca	500	1
45	Aji	150	0.5
46	Mel loco	500	1
47	Hierbas de condimento	250	0.5
48	Hierbas medicinales	250	0.5
49	Haba	500	1
50	Machica	500	1
51	Garbanzo	500	2.5
52	Maíz	500	1.5
53	Aguacate	3 units	1
55	Limón	1	1
56	Uvillas	250	1
57	Mora	250	1
58	Taxo	1	1
59	Frutilla	250	1
60	Frambuesa	250	1
61	Jicama	500	1
62	Higos	500	1
63	Babaco	500 a 1	1 a 2
64	Tomate de árbol	1000	1.5
65	Guayaba	800	1
66	Encurtido	250	2
67	Salsa/pasta	250	2
68	Mermeladas	250	2.5
69	Pulpas	500	2
70	Dulce de higos	500	1.5
71	Aderezo de soya	250	3
72	Aguas aromáticas	500 cc	0,5
73	Mote	500	1
74	Arveja	500	1.5
75	Amaranto/quinua	500	2.5
76	Chocho	500	1.5
77	Haba	500	1
78	Fréjol seco	500	1
79	Trigo	500	1
80	Cebada	500	1
81	Garbanzo	500	1
82	Maíz	500	1.25
83	Maní dulce/sal	70 grams	0.5
84	Soya dulce/sal	70 grams	0.5

85	Garbanzo dulce/sal	70 grams	0.5
86	Habas dulce/sal	70 grams	0.5
87	Tostado dulce/sal y chulpi	70 grams	0.5
88	Granola	200 grams	2
89	Pepas de Zambo y zapallo	25 grams	0.5
90	Chips	70 grams	0.5
91	Pollo faenado	pound	1.7
92	Cuy prepaparado	1000	10
93	Huevos de campo	1 unit	0.3
94	Huevos de codorniz	20 units	1.5
95	Trucha/tilapia	1000	6
96	Miel de abeja	350	3.5
97	Miel de abeja	500	6.5
98	Miel de abeja	1	13
99	Queso con hierbas	450	3
100	Queso	450	2.1
101	Manjar de leche	250	2.5