URBAN AGRICULTURE
SUSTAINABILITY MULTIPLIER
‘When it is obvious that the goals cannot be reached, don’t adjust the goals, adjust the action steps’.  
- Confucius
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1.1. Acronyms

ACTAF: Asociación Cubana de Técnicos Agrícolas y Forestales
ANAP: National Association of Small Farmers, Cuba (sp. Asociación Nacional de Agricultores Pequeños)
AKIS: Agricultural Knowledge and Information System
CFSC: Community Food Security Coalition
COAG: Committee on Agriculture
CPUL: Continuous Productive Urban Landscape
EC: European Commission
EF: Ecological Footprint
EOT: Land management program (EOT, Esquema de Ordenamiento Territorial) (Cuba)
EU: European Union
FAO: Food and Agriculture Organisation of the United Nations
FS: Food Systems
IDRC: International Development Research Centre
MINAG: Ministerio de la Agricultura (Cuban state department of agriculture)
NGO: Non-Governmental Organization
RUAF: Resource Centres on Urban Agriculture and Food Security
SD: Sustainable Development
SEA: Agricultural Extension System (sp. Sistema de Extensión Agrario)

SUD: Sustainable Urban Development
UA: Urban Agriculture
UN: United Nations
UNDP: United Nations Development Programme
UPA: Urban and Peri-urban Agriculture
1.2. Introduction - Research topic

For some years now, the phenomena of urban agriculture have been present in the public discourse on cities and sustainability. It is often assumed that urban agriculture has the potential to contribute to an increased sustainability of the cities. However, many practical and theoretical obstacles might have to be overcome in order to realize this potential. One ambition of this thesis is to analyse urban agriculture as a “sustainability multiplier” – that is, as a practice that can positively affect a large number of dimensions of sustainability. Another ambition is to study how urban agriculture can contribute to lower the “ecological footprint” of our cities. Two concepts are essential in the discussion and have been given special attention in the thesis: “ecological footprint” and “sustainability”.

Today, the cities of the world are putting an enormous load on the ecosystems of the planet, consuming finite resources and consuming ecosystem services on a level that is clearly unsustainable. The resource consumption of the cities in the developed world is particularly problematic. The high standard of living of the citizens of the richest countries is matched by a correspondingly high consumption of resources, and so an equal living standard for the rest of the world’s population would seem to be incompatible with a sustainable society. If all citizens of the world would consume resources at the same level as the minority living in the richer part of the world do today, there would have to be three Earths in order for the ecosystems to produce necessary resources on a sustainable level. It is from this perspective that the concept of “ecological footprint” has grown in importance in the discourse on sustainability. By measuring the amount of ecosystem services a practice or entity consumes, and relating this to the global amount of ecosystems services that are available on a long-term sustainable level, it is possible to evaluate the “sustainability” of the practice or entity studied.

The ecological footprint of a city can be measured roughly. For the cities of Europe, the results are predictably discouraging. For example, 2008 the city of London had an estimated ecological footprint of 300 times the size of the city. On a global level, the cities keep expanding. Today, half of the world’s population live in cities, and by 2030, this figure is expected to have risen to two-thirds (Girardet, 2000). In the developed countries, this figure is already at about three quarters (Habitat, 2001). With the majority of the world’s citizens living in cities, it is obvious that to preserve the carrying capacity of the world’s ecosystems, the ecological footprints of the cities have to be greatly reduced.

This is an enormously difficult task. The Canadian ecologist William Rees, who developed the concept of global footprint together with Mathis Wackernagel, has defined the modern cities as “...black holes drawing in energy and matter from all over the ecosphere” (Rees W. E., 1996). In Rees’ opinion, the only possible way to reduce the ecological footprint of human society on a global scale is to develop cities to become more self-reliant. In this process, urban planning would clearly be one of the main instruments. “To achieve this city planners will have to develop policies where rehabilitating and usage of the local agricultural land will be promoted” (ibid).

Historically, the ecological footprint of cities has been continuously rising. Is it realistic to assume that this development can be reversed? Moreover, if it is possible, can it be done while maintaining at equal or at least satisfactory standard of living for the city dwellers? Is there any practical experience in the world of this process?

In 2011, I came to read a book on the issue of ecological sustainability in Cuba (Strömdahl, 2010). The book describes Cuba’s struggle through a severe economic crisis following the collapse of Soviet Union. Until its demise, Soviet Union was Cuba’s main trading partner. It offered favourable prices on Cuba’s main export product, sugar, and exported oil,
agricultural products and inputs, and industrial products to Cuba, usually under generous conditions. The impact of losing 85% of its external trade within a few years, combined with an acute shortage of energy imports and an intensified US embargo, led to a deep economic crisis. As export revenues collapsed, food imports could not be kept at previously high levels, threatening the food security of the inhabitants. The crisis, however, was overcome, and one of the main contributing factors of this was the development of urban agriculture, which turned out to be a ‘sustainability multiplier’ improving not only the food security, but also contributing positively to social, economic and ecological sustainability.

One of many interesting aspects of the Cuban recent history is the effect the crisis and the recovery has had on the ecological indicators of the country. Resource consumption been reduced significantly, while the standard of living has recovered and surpasses the level of the eighties. Consequently, Cuba today is unique among the world’s countries in one aspect: combined ecological and social sustainability. The World Nature Foundation (WWF) has been producing charts combining the United Nations’ Human Development Index (HDI) and the Ecological footprint of the world (figure 1). According to the WWF, the only ecologically, economically and socially nation in the world sustainability is - Cuba. While one could criticise the simplicity of the method, the indicators used are relevant. The HDI weights together factors such as public health levels, education level, life expectancy, birth mortality rates of the population, but also the GNP of the countries.

As I learned more about the development of urban agriculture in Cuba, I came to be more and more interested in the potential of urban agriculture as a tool in urban planning in the western world. This thesis is an attempt to investigate this potential.

1.3. Research questions

Firstly, the thesis attempts to evaluate the phenomenon of Urban Agriculture in its role as a contributor to ecological sustainability, by reducing ecological footprint. The concept of “Ecological Footprint” is a useful planning tool and a strong indicator of the sustainable development. (Chambers, Simmons, & Wackernagel, 2000). Currently, the concept is only playing a marginal role in the urban planning system, possibly because of a prioritization of other more local and short-term goals. A critical reviewer of the current practice claims that “Land—and by extension natural resources—valued only as a production input or commodity for exchange can be over-exploited for short-term gain with little consideration of its long-term productivity.” (McClintock, 2010)

Figure 1. Human Welfare and Ecological Footprints compared (source: www.science.org.au/novanewscientist.jpg)
There is reason to believe that, as the need of developing sustainable societies becomes more and more pressing, the importance of the ecological footprint as a concept in urban planning will grow accordingly.

Secondly, the potential of urban agriculture to contribute positively in multiple dimensions of sustainability is studied. It has been claimed that urban agriculture could be used to provide other values to the city than just ecological. Lovell (2010, p.2502) suggests that “[i]n addition to production functions, urban agriculture offers a wide range of ecological functions (e.g., biodiversity, nutrient cycling, and micro-climate control) and cultural functions (e.g., recreation, cultural heritage, and visual quality) that benefit the nearby community and society as a whole”.

Thirdly, a question in this thesis is to which extent urban agriculture is useful as a foundational principle in urban planning, something that has been suggested by several scholars, e.g. Lovell (2010), (Mougeot L. J., 2006). If urban agriculture has multiple positive effects, and few negative, one could envision that it could be integrated into urban planning as a standard tool for increasing sustainability. Urban agriculture might in the future be regarded as a city function that should be considered in all urban planning activities, just as other city functions such as for example public transport and recreation areas. In a previous section of this text, the importance of converting the world’s cities into more sustainable structures was introduced. Is the development of urban agriculture an efficient strategy to contribute to this goal being reached?

1.3.1. Method

The thesis is focused on formulating a qualitative understanding of the ‘multi-dimensionality’ of urban agriculture, and on the possible implications of this for urban planning practice. Quantitative research findings made by other researchers are quoted to contribute to the understanding and framing of the research questions. A case study of the existing urban agriculture system in Cuba is included in the work to test some of the assumptions and suggestions formulated in the thesis.

Triangulation of literature on the subject

Literature on several related themes has been used for the thesis. To frame the subject, literature on city ecology and sustainable development has been used. The available literature on urban agriculture has been surveyed to find the most accepted and cited perspectives on the phenomenon. The opinions on UA found in some of the most cited works have been triangulated in order to reduce the risk of relying too heavily on one researcher’s finding (Denscombe, p187).

The case study

The method primarily employed to test the research questions is a case study, which is a qualitative research method. According to Denscombe, the case study is characterised by being focused on one studied entity, with the goal of explaining the whole through the study of the particular. The case study is suitable for providing “an explanation that can cope with the complexity and subtlety of real life situations” (Denscombe, 2010, p55).

Urban agriculture is a complex phenomenon with many aspects, and for this reason, the case study is a suitable approach for studying it.

As Denscombe notes, the case study is in itself a strategic decision related to the scale and the scope of the research that does not necessarily determine which methods that are to be used in the research (Denscombe, 2010, p54).
It is worth noting that the case study mainly makes use of deductive logic in the sense that I am more trying to test the validity of claims and theory on urban agriculture than in discovering new data.

Literature used in the case study

One important source in the chapter on the urban agriculture in Cuba is available literature, and a lot of effort has gone into triangulating literature sources to complete the picture of the subject in focus of the study, and framing the subject. In studying the urban and peri-urban agriculture of Havana, it proved to be necessary to put the phenomena in a wider context, for two reasons in particular: First, urban and peri-urban agriculture cannot be studied in isolation from the rest of the agricultural sector as a whole. The different forms of agriculture are in many ways interconnected, and affected by common macroeconomic, political and institutional factors. Secondly, external factors influencing the UA system, such as state policies and macroeconomic changes, have to be considered in order to evaluate to which extent the Cuban experience can be generalized. As a consequence of this contextual method of work, time had to be devoted to studying literature on subjects connected to urban agriculture, such as the integration of the urban agriculture in the planning system, the historical background for the development of urban agriculture in Cuba, and the recent development of the Cuban agriculture sector as a whole.

Observation and interviews in the case study

To complement the literature studies with a first-hand experience; I visited Cuba for five weeks in March 2012. The visit was valuable to get a better understanding of the lived experience of the people in Havana. During my stay, I visited different sites of production and institutions connected to the urban agriculture and interviewed individuals in different positions. The interviews were informal and unstructured, but very helpful in providing me with a general orientation and understanding. The interviews also helped me to triangulate information found in literature and attained from own observations. Most of the literature on Cuban UA used in this thesis is readily available on the internet.

Before I initiated my research in Cuba, I had some concerns that it would be difficult to carry out research in Cuba. These concerns turned out to be quite unfounded.

I contacted the Swedish-Cuban friendship association, a NGO based in Stockholm, and they recommended me to contact Professor Jorge Peña Diaz at the Faculty of Architecture at the Technical University of Havana (CUJAE). During my stay in Cuba, I have signed up as a student at CUJAE and attended a course on UA. Through Prof Peña, I got in touch with a number of persons in Havana who were involved in UA or had studied the subject. I did not experience any difficulties in accessing the information I was looking for and the people I came to meet in Cuba while researching were all very accessible and helpful.

A few practical aspects of researching in Cuba were learnt in the research process. As in most countries, personal reference goes a long way in Cuba. When planning to visit an institution, it saves a lot of time and explanations if someone acquainted with you can introduce you. Another thing to consider is that due to economic restraints, printed material such as theses and academic books can sometimes be hard to come by, as they are printed in very small volumes. One should also be aware that, in certain cases, some bureaucratic hurdles might need to be overcome. For example, to visit the state-run urban agricultural sites in Cuba (Organopónicos), one should apply for a written permission from the department of Agriculture (MINAG). Since the request can take several weeks to process, it is advisable to make such an application well in advance.
Delimitations

The research question is focusing on only one aspect of the phenomena of urban agriculture in relation to urban planning: its “multi-dimensionality”. It should be emphasized that the purpose has not been to study closely the different “dimensions” or “aspects” of urban agriculture, but to identify them from the existing body of literature on urban agriculture.

Limitations and weaknesses

Although I have tried to identify the available literature relevant to the study, it is proper to acknowledge that it is possible that some relevant literature has not been identified. The consequence of such omission would be that information relevant to this study is not accounted for (Denscombe 2010, p.275). The studied supporting literature on urban agriculture is focused on the understanding of urban agriculture on a conceptual level rather than on practical implementation in planning.

In the case study, one restraining factor has been the limited international availability of Cuban research papers, which are sometimes only available in print and circulated only within Cuba.

Some possible problems associated with the case study approach in general mentioned by Denscombe (2010, p.63) are also relevant to the one in this thesis.

- It is assumed that the findings in the case study are possible to generalize.
- A case study of this kind cannot produce many quantitative data, which could be regarded possibly as a weakness of the approach. This has implications for the third research question (regarding to which extent urban agriculture is useful as a foundational principle in urban planning). It cannot be answered by analysing quantitative data. Instead, the thesis will try to establish an answer through a quantitative approach. The existing UA system in Cuba is described, analysed, and compared to findings from the literature on UA. The benefits of integrating UA in urban planning are estimated through analysis of the potential of UA to address problems belonging to different aspects of sustainability.
2. Concepts

2.1. The Ecological Footprint (EF)

The concept of ecological footprint was developed in the early nineties by Mathis Wackernagel and William Rees at the University of British Columbia, Canada. Since then, the concept has gained wide acceptance. It is often used as an indicator of the amount of ecological services that is claimed by a studied entity or phenomenon. In addition, the concept is sometimes used as a rough indicator of ecological sustainability of an activity or complex of activities, based on the fact that there is a theoretical limit to the amount of ecological services that can be claimed.

Although calculations to quantify ecological footprints can be complicated, the concept is quite simple. The global ecological footprint can be defined as the demand that populations and activities place on the biosphere in a given year. The biological capacity (biocapacity) is a measure of the amount of biologically productive land and sea area available to provide the ecosystem service that humanity consumes (Wackernagel et al, 2002). Correspondingly, the ecological footprint of a city is the amount of biologically productive area required to provide its natural resources and to assimilate its wastes. (Kennedy, Cuddihy, & Engel-Yan, 2007).

The concept of EF has the qualities of being easy to understand and describing complicated environmental issues in an accessible way. For this reasons, many environmental organisations have been using the concept to highlight environmental problems, in particular the pressure of human populations and different practises on the biosphere. Figure 2 and 3 shows two typical illustrations.

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<td>3.1</td>
<td>2.9</td>
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<td>2.3</td>
<td>2.1</td>
<td>2.0</td>
<td>1.8</td>
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Figure 2. ‘Humanity’s Ecological Footprint and biocapacity through time: global hectares per capita (Global Footprint Network).
The WWF Report of 2010 concludes that, in order to avoid disastrous ecological collapses in the future, the rich nations of the world will have to find solution to reduce their ecological footprints, including the reduction of their consumption of fossil fuels. (World Wildlife Foundation, 2010) EF has also been used to draw attention to the unsustainability of the world’s cities. It has been calculated that London alone is using an area of almost 300 times its own land mass to satisfy its demands of resources and to dispose of its waste and emissions (European Environment Agency, 2011, p. 65). Another fact based on the EF concept is that urban settlements consume 70-80 per cent of the ecological resources of the world. (Baccini, 2007)

2.2. Sustainability and sustainable development

The notion of sustainability has been continuously present in the planning discourse since 1987. That year, a report on sustainability by the UN World Commission on Environment and Development, was presented to the General Assembly of UN. Usually known as the “Brundtland report” it had a large impact on the discourse on sustainability. In a famous passage, the report defines sustainable development as a process that seeks “to meet the needs and aspirations of the present without compromising the ability to meet those of the future”.

Since the publishing of the Brundtland report, the concept of sustainable development has been expanded by the idea that it can be divided into three dimensions or pillars: economic development, social development, and ecological protection. This idea has become so widely spread that it is today almost always included in definitions or explanations of the concept of sustainable development. For example, the resolution of the 2005 World Summit of the UN General Assembly states that there are “three components of sustainable development —economic development, social development and environmental protection — as interdependent and mutually reinforcing pillars.”

Together, these two concepts could be said to constitute a “standard definition” of sustainable development. While it has gained wide acceptance it has also been criticised. For example, Jepson (2004) notes that while the concept of sustainable development often constitutes a framework for local planning, it has proven very difficult to incorporate a full range of its components, such as environment, economic and equity, in the balanced consideration of the policies and programs. Jepson’s conclusion is that this failure is based on discrepancies between the worldviews of ecologists and economists.
That the standard definition of Sustainable development has some problematic features is acknowledged by the UN as well. In a report on Sustainable Development issued by UN Headquarters in 2010, it is noted that while the concept of sustainable development has gained wide acceptance, “the concept remains elusive and implementation has proven difficult. Unsustainable trends continue and sustainable development has not found the political entry points to make real progress. [...] While sustainable development is intended to encompass three pillars, over the past 20 years it has often been compartmentalized as an environmental issue. Added to this, and potentially more limiting for the sustainable development agenda, is the reigning orientation of development as purely economic growth.” (Drexhage & Murphy, 2010, p. 2)

A number of writers have discussed the lack of balance between the three “pillars” that is suggested in the quoted passage above. As noted by Chambers, Simmons & Wackernagel (2000), the key question is how the three pillars fit together. According to Levett, 1998, the standard model of the “three pillars” falls short mainly in two ways: “First, the environment is a precondition for the other two. Without the planet’s basic environmental life-support systems, there can be no economy or society. Secondly, ‘the economy’ is not an end in itself or a force of nature. It is a social construct. It only works as it does because human societies have created the institutions and inculcated the assumptions, expectations and behaviours which make it so.” (Levett, 1998, p. 297) To reflect these facts, Levett suggests that the three dimensions or pillars of SD should be represented as a “Russian doll” rather than as three interlocking circles (figure 3).
3. Theoretical Background

3.1. The city as an ecosystem and its metabolism

What is a city? It is obvious that there must be many answers to such a question, largely depending on the almost infinite number of perspectives. The city is a study object for an extremely wide range of different disciplines, and so a comprehensive and consistent description of the city is inconceivable.

In the study of urban agriculture, however, the ecological aspects of the city are of such great importance that the ecological perspective of the city is a useful departure point. From an ecological perspective the ecological functioning of the city, with both its internal processes and its interconnections with the city environs is the focal point of interest.

Hughes (1998) characterizes a city as “…a structured human relationship with the natural environment. Although it is an artificial creation of human culture, it can be seen as an ecosystem related to other ecosystems.” (Hughes, 1998, p. 105).

Of course, from a perspective of sustainability, environmental stability is a precondition for the existence of the social and economic dimensions of the city. It is maybe in light of this one should understand Hughes’ complaint that “…too often, cities are studied only as a series of human social relationships and economic arrangements, and their intimate, constant, and necessary connections with the natural processes of the Earth are forgotten” (Hughes, 1998, p. 106).

From an ecological perspective, a city does not exist in isolation from its environs, but interacts with other ecosystems and is a part of larger compounded ecosystems. Human social factors have to be studied with the appreciation that they are operating within a complex series of ecological processes that impact and affect them.

The dependence of cities on their spatial relationships with surrounding lands has given rise to the study field of “urban metabolism”, a concept that was first developed by Abel Wolman in 1965, defining it as “…all the materials and commodities needed to sustain a city’s inhabitants at home, at work, and at play”. Today, the concept is often used in a broad meaning, including the flows of materials, nutrients and waste as well as the flow of energy. Kennedy, Cuddihy & Engel-Yan (2007) define urban metabolism as "the sum total of the technical and socioeconomic processes that occur in cities, resulting in growth, production of energy, and elimination of waste.”

The metabolism of the cities has changed greatly in the course of history. The modern city’s complex relationship with the connected ecosystems in which the metabolism takes place means that a large part of the supporting ecosystems are usually geographically separated from the city, or in other words, "the ecological locations of high-density human settlements no longer coincide with their geographic locations” (Rees W. E., 1992).

In the first urban populations, the supporting agricultural activities existed primarily within the city limits. Although this gradually changed, it was not until the industrialization of the cities that the practice eventually almost completely disappeared. (Castillo, Livelihoods and the city: An overview of the emergence of agriculture in urban spaces, 2003) (Kennedy, Cuddihy, & Engel-Yan, 2007). In the modern city, the metabolism of the city could be characterized as “linear” - food, goods and energy is produced outside of the cities, consumed in the city and the resulting waste and emission is exported back to the supporting ecosystems (Fig. 5). The main problem of this process is as the metabolic activity of the cities grows, the resulting flow of waste
grows equally, demanding even larger environs to absorb it. It has been questioned if an unmitigated “linear metabolism” is compatible with an ecologically sustainable city. Girardet, 2000, notes that the natural ecosystems are typically circular, and claims that

“[T]o become sustainable, cities have to develop a similar circular metabolism, using and re-using resources as efficiently as possible and minimising materials use and waste discharges into the natural environment” (Girardet, 2000, p. 7).

3.2. The food system – a missing link in urban planning

The American Planning Association of USA defines a food system as “the chain of activities connecting food production, processing, distribution and access, consumption, and waste management, as well as all the associated supporting and regulatory institutions and activities” (APA Food System Planning Committee, 2006). Considering its large share in the cities’ metabolism, it is clear that the urban food system is highly relevant for the work of building more sustainable cities. As figure 6 illustrates, the current food system is consuming a high amount on energy. A large part of this consumption could theoretically be affected by planning practices.

Considering the above, it is surprising that the food system of the city is rarely present on the planning agenda in the developed world. Although interest in subjects such as food waste, food availability and food production appears to be on the rise, “traditional” urban planning subjects such as for example transportation, housing and commercial viability are still receiving the vast majority of attention in planning documents. Policy officials fail to comprehend the importance of the urban food system for the quality of urban life. (Lovell, 2010)

Kaufman and Pothukuchi (1999, p213-4) suggest several explanations to the low visibility of food system in the planning practice.

- The institutional separation of urban and rural policies.
- A tendency of planners to take the existing food system for granted, as there are no acute or serious problems related to food access, availability, or affordability.
- Institutional bias -the historical development of cities led to the definition of specific issues and problems as urban predominantly in opposition to or in contrast with rural or agricultural. Food is not perceived as an urban issue in the same magnitude as are housing, crime, or transportation.
- Historically, cities and their food systems were until the industrial revolution linked, with urban populations depending on a food system based within the cities’ immediate environs to sustain themselves. Since the beginning of the industrial revolution, migration to the cities combined with the rise of mechanized large-scale farming, and industrial methods for the handling and distribution of food have contributed to the almost complete disappearance of farmland in or near urban areas. In this complicated structure, the food system of the system gets less visible, as production and distribution takes place elsewhere, and the products are generic and available with no tangible connection to season or origin.
The low visibility of the food system in planning practice is lamentable, as the food system of the city has importance for many. In addition to contributing to the health of the inhabitants of the city, the food system is linked to many urban issues, such as waste management, local land use and transportation, local economy and the environmental quality of the city. The integration of food system into the planning systems can thus enable a wider array of solutions available for urban problems.

One comprehensive strategy that has been suggested to increase the sustainability of the food system is urban agriculture.

3.3. **The revival of urban agriculture**

Urban Agriculture is, as mentioned previously, by no means a new phenomenon. Historically, agriculture existed in most cities. It is only more recent advances in infrastructure and agriculture that has made the physical separation of the city and its supporting environs a reality. Neither has the process of disintegration of the urban agriculture been complete. Urban agriculture continues to exist in many parts of the world, not only in so-called developing country, but also in many developed countries.

This being said, there is definitively reason to speak about a “revival” for urban agriculture. Figure 7 shows how the number of research publications on the subject has been rising continuously since the 1980’s. In the new millennia, this scientific interest is matched by a much-elevated interest in media on the subject.

![Figure 6. Life cycle energy use in supplying food in USA (Hellner, 2003)](image)

![Figure 7. Number of publications concerning Urban Agriculture (International Development Research Centre, 2009)](image)
The rise in interest for urban agriculture might have many different causes, but those connected to the issues food security and sustainability are likely to be the most influential ones.

Urban Agriculture and food security

Since a long time, FAO is actively promoting urban agriculture in the developing world. Urban agriculture is seen as a development path to address several important issues in the "Global South", such as food security, poverty alleviation, public health, and problems associated with urbanisation. (FAO, 2008). The importance of food related issues in urban communities in the developing world is obvious from figure 8, which shows the proportion of income spent by low-income residents in some selected cities in the world.

![Figure 8. Percentage of income spent on food by low-income residents in selected cities (FAO, 2011, p.14)](image)

The issue of food security in the developing world is not a new issue, but some global trends have made the question one of the most important, if not the most important issues of the developing world of today.

One of these trends is the continued urbanisation of the world. As figure eight shows, the trend of a rapidly rising urban population in the South was visible during the whole twentieth century, but in the twenty-first century, it is matched by stabilization and predicted decline of the rural population. This demographic change is putting an enormous stress on the food systems of the south, many of which were not even earlier able to satisfy the needs of the populations.

![Figure 9. Rural and urban population in North and South, 1950 to 2030 (projected) (Mougeot L. J., Growing better cities: Urban agriculture for sustainable development, 2006)](image)
Another trend that has had negatively impacted the food security of the South is the increased volatility and rise in food prices that has taken place in recent years. A long trend of falling food prices ended in the early twenty-first century and the new trend of rising prices is expected to continue the future (FAO, 2011, p. 12). Figure 10 illustrates the trend in food prices since the 1960s, while figure 11 charts the price volatility in staple products that in 2008 affected the food security of billions of people.

The spike in oil and food prices in 2008 and the shocks of the current economic meltdown are major driving forces behind a growing interest in urban agriculture as a way to achieve better food availability and improve the food security in the South.

Interestingly, the interest in urban agriculture in times of crisis is not a new phenomenon. In the USA and Britain, for example, urban food production has flourished in such moments of economic crisis. (McClintock, 2010)
According to FAO, some of the major ways UA can contribute to an increased food security and better nutrition is by:

- Providing for family self-consumption, thus contributing to healthy diet and allowing for saving on food expenditures.
- Providing a source of income, through sale of surplus or specialized and intensified commercial oriented production systems.
- Improving the supply of local markets with fresh and micronutrient rich foods at competitive prices.
- Ensuring a continuum of tree cover through landscape management and use of agroforestry systems, hedgerows and woodlots.

(FAO, 2008, p. 11)

Beside other forces driving the price increase on food in the future, one important driver might be the expected rise in oil prices that are due to the depletion of the available global oil reserves, as conventional agriculture consumes high amounts of fossil energy. Urban agriculture has proven to be an energy-efficient way of producing food, and with a rise in oil prices, the economic benefits of urban agriculture will be a driving force for its expansion. At the same time, a decreased energy consumption of the food system would also be beneficial for the ecological sustainability.

**Urban agriculture and sustainability**

In the North, the interest in urban agriculture is usually connected with the issue of sustainability.

Many benefits of urban agriculture for ecological, social and economic sustainability have been suggested. Lovell, 2010, cites a number of ecological benefits, such as:

- By producing food locally and balancing production with consumption, the embodied energy of the food required to feed the cities is reduced because of lower transportation distance, less packaging and processing, and greater efficiency in the production inputs.
- The reduced energy requirements could in turn decrease greenhouse gas emissions and global warming impacts compared with conventional food systems.
- Energy is also conserved by reusing urban waste products locally, both biodegradable wastes for compost, and wastewater (e.g., storm water and grey water) for irrigation.
- The reuse of wastes offers another benefit in reducing transportation and land use requirements for disposal and long-term management, essentially closing the loop in the cycle of waste resources.
- Urban agriculture, like urban gardens, can also contribute to biodiversity conservation, particularly when native species are integrated into the system.
- These systems can offer additional ecological benefits in modifying the urban microclimate by regulating humidity, reducing wind, and providing shade.
Urban agriculture contributes to social sustainability by having a direct and indirect impact on the various aspects of the citizens’ quality of life. One basic benefit that UA can provide is to contribute to food security for families and communities and to the improvement of conditions for poor neighbourhoods, both in developing and developed countries (Duchemin, Wegmuller, & Legault, 2009).

Beside the suggested benefits of urban agriculture for ecological, social and economic sustainability, Delshammar, 2011, adds that another interesting reason for the current interest in UA is that it elucidates a current conflict between different strategies in building sustainable community. On the one hand, there is strong motive for increasing condensation in the city centres; on the other hand, there is big demand for more green spaces. (Delshammar, 2011)

Some observers regard a future expansion of urban agriculture as a desirable development that will in part be driven by necessity and economic factors:

“Given the near unavoidable rise in oil prices, the economic benefits of expanding urban agriculture will become more obvious. Aside from supplying more fresh produce, this will help millions discover the social benefits and the psychological well-being that urban gardening and locally produced food can bring.” (Brown, 2009)
3.4. Definitions of Urban Agriculture

Many definitions of urban agriculture have been published. A review of the use of the term lists 22 different definitions, some of which appear to be almost irreconcilable with each other (Quon, 1999). From all these different definitions, the one that is probably the most frequently cited by other sources, is by Luc Mougeot, first printed in the book “Agropolis”:

“Urban Agriculture is an industry located within (intra-urban) or on the fringe (peri-urban) of a town, an urban centre, a city or metropolis, which grows or raises, processes and distributes a diversity of food and non-food products, reusing mainly human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area” (Mougeot L. J., 2005).

The International Development Research Centre, IDRC, an organisation that is part of the Canadian foreign aid program, has formulated another commonly cited definition of urban agriculture:

"Urban Agriculture (UA) is an activity that produces, processes, and markets food and other products, on land and water in urban and peri-urban areas, applying intensive production methods, and (re)using natural resources and urban wastes, to yield a diversity of crops and livestock." (Jacobi, Drescher, & Amend, 2000)

Yet another definition has been suggested by FAO: “Urban and peri-urban agriculture (UA) occurs within and surrounding the boundaries of cities throughout the world and includes products from crop and livestock agriculture, fisheries and forestry in the urban and peri-urban area. It also includes non-wood forest products, as well as ecological services provided by agriculture, fisheries and forestry. Often multiple farming and gardening systems exist in and near a single city.” (FAO, 2001)

The three quoted definitions of urban agriculture have in common that they make a subdivision of urban agriculture into “intra-urban” (or “urban”) and “peri-urban” agriculture, a division that has sometimes been questioned. However, these three definitions are today used by the largest institutions researching urban culture, and are reasonably compatible. In this text, “UA” will be used in the meaning that has been assigned to the phenomenon by Mougeot, including both intra-urban and peri-urban forms of agriculture. The terms “intra-urban agriculture” and “peri-urban agriculture” are used when there is a need to distinguish between the two categories of UA.
Urban Agriculture and Rural Agriculture

The main feature that distinguishes UA from rural agriculture is its integration into the urban economic and ecological system, meaning that it is not primarily its urban location that sets UA apart from rural agriculture, but the fact that it is embedded in and interacting with the urban ecosystem. (Bakker, Dubbeling, Guendel, Sabel Koschella, & de Zeeuw, 2001).

The conceptual separation of agricultural production into urban and rural agriculture that the definition of UA creates does not necessarily suggest that the two forms of production are competing. In fact, research has found that UA usually has a complementary role in the agricultural sector, but instead offers products and functions that are compatible across the region (Lovell, 2010).

Empirical evidence (IDRC 1998), (Drescher A., 2003) suggests that UA complements rural agriculture in a number of ways:

- It can produce goods that substitute food imports intended for urban consumption and thus save on foreign exchange.
- It can free high quality rural agricultural land for other purposes than the production of food for national consumption, such as export-oriented production.
- It can reduce pressure to cultivate new rural land, which can relieve ecological stresses on marginal rural lands.
- It can contribute to the generation of income in the rural sector by various and multiple interactions between the rural and urban areas and their inhabitants.

3.5. The characteristics of urban agriculture

From the definitions of UA quoted above, one might draw the conclusion that the defining characteristic of UA is the location of the agricultural activity. Whereas the location is certainly a defining characteristic of UA, it is just as much the functional aspects of UA that characterizes it, as it is an integral part of the urban economic, social and ecological system. “[UA] ...uses urban resources such as land, labour, urban organic wastes, water and produces for urban citizens. Further, it is strongly influenced by the urban conditions such as policies, competition for land, urban markets and prices, and makes a strong impact on the urban system (urban food security and poverty, urban ecology and health).” (FAO, 2007, p. 6) This perspective on UA is important as it draws attention to the interconnectivity of urban agriculture and other urban processes. Earlier, there has been a tendency to regard UA as a “rural” practice that has either been absorbed by the growing city, or brought to the city by rural populations migrating to the cities. This view of UA as a relic of rural habits could lead to the conclusion that UA will fade away as its practitioners get more integrated in the urban context.

Urban agriculture is an activity that is undertaken in all parts of the world. Although it has sometimes been regarded as a marginal activity, it has tremendous importance for the feeding of the world’s population. 1996, United Nations Development Program estimated that approximately 800 million urban citizens worldwide were involved in UA and identified over 40 farming systems, ranging from horticulture to aquaculture, kitchen gardens to market gardens, and different livestock (Smit, Nasr, & Ratta, 1996). It is not surprising that the variation of form of UA in different countries is large (FAO, 2003). The variation is related to the fact that the cultivation is depending on a number of external factors, such as for example:
• The economic status of the country
• Urban policies
• The character and size of the unit carrying out the activity (e.g., household, private company, institution)
• Cultural aspects (e.g., preference for crop, organisation)
• Infrastructure
• Availability of fossil energy and inputs
• Climate
• Access to soil and water

3.5.1. Sites of production

The variation of the types of production sites for urban agriculture is almost endless. The choice of production site is often not chosen exclusively from agricultural considerations, but usually heavily influenced by other factors, such as land availability and prices, and municipal policies and restrictions.

Larger scale production sites are usually to be found in peri-urban land, and is often if not always old rural farming land that has become peri-urban with the expansion of the city.

Small and medium sized production sites exist in a wide array of locations. In most cities in the world there can be found plenty of spaces that either are unoccupied by any other function or that is used in a function that can be combined with UA. (FAO, 2001) In most parts of the world, rapid urbanization and urban sprawl are strongly influencing UA production sites. As green spaces disappear due to residential development, industrial areas are being demolished, and power lines and roads are being built, sites for agricultural production disappear and new vacant spaces appear. As UA is interlinked with the urban system, it can usually manage to respond to the dynamics of the city and is able to adapt quickly to the changing economic and spatial conditions (FAO, 2007). Especially in the developing world, smaller scale production sites can thus be located on almost any urban site imaginable, such as:

• on vacant plots
• in home gardens
• on verges
• in containers
• on balconies
• on roof tops
• in fishponds
• in school gardens
• on road strips
• along railways
• below power lines
• around airports
• on river banks
• in rivers
• on communal land
3.5.2. Urban farmers and forms of organisation

There is a wide variety of forms in which UA is organised, and the individual farmers represent a large wide spectrum of society.

In most countries, a large proportion of the urban farmers belong to the poorer part of the population, but there are also people of middle income or high income involved in UA. School teachers and lower level government and municipal officials are often find among urban farmers, as well as people practicing UA for leisure or as a part of a commitment to social work and community service. The background of the urban farmers is equally varied. Some of the farmers are recent immigrants, but the majority have lived in the city for a long period before taking up farming in the city. One explanation to this is that in order to gain access to the necessary resources, such as land, water and inputs, one usually has to be integrated in the urban society. Some of the urban farmers have once been agricultural workers in the countryside, but many have no previous experience of farming. In many countries, women constitute a large proportion of the urban farmers. This is usually explained by the women’s responsibility for the household. In the family type of UA, the plot is usually located close to the home, which means that the farming can be combined with other household tasks.

The forms of organisation of the UA vary greatly. A large part of UA in the world is practiced as subsistence farming for the own family. This is often carried out on an individual or family basis, but subsistence farming is also organized in groups and cooperatives. UA is sometimes part of governmental or municipal programs, and can then be organized as forms of institutional UA such as school gardens. Commercial UA is usually carried out in a comparatively large scale.

From the available literature, a list of common forms of organisation of UA could be suggested to read like the following (ordered by size):

- Micro-farming in and around the house/homestead
- Community gardening
- Institutional UA
- Small-scale (semi-) commercial horticulture
- Small-scale (semi-) commercial livestock and aquatic farming
- Specialized urban agriculture and forestry production
- Large-scale agro-enterprises
- Multifunctional farms, i.e. farms that combine agricultural activity with other activities such as tourism.
3.6. Strategies for strengthening of urban agriculture

Generally speaking, the strategies for the expansion and strengthening of UA finds their conceptual foundation in the understanding of UA as an urban activity integrated in the urban fabric. UA is competing for land with other urban land uses; it uses urban resources such as organic wastes and irrigation water; it depends on the urban infrastructure for supply of inputs and distribution of produce. Consequently, UA is strongly influenced by urban policies, plans, norms and regulations.

As discussed earlier, international institutions working with global development, such as the World Bank and UN, today regard UA as an important development path to address several important issues in the “Global South”, such as food security, poverty alleviation, public health, and problems associated with urbanisation. Consequently, a large part of the studies on strategic development of UA has been focused on UA in the developing world, which means that the results might not always be applicable to UA in more affluent countries.

The following compilation of strategic areas and proposed actions within each area is based mainly on research material focusing on the strengthening of UA in the developing world. However, it should be noted that the same division could well be applied to UA in the developed world, while some of the proposed actions would probably have to be adjusted or replaced by others.

Integration of UA in regional food system

On a city-region level, policies are needed to optimize the urban-rural linkages and production potentials. Regional urban food systems plays an important role in balancing and linking urban and rural food supply, and urban agriculture concentrates on production of foods that can be grown under conditions of reduced space (vegetables, small animals). Regional food system enables regional food self-reliance to grow, imports to be reduced and can provide significant economic, social and environmental benefits to all stakeholders, both producers and consumers, in that region. (Dubbeling, 2011)

Land access

- Establishing UA as a legitimate urban land use
- Enhancing land-tenure security
- Making municipal land available for UA by leasing the land
- Establishing fiscal and tax incentives
- Promoting use of vacant private lands

In many countries, lack of access to urban land is one of the principal obstacles for UA. Subsistence UA is often carried out on not owned by the farmer, such as roadsides, riverbanks, along railroads, vacant private lands, or parks, and the farmers land rights are minimal and usually informal. The risk of eviction affects the activity adversely, as it leads to the cultivation of short-duration seasonal crops and discourages investments in the production site.
Participation and democratic processes

- Creating mechanism for participation and dialogue in UA projects through involvement of stakeholders such as farmers, habitants, officials, of public–private associations, civil society, and actors at the local and national levels. (Dubbeling & de Zeeuw, 2006)

Social inclusion

- Promoting UA as a family farming practice for subsistence.
- Gender affirmative actions
- Promoting school and children’s gardens
- Supporting youth entrepreneurs through urban agriculture

Education / Extension

- Farmer training
- Strengthening of farmers’ organisations
- Development of appropriate technologies
- Farmer education on the management of health and environmental risks
- Education of food vendors and consumers on management of health and environmental issues

Financial policies

- Enhancing access of urban farmers to credit and finance
- Facilitating direct marketing by urban farmers
- Supporting micro-enterprise development
- Creation of funding programs tied to actions directed at strengthening social organization, technical assistance, training, and marketing support.

Environmental policies

- Prevention of industrial pollution of soils and water by industry
- Environmental Policy for recycling of organic waste in UA

Urban planning policies

- Promotion of multifunctional land use
- Mapping of vacant land
- Demarcation of zones for UA
- Integrating UA in social housing projects
- Integrating UA in the design of open spaces
- Health considerations when setting aside zones for urban agriculture

Institutional support of UA

- Adequate institutions for UA are needed. Preferably, the responsibility for UA should be placed within a dedicated institution.
- To reduce the risk of health and environmental issues, coordination between health, agriculture and environmental departments is needed.
4. UA – Urban Sustainability Multiplier?

The concept of the “Urban Sustainable Multiplier” was introduced by William E. Rees in 1995, to describe how addressing one urban issue can stimulate change in many related factors contributing to sustainability. Being nodes for the human consumption of natural resources, cities cannot even theoretically be sustainable in the sense of being in balance with the surrounding ecosystems. Cities will always be dependent on supporting ecosystems in the environs and in dispersed geographical locations. However, paradoxically, for this reason it is in cities that the greatest opportunities exist to make the changes necessary for general sustainability. Since most consumption is urban, changed pattern of consumption in the city will have a high impact of the total national consumption. The high density of the urban consumption also means that sustainability patterns can benefit from the economy of scale, and the interconnectivity of urban processes means that one measure can affect several sustainability indicators positively. All of this means that policies of sustainable development gain their greatest leverage in cities. (Rees W. E., 1995)

UA as a phenomenon corresponds very well with the criteria for such an ‘urban sustainability multiplier’ as defined by Rees. Many researchers on UA emphasize its character of a contributor to sustainability on multiple levels, e.g (McClintock, 2010), (LaCroix, 2011), (Lovell, 2010), and (Feenstra, 2005).

4.1. Comparative analysis of some selected “urban sustainable multipliers”

The concept of ‘urban sustainable multipliers’ introduced by William Reese has caught little attention this far, and many aspects and questions surrounding it are yet to be studied. How, for example, should different ‘multipliers’ be evaluated? A conceivable indicator would be the cost/benefit ratio, i.e. the quota between the cost to implement it and the benefit for sustainability that would be achieved. However, gathering the necessary data would be complicated.

Another way of estimating the quality of different ‘multipliers’ would be to measure their ‘multidimensionality’ – the breadth of their impact on sustainability. The 2011 monitoring report of the EU sustainable development strategy by the European Commission lists seven ‘key challenges’ for sustainable development:

- climate change and clean energy
- sustainable transport
- sustainable consumption and production
- conservation and management of natural resources
- public health; social inclusion; demography and migration;
- Global poverty and sustainable development challenges.

While the choice of these key areas maybe should not be seen as an authoritative list of the most important challenges for sustainable development, it arguably provides a reasonably fair basis for a comparison of different strategies for sustainability. By estimating the impact of different strategies on the seven areas listed by European Commission, it is possible to make a rough estimation of the multi-dimensional quality of the
strategy. In his article, Rees suggests two different multipliers: compact city form and public transport. Below, these two strategies and UA are measured against the key challenges listed by the European Commission to evaluate their multi-dimensionality.

4.1.1. Compact city multiplier

In the surveyed literature, some of the significant positive impacts found were:

- Lower costs per capita of providing infrastructure and public amenities
- High potential for advanced material recycling, re-use and remanufacturing.
- High population density reduces the land use per capita.
- High potential to reduce the per capita use of fossil fuel for space heating through economies of scale, co-generation, and the use of waste process heat from industry or power plants.
- High potential to reduce energy consumption by motor vehicles through walking, cycling, and public transit.

(Olofsson, Carlgren, Erlandsson, & Torstensson, 2010), (Rees W. E., 1996)

A few possible negative impacts are also noted, such as higher personal consumption in the city than in the countryside. A literature review found that empirical data regarding the sustainability of compact cities are inconclusive; suggesting that the theoretical impact of city density on sustainability might not be easily achieve in reality (Neuman, 2005)
4.1.2. Public transport multiplier

The main motivation for increasing public transport and reduce the private transportation is no doubt to decrease the fossil energy use. The energy consumption per seat-km is approximately three times higher for private cars than public transport. However, public transport has other positive impacts for sustainability as well. In the surveyed literature, some other significant positive impacts found were:

- Improved health and quality of life through improving of the local air quality
- Fewer lives lost in traffic accidents.
- Improved quality life in the cities as traffic barriers are cleared and less urban space is needed for private cars.
- Improved mobility for disadvantaged groups of citizens.
- More affordable housing.
- More efficient land use and conservation of agricultural land.

(Rees W. E., 1996)

Figure 14. Areas of sustainable development covered by literature concerning ‘Green’ Transport (intensive colour – most discussed, faint colour – little discussed, no colour – omitted in discussion)
4.1.3. UA multiplier

A complete and consistent picture of the impact of UA on ecological, social and economic sustainability is rather difficult to make, as there is an abundance of literature, with different angles to the subject. Some impacts are empirical, while others are theoretical. Duchemin (2009) notes that in the global South, food production and poverty alleviation is the focus of interest in UA. The objectives of the global North however “are never centred solely on food production. Gardening in this case becomes a pretext for social action (leisure activities, education, networking, solidarity, empowerment, physical activity, political activism)”.

The following positive impacts of UA were found in Lovell (2010), McClintock (2010), and (Smit, Nasr, & Ratta, 1996), (Ginsberg, 2000).

<table>
<thead>
<tr>
<th>Environmental sustainability</th>
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<tr>
<td><strong>Resource preservation</strong></td>
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<td><strong>Energy conservation</strong></td>
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<td><strong>Waste management</strong></td>
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<td><strong>Biodiversity</strong></td>
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<td><strong>Social sustainability</strong></td>
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<tr>
<td><strong>Food security</strong></td>
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<tr>
<td><strong>Social inclusion and community development</strong></td>
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<tr>
<td><strong>Human Health</strong></td>
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<tr>
<td><strong>Cultural diversity</strong></td>
</tr>
</tbody>
</table>
**Education**
Through UA, children and adults can learn about foods, nutrition, cooking, environment, economics, and cultures.

**Aesthetic** UA can positively alter microclimate through humidity control, wind protection, and shade. It increases an aesthetic factor of the unused urban spaces. Community and backyard gardens contribute to the greening of urban areas, improving aesthetics and well-being.

**Impact on economic sustainability**

**Benefits for Urban producers – household level:**
- Savings on food expenses.
- Sales of excess crop to local markets, schools, elderly homes, etc.
- Self-process and sale of grown products (jams, marmalade, etc.)

**General – city level:**
- Higher property values from the presence of community gardens
- Maintenance costs of green spaces is reduced
- Aggregate employment and income generated
- Aggregate economic benefits on recreational services (children’s farms, etc.)
- Low establishment cost of the UA practises, income from productivity
- Urban agriculture ventures offer new jobs for neighbourhood residents and vitality from improved economics of the community.
- Food that is sold through local markets, provide income for individual residents and benefits the local economy

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**Figure 15. Areas of sustainable development covered by literature concerning Urban Agriculture (intensive colour – most discussed, faint colour – little discussed, no colour – omitted in discussion)**
5. Current state of UA

5.1. Europe

One key characteristic of the spatial development relevant to UA in Europe is the trend of rapid expansion of urban areas. Each year, an agricultural area equal to the size of Berlin is absorbed by the urban expansion, and the rate is accelerating. The growth of urban areas and associated infrastructure consumed more than 8 000 km² of land in Europe 1990–2000, equivalent to the consumption of 0.25 % of the combined area of agriculture, forest and natural land. (European Environment Agency, 2006).

By magnitude, the most important aspect of UA in Europe today is probably the long tradition of allotment gardens that is kept alive in European cities. The movement was born in England as a response to the urban decay in London (Brown, 2009), and later allotment gardens were created in many parts of Europe.

There are also several recent important cases of successful implementation of UA in European. Most of them have in common that they have been created through the work of individuals or community organizations rather than being the result of favourable planning policies. Although a number of organizations are promoting UA in many cities, one gets the feeling that the approach is chaotic, with organizations pursuing their separate paths. (Pothukuchi & Kaufman, 1999). Economic driven land use planning is a severe obstacle to the development of UA, as agricultural activities cannot pay as high land rent as other land functions.

5.1.1. Commercial UA in Netherlands

As the urban expansion in Netherlands continues, one area of interest for UA in the country has been possibility to secure the commercial viability of traditional farms as their land becomes absorbed into the urban fabric. Since Netherlands is densely populated and urban land resources valuable, food production is not in itself a strong enough argument for local politicians and planners to allocate urban land to agriculture. By identifying land use functions that can be integrated into the farms’ operations, farms on the urban fringe can find extra income, while essential benefits in environmental, health, education, recreation and nature terms are provided to the city and its residents. Some examples of such land use functions that have been proposed or already tried in UA in Netherlands are:

- Agriculture combined with childcare and educational facilities
- Reed production combined with recreation and wastewater treatment
- Aquaculture combined with water storage and recreation
- Production of added-value agricultural products such as cheese, jams and cosmetics, combined with recreation and tourism
- Urban forestry, which offers health and microclimate benefits, combined with energy crops and recreation.
- Paying farmers for the increased property values generated by open agricultural landscape adjacent to housing

In Delft, a viable organic farm has been created through the combination of land uses and integration of policies between different organisations at different levels. One principal obstacle in this process is a lack of land-tenure security. Local municipalities are often unwilling to grant long-term leases to land for UA. Inclusion in local land-use plans would provide urban agriculture with a firmer legal basis (Deelstra, Boydd, & van den Biggelaar, 2001), (Remmers, 2011) and (Visser, 2007).
5.1.2. Allotment gardens in Berlin, Germany

The German allotment gardens provide a representative example of the European allotment gardens. The first allotment gardens in Germany were founded in the early 18th century to provide the urban poor with the possibility to subsistence farming. Especially during the first and second world war, the German allotments proved important for food security and survival in the cities. Shortly after WW II, nearly 200 000 allotments existed only in Berlin. Today, about 80,000 allotments remain in Berlin. In the whole of Germany, there are nearly 1 million allotments, totalling almost 47000 ha. About 4 million people are active users of the allotments, of which many are pensioners. Although the allotment system still produces a substantial amount of fresh fruits and vegetables, the original objective of food production is usually not the major incentive for participation. Recreation and social benefits are more important. For poorer families with children the allotment gardens provide affordable space for recreation. Allotment gardens connected to schools are used in the education. The allotment movement also function as a point for social contacts. This is echoed in the political support of the allotment gardens in the German cities, which is based on the recreational value and the value for nature preservation that the gardens provide, rather than on the food production. Since the 1990’s an increasing share of allotment gardens are owned by migrants from other countries. Observations prove differences in the use of allotment gardens between migrants and Germans. Migrants tend to grow much more vegetables and fruits, while Germans generally grow more flowers and use the gardens for recreation.

A study of the allotment system in Britain indicates that in Britain as well, the public interest in allotment gardens tend to be related to the economic situation, with interest increasing in times of crises. However, like in Germany, recreation is the main motivating factor for the allotment gardeners and that seems to have been the case throughout the 20th century (Acton, 2011). The situation might be somewhat different in central and eastern Europe, where economic hardship in the nineties led to an increase in subsistence agriculture in allotment gardens. (Drescher A., 2001)

Figure 16. Allotment in Köln-Porz.
Available at Http://upload.wikimedia.org/wikipedia/commons/e/ee/Kleingaerten.jpg
5.1.3. Continuous Productive Urban Landscape in London, UK

An assessment by the World Health Organisation (Petts, 2001) gives a rather bleak view of the current UA in a city, which was once a leader in modern urban agriculture in Europe. The report finds that

- A limited amount of commercial agricultural is still present in London, but it is "mostly highly chemical-intensive and focuses mainly on arable and livestock production rather than fruit and vegetable growing, which could yield greater social benefits".
- Dependence on an increasingly globalized food is growing, leading to a gradual decrease of essential life skills such as the ability to cook a meal.
- There are no well-developed markets for urban agriculture in London.
- As regards the environment, growers are using fewer pesticides since the introduction of integrated pest management systems.
- What is now left of London's commercial agricultural food sector is under strain, squeezed between urban housing and other developmental pressures and a skewed system of agricultural support, which favours large cereal producers over small growers.
- Land is scarce and very expensive and urban agriculture is not the most lucrative way of using it.

However, the Allotment system is still present in London. There are about 30,000 active allotment gardeners controlling 831 ha of public land in London. 13.4% of it is located inside the urban area (Bohn & Viljoen, 2011). 14% of London's residents produce some of their own food (Brown, 2009, p. 159)

In recent years, there have been many signs of a renewed interest in UA in London. The city administration has created a policy for the city food system, London Food Strategy. The policy is encouraging local food producers. (Granvik, 2012, p. 117)

The ambitious proposal of a ‘Continuous Productive Urban Landscape’ in London, created by Bohn & Viljoen is another initiative that has raised a lot of interest (Bohn & Viljoen, 2011). The design proposal is suggesting the creation of a continuous 'productive green grid' in the urban fabric of London which could feed tens of thousands of people. The designs includes

- Garden Parks: areas for leisure and sports, combined with areas for fruits and vegetables
- Educational-productive squares: various elements responding to community needs such as playgrounds with meeting spaces, urban greening, and agricultural production.
- 'Productive streets': a design which integrates small scale agricultural activities to existing street.
Figure 17. The CPUL concept. (Bohn & Viljoen, 2011)

Figure 18. A CPUL proposal connecting a public art gallery, the Tate Modern, in central London to the town of East Croydon at the edge of London. (Bohn & Viljoen, 2011)
5.2. UA in the Global South

As mentioned earlier in the paper, UA’s role in the Global South is mainly focused on food production and poverty alleviation. UA is of course not a new phenomenon, but with the urban growth, the agricultural activities in the growing cities have expanded enormously. FAO estimates that 390 million people are engaged in the UA in Africa and Latin America, including more than 10% of the urban population living in the sub-Saharan Africa. A lot of the current UA activity, however, is informal and without technical support. In recent years, this situation has begun to be rectified. FAO and the World Bank have been active in promoting UA, encouraging governments to create policies for UA and supporting development programmes for UA. A number of NGO’s active in African and Latin American countries have also been very active supporters of UA. The UA is seen as an important area of development to fulfil the UN’s Millennium development goals, particularly the goals of reducing urban poverty and hunger and ensuring environmental sustainability. (FAO, 2007).

5.2.1. UA in Africa

There are many successful UA projects in Africa, for example:

- Mali, Bamako – self-sufficient in vegetable production and cattle / population 1 million / 1780 registered farmers
- Senegal, Dakar – 21% of Senegalese population involved in poultry ventures, 70% cultivate land for UA
- Mozambique, Maputo – 6200 registered farmers / 2100 ha land occupied by agriculture structures (Madaleno I. M., 2001)

5.2.2. UA in Latin America

- Belem, Brazil. A study of the informal urban agriculture in the city found that it is an important contribution to health and income for many resource-poor families. (Madaleno I., 2000)
- Rosario, Argentina, is an often-cited example of a successful implementation of UA for poverty alleviation. A local legal framework for UA has been set up by the municipality, making UA an integrated part of the town planning. About ten thousand Families are involved in UA and 800 community farms exist in the city. UA occupies more than 60 ha of land in the town and 63% of the UA participants are women (Merzthal, 2005)
- Havana, Cuba is a unique example of large-scale implementation of urban agriculture. The production in Havana of fruit and vegetables is now large enough to provide the amount recommended by FAO for all the inhabitants. It is estimated that around 300 000 persons in Cuba are involved in UA.
6. UA in Cuba

6.1. Introduction

The development of the urban agriculture in Cuba in the last decade of the twentieth century has been the focus of a great deal of attention from media as well as from researchers. Quite a lot has been written on the urban agriculture in Cuba, as well on the agro-ecological conversion of the Cuban agricultural sector. The UA in Cuba is widely regarded as one of the most successful large scale experiments in UA, and to this day remains a unique process of coordinated effort to convert a conventional food system to a sustainable, low-input form of agriculture system.

Wright (2005) remarks, in her doctoral thesis on sustainable agriculture in Cuba, that "[t]he organisational experiences that Cuba might have gone through to reach a nationwide, ecological production system, as well as the support system that enabled this, would certainly provide a learning model for others to draw from" (Wright, 2005, p. 5). Correspondingly, the unique character of the Urban Agriculture in Cuba is in itself a reason why it can be studied to provide insight in the challenges and opportunities that can emerge in an organized effort to change a conventional food system, dependent on high inputs and high usage of energy and transportation, into a sustainable and localized mode of production.

While some literature and studies on the urban agriculture in Cuba exists¹, very little has been written on its relation to physical planning.

The primary source of this chapter is available literature.

A lot of time has gone into triangulating literature sources to complete the picture of the subject in focus of the study, and framing the subject.

Too complement the literature studies with a first-hand experience; I visited Cuba for five weeks in March 2012. The visit was valuable to get a better understanding of the lived experience of the people in Havana. I visited different sites of production and institutions connected to the urban agriculture and interviewed individuals in different positions. The interviews were informal, but very helpful in providing me with a general orientation and understanding.

In studying the UA of Havana, it proved to be necessary to put the phenomena in a wider context, for two reasons in particular. First, UA cannot be studied in isolation from the rest of the agricultural sector as a whole. The different forms of agriculture are in many ways interconnected, and affected by common macroeconomic, political and institutional factors. Secondly, external factors influencing the UA system, such as state policies and macroeconomic changes, have to be considered in order to evaluate to which extent the Cuban experience can be generalized.

Because of this contextual method of work, a lot of time had to be devoted to studying literature on subjects connected to urban agriculture, such as the different aspects of agricultural policies, AKIS, public participation and others.

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Figure 19. Map of Cuba (CIA, 1994)
6.2. Agriculture in Cuba in the twentieth century

6.2.1. Agriculture in Cuba before 1959

The agriculture and food system of Cuba in the fifties were shaped by the country’s economic situation as a semi-colonial client state to the USA after the defeat of the Spanish colonial rule in 1899. The exportation of sugar and other export crops was the basis of the country’s economy. Monocultures of sugarcane, grazing lands, tobacco and coffee accounted for over 80% of the agricultural land, which was extremely unevenly distributed. In 1959, there were 30,587 landowners. Of these, 9.4% owned 73% of the land. Nine latifundia owners held over 620,000 ha (7.3% of the land). Companies and individuals of US directly owned 25% of the arable land. (Nova, 2001). The picture of an uneven distribution of agricultural land had become more accentuated in the period preceding the revolution of 1959. In 1946 about 8% of the farms were 100 hectares or more in size; by early 1959 the same percentage of farms were 402.7 hectares or more (Alvarez, 2004).

The vast majority of farmers were not legally owning the land they farmed, but leasing, sub-leasing, sharecropping or squatting. The labour-intensive and seasonal character of the sugarcane cultivation meant that 600,000 rural workers (33.5% of the total workforce) were affected by underemployment. The consequences of this agricultural system were quite predictable. In the early 50s, 96% of the rural population suffered from poor nutrition. Infant mortality was 60 per thousand births and life expectancy 61.8 years. Illiteracy exceeded 40%. The lack of property rights meant that forced evictions were a common practice. In the period 1958-1959, around 40,000 farm families were forcefully evicted (Regalero, 1979, as cited in Machín Sosa, Roque Jaime, Ávila Lozano, & Rosset, 2010).

6.2.2. Agriculture in Cuba after 1959

One of the early ambitions of the Cuban revolution was to reform the agriculture of the country. The agriculture was to be diversified, and the dependence on sugarcane and food imports to be replaced by food sovereignty. The land reform of 1959 reduced the maximum area of private farms to 402 ha (with certain exceptions), and divided the rest of the land among tenant farmers and agricultural labourers (Wright, 2009, p. 54).

Political realities, however, soon came to change the course of development into a very different direction. When USA, in a response to the First Agrarian Reform Law in 1959, cancelled the contracts to buy the Cuban sugar harvest, the new Cuban government responded by instead selling it to USSR. The subsequent deterioration of US-Cuban relations, with the failed invasion of Cuba in 1961 as a particularly critical turning point, and the beginning of the US total trade embargo against Cuba in 1964, contributed to Cuba’s rapid integration to the economic sphere of USSR and COMECON. Cuba exported sugar on favourable terms to the industrialized members of COMECON, and could in return buy oil at a favourable prize as well as receiving technological assistance. The result was a rapid modernization of the agriculture, which led to a marked increase in the production of sugar. The early ambition of food sovereignty was abandoned. Cuba remained dependent on food imports and increasingly also became dependent on inputs for the agricultural sector to sustain the high output of the cultivation of sugar. For a long period, these dependencies appeared to be relatively unproblematic.

6.2.3. State of agriculture in 1989

In the late eighties, Cuban agriculture was a world-class case of modernization and of the “Green Revolution” (Machín Sosa, María Roque Jaime, Rocío Ávila Lozano, & Rosset, 2011), with the most tractors per person and per unit of area in Latin America, and the second highest average
grain yields (Rosset & Benjamin, 1994). The dominant form of agriculture was the network of State Farms, which operated 6 million hectares of agricultural land in Cuba. The agriculture made heavy use of chemical inputs such as manufactured fertilizer, of which was 48 per cent imported, and pesticides, which were 82 per cent imported. The agricultural production was to a large extent directed at export crops, mainly sugarcane. In the late 1980s, between 44 and 57% of the population’s caloric intake was imported from the Soviet Union. (Deere, 1993)

6.2.4. Alternative currents in the Cuban food system

It is, however, important to note that the development and domination of the Soviet-styled high-input, mechanized agriculture on large state-owned production units did not conquer all and neither was it without detractors in Cuba.

During the eighties, a vocal minority of scientists and practitioners promoted a more ecologically sustainable form of agriculture. (Vandermeer, Carney, Gersper, Perfecto, & Rosset, 1993)

As early in the 1960s, it was recognized that the reliance on pesticides was becoming an environmental problem that risked aversive effects on public health. The development of integrated pest management techniques (IPM) that begun in Cuba in the seventies aimed at reducing the use of pesticides by controlling vectors with biological methods (Ines Nicholls, Pérez, Vasquez, & Altieri, 2002).

The traditional family farming was never completely replaced by large-scale collective farms. Even though the state-farm system was gradually extended to 83 per cent of the productive land, family farms still remained.

The risks of dependency on imports of food and inputs were also recognized by the Cuban leadership. Various elements of the Food Program were launched well before the demise of the Socialist bloc. During 1987, the goal of becoming completely self-sufficient in food production by 1995 had been announced, largely expected to come about through massive investments in new irrigation schemes. These programmes allowed the government several crucial years to engage in major infrastructure investments before the country’s ability to import was severely reduced. (Deere, 1993)

The practice of urban agriculture was actually researched in Cuba long before the crisis in the nineties. In the 1960s experimental urban agriculture, based on complex construction technology and crop management, such as hydroponic and zeoponic gardens with high utilization of industrial and chemical products, were introduced by the state on a small scale (<60 ha) in Havana (González Novo, 2000).

In the late eighties, Raoul Castro Ruiz, at the time the defence minister of Cuba, initiated the first experiments in UA in Cuba by the ministry of defence, MINFAR. (Carrión Fernández, 2006)

These alternative currents of development in the Cuban food system came to serve as important resources for the drastic changes in the Cuban agriculture and food system that followed the dramatic events that took place in Cuba in the last decade of the twentieth century.

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2Hydroponics is a method of growing plants in water, without soil.

3Zeoponics plant-is a method of growing plants in artificial soil mainly consisting of aluminosilicate minerals.
6.2.5. Crisis in early nineties

The collapse of the Socialist block in 1990 had very severe consequences for the Cuban economy. As OSS cancelled the oil contracts between Cuba and the Soviet Union, Cuba's oil import dropped significantly in the early nineties. Oil imports fell from 13.3 million tons in 1989 to 6.1 million tons in 1992. The total value of imports fell from $8.1 billion in 1989 to less than $3 billion in 1992 (Deere, 1993, p. 40). The intense pressure on the Cuban economy was further aggravated as USA tightened its embargo against Cuba in 1992 and 1996 that penalize third countries if their ships stop in Cuba, allow sanctions on countries trading with Cuba, and stop officials of companies doing business with Cuba from entering the U.S (Kost, 1998, p. 26). As a consequence of these events, the GNP fell by 35% from the onset of the crisis to 1993 (Caridad Cruz & Sánchez Medina, 2003, p. 13).

Another consequence of the crisis was that the domestic food production decreased as a result of the lack of imported agricultural inputs. The import of fertilizer decreased from 1.3 million tons in 1989 to 300,000 tons in 1992 and animal feed, from 1.6 million tons to 475,000 tons (Deere, 1993, p. 40).

The agricultural output fell by 54% between 1989 and 1994. As the domestic food production could not be replaced by importation, the availability of food deteriorated. Daily calorie consumption fell from 2728 in 1990 to only 1863 in 1993 (Caridad Cruz & Sánchez Medina, 2003, p. 13).

As a response to the economic crisis, the Cuban state introduced emergency measures in 1991, which marked the beginning of what became known as the "special period in time of peace"⁴, lasting until approximately 1997. The most important economic measures of the "special period" were the promotion of tourism, reduction of consumption, the reduction of state spending, and programs for foreign investments. In addition, important reforms were introduced solve the crisis in agriculture caused by the lack of imported inputs.

6.2.6. State response to crisis of food system

Cuba’s domestic policy-makers first responded to the food system crisis of the 1990s by introducing new strategies to counteract the falling agricultural production. Volunteers in the cities were mobilized for seasonal work in state farms and two-year work contracts were offered for work on state farms. Self-provisioning on the state farms and decentralized management were actively encouraged. (Deere, 1997) While these strategies served to maintain a minimum of food security, they were temporary measures that could not replace the structural reforms that were needed to adapt the agricultural sector to the new economic reality.

In 1993, the government introduced land reforms, as a longer-term solution for food security (Enríquez, 2000).

- Workers on state farm were given the opportunity to form Basic Units of co-operative production (UBPC) and lease the state land for free and indefinitely. The farms’ equipment has been transferred to the co-operations. UBPC Cooperatives were also formed on state-owned farmable land in urban and suburban settings.
- The food distribution system was reformed to reduce the need of transportation, saving valuable fuel. Farming cooperatives and family farmd were allowed sell their production directly to the consumers. “Farmer markets” were opened in which consumers could purchase food directly from the producers.
- An already existing mandate that some land on all farms (large and small) be set aside for subsistence production was expanded, which marked the departure from the previous tendency on specialized agricultural production.

⁴ Spanish periodo especial en tiempos de paz
A programme initiated in the eighties aimed at linking state-employed agricultural workers to specific parcels of land was again activated. The intention was to motivate the individual workers by directly linking their salary bonuses to their productivity.

6.2.7. New forms of agricultural production after 1990

As a result of the agricultural reforms initiated by the state in the early nineties, the organization of the agricultural production changed profoundly during the following years. State farms were dismantled and their resources transferred to collective units owned by the former state-employed agricultural workers.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>State</td>
<td>83</td>
<td>47,5</td>
<td>33,1</td>
<td>23,2</td>
</tr>
<tr>
<td>Other state sector organizations</td>
<td>9,0</td>
<td>9,0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UBPC</td>
<td>-</td>
<td>26,5</td>
<td>40,6</td>
<td>39,8</td>
</tr>
<tr>
<td>CPA</td>
<td>12</td>
<td>7,0</td>
<td>26,3</td>
<td>37,0</td>
</tr>
<tr>
<td>CCS</td>
<td>10,0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: (Funes-Monzote, 2008)

UBPC

The UBPC cooperatives are formed out of state-owned farms. The workers of the farm form a cooperative, and the ownership of the land and farming equipment is transferred. The legal framework for the creation of the cooperatives was codified in 1993.

CPA / CCS

CPA⁶ and CCS⁷ are two common forms of farming cooperatives for land owning farmers in Cuba. The inclusion in a cooperative gives the farmers access to state-provided inputs and credits, and in return, the cooperative commits to selling pre-agreed quotas of the harvest to the state at fixed prices. Aside from selling produce to the state, the collectives also sell their production to consumers or food market vendors, and also cultivate crops and raise animals for self-provisioning. The CPA form of cooperative was legislated in 1990 as an agricultural cooperative with collective ownership of the land. It is formed by individual farmers transferring the ownership to the CPA entity. In the CCS form of cooperative, which has existed in Cuba since the sixties, the farmers retain the individual ownership of land and farming equipment. (Funes-Monzote, 2008)

6.3. The rise of urban agriculture in Cuba

6.3.1. Spontaneous urban agriculture and state involvement in the early nineties

When the economic crisis hit the Cuban society, the urban areas were the most affected as the scarcity of fuel affected the food distribution to the cities. As a result, in many communities people spontaneously began to use vacant lots to grow food. Others asked the local authorities for permission to cultivate unused spaces of the cities. Many of the early orchards were planted in private lots and terraces of families for their own consumption. However, few of the Cuban city dwellers had the adequate experience in

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⁵ Unidad Basica de Produccion Cooperativa, Basic Unit for Cooperative Production.

⁶ Cooperativa de Produccion Agricola, Agricultural Production Cooperative.

⁷ Cooperativa de Creditos y Servicios, Credit and Service Cooperative.
agriculture, and even those with rural background knew little of the specific techniques of small-scale organic agriculture, which are necessary for urban agriculture. At the same time, the government seems to have concluded that UA was a resource-efficient method to mitigate the loss of food security in the cities. Consequently, the state rapidly expanded its support for UA. A programme for ‘popular gardens’, in which state land in the cities were leased for free in usufruct to individuals taking up gardening, was started in 1990. By 1995, there were an estimated 26 600 popular garden parcels in Havana alone (Chaplowe, 1998).

6.4. Urban agriculture in Cuba today

According to Grupo Nacional de la Agricultura Urbana y Suburbana (GNAUS), the Cuban urban and suburban agriculture covers 8912 ha, of which 1275 ha organopónicos (sites with raised beds), 7 396 ha huertos intensivos (high intensity agriculture sites) and 241 shade houses. The current target is to reach 10000 ha. The annual productivity was almost 19 kg/m². (Delgado Guerra, 2012)

In a response to expected climate change in the future, GNAUS is supporting the creation of more shade houses to reach a thousand hectares in 2015. (Sierra, 2012)

“The technological impacts, economic and social Urban Agriculture Movement of Cuba are etched in history forever: they have generated more than 300 000 jobs, has contributed to food security, have developed healthy eating habits, has increased the ecological culture of population with the use of agricultural practices in harmony with Nature and Society, apply organic fertilizers and use systems and efficient irrigation practices.” (Rodríguez Nodals, 2006)

6.4.1. Characteristics of the Cuban model of urban agriculture

According to (Murphy, 1999), the most important characteristics of the Cuban UA system are:

- Strong political commitment
- Access to public land
- Coordination of local resources
- Programs to support small producers
- Encouraging producers sense of ownership
- Establishing a strong extension program
- Guaranteeing affordable inputs
- Strong local demand for fresh produce
- Farmers markets and direct marketing

Definition and strategic framework of UA in Cuba

GNAUS defines the Cuban UA as “Food production within the urban and suburban perimeter, applying intensive practices, taking into account the interrelationship of man - crops - livestock - environment and the urban infrastructure facilities conducive to the stability of the labour and diversified production of crops and animals throughout the year, based on sustainable management techniques that allow the recycling of waste” (Hernández, 2006, p. 15)

The goal of the UA is to “Mobilize the productive potential existing in each locality to produce food all year round, even in exceptional conditions, creating an infrastructure empowered by its capacity to create employment and educate the participants in order to achieve the best possible
performance; increasing biodiversity and environmental conservation in harmony with the built environment.”

The Strategic framework for UA consists of the following goals:

1. Rational and intensive use of productive areas, with programmes defined for each unit and systematic checks of all activity.
2. Using mechanisms that encourage the interest of man to produce more and to create facilities for this, including services for the producer, organic matter, seeds, irrigation and biologic control.
3. Maximizing the diversification of the species, breeds and varieties in each production unit. Creating a strong foundation to ensure the supply of organic matter and breeding stock.
4. Elevate the agricultural, nutritional and environmental cultural knowledge of the population through a dynamic extensive practice that reach all producers and local populations, with continuous training, generalization of the scientific-technical results and positive experiences of the producers.
5. Close coordination among all entities concerned with the production, processing and distribution of food.

6.4.2. Types of urban agriculture in Havana

In describing the different expressions of urban and peri-urban agriculture in Cuba, I have adhered to the classifications by the Cuban UA organizations and available literature. It is worth to keep in mind that the categories are not always mutually exclusive, and might not always be entirely consistent over time. The different forms of UA in Cuba are usually sorted by the different economic forms of production. Organopónicos is the Cuban name for cultivation in raised beds, a method used when the soil on site is unsuitable. Huertos intensivos are slightly larger sites where the land is cultivated by a collective of workers, usually organized as a cooperative but sometimes part of the state farms system. Patios (or huertos caseros) are privately owned lots, often adjacent to a residence, used mainly for subsistence farming. Parcelas are state-owned lots held in usufruct by individuals for subsistence farming. Fincas suburbanas are larger farms in the countryside bordering to the cities. Areas de Autobastecimiento are sites near workplaces that are used for farming for the workers meals at work.

<table>
<thead>
<tr>
<th>Type</th>
<th>Units</th>
<th>Area (hectares)</th>
<th>Yield (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organoponicos</td>
<td>3 810</td>
<td>1183,4</td>
<td>18,44</td>
</tr>
<tr>
<td>Huertos intensivos</td>
<td>6 961</td>
<td>7557,0</td>
<td>11,30</td>
</tr>
<tr>
<td>Microhuertos</td>
<td>100 000</td>
<td>12 774,0</td>
<td>5,79</td>
</tr>
<tr>
<td>Parcelas</td>
<td>139 960</td>
<td>30 975,0</td>
<td>6,8</td>
</tr>
</tbody>
</table>

Table 1: Area and Yield by modes of production (GNAU, 2006)
<table>
<thead>
<tr>
<th>Type</th>
<th>Agriculture mode</th>
<th>Typical size (ha)</th>
<th>Land ownership</th>
<th>Economic mode</th>
<th>Main Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organopónicos</strong></td>
<td>Intensive agriculture in raised beds</td>
<td>0.2–0.5</td>
<td>State land held in usufruct</td>
<td>State owned or CSS or UBPC</td>
<td>Commercialization</td>
</tr>
<tr>
<td><strong>Huertos intensivos</strong></td>
<td>Intensive agriculture</td>
<td>1–3</td>
<td>State land held in usufruct</td>
<td>CSS or UBPC</td>
<td>Commercialization</td>
</tr>
<tr>
<td><strong>Patios, huertos caseros</strong></td>
<td>Intensive agriculture</td>
<td>&lt;1</td>
<td>Privately owned</td>
<td>Subsistence</td>
<td>Subsistence</td>
</tr>
<tr>
<td><strong>Parcelas</strong></td>
<td>Intensive agriculture</td>
<td>&lt;1</td>
<td>State owned held in usufruct</td>
<td>Subsistence</td>
<td>Subsistence</td>
</tr>
<tr>
<td><strong>Fincas suburbanas</strong></td>
<td>Agriculture/Livestock/Agro forestry</td>
<td>N/A</td>
<td>State owned /Privately owned/ held in usufruct</td>
<td>CSS or State owned</td>
<td>Commercialization</td>
</tr>
<tr>
<td><strong>Áreas de Autoabastecimiento de Empresas y Organismos</strong></td>
<td>Agriculture</td>
<td>&gt;1</td>
<td>State owned</td>
<td>Subsistence</td>
<td>Subsistence</td>
</tr>
</tbody>
</table>

Table 2: modes of production, after (Caridad Cruz & Sánchez Medina, 2003)

**Organic methods**

When it comes to the issue of agrochemicals, it is not formally illegal to apply chemical fertilisers, but in practice, it only occurs on a very limited scale. The GNAU standards for urban agriculture do not recommend the usage of chemical fertilisers, and thus those who chose to use chemical fertilisers, would risk their municipal support, and also receive poor evaluations from the local representatives of GNAU. Agrochemical pesticides are effectively banned. The municipal department for agricultural health and safety prohibits the use of pesticides unless it is authorized by a municipal urban farm, and offenders may be fined. (Wright, 2005, p. 76)

The official view of the Cuban state is that urban agriculture is a measure to achieve ecological and social sustainability (Delgado Díaz, 2006). The ideology of ecological sustainability is clearly noticed in how the usage of agrochemical pesticides and fertilisers are persistently discouraged in the extension services.

Instead of agrochemical pesticides, Cuba has made efforts to develop biological methods to control vectors. Biological agents such as predators, parasitoids and entomopathogens have been studied and used since the early 1970’s. A national grid of research stations are monitoring out brakes of agricultural pests and producing biological pesticides. In 2002, a study made by researchers from Berkley University in California, US, found that about 982,000 ha of various crops were under biological control (Ines Nicholls, Pérez, Vasquez, & Altieri, 2002). These methods, that started to be
developed for use in the rural agricultural sector, was later applied in the urban agriculture, and biological pesticides and advice on how to apply them are available in the agricultural support stores (CTAs) in the cities. Another way of pest control that is used on the larger production sites is to plant trees and plants that repel insects. Leaves of the neem tree (Azadirachta indica A.Juss) and tobacco plants are used to produce natural insecticides (figure 20).

Permaculture

Permaculture has mainly been promoted in Cuba by an influential NGO, Fundación Antonio Núñez Jiménez de la Naturaleza y el Hombre (FANJ). Although the projects that have been initiated by the foundation make up only a small part of the total UA activity, it has been influential in the Cuban UA sector. The foundation published a study on the Cuban urban agriculture that was translated to English and has found a large audience (Caridad Cruz & Sánchez Medina, 2003).

During my stay in Havana, I visited a farm in Pogolotti, one of the poorer suburbs of Havana, experimenting in permaculture. The farmer had created a kitchen garden following permaculture principles on land belonging to her family. The main purpose of the garden was to function as a demonstration garden for visiting school classes and people interested in permaculture.

Figure 20. Neem Tree has been planted beside a organopónico and is used to repel pests and to produce organic pesticides (Havana, photo by author)
6.4.3. The agricultural knowledge and information system (AKIS) of Cuban urban agriculture

The purpose of this section is to briefly describe the way information and knowledge has been transferred in the urban agriculture between different actors. As a framework for the section I have used the AKIS model developed by the Food and Agriculture Organization of UN (FAO) and the World Bank.

Definition

The AKIS model of the process of building knowledge in the agricultural sector was developed by the World Bank and FAO. An often-quoted definition of AKIS is from Röniger & Engel, (1991), who state that AKIS is “...a set of agricultural organizations and/or persons, and the links and interactions between them, engaged in the generation, transformation, transmission, storage, retrieval, integration, diffusion and utilization of knowledge and information, with the purpose of working synergistically to support decision making, problem solving and innovation in agriculture.” (Röling & Engel, 1991, p. 31).

The standard AKIS model is often graphically represented as in the figure above. The individual farmer is the centre of the model, and the surrounding parts are divided into Education, Research and Extension sectors. Obviously, this is an extremely generalized figure. The reason for this generalization is that the definition of AKIS is meant to be applicable to all different configurations that exist in the world.

Starting from the basic AKIS figure, Carasco, Acker & Grieshop (2003) have developed a more detailed map of the extension part of the Cuban AKIS.
Even though figure 22 focuses on the extension, it should be noted that many of the actors would figure in description of the research and education in the overall AKIS system, e.g., universities, research institutions, NGOs.

The above figure also draws attention to one important characteristic of the Cuban extension system: the high number of actors. One explanation to this might be the way it was developed. Following the reformation and decentralization of the agricultural sector, the AKIS was developed in an equally decentralized manner. The state encouraged existing institutions, such as research institutes, to take up extension to make their research accessible to the new cooperatives and individual farmers, a cost-efficient approach that was essential in the years of economic crisis.

In addition, in the nineties, the Cuban state opened the country for international NGOs, which lead to a number of foreign organizations cooperating with national NGOs and state organizations in the agricultural sector.

Several national NGOs, such as ACTAF and ANAP, grew to be important actors in the extension.

Consequently, the extension part of the AKIS grew to become a highly dispersed and decentralized system, with little central coordination. Today the activity is to an increasing extent coordinated within the framework of SEA (see below), but the NGOs still play an important role in the system.

### 6.4.4. SEA, the agricultural extension system in Cuba

The intense activity to combat the food crisis in Cuba in the nineties led to a large amount of decentralized extension services to satisfy an enormous demand from the new cooperatives and urban farmers. The state did not coordinate the extension work its institutions were performing. Extension, training, and communication were integrated within the activities of the research centres and within the system of planning and management control of the Ministry of Agriculture. From the state’s point of view, some framework of coordination was needed. In 2003, the Ministry of Agriculture decided to implement a system of agricultural extension, known as SEA (Sistema de Extensión Agraria), with the objectives of reaching a larger number of producers and of increasing the agricultural production while applying a more sustainable agricultural model.

This new framework for the extension work was also meant to rectify the problems associated with the older model of state-led extension that had been developed during the seventies and eighties. This traditional state extension system ensured that scientific findings were applied in the agriculture, but, according to MINAG itself, the practices tended to be vertical, hierarchical, and focused on the supply of technologies, in accordance with a model of agricultural development that was centralized and involving a high amount of input. (López, 2005)

The Ministry of Agriculture states the mission of the SEA as “...to help develop competitive and sustainable supply chains in agriculture, to raise the standard of living of the producers and consumers, and to contribute to the producer’s management and appropriation of mechanisms for economic and social development by solving the problems and challenges of the agricultural and forestry sectors.” (López, 2005)

### 6.4.5. Extension services for Urban Agriculture

The official ideology of the extension service is that it should be a participatory learning process with practical experiences giving feedback to
the research work. An often cited motto is “Producing while learning; teaching while producing and learning while teaching”\(^8\). The extension services are not only supplying the producers with inputs and knowledge, but they also are expected to participate in the application of the proposed methods and new strategies, in order to convey the producers’ feedback to the extension system (Companioni Concepción, 2006).

**Horticulture clubs**

After the Provincial Group of Urban Agriculture of Havana was formed in 1994, the group began to promote the organization of the “popular gardens” into Horticulture clubs. In 2000, there were 894 clubs, organizing 17,396 producers (González Novo, 2000). The clubs serve to support the popular gardens by allowing the gardeners to exchange experience and receive training from agricultural advisors (“extensionists”). They also serve to extend interest in gardening among the communities. Clubs are often started with the guidance of an agricultural extensionist. There are also material incentives to be part of the clubs. In addition to allowing improved access to state-distributed resources, the clubs also qualify participating gardens to receive benefits and donations from domestic and international NGOs, such as tools and seeds. A study made in the years of severe crisis in the nineties found that “Some clubs only exist as a means to receive and distribute NGO donations, while other clubs meet regularly to exchange seeds, share produce, share tools, distribute literature, etc.” (Chaplowe, 1998).

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\(^8\) Sp. “producir aprendiendo; enseñar produciendo y aprender enseñando”

**Support stores (Consultorio Tienda del agricultor, CTA)**

The agricultural support stores (Consultorios tiendas agropecuarios, CTA) supply the urban farmers with seeds, tools and equipment, but also employ professional agronomists providing advice or consultations. In 2006, there were 52 CTA centres in Havana (Hernández Pérez, 2006).

**Organic fertilizer centres**

The state-run compost centres buy organic waste, compost it, and sell the produce to urban production units.

**Seed houses (casas de posturas)**

The state is supporting seed houses to guarantee that high quality seeds are available at subsidized prices. The coordination of the seed house system also makes it easier to maintain a close connection to the extensive Cuban research in plant breeding. In 2000, there were 70 seed houses in Havana. (Hernández, 2006)

**Centres for biological pest control (CREE)**

A network of centres for biological pest control (known as CREE, Centros de Reproducción de Entomófagos y Entomopatógenos) is producing biological pest control agents such as using parasite and microorganisms for the control of pests and diseases. There are 13 CREE centres in Havana. (González Novo, Castellanos Quintero, & Price Masalías, 2011, p. 24).

**6.4.6. Research institutions for Urban Agriculture**

A peculiarity of Cuba in comparison to most other developing countries is the emphasis that the state has put on scientific progress. Cuba has 2% of the population of Latin America but 11% of its scientists. With this in mind, it is maybe not surprising that the Cuban AKIS features a significant presence
of scientific involvement. The findings of the different institutions are distributed to the producers by the extension system. Many of the institutions are also directly involved in the extension work.

6.4.7. Education

School Gardens (Huertos escolares)

Most of the primary schools have gardens in the proximity. The primary curriculum includes 480 hours of "labour education" over six years, out of a total of 5,680 hours. Here the Cuban ideological principle of combining study and work is applied to school gardens (*las huertas escolares*). By participating in simple agricultural activities, students are expected to develop a positive attitude toward work along with attitudes of solidarity with workers. School gardens size range from one to more than 20 hectares. When schools do not have their own garden, students work in "collective gardens" in the provincial capitals. "Education, and not production, is the aim of this experience" (Gasperinini, L., 2000). There are also many educative initiatives aimed at children in the extension service system and by the individual producers. (Moya Lopéz & Álvarez Gil, 2004).
6.5. **Urban agriculture in Cuban Planning**

According to the Land Management Programme (EOT) of Havana, 2010, the ambition of the Spatial planning of the UA is to “adapt the methods of urban agriculture in a manner that allows them to be inserted consistent with the functional structure of the territory”.

6.5.1. **Land use mapping**

Cienfuegos in Cuba was one of the first cities in the world to make an inventory of available vacant open land in the city and analysing its suitability for use in agriculture. The inventory was created through participatory methods and GIS (Socorro Castro, 2003). The central physical planning office of Havana has also created an inventory of vacant open land suitable for use in agriculture. The data was used to produce an overview map of the Havana region in the Land Management Programme (EOT) showing the planned expansion of urban and peri-urban agriculture in the future (fig.23).

**Figure 23. Proposal for urban agriculture in EOT for Havana**
6.5.2. Cuban planners and Urban Agriculture

As part of a yet unpublished study, Professor Jorge Peña Díaz of the CUJAE University of Havana has conducted a survey to investigate the attitudes of the planners in Havana to UA. I am very grateful to Professor Peña Díaz for making the data available to me.

Prof Peña Díaz’s survey shows that many of the planners have ambiguous attitudes to UA. 53% were of the opinion that the UAP should be a temporary activity. 64% thought that UAP should surrender spaces that could be put to uses that are more profitable. 28% thought that UAP deteriorated the esthetical urban character of Havana. As much as 40% considered AUP as a marginal activity or activity for survival. 25% answered “yes” to the question “Do you consider UA to be incompatible with the environment of the city of Havana”. The survey also indicated a lack of planning tools and information concerning UA. 67% answered that they didn’t have sufficient tools and work methods to handle UA, and 78% said that they did not have sufficient information about the peculiarities of UA.

The majority of the planners that had answered the questionnaire had a positive view of UA. 71% thought that UA had influenced the urban landscape in a positive way, 18 thought that the influence had been negative, and the remaining group thought that the influence had been neutral. 100% of the respondents thought that planners should assign UA a high level of importance (the other possible answers were “low importance” and “neutral”). As to the planner’s role in the development of UA, 86% thought that the planning offices should “exercise control on UA”, 14% thought the offices should promote UA, and 0% thought that the offices should discourage UA.

The questionnaire featured a section with question on the positive and negative consequences of UA. Among the negative consequences caused by UA, smells and vectors can be distinguished. 35% of the respondents had received complains about smell generated by UA. 75% thought that UA had attracted “undesired animals” and vectors.

While there were some problems reported, a very high percentage of the planners reported on positive effects of the UA in the communities of Havana where they were working. A large majority confirmed many of the positive impact of UA for environmental indicators such as biodiversity, lower CO2 emissions, better microclimate, and better resource management. 94% considered UA to have contributed to the food security of Havana and 80% thought that UA contributed to the mitigation of disasters. Some interesting figures concerning social indicators should be noted. As much as 93% thought that UA had promoted “the solidarity of the community”. The same percentage thought that UAP had promoted “the integration of women into work”.

Conclusions

The statistics that I was given access to is yet unpublished and not complemented by analysis of the data or quantitative interviews. Until the study in which the survey will be part has been published, it is especially hard to draw any definite conclusions from the survey.

Some tentative conclusions and suggestions could maybe be made.

One significant characteristic of the survey is that almost all planners that participated attributed many positive results to UA in Havana.

Considering that a large majority considered UA to have had a lot of positive impact in Havana, it is surprising to see that over half of them thought that UA should be a “temporary activity”. Over 40% considered AUP as a
marginal activity or activity for survival, and 25% even considered UA to be "incompatible with the environment of the city of Havana".

The somewhat ambiguous attitude to UA that some planners seem to express in the survey could be attributed to many different reasons. One might be cultural bias. For most of the 20th century, urban agriculture in Cuba has been popularly associated with poverty and underdevelopment (Murphy, 1999). It is conceivable that this cultural bias is to some degree still present even among professional planners.

Another explanation of some hesitant or negative opinions on UA might be related to professional bias. Cuban urban planners work in a modernist tradition. The concept of agriculture in an urban setting does not fit well with the modernist images and conceptions of "urbanity" and "modernity". Urban agriculture challenges the dichotomy of urban and rural that is at the core of 21st century planning practice.

"The expressed perception that non-agricultural (as in food-producing) functions are 'more appropriate for a city' recalls an anti-agricultural bias in Cuba's urban population at large and within decision-making circles in particular, previously identified in the literature (for example, Murphy, 1999). This bias found past expression in Havana's by-laws prohibiting the cultivation of 'agricultural' crops in front yards, permitting only ornamental plants (Benjamin et al, 1984, cited in Murphy, 1999). As will be argued, this attitude, rather than being based on the real limitations to urban land-use for UA, appears to derive from a preconceived notion of what is 'proper' to the city." (Premat A., 2005)

Another conceivable explanation would be a bias related to the practical work of planners. One of the most important tasks of the modern professional planner is to monitor, control and restrict urban practices that generate hazards and nuisances. From this perspective, UA has the potential of causing sanitary problems, such as smell, vectors and health risks from animals. The increased complexity that UA introduces might be a practical reason why some planners have a hesitant or reserved attitude.

The survey clearly indicates that the majority of urban planners in Havana feel they need more knowledge on UA and professional tools to handle issues connected to UA properly. This supports the aforementioned hypothesis of a gap between UA and planning practices and that the integration of UA into the planning system in Cuba is yet incomplete. By the account of one of the individuals who founded the Urban Agriculture Department of MINAG in 1994 it is clear that there has been a great deal of institutional resistance to the small scale UA. According to Sio Wong, this resistance probably depended on the conception that small-scale solutions, such as UA, could not solve the large problem of national food security (Premat A., 2012, p. 7).

6.5.3. Land legislation

The development of the urban agriculture in Cuba is closely related to the legal reforms of the land ownership. The fact that the state owned a high percentage of all land in Cuba prior to 1990, meant that it was relatively uncomplicated to distribute land for urban farming when the UA project was initiated. The following table is combining information from several sources, mainly Caridad Cruz Sánchez Medina, 2003, and gives some insight in how the state has enabled the urban agriculture by gradually allowing cooperatives and individual to start and expand agricultural activities on land that was previously controlled by the state.
| **By-law 159/90.** | General Rules of Agricultural Production Cooperatives (CPA) Authorizes small farmers to join their lands to form cooperatives. |
| **Resolution 189/90.** | Allows for the transfer of state land in usufruct to Agricultural Production Cooperatives (CPA).  
*The resolution authorizes the transfer of idle land belonging to state enterprises, on the conditions that the land is in cooperative development area and that the CPA has the capacity to start cultivating it.* |
| **Resolution 24/91, article 13** | Allows for the transfer of state land in usufruct to persons using it for agricultural purposes since before July 86.  
*Mainly applying to producers who, in the early years of the Revolution, occupied land for various reasons and lacked proper documents, and to people who worked inherited family land that was not legally theirs.* |
| **Resolution 140/92** | Allows for the transfer of land to be beneficially owned, free of charge, to agencies, companies, research centres, schools and other government bodies for the purpose of cultivating products for their own needs. |
| **By-law 142/93** | Concerning the UBPC.  
Allows for the transfer of state-owned land in usufruct and rent-free, to a group of people who are legally incorporated. |
| **Resolution 356/93** | Allows for the transfer in usufruct of vacant lots up 2500 m² in size to retirees for part-time agriculture for family consumption purposes. |
| **Resolution 223/95** | Allows for the transfer of state land, free of charge, to small, well-established farms for expanding of agriculture.  
*On the conditions that the farm is in operation and has the resources to cultivate the additional land.* |
| **Joint Resolution 1998** | By the President of the Havana government and the Minister of Agriculture. Legalising and regulating pig breeding in Havana.  
*The activity had previously been banned for sanitary reasons.* |
| **Provincial Reforestation Commission 1998** | Commission created by agreement of the City Council, integrating as members a large number of institutions of Havana. |
| **Circular letter 03/98** | From the government.  
Presidents of the Provincial Councils and the Ministry of Agriculture are instructed to jointly set out measures for rapid and sustainable development of the production of fresh vegetables in urban areas. |
| **Resolution 768/98** | Allows for the transfer of land, to be beneficially owned to Enhanced Credit and Service Unions (CCSF).  
*This type of cooperatives has existed since the 1960s.* |
| **Resolution 960/98** | Defines basic principles for creating a new type of state farms. |
| **Land Management Program of Havana (EOT), 1999** | The Land Management Program (Esquema de Ordenamiento Territorial, EOT) defines the areas in the city that can be used temporarily or permanently for urban agriculture, and states the goal of “adapting the different forms of UA so that they can be inserted in a coherent manner with the functional structure of the territory”. |
| **Resolution 4/99** | Rules and regulations for products and phyto-sanitary mixtures that are allowed in UA. |
| **Law 85. Forest Act September 8, 1999** | Setting out legal provisions in line with the urban forestry concepts expressed in the reforestation program of Havana, “Mi Programa Verde” ("My green program").  
*Enabling incentives for reforestation, and setting out forms of participation of companies, cooperatives, small land owners and communities for sustainable use of forest resources.* |
| **Resolution 40/02** | Authorizes workers belonging to the occupational categories of workers and technicians in other sector or economic activity in Havana to work in UA for a period up to two years without losing their employment rights and in the case of retirees or pensioners receive full salary from their employment in UA. |
| **By-law No. 259/2008** | Allowing transfer of idle state land in usufruct to individuals or legal entities. |

*Figure 24. Important land legislation changes concerning UA in Cuba 1990-2008*
6.6. Obstacles to the development of urban agriculture

6.6.1. Cultural challenges

One challenge to the continued development of urban agriculture might be the cultural images of urban agriculture. Cuban society was modernized during the second half of the past century. Today, Cuba is highly urbanized, with a high average education level, and it is not surprising that urban gardening has been popularly associated with poverty and underdevelopment (Murphy, 1999). This has no doubt changed during the past 20 years of intensive development of urban agriculture, but it remains to be seen if urban agriculture has gained enough acceptance to continue to grow in importance in the Cuban society as an improving economy allows for more energy- and capital-intensive models of agriculture again become available.

To keep the urban agricultural production ecological in the future might also be a challenge. In the country’s highest political leadership, there appears to be a strong endorsement of urban agriculture and of agro-ecological farming in general. However, as the country’s economy continues to improve, inputs will be more accessible and the option of returning to the previous high input model of agriculture might appear more appealing. The on-going debate in Cuba on the urban agricultural sector seems currently to be focused on the need to strengthen the economic viability of the system. Efficient production and distribution are key questions. To maintain a close relationship between growers and consumers and reduce unnecessary bureaucracy, the state has since 2012 begun to gradually reform the distribution chain, allowing cooperatives to trade directly with the tourist industry. Another important challenge is to promote the interest for urban agriculture, agricultural science and techniques among all members of society. It is very noticeable in Cuban media how the state is actively promoting urban agriculture. Achievements made by successful UA cooperatives and articles on developments and trends in the sector are frequently published in both national and local newspapers, as well as in television and radio. See also (Rodríguez Nodals & Companioni Concepción, 2006)

Two conflicting paradigms

Several literature sources mention the conflict of two different mind-sets or paradigms present in the agricultural sector (e.g. Murphy, 1999, Altieri & Funes-Monzote, 2012, Iglesias, Funes, Machado & Soca, 2011). The first is based on the technologically advanced high-input model, which dominated the Cuban agriculture from the sixties to the nineties. The alternative paradigm is the “agro-ecological”. One could view these two paradigms expressed in two conflicting discourses in the Cuban society. Some promoters of organic agriculture in Cuba are concerned that many Cuban leaders and farmers are still committed to the ‘green revolution’ model of agriculture based on mechanization, artificial and high input: “...in the minds of the decision-makers of agriculture and many producers, the agronomic focus still predominates over the ecological in the management and conservation of the lands, the increased productivity by delivering new land and the clearing of virgin areas, the use of fertilizers to compensate for the loss of fertility, the introduction of improved [crop] varieties and the use of sophisticated machinery to render the farming tasks more effective” (Iglesias, Funes, Machado, & Soca, 2011). Interestingly, this conflict is not as noticeable in the discourse on urban and peri-urban agriculture.

For some Cuban decision-makers, an increased agricultural production can best be achieved by high input systems with technological packages, sometimes with foreign financing. This approach is met with fierce opposition by environmentalists connected to the small farmer’s movement. One notable advocate of
this critique is the well-known agricultural expert Fernando Funes-Monzote: “The agro-ecological movement constantly urges those Cuban policy makers with a conventional, Green Revolution, industrial farming mind-set to consider the reality of a small island nation facing an embargo and potentially devastating hurricanes. Given these realities, embracing agro-ecological approaches and methods throughout the country’s agriculture can help Cuba achieve food sovereignty while maintaining its political autonomy.” (Altieri & Funes-Monzote, 2012)

6.6.2. Challenges for physical planning

The City planning office of Havana, DPPF, emphasises the strategic importance of the agriculture for the food supply of the population of the city in its Land management program (EOT, Esquema de Ordenamiento Territorial) of 2001. In Havana, the environmental situation could be improved by finding spaces for agricultural production closer to the consumers, in orders to reduce transportation. Additionally, in the future managers and workers in the UA should, within the frame of agro-ecological environmental education, receive comprehensive training. Also, the characteristics of the natural and cultural landscapes have be to more strongly dealt with in relation to UA, for each urban zone as well as for particular places. Figure 25 lists the most important ecological issues that are affecting UA in Havana, as well as the measured suggested in the EOT.

<table>
<thead>
<tr>
<th>Important ecological problems</th>
<th>Suggestions in the EOT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>City Centre</strong></td>
<td>• Use of public, non-cultivated open spaces and urban parks (forest pasture / Silvicultura)</td>
</tr>
<tr>
<td>• Shortage of suitable arable land due to the high degree of urbanization</td>
<td>• Improving the aesthetic townscape (Linear parks).</td>
</tr>
<tr>
<td>• Frequent use of drinking water for irrigation</td>
<td>• Infrastructure development for irrigation purposes (Gray water).</td>
</tr>
<tr>
<td>• Contamination of production areas through soot and particles from neighbouring industries</td>
<td>• Promotion of migration corridors (Flora and fauna).</td>
</tr>
<tr>
<td><strong>Transitional area</strong></td>
<td>• Cultivation of flowers, ornamental plants, medicinal plants and spices on balconies and in public parks.</td>
</tr>
<tr>
<td>• Contamination of crops through contact with primary roads</td>
<td>• Prohibition of animal breeding</td>
</tr>
<tr>
<td>• Frequent use of drinking water for irrigation</td>
<td>• Transitory agriculture (temporary use of open spaces that will later be urbanized)</td>
</tr>
<tr>
<td>• Lack of plan for harmonization of the urban landscape with agriculture</td>
<td>• Increased production in patios and plots (cultivation of medicinal plants and spices)</td>
</tr>
<tr>
<td>• Infrastructure development for irrigation purposes (grey water)</td>
<td>• Agroforestry integration systems (temporary forest pasture)</td>
</tr>
<tr>
<td>• Agroforestry integration systems (temporary forest pasture)</td>
<td>• Application of sub-programs for agriculture and animal breeding</td>
</tr>
<tr>
<td>• Application of sub-programs for agriculture and animal breeding</td>
<td>• Reforestation of the river areas (ports, zone of Almendares-Vento)</td>
</tr>
<tr>
<td><strong>Periphery</strong></td>
<td>• Drafting of updated plans</td>
</tr>
<tr>
<td>• Failures to identify high quality soils</td>
<td>• Minimization of non-agricultural activities (e.g. edge of reservoirs)</td>
</tr>
<tr>
<td>• Lack of a land use concept</td>
<td>• Infrastructure development for irrigation purposes (gray water)</td>
</tr>
<tr>
<td>• Lack of skilled labour</td>
<td>• Reforestation of the river areas (Playas del Este)</td>
</tr>
<tr>
<td>• Frequent use of drinking water for irrigation</td>
<td>• South (EZG Vento): Organic farming and grazing instead of sugar cultivation, Land improvement (no mineral fertilizer), expansion of greenhouses</td>
</tr>
<tr>
<td>• Marabú weed spreading in grazing lands due to inadequate land management</td>
<td>• East: the extension of grazing</td>
</tr>
<tr>
<td><strong>South (EZG Vento)</strong></td>
<td>• Southeast: Integration of grazing and tourism</td>
</tr>
</tbody>
</table>

Figure 25. Challenges in EOT. Adopted from (Ammerl, 2005)
6.6.4. Competition for land-use

In 2006, 33 thousand ha was used for different forms of agriculture, agro-forestry or as grazing lands, which meant that 92% of the cultivable land in Havana was in use. (Puente Nápoles, 2006) The policy of putting all agricultural land within the city boundary to productive use has the effect of highlighting the conflict of land-use. While it is can be regarded as positive that the urban land is properly utilized, it also means that agriculture and agro-forestry can only expand at the expense of the other practices. Increased production can only be achieved by higher productivity per land unit. In addition, the existing land utilized for agriculture is also exploitable for building construction.

6.7. Urban agriculture as a sustainability multiplier in Cuba

The urban agriculture system in Cuba proved to be an efficient coping strategy in a situation when access to inputs and energy was extremely limited. In order to be regarded as an efficient "sustainability multiplier" described in chapter 4, however, UA should positively affect other indicators of sustainability. This section will briefly look at some indicators of sustainability that have been affected by the UA system in Cuba.

6.7.1. Indicators

Food security

In contrast to the very difficult times in the mid-nineties, the caloric intake of the Cubans has improved immensely. At the same time, the food import has decreased. According to the UN’s Food and Agriculture Organization (FAO), Cuba’s average daily per capita dietary energy supply in 2007 (the last year available) was over 3,200 kcal, the highest of all Latin American and Caribbean nations. (Altieri & Funes-Monzote, 2012). One should of course be careful to make the distinction between caloric intake and food security. Also, perceived food security is also not always the same as the real food security. It seems reasonable to assume that the reduced import dependency (which is partly attributable to the UA system) and the decentralised and local food production and distribution system that the UA consists has contributed to a greater food security in Cuba.

Food sovereignty

The issue of food security has a close relation to the concept of food sovereignty, promoted by the international small farmer’s organization “Via Campensina”. The aim is to establish a less vulnerable food system based on agro-ecological production principles and the recognition of food as a basic human right. An important part of the concept is the aim to secure sufficient domestic food production via the protection of local producers from global economic forces or outside interference. (Simón Reardon & Alemán Pérez, 2010)

During the whole twentieth century, Cuba was importing food, both for human consumption and for feeding the livestock. Most of the arable land was used for sugar cane cultivation. The food importation started to decline in the 1990ies during the special period, and has continued to fall. The food importation is still large, but the level is significantly lower than 30 years ago (fig 26) and is now so low that it is reasonable to believe that food sovereignty is within reach in a not so distant future. Of course, food sovereignty does not mean that all the consumed food has to be produced in the country. The current food imports are not critical for the food security of the population, and consist mainly of products that are difficult or expensive to produce due to the tropical climate. An example of this is that while the Cuban climate and soil does not permit cultivation of cereals, most Cubans have a preferred diet that includes plenty of bread. Consequently, imports of products such as cereal remain high (fig 27).
Impact on diet

The urban agriculture has contributed to improvements in the average Cuban diet. Traditionally, the consumption of fruit and vegetables has been low. Today, as prices have gone down and the availability of fruit and vegetables has improved, the consumption surpasses the WHO recommendation of 400 grams per person and day (figure 28).

Food prices and availability

In Havana, the UA system has contributed to lower prices on fruit and vegetables. Between 1994 and 1999, the price of fruit fell about 70%, of tomatoes almost 75%, and of onions about 60%. The most important reasons for the lowering of the prices were the intensified urban production and the fact that most of the produce was sold.
directly at the side, eliminating the cost for middlemen and transportation. With lower prices, more people could afford food products of better quality. (González Novo, 2002)

Social inclusion

In Cuba, agriculture was traditionally considered to be an occupation reserved for men (Dueñas, Plana, Salcines, Benítez, Medina, & Domí, 2009). In the UA system, as in other parts of Cuban society, the participation of women is encouraged. In 2007, 25% of the workforce, and almost 40% of the managers, in the UA system in Havana were women (Pagés, 2006).

One quite unique feature of the urban agriculture in Cuba should get highlighted here. The practice of distributing of part of the production for free to schools, hospitals and vulnerable individuals in the local community appears to be widespread. There is no legal or other obligation to this practice. For example, one report from an organopónico in a Havana suburb showed that local schools and hospitals receive at least 10% of the vegetables produced (Dueñas, Plana, Salcines, Benítez, Medina, & Domí, 2009).

Economic impact of urban agriculture

In 2007, UA employed around 300,000 in Cuba, almost 50,000 of them in Havana. (Pagés, 2006).

Production figures, of course, fail to take the non-commercial values of UA into account. An estimation of the non-commercial value of the UA to the individual private gardeners in Havana was made in 2001. The producers were asked what they would hypothetically be willing to pay for the land that they had received in usufruct from the state. The study estimated the user value to around 500,000 USD, excluding the wider value to the community (Henn & Henning, 2001). Since then UA has expanded considerably.

Public participation

The subject of public participation is complicated. There is a web of complex relationship of state, individuals and NGOs in the Cuban UA system. The UA initiatives of individuals or groups of individuals on a local level are encouraged, and no doubt, a lot of the UA activity has been initiated by grass root initiatives. On the other hand, in Cuba the state is involved in every activity in society, and UA is no exception. The state’s commitment to UA is also crucial for the dramatic development and persistence of the sector, which is still developing (González Novo, 2002, pp. 26-27). The US anthropologist Adriana Premat has studied the urban agriculture in Havana for almost ten years. Her evaluation of the relation between the state and the public in the project for sustainability is also true for the urban agriculture in general:

“Contradicting common understandings of the Cuban state, the ideal of sustainability in Havana has not merely been imposed from above. Environmentally-sound practices in Havana’s model urban agriculture sites, instead, have been constituted through a joint project in which the national (and international) institutions involved in guiding the creation of these sites, and the producers who inhabit the sites, play active roles.” (Premat A., 2009)

Support of biodiversity

In one way, it might be obvious that organic urban agriculture supports the biodiversity in the urban ecosystems as the practice introduces plants that would otherwise not be found in the city. In Cuba, however, the UA also supports biodiversity on the national level. The urban agriculture in Havana is growing many species that are part of the traditional Cuban diet, but are not cultivated anymore in rural agriculture, e.g. arrow root, yam and capuli. Yam is an ingredient in many traditional dishes. The capuli, a small tree, provides small fruits and sweets that are similar to cherries. As part of its food security policy, the National Association for Urban Agriculture promotes these and other species as a way to “halt the
process of their extinction and optimise their different uses” (Santandreu, Gómez Perazzoli, & Dubbeling, 2002).

The biodiversity in Cuba has also been positively affected by the decreased usage of fertilizer and pesticides. In 1989, the production of 1 ton of food required 274 kilograms of fertilizer and 4.2 kilograms of pesticides. At the turn of the century, these figures had dropped to 29 kilograms and 1.1 kilograms respectively. (Premat A., 2012)

**Resilience of the food system**

Cuba is frequently hit by severe hurricanes, destroying infrastructure and plantations. A Spanish study found that the Cuban urban agriculture has contributed to the resilience of the country’s food system (Garcia-Sastre & Kallis, 2011). When a hurricane is approaching the efforts of the local institutions, including UA, is coordinated by the Civil Defence. Cuban urban farmers have developed knowledge of how to take protective measures when hurricanes are threatening, and their efforts are coordinated and supported by the local institutions. After the hurricane has passed, production is kick-started with short crop cycles to quickly get food to distribute to the local community. Local institutions have routines for how to support UA to prepare for a hurricane to be able to restart production immediately. The social dimension behind urban agriculture is essential for the resilience. In Cuba, there is a practice of both formal and informal distribution of some of the UA production within the local community. Recipients may be schools and elderly or incapacitated persons in the neighbourhood. In times of crisis, this established network of distribution is especially efficient and valuable.

**6.7.2. Conclusions**

From the available studies, it can be concluded that the UA system in Cuba has contributed to sustainability in many different aspects.

In the early days of the Cuban urban agriculture, it was a coping strategy to respond to an acute and severe crisis in the food system due to scarcity of energy and inputs. Today, the urban agriculture sector is providing a wide range of ecological, social and economic values.
7. The potential of UA in Sweden

7.1. Introduction

In recent years, urban agriculture has attracted significant interest in Swedish media. A number of projects have also been initiated. Usually, the interest in UA seems to be motivated by an association of the phenomenon with environmental or social sustainability. As has been established in previous chapters, there is a strong indication in the body of literature on UA in the world that UA indeed has the potential of contributing to sustainability in a large number of ways, thereby acting as a 'sustainability multiplier'. As the case study demonstrates, this potential is also possible to realise, given the right conditions. This chapter focuses on UA in Sweden and its potential to function as a sustainability multiplier in the Swedish society. The chapter discusses the possibility of UA as a sustainability multiplier in Sweden. It begins with a very brief overview of how UA has been practiced historically in Sweden, and of the character and importance of the current UA practices. This is followed by a discussion on the obstacles of further development of UA that exist. The last section of the chapter studies the potential of UA to be a sustainability multiplier in Sweden more directly, by assessing the relevance of the previously noted potential benefits of UA in the Swedish context. The assumption is, that in order to be a strong sustainability multiplier, UA needs to contribute to sustainability in multiple ways in each sphere of sustainability: environmental, social and economic.

7.2. Overview of UA in Sweden

7.2.1. Development of UA

In Sweden today, agriculture in an urban context is frequently regarded as an exotic and perhaps even contradictory activity. It is perhaps worth noting that historically urban agriculture was an integrated part of the Swedish towns. In a doctoral thesis on urban agriculture in Sweden before 1900, it was found that urban agriculture “was common and highly important in relation to historical urban food provision” (Björklund, 2010, p. 214). The thesis suggests that the demise of UA in Sweden during the 19th and 20th centuries can be explained by factors such as improved social security, raising land values, competition from other land uses, and the growing dominance of a capitalist market economy (213ff).

As the historical form of UA activity dwindled, a new form of UA came to exist in the Swedish towns in the 20th century as allotment gardens were created. The main function of the allotment gardens was to allow for subsistence farming for the growing urban working class, but the recreational and social values of the were also emphasized (Berquist, 1996). The first Swedish allotment garden was established in 1895 in Malmö. (Delshammar, 2011). Soon, allotment gardens could be found in every major town or city. During the First and Second World War periods, the allotment gardens were especially important for the alimentation of the urban population.

7.2.2. UA today

The allotment system is still viable in Sweden, although the predominant use is today recreation rather than food production (Delshammar, 2011, 14). The total acreage of the allotment gardens is also comparatively small. Allotment gardens, fields used for agriculture, grazing lands and greenhouses together constitute about 1% of the urban land in Sweden (Delshammar, 2011, p. 13).

Measured by total output, the most important form of UA is probably cultivation in residential areas, mostly in private gardens. Almost 30% of the urban land area in Sweden is designated for detached houses, semi-detached houses or row houses. Apartment housing amounts to approximately 5% of the urban land area.
Although it is difficult to find any reliable statistics for the total agricultural production in private gardens, it is clear that the production is substantial, especially for potato and apples.9

The motives for UA differ as much as types of cultivation. Delshammar (2011) identifies three groups of motives among Swedish urban growers: motives related to status and well-being, motives related to function and accessibility, and motives related to creativity and self-realization. According to Delshammar, cultivation is an activity that brings people together and reduces the levels of conflicts. Thanks to UA, children learn through practice about food products and cultivation processes. (Delshammar, 2011) UA is also especially valuable to immigrants with rural backgrounds, as UA lets them connect to the life style they were leading in their homeland, and giving them chance to integrate with other community members. This aspect of UA has also been noted in other countries (McClintock, 2010), (Duchemin, Wegmuller, & Legault, 2009).


Even though UA has a marginal role in the Swedish urban areas, it has received a lot of attention in Swedish media in recent years, and a number of projects related to UA have been initiated. To illustrate the varying character and scale of the current practices a few high profile projects will be presented.

**Housing design integrating UA in Malmoe**

The apartment building ‘Urbana villor’ (Urban Villas), built in Malmoe 2009, was awarded the most prestigious Swedish architectural price in 2009 solutions for new residential development. A prominent feature of the building is the deep balconies, designed to be used for cultivation. The Jury commented that "...with sustainability as a starting point, a new form of collaboration between architecture and landscape has been initiated in this building for community living rooted in cultivation and greenery.” (Sveriges Arkitekter, 2010)

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9 A survey from 2002 indicated that the yearly non-commercial production of potato amounted to 58,000 tons, which (assuming that all of it was consumed) would amount to 17% of the total potato consumption.
Vertical, high input UA in Linkoping
In Linkoping, construction began in 2013 for a 17 story high ‘vertical greenhouse’ in a central location of the city. Within the building, the floors are mounted in a large-scale lift construction and will be continuously moving, to allow an optimal amount of sunshine for the plants. The building design is a pilot project and while the building might not be an economically viable solution in Sweden, it is hoped that the project will build a foundation for export of the design to more densely populated countries.

UA as a strategy for social sustainability in Malmoe
Holma is an estate in Malmoe, consisting of 1500 apartments built in 1972-74. The physical character and social profile of the Holma estate are similar to those of a large number of other areas constructed in Sweden in the same period. The buildings are 3 to 8 stories high with large open yards between them and the area is surrounded by open spaces. A lack of funding for landscaping led to many of these estates suffering from plainly designed local environments.
In the beginning of the nineties, the municipal housing corporation MKB established a group of allotments in the area, intended to be cultivated and maintained by the residents. The explicit goal of the project was to promote social cohesion. The project in Holma has been regarded as highly successful. Vandalism and littering was reduced. (Delshammar, 2011). The project is perhaps especially interesting due to the large number of similar estates were it could be applied.

Figure 30 Illustration of proposed vertical greenhouse, Linkoping
(www.good.is/post/a-vertical-greenhouse-could-make-a-swedish-city-self-sufficient/)

Figure 31 View over Holma, Malmo (www.googlemap.com)
UA initiative in Malmoe

Odla i stan (Cultivate the city) is a cooperative formed as a spin-off from a project working with children in Seved, an urban district of Malmoe. The organisation is working with spreading information on sustainability and with the development of urban agriculture, cooperating with housing associations, property owners and local businesses in Malmoe. The organisation has its headquarters in Seved but has on-going projects in several districts of Malmoe.

The project has been successful in several aspects. It has helped improving the social cohesion of Seved, and also instilled a sense of community spirit and pride among many of the residents, who also fee that the UA projects have made the local environment more beautiful. Children in the area have gained knowledge in ecology and sustainability (Lööw, 2010) (Delshammar, 2011).
7.2.4. Current Policies

In recent years, there has clearly been a rise in interest in UA in Sweden. This rise is also reflected in the Swedish public administration. Especially on a local level, there is currently a noticeable interest in UA.

Many municipalities have adopted, or are in the process of adopting, policies for UA. These policies are typically included in the municipality master plan (“Översiktsplan”), outlining the municipality's general ambitions for UA. The section on UA in the Malmö master plan of 2012 is fairly typical: “The allotment gardens are to be protected and facilitated as far as is possible. [...] The Municipality will have a positive and permissive attitude towards local initiatives to satisfy people's desire to maintain their surroundings by practicing urban agriculture.”

(Malmö stad, 2011b:63)

As this quote suggests, the UA policies that have this far been adopted in Swedish municipal master plans are usually stating a general sympathetic and permissive attitude towards the phenomenon rather than presenting any action plans or stating future goals. However, there are also several examples how Swedish municipalities actively promote UA. Among others, the municipalities of Falun, Gothenburg, Haninge, Lund Malmö, Norrköping and Ängelholm are currently running or supporting UA projects.

On a national level, the image is quite different. The national government and parliamentary majority are explicitly against a national guideline for UA or promotion of UA on the national level. This was perhaps most clearly stated in 2011 when a Swedish MP wrote a motion to the parliament urging the government to instruct the Swedish National Board of Housing, Building and Planning (Boverket) to promote UA in the city planning, and to investigate the possible contribution of small scale UA in the cities food systems. The motion was turned down by the four parties in the government with the motivation that the issues of UA and food systems should be handled by the Swedish municipalities independently and not be coordinated on a national level. (Civilutskottets betänkande 2011/12:CU14, Planering och byggnad.

7.3. Obstacles to the expansion of UA

Given the current interest in Sweden for UA, both from citizens and local public administration, it is reasonable to believe that agriculture will be a lot more common urban practice in the future than today. The growth of UA might be complicated, however, as there are many possible challenges and obstacles that could be blocking the progress. In this section, a selection of the obstacles and challenges discussed in the literature on UA is presented. The selection is limited to the problems thought to be most the most relevant in the Sweden.

Based on his research on UA projects in Malmo, Delshammar (2010) distinguishes four main factors restraining UA in the Swedish context.

1. Lack of institutional support and deficiency of educational programs promoting UA, inappropriate urban policies and regulations.
2. UA objectives differ significantly for different groups of possible stakeholders and urban planners.
3. Lack of role models or legitimate examples of successful implication of UA in the urban spaces.
4. Land competition from other urban functions and activities.

In addition to the restraining factors suggested by Delshammar, the international literature on UA provides many examples of obstacles for the development of the practice. Some of these might be specific for certain countries or regions, while others would appear to be general. For the sake of clarity, these examples have been structured into four groups: Political-Economic, Structural and Social obstacles.
The first, second and third of the factors mentioned by Delshammar could be regarded as social obstacles, and the fourth as a structural obstacle.

Political-economic obstacles
- UA is local in scope, a characteristic which puts it in conflict with the dominating economic pattern of globalisation and long-distance trade. The procurement of local food might be a telling example. If UA is to be an integrated part of the urban food systems, then the demand for local produce probably needs to be actively supported. Schools, hospitals and other public buyers of food could support UA by choosing to buy local produce. This is however difficult to achieve while obeying the law regulating public procurement. A recent study found that the Swedish Public Procurement Act is discouraging public buyers from giving local products preference. (Granvik, 2012) Thus the application of EU law is 'in direct conflict with other national and local policies, regarding environmental issues and local food' in Sweden. (Granvik, 2012)
- In Western Europe, the food systems are made up almost exclusively of private enterprises operating on a free market for profit. In this environment, the socio-cultural values provided by UA are of less importance than economic considerations in decision-making in most of the food system entities. (McClintock, 2010, p. 200)

The problem of evaluating the benefits of UA in the current food systems applies also to the economic benefits. L.J. Mougeot, an often-cited author on UA, claims that one of the major strategic challenges is to start calculating the contributions of UA to the urban economy. If this could be done more accurately, it would provide a strong argument for the usefulness of the practice (Mougeot L. J., 2011, p. 16).

Structural obstacles
- According to Delshammar municipality, physical planning plays an important role to create supporting conditions for UA. (Delshammar, 2011). One necessary step on the path towards integration of UA in the urban planning is to adjust the legal framework of the planning policies. Today, no framework of support for UA is in place in the planning systems.
- A major challenge to the viability of urban agriculture is land availability and access. One of the restraining factors of UA in Sweden that Delshammar mentions is the completion for land by other land uses. This is an obstacle that has been identified by many writers on UA internationally (e.g. Dubbeling (2011), Mougeot (2011), Quon (1999)).

Social obstacles
Many authors note that a future expansion of UA is highly dependent on the support of urban planning. There are, however, obstacles in the current planning. These are related to both the planning practice and to the planners themselves.
- In the context of US planning, Pothukuchi & Kaufman (1999) point out that the urban food system, though it is as important as other urban systems such as transportation and housing, is almost entirely absent in the planning practice. This is obviously a severe obstacle for the development of UA. According to the authors, the “low visibility of food system” in the planning practice can be largely explained by four factors:
  - The food system appears to be self-regulating and unproblematic. Food is always available in the modern city (assuming that one has the money to
buy it and access to transportation to get to the food store).

- The food system is often regarded as a rural issue in the urban planning discourse, in contrast to issues such as crime and sanitation, which are regarded as urban issues. This could be regarded as a bias or prejudice in the planning discourse.

- Technical development of transportation and food preservation has led to that the only function of the food system visible to the urban consumer is the food store. The production processes are invisible to the consumer.

- Institutionally, urban planning and rural planning are separated in US. Because of this separation, agricultural issues tend to managed by institutions for rural planning.

- Another important factor restraining the development of UA is the hesitant attitude among planners to food system issues. According to some literature, the reason for this attitude might be that planners are simply lacking knowledge about food systems. (Mendes, Balmer, Kaethler, & Rhoads, 2008), (Quon, 1999). Lovell suggests that planners are often ‘ill-equipped to integrate food-systems thinking into future plans for cities.’ (Lovell, 2010). Even in Cuba, where UA has been successfully implemented, this hesitant attitude has also been present, as was pointed out in the previous chapter. Swedish planner’s attitude towards UA has not yet been studied, but it reasonable to believe that the same tendencies noted in other countries are also present in Sweden.

7.4. Paths forward for UA in Sweden

Structural issues

To reconcile the land competition from tradition urban land uses such as housing, industries and infrastructure, urban agriculture has to be included in urban planning and municipal development plans.

- UA has to be enabled in the planning through a formal acceptance of UA as a legitimate use of urban land (Dubbeling, 2011). This could be taken further by making UA a formal land use in the Swedish municipal zoning plans (‘detaljplan’). Including UA in the land zoning system has been suggested by Quon (1999) and FAO (2007).

- Already, UA is mentioned in several Swedish municipality master plans (‘Översiktsplan’). This is important, as the master plans express the long-term goals of the spatial planning. Working with integrating UA into master plans could lead to increased institutional support and recognition for the practice. (Dubbeling & de Zeeuw, 2006)

- An important task would be to conduct site surveys to identify of current and potential sites for UA (FAO Report on UA, p.46)

- Multifunctional Land Use should be promoted. Aside from producing food, urban agriculture land has other potential uses that are not in conflict with the production. Multifunctional Land Uses strengthens UA by providing Examples of secondary land uses are recreation, wildlife habitats and education. Farmers may provide recreational services to urban citizens and receive youth groups to provide education, (Dubbeling, Zeeuw, Wilbers, ‘Courses of Action for Municipal Policies, 2006, p.16). Many authors on UA hold the idea that recognising and strengthening UA relations with other urban systems such as agriculture, health and ecology

Social issues
- Land use planners and decision-makers about UA is an important priority’ including existence examples of UA in the world. To help the informed decisions on UA, Governmental and municipal awareness ought to be improved, according to (FAO Report on UA, p.46).
- In a Swedish context, the public sector has this far been encouraging UA rather than actively promoting it. Even though this might be rapidly changing, enthusiasts and NGO organisations in Sweden are presently the main promoters of UA on a local level. As the example of the Cuban UA system shows, extension services by advisory staff with background theory and practical skills can play an important role in supporting these actors and maximize the results of their efforts. Extension services is mentioned by FAO (2007, p.48) as an important factor in promoting UA.
- A higher academic status, such as for example High Degree School course in UA, would help to legitimize UA in the planning system as well as in the society as a whole.

Political-economic issues
- In 1999, the Swedish parliament adopted 16 environmental quality objectives (‘miljömål’). The purpose of these objectives is to create a framework for how progress in ecological sustainability can be measured. The objectives form a basis for formulating policies and strategies in the environmental work. The main objectives are translated into programs which progress can be measured. (http://www.naturvardsverket.se) One of the 16 objectives is ‘Good built environment’. There are currently 27 indicators for this objective, e.g. household waste, traffic-generated noise, car usage and several concerning recycling (Swedish National Board of Housing, 2012). The connection between the good built environment objective and UA is quite clear. If UA is accepted as an urban sustainability multiplier, a natural step would be to make the development of ecologically sound UA an important indicator for the objective, as promoting UA would benefit many others of the indicators.
- As noted in the previous section, the Procurement Act is restraining the local consumption of agricultural products, which is especially harmful for UA, which is almost always producing for local consumption. Finding a solution for this problem is an important measure to promote UA.
7.5. UA as a sustainability multiplier in Sweden?

In a previous chapter, the existing UA system of Cuba was studied and found to be an efficient environmental multiplier. Obviously, the conditions in Sweden are quite different to those in Cuba. The ambition of this section is to briefly evaluate the potential of UA to be a sustainability multiplier in Sweden by looking at the relevance of the previously noted potential benefits of UA in the Swedish context.

7.5.1. UA supporting ecological sustainability in Sweden

The dominating discourse on Sustainable Development in Sweden expressed by public bodies has been characterized as ‘a manifestation of ecological modernization consolidated with economic growth’ (Håkansson, Isaksson, & Hilding-Rydevik, 2011). In other words, sustainability is to be achieved by economic growth and technological advances. In a global perspective, Sweden has a large ecological footprint per capita (figure 34).

The official goals for environmental sustainability were stated by the Swedish parliament in 1999, when 16 national environmental objectives (‘miljömål’) were decided. In this section it will be assumed that these objectives are accurately reflecting the most important challenges to ecological sustainability in Sweden.

In this section the possible impact of a large-scale UA system in Sweden on the national environmental objectives are considered in a very brief overview. The purpose is to make a simple assessment of the plausibility of UA being relevant for the environmental objectives in Sweden. The main source of information on the objectives and indicators connected to them is the yearly review of how the work to reach the national environmental objectives is progressing, issued by the Swedish Environmental Protection Agency (Swedish Environmental Protection Agency, 2013).

Figure 34. Ecological Footprint by Country per person, 2007. Sweden marked with black rectangle (source: www.footprintnetwork.org).
Objective One: Reduced carbon impact.

Considering that the average standard of living in Sweden is high in a global perspective, it is not surprising that the CO₂ emissions of the Swedish society are higher than the global average. These emissions are usually calculated and presented as either ‘territorial CO₂ emissions’ or ‘carbon footprint’. Territorial CO₂ emission is the sum of all greenhouse gas emissions caused by human activity within the country borders. ‘Carbon footprint’ is the sum of greenhouse gas emissions caused the consumption by persons living in Sweden, therefore excluding the emissions caused by exported goods and services, but including the emissions caused by imported ones. Official sources tend to focus on the territorial CO₂ emissions. One reason for this might be that these emissions can typically be calculated rather easily, in contrast to emissions generated by imports that usually can only be estimated. Another conceivable reason is that territorial emissions are easier to target directly by governmental initiatives.

Others, however, have argued that the ‘carbon footprint’ statistics is a more adequate representation of Sweden’s contribution to climate change (e.g. Minx, Scott, Peters, & Barrett, 2008). In 2008, Sweden’s carbon footprint was 8.4 tons of CO₂ per capita. The territorial CO₂ emissions were 7.2 tons per capita.

In the 2013 evaluation, The Swedish Environmental Protection Agency states that Sweden’s emissions need to be drastically reduced (Swedish Environmental Protection Agency, 2013, p. 28).

The detailed statistic provided in the report shows that transportation, energy, agriculture and industrial processes are the major sources of emissions (figure 35). Urban agriculture is highly relevant for reducing the emissions from the first three of these sectors.

Objective Two: Clean air.

Indicators for this objectives are the levels of Benzene, Benzo[a]pyrene, Butadiene, Formaldehyde, Particulate matter PM₂.₅ and PM₁₀, Ozone, and Nitrogen dioxide. UA is relevant for the emissions of PM₂.₅ and PM₁₀, Ozone and Nitrogen Dioxide, which are to a high degree caused by transportation and agriculture. The higher concentrations of PM₂.₅, PM₁₀, Ozone and Nitrogen Dioxide are typically found in the cities and caused by transportation and heavy machinery. UA has the potential to reduce transportation in the urban settlements, which would lead to lower local emissions. Replacing conventional agriculture dependant on fossil fuel with UA would also lead to lower emissions.

Objective three: Natural acidification only.

The acidification of forest and water is primarily cause by emissions of sulphur dioxides and nitrogen dioxides as well as forestry. The emissions are mainly caused by transportation on sea and land. UA could contribute to some reduction of the need for transportation, but its relevance for meeting the objective would be small in
comparison to other measures, such as reducing sulphur levels in marine fuels and improving forestry practices.

Objective Four: A non-toxic environment

An important group of toxins affecting humans are residue of pesticides in food and water. UA has the potential to reduce this problem if it is practiced without the usage of pesticides. As mentioned in the chapter on Cuban UA, it is possible to greatly reduce the usage of pesticides in UA. Another aspect of toxic residues in food is that the current global food system leads to imports of food products containing toxins from countries without strict control of pesticide and fertilizer usage. The local production of UA allows for better monitoring of the production.

Objective Seven: Zero Eutrophication

Eutrophication is caused by nitrates and phosphates being added to lakes and sea. Almost half of the flow of nitrates and phosphates that is caused by human activity has its origin in agriculture. If UA is practiced without the usage of artificial fertilizers, there is a great potential for reducing the eutrophication caused by agriculture. The high intensity of UA and its localization in the cities also allows for more efficient control and purification of leaks of nitrates and phosphates to water.

Objective eight: Flourishing lakes and streams

Pesticides and nitrates from agriculture are affecting aquatic life negatively. A survey made 2011 found 23 different pesticides in water in concentrations over the target values (Swedish Environmental Protection Agency, 2013, p. 113). Organic UA could have a high impact in this area.

Objective nine: Good-quality groundwater

The conventional agriculture is causing pollution of groundwater by pesticides and nitrates. UA, if practiced without the usage of artificial fertilizers or pesticides, could possibly reduce the amount of toxic leakages to the ground water reservoirs.

Objective ten: A balanced marine environment, flourishing coastal areas and archipelagos

One of the factors affecting the marine environment negatively is the eutrophication caused by nitrates and phosphates leaked from the agricultural business. As previously mentioned in the paragraph on objective seven, there is a potential of UA to reduce such leakage.

Objective thirteen: A varied agricultural landscape

The objective is that “the value of the agricultural landscape and agricultural land for biological production and food production is to be protected and the same time as the biological diversity and cultural heritage values are preserved and strengthened” (Swedish Environmental Protection Agency, 2013, p. 176). It could easily be argued that UA is an appropriate way to work towards the objective in urban and peri-urban areas. In Sweden, urban expansion is often taking former agricultural land in use, and by reserving land for urban agriculture, agricultural land could be preserved or regained.

Objective fifteen: A good built environment

The stated objective is that “cities, towns and other built-up areas should provide a high quality and healthy living environment and contribute to a good regional and global environment. Natural and cultural values should be protected and developed. Buildings and facilities should be located and designed in an environmentally sound manner and to promote sustainable management of land, water and other resources” (Swedish Environmental Protection Agency, 2013, p. 202). UA can contribute to several of the nine indicators that are connected to this objective.
Objective sixteen: A rich diversity of plant and animal life

“Biodiversity should be preserved and used in a sustainable way for present and future generations. The habitats of the species, the ecosystems and their functions and processes must be safeguarded. Species must be able to survive in the long-term viable populations with sufficient genetic variation. People should have access to a good natural and cultural environment rich in biodiversity, as the basis of health, quality of life and welfare.”

UA would be relevant for several indicators of this objective such as

- *Nature near urban areas.* Nature valuable for the cultural heritage and biologic diversity should be protected and preserved. UA would help preserving valuable agricultural land in and close to the cities.

- *Green infrastructure.* Fragmentation of populations and habitats should be avoided. UA would contribute to this goal in populated areas, where other urban land uses would cause fragmentation.

- *Biological cultural heritage.* UA could preserve agricultural land that is in danger to get absorbed by the growing cities.

Analysis

A brief overview of the national environmental objectives of Sweden suggests that it is reasonable to believe that UA has a high potential to contribute to the objectives. In the table below, the potential impact of UA on the Swedish environmental objectives is estimated.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Potential impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Reduced climate impact</td>
<td>High</td>
</tr>
<tr>
<td>2. Clean air</td>
<td>High</td>
</tr>
<tr>
<td>3. Natural acidification only</td>
<td>Little</td>
</tr>
<tr>
<td>4. A non-toxic environment</td>
<td>High</td>
</tr>
<tr>
<td>5. A protective ozone layer</td>
<td>None</td>
</tr>
<tr>
<td>6. A safe radiation environment</td>
<td>None</td>
</tr>
<tr>
<td>7. Zero eutrophication</td>
<td>High</td>
</tr>
<tr>
<td>8. Flourishing lakes and streams</td>
<td>High</td>
</tr>
<tr>
<td>9. good-quality groundwater</td>
<td>Medium</td>
</tr>
<tr>
<td>10. A balanced marine environment</td>
<td>Medium</td>
</tr>
<tr>
<td>11. Thriving wetlands</td>
<td>None</td>
</tr>
<tr>
<td>12. Sustainable forests</td>
<td>None</td>
</tr>
<tr>
<td>13. A Varied agricultural landscape</td>
<td>High</td>
</tr>
<tr>
<td>14. A magnificent mountain landscape</td>
<td>None</td>
</tr>
<tr>
<td>15. A good built environment</td>
<td>High</td>
</tr>
<tr>
<td>16. A rich diversity of plant and animal life</td>
<td>Medium</td>
</tr>
</tbody>
</table>
7.5.2. UA supporting social sustainability in Sweden

The positive contribution to social sustainability is an important dimension of UA. The available international literature strongly suggests that UA can contribute to social sustainability (e.g., (Jacobi, Drescher, & Amend, 2000) and (De Zeeuw, Dubbeling, van Veenhuizen, & Wilbers, 2007)). The study of the UA projects carried out in Malmoe by Delshammar (2011) also points to positive social effects of UA.

7.5.3. UA supporting economic sustainability in Sweden

De Zeeuw, Dubbeling, van Veenhuizen & Wilbers (2007) suggest that UA contributes to local economic development and employment generation. Of special interest in the Swedish context is the fact that UA offers employment for unskilled labour. Currently, unemployment in Sweden is high in a historic perspective. People with shorter education are the worst affected. In 2011, in the group of the workforce with education of 9 years or less, unemployment was 18.2%. For the part with 9-12 years of education, it was 8.1% and for the part with 13 years or longer 5.3% (Statistics Sweden).

Sweden is a highly urbanized country and consequently most unemployed people live in urban areas. UA is an urban activity that is labour intensive and can be localize near the available workforce. For this reason, UA could be an efficient approach in projects aiming at creating local employment in areas affected by high unemployment.
8. Conclusions and discussion of the results

The research for this thesis has been focus on three interconnected questions. Firstly, the thesis attempts to evaluate the potential of Urban Agriculture to contribute to a reduced ecological footprint. Secondly, the potential of urban agriculture to contribute positively in multiple dimensions of sustainability was studied. A third question in this thesis was to which extent urban agriculture is worth to consider as an integrated part in urban planning, as a sustainability multiplier.

Results

The case study of the changes in the Cuban agricultural system suggests that UA has been an efficient strategy to maintain and increase food production in a situation where access to fossil fuels and artificial fertilizers was drastically reduced. The ecological footprint of Cuba has been significantly reduced while access to food has been secured and the human development index has risen. The Cuban example convincingly demonstrates that organic UA can be an important part of an efficient food system with a very small ecological footprint.

In chapter 7, the potential of urban agriculture in Sweden was studied. Currently there is a notable rise in public interest for urban agriculture. There is also a continuous practice of urban agriculture cities through history, although it has taken different forms through different times. It was found that urban agriculture has a high potential to contribute to increased environmental, social and economic sustainability in Sweden. An estimation of the potential benefit of urban agriculture to the sixteen environmental objectives of Sweden showed that it could be highly relevant for reaching seven of the objectives, and relevant to an additional four.

Why is urban agriculture an efficient sustainability multiplier?

An interesting question is why urban agriculture was found to be an efficient sustainability multiplier,

Cities can be viewed as nodes of resource consumption. This is especially clear when considering the larger cities on earth. London, for example, has an estimated ecological footprint of 300 times the size of the city. A city interacts with other ecosystems and is a part of larger compounded ecosystems. The dependence of cities on their spatial relationships with surrounding lands has given rise to the study field of “urban metabolism”. Kennedy, Cuddihy & Engel-Yan (2007) define urban metabolism as “the sum total of the technical and socioeconomic processes that occur in cities, resulting in growth, production of energy, and elimination of waste.” The metabolism of the cities has changed greatly in the course of history. The modern city's complex relationship with the connected ecosystems in which the metabolism takes place means that a large part of the supporting ecosystems are usually geographically separated from the city, or in other words, “the ecological locations of high-density human settlements no longer coincide with their geographic locations” (Rees W. E., 1992). In the modern food system, food production and distribution of food and waste are almost invisible in the cities and the metabolism can be characterized as “linear” - food, goods and energy is produced outside of the cities, consumed in the city and the resulting waste and emission is exported back to the supporting ecosystems (figure 36).
Girardet notes that the natural ecosystems are typically circular, and claims that “To become sustainable, cities have to develop a similar circular metabolism, using and re-using resources as efficiently as possible and minimising materials use and waste discharges into the natural environment.” (Girardet, 2000, p. 7)

Modern organic urban agriculture can be seen as the reintroduction of the natural ecosystems in the urban context, including the inhabitant's food consumption and waste production in a circular metabolism (figure 37). This is the fundamental reason why urban agriculture is such an efficient sustainability multiplier.

The way forward for urban agriculture in Sweden

There is currently a high degree of interest in urban agriculture, noticeable in media but also in how local governments and public administrations are getting involved in promoting and enabling the practice of urban agriculture.

There are currently few academic studies on the subject of urban agriculture in Sweden. This is likely to change within the next few years as academic interest in the subject seems to be increasing. There is a great need of academic research in the subject in order to support decision makers and public institutions who want to develop urban agriculture. The perhaps most important issue to study is the integration of urban agriculture into the planning system.

In order to reach its full potential as a sustainability multiplier, urban agriculture needs to be recognized as a valuable urban function both in the formal planning system and in the planning practice. UA exists in Swedish cities today, as it has always done, but it is to large extent an informal business, receiving too little attention and recognition to fully utilize its potential. In the future, municipality planners will need to address the urban agricultural and food system issues in a much more comprehensive manner, as a subject of its own.

Opportunities for urban agriculture in Sweden

One of the many pieces that need to be put in place to integrate urban agriculture in the planning system would be to create inventories of existing and suitable locations for urban agriculture. In comparison to many countries on the European continent, Sweden has the advantage of having preserved comparatively large green spaces within the urban areas. The selection of suitable sites for urban agriculture is however more complicated than merely finding areas with favourable soil conditions. Just as important are factors such as demographics, accessibility and socio-economic conditions,
among others. A specific illustration of this is the opportunity for urban agriculture in the suburban multi-apartment housing areas that were built in Sweden during the 1960ies and 1970ies. The neighbourhoods were often built several kilometres away from the cities. Although the standard of the housing is relatively high, despite efforts over the years, the local environment around and between the multi-storey housing is still in many places mainly consisting of lawns or asphalt (fig 38). Urban agriculture could transform these under-utilized areas into productive land that also provide social value for the inhabitants (fig. 39). Socio-economically, there are also reasons why these areas are especially suitable for urban agriculture projects. Unemployment is in many cases higher than the national average, and urban agriculture could be a valuable source of local employment. The population in many of the areas is characterized by its diversity, with many nationalities represented. Urban agriculture could function as a tool for integration of immigrants to the Swedish society. Some of the immigrants might also have experience of agricultural work from their native countries, which could be applied in urban agriculture. In Malmö, Seved, a housing estate of the aforementioned type, has been the place of a successful urban agriculture project and might be the first of many more to come.

Figure 38. Råslätt, Jönköping, Sweden. Residential park, rarely used.
Figure 39. Råslätt - proposal for Urban Agriculture
Litterature


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