- *Manual* -

URBAN GARDEN CULTIVATION SYSTEMS

HORTIS

Lifelong Learning Programme

/

This project has been funded with support from the European Commission.
This publication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Material can be used according to the:
Creative Commons License
Non Commercial Share Alike

Publication realised within the European project
Hortis – Horticulture in towns for inclusion and socialisation
(n. 526476-LLP-1-2012-1-IT-GRUNDTVIG-GMP)
www.hortis-europe.net

Editors:
Inmaculada Fernández García [1]
Cayetano García Rosa [1]
Adriana F. Esteban López [2]
Juan A. Fernández Hernández [2]
Sebastián Bañón Arias [2]
Jesus Ochoa Rego [2]

Photographic material:
Inmaculada Fernández García [1]
Adriana F. Esteban López [2]
Jesus Ochoa Rego [2]

Book Design:
Lucrezia Pascale & Pietro Nicola Coletta

[1] *CEAMA. Fundación Tierra Integral, Paraje de la Rafa s/n. 30180 Bullas, Spain.*
[2] *Departamento de Producción Vegetal. Universidad Politécnica de Cartagena, Paseo Alfonso XIII, 48. 30203 Cartagena, Spain.*

Urban gardening activities can encourage lifelong learning among adults by fostering the acquisition of key competences that are fundamental for each individual in a knowledge-based society.

The following educational materials were designed within the context of the European project Hortis – Horticulture in towns for inclusion and socialization (526476-LLP-1-2012-1-IT-GRUNDTVIG-GMP), bringing together the urban gardening experiences from the partner cities, namely Bologna (Italy), Berlin (Germany), Budapest (Hungary) and Cartagena (Spain).

Each partner contributed with its own knowledge on a specific topic in form of an e-book, which successively evolved through an empirical approach of knowledge transfer and participatory review, toward a common and transversal vision of urban agriculture.

The outcome of this participatory process are five knowledgeable e-books covering different topics such as Sustainable Community Gardening in Cities (e-book 1), Sustainable Urban Garden Management (e-book 2), Urban Garden Cultivation Systems (e-book 3), Simplified Soilless Systems for Urban Vegetable Production (e-book 4) and Eating closer to home: An urban consumer's manual (e-book 5).

We hope these material will bring a new dimension to your work and inspire you in turning your life and city greener.

/

CONTENTS

1. INTRODUCTION TO URBAN GARDENING

/ Urban Horticulture may be defined as a potentially productive agricultural activity, located within the city environment, which is mainly oriented to self-consumption and which may pursue different purposes. This concept also relies in the possibilities offered by available hydroponic systems, which allow to cultivate also where fertile soil is not available. For this reason, Urban Horticulture can be developed in almost any urban environment, including rooftop terraces, as long as no limiting environmental factors exist (radiation and light, water availability, adequate temperatures for plant development, etc.).

Urban Horticulture is presented in international forums as a response to several current challenges faced in European cities, such as: food security, access to basic services such as education and health, climate change, urban planning, etc.

According to the United Nations, in 2030 more than 60% of the world population will live in cities, which means almost three times as much as in 1950 (Moreno, 2007). These data show the rate of population growth in cities on a global scale, which is very often associated to an in increase in service and basic resources supply needs. The rapid urban growth, together with the lack of planning, is the source of social inequalities and poverty, which have notably increased with the current global economic crisis.

By making a historical review we can see how agriculture in the urban environment has proved to be a solution to many world crises. In the 19th century, countries such as United Kingdom, Germany or France gave the right to use the land up to workers, so that they could supplement their resources and feed their families. In the first half of the 20th century, urban agriculture was linked to the two World Wars, as it had an obvious subsistence role, supporting the economy of the war

and post-war processes. In more recent times, community and environmental organisations practicing urban gardening promoted its developmental functions, such as social integration and environmental education. However, it was not until the nineties that urban gardens gained importance and acquired new meanings, such as those related to food sovereignty, food quality, promotion of employment, improvement of living standards, environmental education, social relations and urban regeneration (Hermi, 2011).

It can be said that Urban Horticulture emerges as a platform for local and community development, which faces the challenge of setting up a structure that combines habitat, recovery of resources and creation of agro-cultural productive activities, generating an operative union of the ecological, economic and social dimensions of the concept of sustainability (Moreno, 2007). Urban Gardening assumes a potentially beneficial socio-economic role (Smit et al., 1996), involving an income either from direct or from indirect sale, since food expenditure is lower because there is no need to buy it (Foeken et al., 2004).

The important benefits associated to Urban Horticulture (Taylor, 2010) may be listed as follows:

• food production: citizens produce fruits, vegetables, mushrooms, herbs, medicinal plants, meat, milk, cheese, eggs and other products;

• improvement of local capacities: members of the community can develop skills such as planning, project management, agriculture and environmental sciences;

• mitigation of environmental degradation and climate change: the beneficial environmental effects of green urban areas (and therein urban vegetable gardens too) on the city resilience to climate change are known (Bowler et al., 2010). In addition, some of the noteworthy benefits to the environment could be: reusing plant and animal composted waste for the improvement of fertility and soil properties, preserving biodiversity through cultivating a wide range of species and local varieties. Furthermore, by growing food in cities we can reduce locally the cost of energy derived from transport, packaging and storage;

• "greening" of cities: community and family gardens contribute to the ecological transformation of the urban areas, improving their appearance and providing wellness;
• real economic benefits: community gardens and farmers' markets can provide employment and job training. On the other hand, families have to buy fewer products to feed themselves;
• promoting mental and physical health: the work needed to prepare and keep a garden involves good physical activity in terms of both mental and physical health (Armstrong, 2000, Milligan et al., 2004, Wakefield et al., 2007);
• creating and encouraging social cohesion and inclusion: both in community gardens and in farmers' markets new economic opportunities emerge, as well as social interaction;
• training future generations: community and school gardens may enable the creation of active and cooperative learning environments. It also offers new ways to learn about areas across the school curriculum;
• cultural heritage: urban agriculture may contribute to accessing and promoting traditional methods that are part of our cultural heritage as recognised by the UNESCO. For example, ethnic cuisine in some given countries or certain ancestral cultivating techniques, which are unique in the world;

Currently, different social groups (neighbourhood and cultural associations, groups of people who are concerned about their diets or lifestyles, etc.) are taking actions, demanding from governments the creation/adaptation of new city environments, for the exchange of experiences and the development of ecological activities (Hermi, 2011) around Urban Horticulture. Urban Gardening offers a wide and varied range of possibilities, considering all the numerous factors influencing its settings. They range from large gardens in traditional grounds to small gardens located in spaces where imagination and recycling are used to allow cultivation, e.g. by building soilless growing systems out of recycled materials (Figure 1). These aspects will be extensively described in the following chapter.

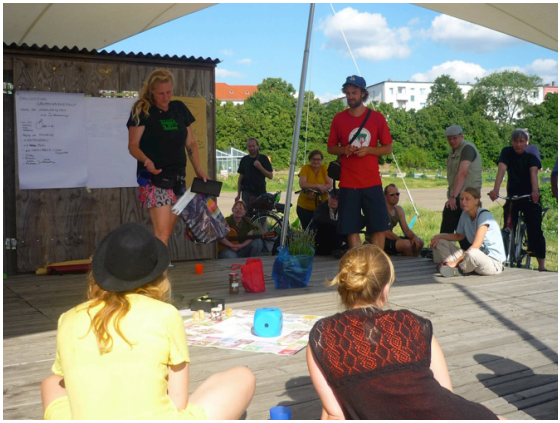

Figure 1. Assembly in the Allmende-Kontor garden (Berlin).
Figure 2. Cultivating on recicled elements.

2. AGRICULTURAL SYSTEMS AND NEW FORMS OF AGRICULTURE

/ Agricultural systems comprise all production factors (biological, physical, social and economic) and farming practices which differ from one another, depending on environmental conditions, available resources, level of technology and types of production obtained (Arnon, 1987).
For instance, Mediterranean agricultural systems typically face important and prolonged water shortages, as well as various climate, cultural and economic disruptions.
Throughout the past thirty years, periods of drought have affected 17% of the European territory and 11% of its population, causing losses of up to 100 billion Euros (Collins et al. 2009).
Thus, Mediterranean agro-systems must face water scarcity, soil fertility and socio-economic aspects that are inherent to the evolution of agriculture itself.

2.1 / EXTENSIVE FARMING

Extensive Farming is characterised by its low use of inputs (means of production) that are mainly represented by fertilisers and phytosanitary products.
In this respect, numerous Mediterranean rain-fed agricultural systems comply with this and are very close to the objectives of Sustainable Agriculture.
Some of the farming practices related to the rain shortage typical of the Mediterranean and which are linked to rain-fed agricultural systems are highly sustainable.
Practices include crop rotation, use of legumes for nitrogen fixation, soil properties improvement and genetic resources conservation.

2.2 / INTENSIVE FARMING

This kind of agriculture emerges in response to the need to produce great amount of food so as to supply the vast populations concentrated in cities. It is characterised by a high volume of production per unit area.
Usually, several crops per year are produced, which are sustained thanks to the use of great amounts of pesticides and chemicals. However, in recent years the load of chemicals has been decreasing, due to a greater use of integrated and organic control of pests.
The main characteristics that define this system are:
• increase in productivity in the last century, aimed at securing a stable source of food for the increasing population as the farmland available is reduced;
• production of large amounts of food all-year round;
• optimal use of current technology;
• high consumption of energy, since a greater use of oil is required for machinery and transport;
• possibility to use any plant type, though it has been shown that the tendency is towards using fewer varieties and species than the ones available.
One of the main problems of this type of agriculture is that it does not take into account the environment or the fertility of the soil. Intensive use of the soil creates large yields at first, but in the long-term can result in soil exhaustion and degradation.

2.3 / ORGANIC FARMING

Organic Farming is a general food production and management system that combines sustainable environmental practices, high level of biodiversity and preservation of natural resources, and which is considered able to ensure provision of healthy food. Across Europe a number of terms is used to identify it, which include Ecological or Biological Agriculture. Organic production methods are considered

to play a dual societal role: on one hand provides for a specific market responding to a consumer demand for organic products, and on the other hand delivers public goods contributing to the protection of the environment and to rural development (Regulation nº 834/2007 of the EU Council).
The main characteristics that define this system are:
• no use of pollutant or toxic products;
• respect for the environment, pursuing an optimal use of the natural resources and preserving soil fertility;
• use of crop rotation to avoid soil exhaustion as well as diseases and pests, maintaining soil fertility;
• production of seasonal food;
• taking advantage of on-site resources, such as livestock manure for fertiliser or feed produced on the farm;
• choosing animals and plants species that are resistant to disease and adapted to local conditions.

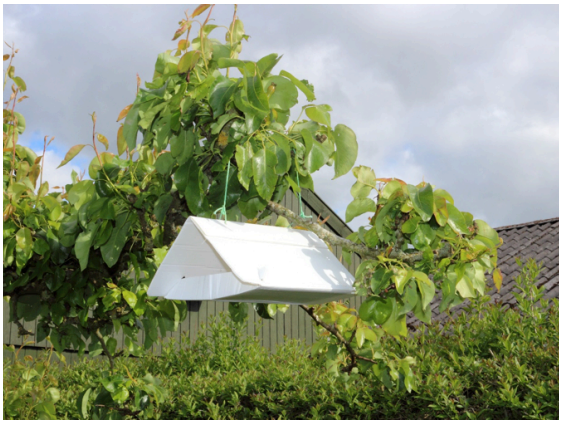

Figure 3. Water trap with pheromones to capture flying insects (Photo: Wikipedia commons).

With this type of agriculture high quality food can be obtained. Furthermore, production is expected to gradually increase with the years. For a good management it becomes necessary to have an extensive

knowledge of the farming system and to control plants development thoroughly, which may imply harder work for the farmer. According to regulation (CE) NO 834/2007, genetically modified plants are not be used, being incompatible with the concept of organic production.

2.4 / BIODYNAMIC AGRICULTURE

Biodynamic Agriculture was first developed in 1924 based on the theories advanced by Rudolf Steiner, founder of the "spiritual science" or Antroposophy. It bases on the belief that plants and humans, as well as the rest of living beings, are affected by cosmic and astrological influence and therefore agriculture turns to be a result of biological, land and energy processes linked to cosmic and philosophical aspects of Nature. It basically aims at improving the soil both physically and spiritually, integrating human life in the environment. The main features defining this system are sometime assimilable to those of Organic Farming. However, some of them are:

- the farm is conceived as an organism, a starting point from which work conditions and functioning are established;
- biodynamic preparations have homeopathy and biocatalyst features, aiming at stimulating life. These products are thoroughly planned and calculated in their preparation;
- use of a biodynamic calendar which consist of an annual calendar following the lunar cycle and indicating the appropriate moment for sowing and planting of the different vegetables;
- sowing dates are chosen vey carefully, considering the biological relations between plants.

The farm conceived as an organism

The role of man within the organism according to Biodynamic Agriculture is to seek harmony, to balance transformations and to encourage auto regulation. Thus, it must: protect the organism from disruptive elements, enhance and support the forces of nature that guide

to a healthy development and to recovery when damaged or suffering from disease. The farm is ruled by the relationship between cosmos and soil, as well as by plants as living beings. On one hand, plants have leaves and flowers that need support from the upper pole to develop properly. On the other hand, roots are in the soil and need water and darkness. Each plant has a maximum level of tolerance to one of these two poles, if one of them is overrun, disease will appear. (Cánovas Fernández et al., 1993).

Biodynamic Preparations

Biodynamic preparations can be divided into two main groups:
a) Spray preparations: named as 500 and 501. They are specifically and carefully made from cow manure and quartz, and they are applied to crops in a very diluted form in 300 g and 4 g/ha respectively (Lampkin, 1998). They present opposite properties, so while one stimulates the soil and roots, the other one affects the upper part of the plant.
b) Compost preparations: six preparations made from plants (yarrow, dandelion, stinging nettle, chamomile, oak bark and valerian) in concentrations of 2-4 ppm that are added to compost and to compost piles with the aim of boosting decomposition and fermentation processes.

The role of cosmos in Biodynamic Agriculture

Biodynamic agriculture is based on the belief that astrology clearly influences soils and plants. While the sun plays an intermediary role, the moon, Mercury and Mars influence the forces of reproduction and fertility, and Venus, Jupiter and Saturn on those of ripeness and nutrition. (Cánovas Fernández et al., 1993).

2.5 / NATURAL FARMING

This type of agriculture was created and spread by the Japanese farmer Masanobu Fukuoka in 1950, and it is based on the respect for and imitation of Nature.
The main characteristics that define this system are:
- minimised human labour;
- respect for the environment;
- maintenance and improvement of soil fertility;
- no chemicals or synthetic products;
- production of seasonal products;
- use of mud tablets with seeds instead of sowing or replanting.

This philosophy is also known as the "no-tillage" or "minimum tillage" farming and it follows five principles:
1) no tillage;
2) no fertilisers;
3) no pesticides herbicides;
4) no weeding (chemically, mechanically or manually);
5) no pruning.

In this way the soil is never altered, which is one of the keys to its productive success. Fukuoka used tablets of mud and seeds mixed, added to unploughed soil which was thereafter watered. Moreover, Fukuoka gave great relevance to mulching as a way to control weeds. For this reason, straw obtained in previous crops should generally left on the field. According to Fukuoka theories, the human labour can be reduced if the farmer allows nature to do its job, for example, letting insects and roots mulch the topsoil, sowing with no tillage by scattering the seed on the soil, etc. However, this must not be understood as neglecting the land, but as a way to minimise the farmer's intervention, reducing it to those activities only that are essential such as sowing (not always) and harvesting.

2.6 / PERMACULTURE

Permaculture is a close relative to the Fukuoka's natural farming, developed since 1975 by Bill Mollison and David Homgren, from the University of Hobart (Tasmania-Australia). Permaculture can be defined as a comprehensive farming system that develops itself. It is a stable, self-regulating and complete system, modeled from simpler, already existing models, and whose main principle is that each element should be able to assume multiple functions and each one of those functions should be supported by multiple elements (Cánovas Fernandez et al., 1993). Permaculture gathers different ideas, skills, and lifestyles which need to be rediscovered and developed, so as to obtain the power to turn from dependent consumers into responsible and productive citizens. (Holmgren 2002).

Initially permaculture arises as a consequence of two phenomena in industrialised urban societies: first, food dependence with respect to the rural area and high consumption of energy from non- renewable sources; second, urban-rural migration by disenchanted urban citizens. Consistently, permaculture main aims are to create agricultural systems with low energy consumption and high productivity, obtaining the highest degree of self-maintenance possible, employing simple techniques and seeking the integration of landscape, functional and aesthetical value. (Cánovas Fernández et al., 1993).

Permaculture is generally targeted at urban communities that intend to work part-time on agriculture, aiming to become self-sufficient (Mollison and Holmgren, 1978).

The main characteristics that define this system are very similar to those of Organic Farming. In fact, it can be considered as a variety of Organic Farming with a globalisation touch.

The most important difference might be that permaculture seeks to develop human environments that are ecologically and financially viable, as well as sustainable.

Permaculture uses plants' and animals' inherent qualities, combined with the natural characteristics of land and structures, to produce a

system that can support life both in the city and in the countryside, while using the least possible physical area. (Mollison, 1994).

The Flower of Permaculture

In the last 30 years the permaculture method has been expressed through seven areas or "domains":
- management of the land and nature;
- built environments;
- tools and technology;
- education and culture;
- physical and spiritual wellness;
- economy and finance;
- ownership of the land and collective governance.

These key areas, which require integration and transformation if a sustainable culture is to be created, can be called at as "the Flower of Permaculture". The flower of Permaculture summarises how the development of Permaculture begins with Ethics and Design Principles and it is developed through key phases that are necessary for the creation of a sustainable future. These phases are connected by a pattern of evolution in the shape of a spiral. It starts at a personal and local level, and then it goes towards the global and collective.

2.7 / AGRO-ECOLOGY

This is a farming system recently developed within the scope of organic farming, which provides the so-called "ecological" farming systems with a scientific and ecological basis, incorporating a social component and system analysis dimension to its developments (Sevilla Guzmán, 1990). Agro-ecology appears in the seventies as a response to the effects of intensive farming on environment, society and human health. Besides, at that time people were aware of the functioning of agro-systems, and some experiences of farmers who used environmentally-friendly methods were already known.

Altieri (1997) defines agro-ecology as "a discipline which provides the basic organic principles to study design and manage agro-ecosystems that are productive and preserve natural resources, and which are also culturally sensitive, socially fair and financially viable". This method shares the characteristics of Organic Farming, and it adds the creation of human agro-systems that are ecologically, financially and socially sustainable and fair.

2.8 / AQUAPONICS

Aquaponics is a cultivation system which combines traditional aquaculture (cultivation of fish) and hydroponics (cultivation of plants without soil either in water, or in an inert medium). It creates a system that imitates natural aquatic environments, where aquatic animals and plants can benefit from each other. It depends on the plants filtering the waste generated by fish and the action of some bacteria which convert these waste into compounds that are reused for plants and that are less toxic for the fish. The water used can be kept in the tank indefinitely. Generally, only 1,5% of the total volume is replaced after a whole cycle.
The main characteristics that define this system are:
• combined production of fish and vegetables;
• vegetable and animal production (seasonal foods) which is stable over time;
• requires an initial investment in pumping equipment and systems to control the variables;
This farming method makes little use of water and space, and it does not need available fertile soil, so it can be used in urban areas.

2.9 / URBAN AGRICULTURAL SYSTEMS

Urban Agriculture (UA) plays an essential role in the current essential processes of urban development and food safety, and it also presents a high innovative and knowledge potential, strongly related to its con-

text (local markets, active citizenship, use of urban space, traditions, cultural heritage, etc.). For this reason, UA is represented in Europe by a wide typology of multifunctional spaces of great socio-cultural, environmental, recreational, educational and therapeutic value. UA is also promoting experiences that reflect and jointly intervene on issues of citizenship, public space, community identity or processes of space ownership, and the notion of food-sovereignty (Fernández y Morán, 2012).

With regards to consumption and commercialisation of products, UA is a tool to raise social awareness, seeking a fairer and more respectful system, acting at a local level. In this way, UA may assume a number of forms which range from individual cultivation and consumption of products within the community (neighbourhoods, friends, etc.), to the small producer who supplies several consumers with their products, creating short-chain of small-scale trade (groups of producers-

Figure 4. Tool area and rest area at the "Verdecillo" (Spain).

consumers, community supported agriculture).

Among the advantages of UA are the production of quality foods, a greater respect to the environment, as well as decreases in surplus foods (quantities of food more adjusted to real demands) and in the economic risks for small producers (because of price volatility of great

markets).

Urban areas have a strong influence on the environment due to the impact of cultural, social and economic conditions, the exploitation of resources and retail sale and commerce. Therefore, the location of UA (where it develops its activity in relation to urban space) plays an important role because of the cities' influence on their immediate environment. UA must adapt and respond to the city demands, and take advantage of its location and infrastructures. Consistently, the

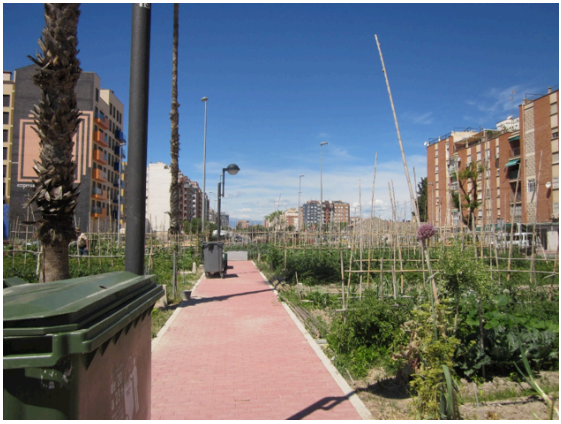

Figure 5 and 6 . Leisure gardens created in a residential green area of the city of Murcia. Iniciative of the Town Council of Murcia.

degree of proximity to the city centre is also a crucial factor in the UA, resulting in gardens appearing in underused lands as well as in building rooftops. It has been estimated that if each individual grew food in their windows, patios, terraces, balconies and gardens, more than 70% of the food consumed in urban centres could be produced. Moreover, by transforming unused urban lands into productive gardens, their evolution into degraded dumping sites is avoided.
From a social perspective, UA refers to any activity that employs agricultural resources and livestock keeping to promote therapeutic, rehabilitative actions, as well as actions of social and occupational integration, recreation, education and other services useful to everyday life in local communities (Di Iacovo 2009).

3. POSSIBILITIES FOR DEVELOPMENT OF URBAN AGRICULTURE

/ UA comprises all the actors, communities, activities, places and economies which focus on biologic production in an urban context and its proximity outskirts. Indeed, UA should not be overlooked as a rural surplus, but as a result of permanent interaction between the urban and the rural environment. The process of adaptation to the needs of urban society is therefore crucial to understand UA, its possibilities and typologies. UA activities can be divided into 3 main categories:

1) urban gardens: horticultural activities with little financial dependence on materials and which use agriculture with mainly social aims. Some examples are:

• family Gardens: generally outside the political agenda and of individual initiative;

• allotments: the most internationally popular and frequent kind of urban garden. Located both inside and outside cities, they are generally small individual plots either rented or transferred by a third part by means of an agreement that can be provided and managed by a town council or association/social group;

• educational or school garden: developed by an educational institution, which can be developed either inside or outside their own premises, with educational aims and open to visitors. Generally managed by Public Administration and relying on the degree of commitment of the teachers.

• therapeutic garden: generally located in health institutions, hospitals and elderly care homes.

• community gardens: recently showing increasing development, typically located in public areas, of a collaborative character, collectively developed with rules or norms and an organisation established

by the community. They are open and, usually but not always, integrated in a network that shares experiences and learning. The main functions are social, though also educacional and cultural;

• "squatter" gardens: managed by collective movements which get hold of abandoned urban sites, which generally belong to the local government, for the communal production and auto-consumption of fresh food and the promotion of social relation;

Figure 7. "Family Organic Gardens" in Alhama (Murcia) a good example of allotments in grounds given by the church, with local iniciative and management through an association with various objetives: cultural, social, educational, etc.

2) urban Farms: based on business models, taking advantage of the proximity of the city and offering farming products (local or regional), or services.

Inside this category different sub-categories can be found, such as:

• local farms aiming their production to direct sale to the local consumer;

• school farms (with educational purposes);

• pilot/experimental farms (focused on research);

• social/therapeutic farms which use farming as a way to promote rehabilitation of underprivileged people and integration of disabled, in-

mates, drug addicts, immigrants, etc.);

• agro-environmental farms (which contribute to the preservation of biodiversity, offering some kind of interaction with the urban population aimed at fulfilling the urban leisure demand);

3) Non-oriented urban agriculture: Includes farms located in urban areas, whose business models have not been deliberately adapted to proximity of the garden. These are the traditional agricultural models found in the outskirts or peripheral areas of the city.

This eBook will mainly address the first category (Urban gardens) and the possibilities to produce foods almost anywhere within the vast and complex urban context. Consistently, the spaces where urban agriculture (and in particular urban gardening) can be practiced, are hereafter described.

Figure 8. Example of Agri-environmental Farm in which workshops are organised to train future urban garden users. CEAMA, Bullas (Spain).

3.1 / PUBLIC URBAN ENVIRONMENTS WITH POTENTIAL FOR URBAN GARDENING

Despite the fact that in cities the urban land is intended to provide services and guarantee habitability, a large amount of spaces that are not used (known as "abandoned sites") and that are not under construction may be generally found. Sometimes it could be the case that they do not meet the requiremnts indicated by the General Urban Development Plan. These are free, generally uncemented areas, usually known as green areas, which, due to the absence of green elements (trees, bushes, and other ornamental species), have turned into "abandoned" sites. Very often they are the source for complaints among the neighbourhood because of the lack of care and cleaning, becoming also a source of neighbourhood degradation. They therefore do not fulfil their original and intended function, nor do they cover the expectatitions of use of the community.

Addressing the available places in cities for the development of urban gardening activities, these green areas can generally be an excellent option, because of their features (public open areas, with infrastructures such as water, light, etc., soil with acceptable physical properties), and because of their social and environmental functions and their view as leisure areas. However, it must be taken into account the fact that local legislation does not allow privatising public utilities and therefore, creating these islands for restricted use within the context of a public area is not generally allowed.

As opposed to the case of public areas, private areas and plots which are not being used are revently being given up for urban garden initiatives. These private sites, are an excellent opportunity for families or community groups who sign a private agreement with the owner of the land so that they can use it as an urban garden. It is obvious that real estate speculation has significantly slowed down so maybe a good way to reach an agreement is to give up the land in exchange for either providing basic service (such as maintenance) or even a certain percentage of the crops obtained. Both alternatives can benefit both the owner and the tenant, the former not having to worry about

maintenance and the latter obtaining a certain volume of food produce at a low cost. Hernández et al. (2014) see the current housing crisis as an opportunity to reconsider the urban system and to plan new ways that foster the cooperation between social agents, local population and politicians as well as the improvement of land and human sustainability.

However, using public areas can be more advantageous for urban garden practisioners, considering the current economic circumstances and the influence of the volatility of the real estate market.

These plots or areas controlled by the local administration are organised around different aspects such as accessing times and work done on the premises, the system for the award of the plot and the maximum length of time that a user can enjoy it, the farming method, destination of the production, etc. Sometimes also the previous training and qualifying actions that enable the user to implement the farming techniques for growing the food are also taken into account.

The main aims of these gardens are: recovery of the use of public space, environmental education and the creation of socialising spaces. Sometimes they are targeted at a particular population sector, for example elder, unemployed, children or people under risk of social exclusion, but they must be aimed at more varied social groups.

According to Morán (2011) gardens favour sustainability of urban environments, since they are a way to integrate nature in the city and a tool to further help the design of the city on a human scale, providing public space with character and local identity, catering for social and cultural diversity and for the complexity of climate, physical and social constraints.

Urban gardens that are located in public city parks may occasionally be managed by residents themselves or by users who set up a community to that aim. These communities grow fruits and vegetables and they usually give courses and organise activities around urban gardening. In these public spaces (parks or leisure areas), the garden continues to be an area open to the city that acts as a green lung. It is often the case that within these parks business opportunities arise which are

not directly related to the urban agriculture activity. In these crowded and lively gardens other services can be developed that foster economic diversity, such as cafes, libraries and fair trade small markets. In these premises, products grown by volunteers and workers can be purchased, or fairs, music or cooking events can also take place; an example of this is given by Prinzessinengarten (Moritzplatz, Berlín). These public urban gardens are generally managed following democratic roles, and this is possible thanks to the bottom-up approach generally adopted in implementing such initiatives.
The situation of urban gardens in green public areas offers an excellent opportunity to address deeper human issues such as: preservation of open spaces and their diversity, social involvement values, the balance between economic interests and prevention from suspension of existing social structures (Pradel, 2012). As an example of the above the case of the Comité Pro-Parque Educativo Miraflores (Committee in favour of Educational Park Miraflores) in the city of

Figure 9. Bar at Prinzessinengarten (Berlin, Germany).

Seville may be mentioned. This is an association movement formed in 1983 in a city that did not have any Urban Garden policy. This lead to the creation of an urban park (green area), still today managed with

the sponsorship of the City Council. This committee, originally integrated by several associations of a different nature, undertakes various projects (leisure garden, school garden, etc.) and has also started the recovery of some building and spaces of great historical and cultural value (among others, an old tobacco dryhouse, a Manor House including an oil mill from the 18th century, etc.). All this provides a basis for numerous educational and informative activities interrelated and oriented towards the use and participatory recovery of the agricultural identity and of the history of the land on which they take place. The space devoted to Leisure Gardens occupies aproximately a 26% of the total surface of the park and it is organised in 160 individual plots of 75 to 150 m2, of which only 15 are drawn annually.

Despite the benefits that these socially innovative initiatives have on cities, they depend to a great extent on the will and the degree of tolerance of local administrations and other interested parts (stakeholders). The problem is further worsen with the lack of space in some cities where the possibilities for urban gardening are limited, since city centres are under great pressure from those who desire to maximise more profitable building destination of the lands. The former example of the Parque de Miraflores, is an instance of citizen action-taking, with citizens opposing in the 80s to the reassessment of urban planning and to the construction of new houses in a space that the Plan General de Ordenación Urbana (General Urban Development Plan) considered as “green space”.

The neighbourhood action recovered and transformed the green space into a space with its own identity for the development of cultural and environmental activities. Despite all, the park is not finished yet and the association movement is still claiming the true value of the space taken by the government.

The history of this association movement is of great relevance, because understanding certain urban areas as cultural and social parks (beyond considering them only as productive agriucultural parks), could turn into a new modality to be included into the general urban plan: coherently, conflicts between the different parties and stake-

holders (originated by different economic interests) could be avoided. Support from the local community is crucial, otherwise these actions may be understood as an illicit occupation of public space.
In short, dedicating spaces to urban agriculture activities:

- promote inter-generational relations and exchange;
- promote citizen participation, free from speculation and politics;
- defend public spaces as places for leisure, relax, learning, exchanging of experiences, promoting healthy hobbies, etc;
- defend a sustainable city model;
- fight for a more balanced society that is also plural, tolerant and multi-ethnic;
- foster and implement renewable energies, favouring the use of renewable resources, non-polluted and accessible to all, promoting recycling of materials, etc;
- report on bad policies that generate social and climate imbalance;
- fight agains discrimination and social exclusion. Fight for gender equality. Fight against child abuse exploitation and promote fair trade;
- develop the local resources (fast and close flow) optimising these by

Figure 10. Urban Garden "Las Moreras" in Seville. Image of the farming plots (allotments) being part of the green area (Parque Miraflores).

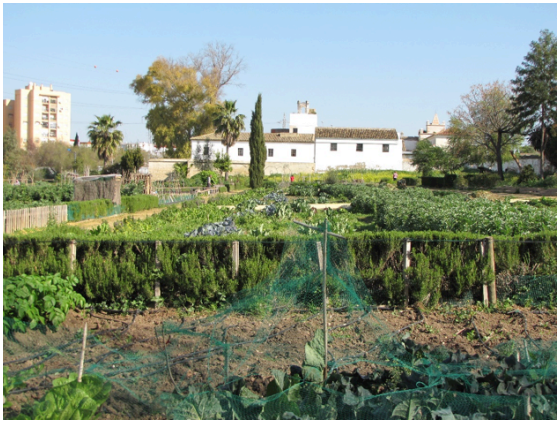

Figure 11. Urban Garden "Las Moreras" in Seville. View of school garden plots with recovered tobacco dryhouse at the background.

caring for the environment;
• favour a certain level of self-sufficiency in the local production of organic foods, saving means and energy in their processing;
• activate new direct forms of distribution of food, enabling the creation of cooperatives;
• balance wellness and abundance of foods in the local population;
• boost new opportunities for local employment in market sectors around a organic farming and its processes (environmental education, organic food, treatment of organic waste and waste waters, etc...);
• foster the collaborative caring for urban green spaces, in neighbourhood spontaneous movements, stimulating the efficient management and saving of local resources;
• increase the quality of the natural landscape and strengthen the value of the place as a driving force of external flow (leisure, residence, etc.);
• recover local historical agricultural values, which altogether with a correct planning, can in time become a tourist attraction (cultivation of autochton species and development of traditional techniques).

3.2 / SCHOOL GARDENS

Other types of urban gardens found in cities are those called school gardens. In these cases the land belongs to the competent body of

Figure 12 and 13. Two school gardens located in Murcia city (Spain).

education or to the school itself, if the school is a private one. These school gardens have great potential not only because of the consumption of organic products by the students in school cantines, but also because the offer great educational benefits too. They are an excellent

way to turn these educational centres into places that enable students to enjoy multiple experiences on the natural and rural environment, as well as to understand the relations and dependence the city have on it, implementing attitudes and habits of responsibility and care for the environment. School gardens are also a didactic resource that can be used at all educational levels, since teachers can adapt the contents and activitites accordingly.

Educational programmes can adopt different approaches. On one hand activities must be able to make students work directly on the close environment, relating the problems that affect it with more global issues; on the other hand, they must make students learn about the elements integrating the school garden, the interactions between the differents interfaces and the changes produced in the garden. Students should also learn about the organisation of the garden and how it depends on other systems, and they should become aware of the necessary attitudes and values to promote a change towards more environmentally-friendly behaviours.

According to Netle (2010), some of the abilities and attitudes that education in school gardens can provide are:

• children can collaboratively work on real tasks, assuming responsibility for plant care;

• children experiment and feel proud of the food that has grown thanks to their care and dedication;

• children with difficulties can find ways to improve, to integrate and behave well. Moreover, they can create links to neighbours, volunteers, parents, and business of the community;

• in the garden, students can observe and interact with all the principles of ecology, and they can understand the seasonal and life cycles;

• students learn about the real origin of food and understand its role in cooking, life and the garden. From this space discovering and exploring is promoted, for example by tasting new food, trying new activities and making new friends;

• experiences in the garden reinforce the syllabus in the classroom and offer opportunities to integrate into schools educational pro-

grammes from the school garden;
• communication between teachers and students is made easier in the school garden;
• these initiatives offer a different cultural activity, above all if combined with cooking programmes where the traditional dishes and local products are promoted, and other programmes aimed at recovering local culture;
• with regards to eating, the garden offers new positive experiences with healthy foods, promoting knowledge of the fruits, vegetables and herbs and improving the children's and youngsters' nutrition.

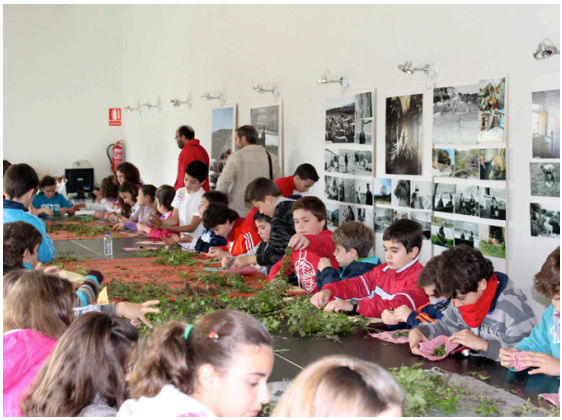

Figure 14. Activities in a school garden programme, CEAMA, Bullas (Spain).

In short, it is an activity that we can use to "improve eating habits and foster socialisation".
School gardens are often consisting of small plots, since educational centres do not have a space specifically dedicated for the implementation of the garden. These small plots usually have a didactic character, more than a productive or consumption-oriented one. However, there are other projects of greater importance, in which thanks to participation of neighbours, teachers, parents, etc., the outcomes are really a stock of organic food for the school cantines, or can even be

sold in markets and fairs or social events organized by the school. Other times despite the willingness of the teachers or school director to introduce the urban garden into the school subject areas, it cannot be done because of lack of available space. In this case, visits to urban gardens that organise activities for children are often found.
In the garden educational activities of different nature and modality can be done, which will range from the observation and monitoring of the tasks implemented by way of forms, notes, etc., to the organisation of workshops in which students work on supplementary aspects, related to plants and their use, health, waste, etc.

Some considerations for the set-up of an urban garden

Setting up an urban garden is easy, but a correct organisation is crucial in order to achieve an adequate assignment of the resources and an equitable distribution of the tasks to be developed throughout the productive cycle of the garden, its preparation and maintenance. This can be achieved by creating a group or small community formed by users who belong to the school or are linked to it, so that a great interest in bringing the garden alive, as well as in defending its interests and coping with problems is guaranteed. This community may be formed by teachers, parent associations (with parents who are interested and committed), or student groups from higher courses who seek a curricular activity.
According to the FAO there are a number of steps to be taken in the implementation of an urban garden. First, the educational community must hold a meeting to inform about the creation of the garden in the school. In this meeting, the objectives and importance of creating the garden must be presented. Next, support will be asked from those attending, so that the different activities to implement and manage the garden can be developed. Following the meeting, the teaching team will become the managing board of the garden. A committee for the school garden will be created as a working team, whose function will base on participation, management and sustainability of the

school garden. Ideally the team will be created at the beginning of the academic year, or at the moment the decision to create the garden is taken. From then onwards, the tasks and duties of the committee are settled, so as to make the work in the garden easier. The whole educational community must support the committee in the different actions that are required for the establishment of the garden, its management and the destination of its outcomes. The president of the committee will lead the meetings, and will also plan the activities, motivate participants, and be the link to institutions, ensuring the support of each member of the committee in the actions of the garden. On the other hand, teachers will be the ones to organise students around the activities required for the garden, ensuring that it is taken care of, guaranteeing its safety and the proper use of the materials, equipment and tools, and guiding students in the maintenance of the school garden. The main characters, i.e. the students, will be the ones to take care of the maintenance tasks, caring for the garden, participating in the activities to empower the gardens. They will also act as leaders, incorporating other students into the experience, and multiply the actions of the garden by taking it to their homes and communities. Finally, parents will offer their support in all the activities of the school that benefit their children, getting involved in the tasks for implementing, maintaining, and taking care of the garden. They will help by contributing with input and tools when necessary, participating in activities to empower the gardens, as well as in meetings and committees. Other participants will be neighbours of the school, who will have the same functions as parents, but will also have to help to look after the safety of the garden. Once the managing board of the garden has been established, it becomes necessary to design a working plan, which will include a number of objectives, activities, organisation, resources, a cronogramme and finally an assessment of the already existing resources. Guaranteeing the resources for the correct functioning of the school garden is a task for the committee. In case ther is a lack of resources, there must be a management action for the purchase of those resources needed, with the approval of the director

of the school and provided there is a budget previously agreed to this aim. If the school has no budget, help can be sought from parents, NGOs, councils, etc. Some of the resources needed, proposed by the FAO, are:

- available ground for the establishement of the garden in the educational centre and an available store or pantry where the goods, tools and materials can be kept;
- availability of water;
- tools: hoe, shovel, hoses, gloves, among others;
- materials: black soil, organic matter, sand;
- inputs: seed, organic pesticides and organic fertilisers, others.

It is important to keep a register of all the processes so as to develop a structure that can be easily reproduced in future projects. These registers help develop new gardens since they allow to know every step that was taken, as well as the results obtained, whether good or bad. Finally, promoting the garden is indispensable, and it must be done through the committee, organising different events such as: school agro-markets, tours around the garden, and exchange of experiences between centres.

3.3 / HOUSEHOLD GARDENS (YARD, BALCONIES AND TERRACED GARDENS)

Having an urban garden in the yard, balcony or terrace (very usual in residential areas) is an interesting opportunity to practice agriculture in families within the city, since these spaces are abundant and often not used. Although they are reduced in size, they ar ideal for beginners who do not have much time to dedicate to a large crop, and users that do not need to move away from the city or go to a specific park. The only thing needed is a sunny place, a good orientation and water for irrigation. Building up a little urban garden is easy and viable. A range of manuals, (e.g. The Manual para el huerto en casa / Handbook for the urban garden at home, DA, 2013 or the enclosed HORTIS eBOOK on simplified soilless systems), registers numerous benefits derived from setting up an urban garden in the house-

hold. Among others:
• fosters the observation skills and the understanding of the environment, helping us to understand better natural cycles;
• increases sensibility towards sustainability and motivates for a more reasonable life, in issues like consumption, energy saving, etc;
• the garden turns out to be a ver funny activity, relaxing and stress-reducing;
• the garden is an extraordinary tool for environmental education for children, since they can feel, experimentation, touch and recognise the plants and vegetables that they planted themselves and helped to grow;
• it allows to discover the organoleptic quality of the food. Vegetables can be harvested in their highest ripening point, and they can be eaten minutes after that. This makes them keep all their taste, much better than the vegetables bought in most of the supermarkets and shops;
• food safety of what we consume. This is caused by the fact that the production is not aimed at commerce, but at self-consumption and for the mere pleasure of cultivating;
• it helps give more value to the farmer and to traditional farming;
• in some cases it can help in the energy saving of the household, since the cultivating of plants reduces temperature considerably, increasing the relative humidity, which may mean saving in air conditioning.

Where to cultivate

Due to the characteristic of the areas where the garden will be created, it becomes indispensable to use containers fitted to the shape of that space, and which allow to make the best use of it. These containers can be purchased in specialised shops (more and more usual) or can be made from different materials such as boards, plastic boxes, wooden boxes, etc. These recipients or containers can make work easier for children, disabled and aged people, if well positioned in the garden. They can be placed at a comfortable height or forming

Figure 15. Recycled materials for farming, residues free. Prinzessinengarten (Berlín).

aisles that allow access to the different crops. On the other hand, with this farming systems water can be very well used if a storage and drainage system is included, reusing the water and taking only the amount needed for ensuring plant life. There are multiple inventions for household farming in the market, but the costs of these can be a problem. Economy of the containers is an important issue that need to addressed, through the good use of material and packaging and by adapting them to specific needs.To this aim, it shall be beared in mind

the volume of soil needed, so that plants can grow properly. To enable mobility of the farming containers, it is interesting to install wheels on them, so that once they are full for farming they can be transported easily (they can be very heavy and difficult to move). Containers can be made of plastic, mud/ceramics, wood, etc. Almost any kind of recipient can be used as long as it has drainage and does not get too hot (e.g. when metal recipients are used). With respect to materials, in particular when they are recycled, it is important that they don not contain toxic substances such as paint or varnish, solvents, heavy metals or other toxic liquids.

Planting and maintenance

The considerations to be taken into account to plant in recipients do not differ much from those we need to plan in other spaces. We just have to remember to place a porous material in the bottom part, where the holes for drainage are, and then to fill in the recipient (about three quarters of its total capacity), with a soil or a substrate that allows it to drain properly. Also it is crucial that it gets enough air and it contains

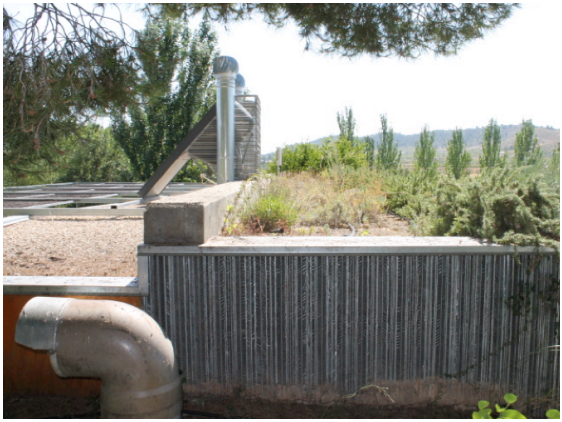

Figure 16. Plant rooftop in bioclimatic building cultivating aromatic plants, Centro de Agroecología y Medio Ambiente de Murcia, CEAMA, Bullas (Spain).

enough organic matter. Irrigation can be the most complicated task. On the one hand, watering can be operated manually with the help of a hose or a watering can; this is an activity that can be very funny for children, but it is only valid for very small gardens with very few plants. The most suitable system for a bigger garden is drip irrigation with an hydraulic timer.
Hydroponic agriculture, which is presented in the dedicated HORTIS Ebook, is one of the most frequently used techniques in balconies, yards and terraces. It is easy to set it up in these places due to the absence of soil, though installing the system can be more expensive, sometimes requiring electricity and technical competences. Such system has a number of advantages with regard to the space used, no soil required and high water use efficiency.

3.4 / ROOFTOPS

Rooftops are one of the most abundant spaces in cities, especially in big cities with tall buildings. Because of their horizontal position, in many cases, they are an important part of the surface built in the urban environment. Also, the fact that they are open-air turns them into ideal places for the set up of urban gardens.
The first gardens and orchards built on rooftops that have been registered are those of the Semiramis hanging gardens, in what is now known as Siria, considered as one of the classic seven wonders of the old world. Later on, "green rooftops" practice became usual as a way to mitigate the damaging effects of solar radiation on roof structures, and as fire-proof structures (Oberndorfer, 2007). However, the current "green roofs" or the so-called "roof-gardens" are undoubtedly more and more important now. The advantages they bring to buildings and cities are varied, since apart from the possibility to obtain food or flowers from each own home, these systems have beneficial effects on the buildings temperatures, and they also reduce the risk of floods. They act as systems able to filter pollutants from the atmosphere and CO_2, as well as pollutants from rain water, working

as an acoustic barrier and thus contributing to favour and preserve biodiversity in urban areas. Although the rythm of construction has reduced considerably, new buildings, hotels, shops, offices, etc., are starting to incorporate more and more some kind of green roofs. Consistently, if an "ornamental green roof" can be created according to these functions, why not think of the possibility of a "green

Figure 17. Garden in boxes. Community Rooftop garden (Bologna, Italia).

roof" with productive function? Undoubtedly, the surface of roofs of buildings already built is much higher than that which can be built in the near future. However, turning the roofs of old buildings into gardens must be analised carefully, so to avoid possible unwanted effects caused by the load of the weight of the cultivated area. On the other hand, other technical considerations to bear in mind are mainly: waterproofing and resistance (of the roof) against the plant roots.
A roof can be totally or partially cultivated. In the second case, it can be organised in such a way that the space that is not cultivated can contain other facilities which are necessary, or it can be an area (with some furniture) for leisure, rest or solarium. This is not always possible, since often roofs are shaded because of nearby buildings. Except in those cases in which the shade is permanent and the light is low,

the garden can be adapted to the conditions of the roof, keeping the sunny area or areas for farming and other portions for leisure.
With respect to farming considerations, it shall be taken into account the fact that the environmental conditions are particular, since roofs are very exposed to solar radiation and wind. This must be considered when designing the garden in a building.
On the other hand, the substrate is another important aspect because of several technical reasons: ability to keep water, content in organic matter, durability (or replacing and maintenance needs) and weight/lightness. All these factors will determine the suitability of the substrate for farming. With regards to weight/lightness of substrate, it is important to consider the overall quantity required for the garden and its impact on the building characteristics of the roof.
For urban rooftop garden projects, it is important to consider aspects such as: characteristics of the water used, kind of recipient used for placing the plants (flowerpots, containers, staking, etc.), management of the crops (including mineral and water needs) and the ways to be used to control pests. It is therefore recommended to consult a qualified specialist who analyses and ensures accessibility, safety and viability of the project, since there is a great variety of rooftops.
When choosing the plant species to be grown in the garden it is convenient to go for those which need little soil depth and which get to a small to medium size.
There are many plant species with these features so it will not be difficult to find them. If an urban garden is to be set on a rooftop, care shall also be given to the people who are going to get involved in the project, and to identify their limitations (e.g. physical and/or psychic). Both the access to the rooftop and its safety must be guaranteed.
Antoher issue to take into account is the legal aspect, since by using a communal space, it is advisable that the approval of the garden by all neighbours during a community meeting.

3.5 / VERTICAL FARMING: HANGING FIELDS AND OTHER WAYS FOR UPRIGHT VEGETATION

The concept of vertical farming was developed in 1999 by biologist Dickson Despomnier of the University of Columbia in New York, though there were some precursors, as the physicist Cesare Marchetti, who in 1979 already coined a similar concept as a response to the report The limits to growth. However, in 2007 an article from

Figure 18. Simple vertical farming system made with recycled packaging. Prinzessinengarten (Berlín).

the New York Magazine on this subjcet caught the attention of several scientists from USA and Europe and they then spread the issue at a world level. The concept of vertical farm can be defined as a kind of agriculture which grows plants in buildings or skyscrapers which act as greenhouses. Examples of vertical gardens are being implemented in a number of cities worldwide. There are numerous initiatives around this innovative building technique that integrates architectural vegetation into buildings and their urban environment. These farming walls are real pieces of art because of their beauty, and can make the grey landscape of cities nicer, adding a new "touch of green" to it. Apart from their contribution to cities, these verticle systems provide a solution to pollution problems such as the "sick build-

ing syndrome". On the other hand, they increase the level of oxygen circulating in the air, improve the building water use efficiency and microclimate, etc. But apart from these environmental and aesthetic benefits, these farming systems are argued to be a viable solution for the production of food, above all for those cities in which other types of farming systems are not available. These farming structures are a follow-up to those already existing in balconies and terraces, which could lead to cultivation of great quantities of food for citizens in the future, since with this technology the original surface for farming land can be multiplied. One of the great advantages of vertical farming or wall gardens is that they can be installed in places where there really is no space for the set up of a traditional garden. This is because the crops are vertically placed on a wall using sheets of laminated glass, or a metal structure, or some other kind of structure made with cables or intertwined wood. Under the structures, a substrate is placed that provides a basis for rooting, since the nutrients get to the rootzone dissolved in a nutritive solution, as in hydroponic farming. Other techniques used are aeroponics (soilless growing, with roots hanging in mid-air in an atmosphere or in a water-vapour and nutrients mist) and drip-irrigation (indirect irrigation of root zone, drop by drop, adding water and nutrient). These infrastructures are used in many countries which are concerned about environmental issues and the creation of employment, as well as about covering the demand for local fruits and vegetables or improving food safety.

In Sweden, there already exist some initiatives such as the twelve-floor triangular building in Linköping (www.plantagon.com), in which plants travel on tracks from the top floor to the bottom to take advantage of sunlight and make harvesting easier. This is one of the highest vertical wall gardens in the world, a very expensive project that intends to repay by selling products in the city, renting some of the floors to build offices, and saving in energy expenditures, taking advantage of the biogas produced by the conversion of the building's organic waste. Other examples of these systems in cities are found in the USA, where vertical gardens are emerging in all urban areas

around the country, some of them in old buildings that have been re-adapted for farming.

Although these projects might seem something of the future, the truth is that urban gardening is available to anybody. On a household level or even on a community level, simple techniques are accessible such as using mesh or recycled materials like PET plastic, wood structures, etc.; on any house or warehouse wall systems to develop vertical farming may actually be implemented.

4. CONCLUSIONS

/ Urban gardening is revealing itself as an interesting and valuable way to address the numerous social challenges of today's society. The different farming techniques and systems revised here aim to contribute to facing these challenges, and they also pursue the production of food with desirable and advisable high quality and safety levels. On the other hand, an attempt has been made to define urban agriculture, to classify the different types of possible activities within it, and to contextualise urban agriculture and the urban garden as an activity with great potential. Finally, the different spaces and areas (inside the wide and complex urban context) where these kind of initiatives can be developed have been addressed.

5. SUGGESTED READINGS

- Acosta, D., Castillo, N.; Carrasquel, G.; Correa, Z.; Hurtado, K.; Montenegro, A.; Ostos, E.; Paéz, D.; Parra, J.; Quintero, J.; Leonidremeo A. Franklivenero, M. 2012 Promover en las comunidades la siembre de cultivos organopónicos y la lombricultura como base de la agricultura en el estado de Apure. Universidad Nacional Experimental de los Lanos Occidentales "EZEQUIEL ZAMORA".
- Altieri, M. 1997. Agroecología. Bases Científicas para una Agricultura Sustentable. Ed. CIED. Lima.
- Armstrong, D. 2000. A survey of community gardens in upstate New York: Implications for health promotion and community development. Health & Place 6: 319-327.
- Bowler, D.E, Buyung-Ali, L.M, Knight, T.M, A.S. Pullin. 2010. Urban greening to cool towns and cities: a systematic review of the empirical evidence. Landscape and Urban Planning; 97: 147-155. DOI:10.1016/j.landurbplan.2010.05.006
- Cánovas, A. 1993. Tratado de Agricultura Ecológica. Departamento de Ecología y Medio Ambiente. Instituto de Estudios Almerienses de la Diputación de Almería. Cuadernos monográficos 23. Almería
- Collins, R., Kristensen, P., Thyssen, N. 2009.Water resources across Europe – confronting water scarcity and drought. EEA Report No. 2/2009, European Environment Agency, Copenhagen.
- Despommier, D. 2010. The vertical farm. Feeding the world in the 21st century. Thomas Dunne Books. New York.
- Di Iacovo, F. 2009. L'agricoltura sociale: pratiche e paradigmi nello scenario comunitario. Universitá di Pisa.
- Foeken Dick, Sofer Michael, Mlozi Malongo, 2004. Urban agriculture in Tanzania. Issues of sustainability. African Studies Centre Research Report 75 / 2004

- Gutierrez O. Raimundo, 2011. Centro Capacitación y Desarrollo de Agricultura Urbana. Universidad de Chile Facultad de Arquitectura y Urbanismo
- Henk de Zeeuw, Ir. 2004. The development of Urban Agriculture; some lessons learnt. Key note paper for the International Conference "Urban Agriculture, Agro-tourism and City Region Development", Beijing, 10-14 October, 2004
- Hermi Zaar, M. 2011. Agricultura Urbana: algunas reflexiones sobre su origen e importancia actual. Revista bibliográfica de geografía y ciencias sociales. Universidad de Barcelona. ISSN: 1138-9796. Depósito Legal: B. 21.742-98 Vol. XVI, nº 944, 15 de octubre de 2011
- Hernández, V., Simón, M., Zazo, A., Rodriguez, R., Morán, N. 2014. La agricultura periurbana en la ordenación territorial: una oportunidad que no podemos dejar escapar. Libro de actas del II Congreso Estatal de Agricultura Ecológica Urbana y Periurbana. Accedido en http://habitat.aq.upm.es/boletin/n47/anmor_1.html el 30 de mayo de 2013.
- Holmgren, D. 2002. Permacultura. Principios y senderos mas allá de la sustentabilidad. Kraigon.
- Jane E. Schukoske Jane E. 1999. Community development through gardening: state and local policies transforming urban open space. University Journal of Legislation and Public Policy, 3: 351-92.
- Lampkin, Nicolas, 2001. Agricultura Ecológica. Ediciones Mundi-Prensa.
- Milligan, C., Gatrell, A., Bingley A. 2004. 'Cultivating health': therapeutic landscapes and older people in northern England. Social Science & Medicine 58: 1781–1793.
- Mollison, Bill & Slay, Reny Mia, 1994. Introducción a la Permacultura. Tagari Press.
- Mollison, Bill and Holmgren, David, 1978. Permaculture One: A Perennial Agriculture for Human Settlements. Corgi.ISBN 978-0-938240-00-6.
- Morán Alonso N., Aja Hernández A. 2011 Historia de los huertos urbanos. De los huertos para pobres a los programas de agricul-

tura urbana ecológica. Departamento de Urbanística y Ordenación del Territorio Escuela Técnica Superior de Arquitectura de Madrid. Universidad Politécnica de Madrid (UPM)
- Morán Alonso, Nerea; 2011. Huertos urbanos en tres ciudades europeas: Londres, Berlín, Madrid.Boletín CF+S, 47/48, pp. 75-124. Recurso electrónico en línea.
- Moreno Flores, Osvaldo. 2007. Agricultura Urbana: Nuevas Estrategias de Integración Social y Recuperación Ambiental en la Ciudad. Revista Electrónica DU&P. Diseño Urbano y Paisaje Volumen IV N°11. Centro de Estudios Arquitectónicos, Urbanísticos y del Paisaje Universidad Central de Chile. Santiago, Chile. Agosto 2007
- Mougeot, J.M., 2000. Urban Agriculture: Definition, Presence, Potentials and Risks, and Policy Challenges. International Development Research. Centre (IDRC).
- Nettle, Claire 2010 Growing Community: Starting and nurturing community gardens, Adelaide. Health SA, Government of South Australia and Community and Neighbourhood Houses and Centres Association Inc.
- Nipen Anita, 2009. Assessing the available land area for urban agricultura on the Halifax península. Environmental Science Honours Thesis Dalhousie University, Halifax Nova Scotia 18 December 2009
- Oberndorfer, E.; Lundholm, J.; Bass, B.; Coffman R.R.; Doshi H.; Dunnet, N.; Gaffin, S.; Köhler, M.; Liu, K.; and Rowe, B. 2007 Green Roofs as Urban Ecosystems: Ecological Structures, Functions, and Services. Published by: University of California Press on behalf of the American Institute of Biological Sciences. Article DOI: 10.1641/B571005.
- Pradel, James. 2001. Urban Agriculture in London. Who, regional office for Europe. Series on Urban Food Security Case Study 2. EUROPEAN HEALTH 21 TARGET 11
- Pradel, Marc, 2012. Huertos urbanos: repensando la ciudad y la alimentación. (La trama urbana: latramaurbana.net).
- Reglamento nº 834/2007 del Consejo de la Unión Europea. (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:189:0

001:0023:ES:PDF)
- Sevilla Guzmán, E.; González M., M., 2000. Introducción a la Agroecología como desarrollo rural sostenible. Ediciones Mundi-Prensa.
- Wakefield, S., Yeudall, F., Taron, C., Reynolds, J., Skinner, A. 2007. Growing urban health: Community gardening in South-East Toronto. Health Promotion International, 22: 92-101.


HORTIS