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TOWARDS SUSTAINABLE CITIES: ASSESSMENT OF URBAN AGRICULTURE AS A GOOD PRACTICE

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TOWARDS SUSTAINABLE CITIES: ASSESSMENT OF URBAN AGRICULTURE AS A GOOD PRACTICE

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APPROVAL

This thesis titled TOWARDS SUSTAINABLE CITIES: ASSESSMENT OF URBAN AGRICULTURE AS A GOOD PRACTICE submitted by SEZGİ UYGUR GİANFRANCESCO, in partial fulfillment of the requirements for the degree of Master of Science in Architecture and Urban Studies is approved by

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DECLARATION ON RESEARCH ETHICS AND PUBLISHING METHODS

I, SEZGİ UYGUR GİANFRANCESCO; hereby declare

- that this Master of Science Thesis that I have submitted is entirely my own work and I have cited and referenced all material and results that are not my own in accordance with the rules;
- that this Master of Science Thesis does not contain any material from any research submitted or accepted to obtain a degree or diploma at another educational institution;
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In addition, I acknowledge that any claim of irregularity that may arise in relation to this work will result in a disciplinary action in accordance with the university legislation.

Sezgi Uygur Gianfrancesco

_____

Date (22/06/2022)

To My Dearest Family...

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TOWARDS SUSTAINABLE CITIES: ASSESSMENT OF URBAN AGRICULTURE AS A GOOD PRACTICE

ABSTRACT

Urban agriculture has the potential to be a solution to increase the urban resilience of cities. At the same time, it can help mitigate the effects of the growing food crisis and other crises related to climate change. Through a literature review and case studies, three prime areas of good practices have been researched and highlighted. These are the methods which produce better outcomes when followed. The study indicates that the contributions in environmental, socio-cultural and economic areas are crucial for the sustainability of the urban agriculture practice. Furthermore, the environmental impact of an UA practice depends on its implementations of increasing biodiversity, soil fertility, and water efficiency through several methods. Its socio-cultural impact depends on its capacity of community building, the contribution to the health and the education of its community, and its power to reappropriate a space in consequence of the community engagement. The economic impact comprises its contribution to the local economy, the empowerment an UA practice offers to its most vulnerable community members i.e. women and immigrants, the business tools and its relationship with the legislative bodies ensuring the continuity of the UA practice. Following the areas of impact an assessment criterion has been determined. This criterion was used as a tool to select and evaluate three UA practices in Istanbul. The thesis provides a strategy to implement recommended good practices in these examples and proposes an efficient integration of new UA examples in the urban planning process.

Keywords: Urban Agriculture, Urban Gardening, Good Practices, Urban Resilience, Assessment Tool

SÜRDÜRÜLEBİLİR KENTLERE DOĞRU: BİR İYİ UYGULAMA ÖRNEĞİ OLARAK ŞEHİR TARIMININ DEĞERLENDİRİLMESİ

ÖZET

Kentsel tarım, dirençli şehirler yaratmak için bir çözüm olma potansiyeline sahiptir. Aynı zamanda, büyüyen gıda krizinin ve iklim değişikliğiyle ilgili diğer krizlerin etkilerini azaltmaya yardımcı olabilir. Bir literatür taraması ve vaka çalışmaları yoluyla kentsel tarımdaki üç ana iyi uygulama alanı araştırılmış ve vurgulanmıştır. İyi uygulamalar takip edildiğinde daha iyi sonuçlar veren yöntemlerdir. Çalışma, kentsel tarım uygulamasının sürdürülebilirliği için çevresel, sosyo-kültürel ve ekonomik alanlardaki katkılarının mühim olduğunu göstermektedir. Bu başlıkların altında, bir kentsel tarım uygulamasının çevresel etkisi, çeşitli yöntemlerle biyolojik çeşitliliği, toprak verimliliğini ve su verimliliğini artırma uygulamalarına bağlıdır. Sosyo-kültürel etkisi, topluluk oluşturma kapasitesine, topluluğunun sağlığına ve eğitimine katkısına ve topluluk katılımı sonucunda bir alanı yeniden sahiplenme gücüne bağlıdır. Ekonomik etkisi ise, yerel ekonomiye katkısı, kadınlar ve göçmenler gibi toplumun en savunmasız üyelerini güçlendirmeye katkısına, ekonomik araçlar yaratmasına ve kentsel tarım uygulamasının sürekliliğini sağlayan yasama organları ile ilişkisine bağlıdır. Etki alanlarının ardından bir değerlendirme kriteri belirlenmiştir. Bu kriter, İstanbul'daki üç kentsel tarım uygulamasını seçmek ve Likert ölçeği ile değerlendirmek için bir araç olarak kullanılmıştır. Tez, bu örneklerde önerilen iyi pratikleri uygulamak için bir strateji sağlar ve yeni kentsel tarım örneklerinin şehir planlama sürecine verimli bir şekilde uyumlanmasını önermektedir.

Anahtar Sözcükler: Kentsel tarım, Kent bostanları, İyi uygulamalar, Dirençli şehir, Değerlendirme aracı

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CEA - Controlled Environment Agriculture, a technology based agricultural approach used to optimize plant growing systems, plant quality, and production efficiency.

CSA - Community Supported Agriculture, a system that connects producers and consumers through sharing crops in a local area.

DSNI - Dudley Street Neighborhood Initiative, a community initiative in Boston, USA.

MDGs - Millennium Development Goals, a declaration signed by 189 countries during the United Nations Millennium Summit in 2000, consisting of eight goals for improving the lives of the world's poorest people.

SDGs - Sustainable Development Goals, a collection of 17 interlinked global goals designed to be a "blueprint to achieve a better and more sustainable future for all", set up in 2015 by the United Nations General Assembly with the deadline of 2030.

UA - Urban Agriculture, agriculture practiced in urban areas.

1. INTRODUCTION

Urban agriculture has been a prominent movement since the beginning of the 21st century. The escalation of the food crisis and the gradual shift in perception toward climate change has brought UA into focus as a resilience strategy for urban areas. With major metropolitan cities introducing urban gardening programs, experts predict, "more cities will push urban agriculture policy initiatives forward" (Stephens & Landau, 2022). Meanwhile, policymakers are investing in agricultural technology to create floating, self-sufficient, zero-waste systems (UN-Habitat, 2021), meaning urban agriculture will become pivotal to master planning projects.

Urban agriculture supports food resilience in cities by providing families with an additional source of healthy, low-cost produce. It increases food literacy, reduces food waste through appreciation of the practice of cultivating, and promotes fruit and vegetable intake (Alaimo et al, 2008; Gray et al, 2013). However the positive effects are not limited to cultivating food; it also improves soil quality, and reduces storm runoff, thereby reducing the risk of major flooding and water treatment costs, protects from extreme weather and reduces urban heat island effects, increases biodiversity (Matteson et al, 2008), reduces organic home waste through compost bins, thereby reducing emissions from the urban waste, creates quiet spaces and helps noise abatement, supports physical wellness (Wolf & Robbins, 2015), lowers mental distress and improves mental health by creating sensory interactions, increases the air quality in urban spaces (Janhäll, 2015), increases social bonds and creates communities (Alaimo et al, 2010; Kingsley & Townsend, 2007), helps passing horticultural knowledge and know-how, makes productive use of vacant land (Hodgson et al, 2011), promotes cultural preservation, self-determination, and collective action, thereby regenerating neighborhoods falling into decay, extending from individual level, to neighborhood and community level (Milbourne, 2011; Poulsen et al, 2014; Teig et al, 2009).

Urban agriculture or urban gardening is the practice of "growing, processing and distributing of food and other products through intensive plant cultivation and animal husbandry" in urban and peri-urban areas (Bailkey & Nasr, 2000, p. 6). Residents of cities across the world have adopted urban agriculture during crises in the past; such as the Great Depression in the USA, the First and Second World Wars, the global economic crisis of the 1970s, the global recession that started in the late 2000s and recently with the Covid-19 pandemic. (Mees, 2020).

Today, within cities or surrounding urban boundaries, citizens practice an extensive array of agricultural activities. The qualities of these activities depend on the geographical, cultural and economic urban environment in which they are applied. A study on sustainable horticulture development and nutrition security identified a series of UA examples including and combining following practices: "allotment gardens, backyard gardens, beehives, berry patches, community gardens, community supported agriculture (CSA), container gardens, edible landscapes (landscaping that incorporates food-producing plants), greenbelt agriculture, greenhouse agriculture, hedgerows consisting of edible plants, herb gardens (culinary and medical), kitchen gardens, micro-livestock (including insects), orchards, prison farms, rooftop gardens, schoolyard gardens, trellis/fence farms, vegetable gardens, vertical agriculture, and vineyards" (Nath, 2018, p. 149).

Urban agriculture practices can help decrease food inequality, thus increasing urban resilience (Nicholls et al, 2020). Referring to socio-ecological resilience in 1973, Canadian ecologist C. S. Holling defined resilience as a "measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973, p. 14). Urban resilience has since been defined in different fields by academics and policymakers, regaining its popularity in the field of ecology in the last decade. Urban Resilience Hub describes it as “the measurable ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability” (UN-Habitat, 2018).

Urban planning stakeholders should consider urban gardens complementary to the food system, and larger tracts in the peripheries should be protected from being developed for future crises (Barthel et al, 2013, p. 1335).

In September 2015, the United Nations released a set of 17 global goals for sustainable development (SDGs) as their 2030 agenda. Adopted by 193 member countries, the focus areas of the goals are poverty reduction, urbanization, health, gender, and environmental protection. Each goal interrelates with others; having said that, some of the goals are more related to the discussion of urban agriculture. SDG 2, "Zero Hunger," aims for reliable access to a sufficient quantity of affordable, nutritious food for everyone. SDG 11 is called "sustainable cities and communities," encompassing inclusive green and public spaces, reduced environmental impact through waste management, and protected cultural and natural heritage (United Nations, 2015). Goal 5 addresses gender inequality and women's rights, connecting economic, political, and social features. Goal 10 addresses the inequalities "within and among countries," which is a stand-alone goal for eliminating inequality between the Global North and South. Women are both protagonists of a sustainable food system as small farmers as opposed to industrial farming and organizers of grassroots groups, supporters of organic agriculture, and solar energy cooperatives (WMG, 2017). Goal 15 is to stop biodiversity loss, which is deeply interrelated to food production from the human perspective.

According to the UN, Goal number 2, "Zero Hunger," was already in motion; rapid economic growth and increased agricultural productivity led to decreasing the number of undernourished people by almost half in the two decades before then (United Nations, 2020). Climate shocks slowed down the process, and the Covid-19 pandemic turned around this optimistic trend drastically. Almost 10% of the world's population faced hunger in 2020 (United Nations, 2021). 36 percent of the world’s crop calories are used to feed animals, which in turn partially become human food and mainly a big emission problem to tackle. 9 percent of crop calories are used for biofuels and other industrial purposes. Only the remaining 55 percent of crop calories are in effect eaten directly by people. (Cassidy et al, 2013). In addition, “one-third of food cultivated for human

consumption is wasted every year" (World Food Programme, 2020). Overseas transportation, aesthetic standards of the supply chain, and "best-before" date recommendations are some of the reasons for the food waste, which reaches about 1.3 billion tons per year. "At present, agriculture plays a serious part by transcending the identified ecological "planetary boundaries," including the four boundaries that are already thought to be exceeded or at high risk of being exceeded: global warming, disruption of the nitrogen cycle, land-use changes and extinction of species" (Steffen et al, 2015).

Contemporary understandings of urbanity place agricultural production as "the antithesis of the city" (Barthel & Isendahl, 2013). However, recent research gives voice to the fact that it is indeed an urban activity, and its place must be emphasized next to other urban infrastructures, such as sewage, transport, recreational activities, and electricity (Newman et al, 2009, p. 78; Steel, 2013, p. 316).

While UA cannot substitute rural agriculture for food security or compensate for carbon emissions for climate action, it can be an asset in confronting all of these issues. These goals require the collaboration of governments and global partners, but urban gardens around the world adopt strategies for the same goals and can help to contribute to the process (Nicholls et al, 2020). On the other hand, despite the fact that the SDGs are seen as an improvement from the Millennium Development Goals (MDGs) established in 2000, SDGs are criticized by many authors because of unclear institutional factors, unestablished perspective on sustainability and liberty for cherry-picking priorities in favor of economic motives (Vijge et al, 2020).

Many networks created by different actors are assessing similar problems like the UN SDGs. In 2005 the biggest municipalities in the world founded C40 as a climate group of important stakeholders. Today C40 connects 97 major cities, representing more than 650 million people and a quarter of the global GDP. The alliance's aim, both from Global North and Global South cities, is to reduce climate pollution and increase urban resilience. One of the focus areas of C40 is implementing sustainable food systems: In 2019, 14 of the C40 cities signed a declaration called Good Food Cities to introduce

sustainable policies for healthy food for all and reduce food waste. One of the five focus areas is to encourage regenerative urban agriculture: The group promotes it as a climate change adaptation measure against extreme heat, flooding, and drought (C40 Cities Climate Leadership Group, 2020). Founded with strong corporate fundamentals and working with a diverse set of actors ranging from banks to environmental groups, the prospects of intricate power relations are questioned by academics, as these may "potentially inhibit the collective purpose" (Davidson et al, 2019). Nevertheless, the same article underlines the potential of efficacy with "climate mitigation and social resilience" that traditional urban planning did not possess.

Another initiative of policymakers is the Edible Cities Network, a research, and innovation program funded by the EU. The project connects private and public urban agriculture projects worldwide, SMEs, NGOs, and researchers, empowering the inhabitants of the partner cities.

According to the network, planning the cities with urban agriculture (UA) in focus realizes "a paradigm shift towards reuse oriented, "cross-sectoral management of resources in cities," "encourages the development of social cohesion to increase human health and well-being," "improves multifunctionality, sustainability and overall ecosystem services of urban infrastructure," and "give rise to growth in the local green economy, creating new sustainable businesses and jobs" (Edible Cities Network, 2019).

This work aims to evaluate UA methods to determine the impact of each practice, develop a guideline, and establish an assessment tool. The study focuses on effective methods used in particular cases in urban areas from diverse climate regions and socio-economic circumstances. The thesis underlines the value of UA in increasing the resilience of urban and peri-urban areas preparatory to facing the impact of future crises.

The literature on the effects of UA is growing substantially. The data used for this study has been gathered from the literature review and case studies. “Urban agriculture” and “urban gardening” were used as search keywords. Published sources in environmentalism, psychology, chemistry, soil microbiology, regenerative agriculture,

urban planning, landscaping, rewilding, and community resilience fields have been scanned. The aim of the thesis is to deduct an assessment criterion by examining various urban agriculture practices. The study evaluates the criteria through the application of it to several urban agriculture operations in different climates, including private, public, and community urban gardens. The assessment tool is created with a typical five-level Likert scale, with the value assigned to each Likert item simply determined by the researcher based on the qualitative research. This tool serves to constitute a model to improve present urban agriculture spaces and to establish new cases.

There are several studies in the urban agriculture literature to create assessment tools for urban gardening in urban planning. Researchers present several methods (Moragues-Faus et al, 2013; Pothukuchi et al, 2002; Sustain, 2011; Zeeuw & Dubbeling, 2015). Zeeuw and Dubbeling (2015, p. 83) propose to choose a specific geographical scope, a specific focus, a direct action or an institutional approach, and the position in relation to local authorities. According to the authors, finalizing the process with implementation, monitoring, and renewal of the plan is crucial. Moragues-Faus et al. (2013, p. 17) look into cases from Basel, Bristol, Cardiff, Malmö, Tukums, Victoria-Gasteiz, and Vienna. The research suggests a methodologically rigorous approach, taking an account of stakeholders in view of the diversity of food system concerns. The study recommends considering stages of the food chains, action fields, and institutional dimensions of the agro-food system. Pothukuchi et al. (2002) sum up their steps including the analysis of the current food system and the community food security concept, defining their Community Food Assessment approach, and observing specific case studies. Other than implementing the assessment, they consider how to employ the observations. The Sustain alliance in the UK (2011) studies cases from the UK while focusing on community well-being, environment, and economic development. The criteria used in these studies focus more on the legislative parts of UA while this thesis puts emphasis on detecting singular methods suited for diverse geographical areas and socio-economic states.

2. URBAN AGRICULTURE AS A GOOD PRACTICE

Urban agriculture or urban gardening is growing, processing and distributing of food and other products through intensive plant cultivation and animal husbandry in urban and peri-urban areas. The hypothesis of this study is that by giving the inhabitants of urban settings the tool of urban agriculture would increase the possibility of vulnerable groups withstanding the effects of climate change.

The world population is moving towards urban areas. At the beginning of the last century, cities with a population larger than a million people were only sixteen, while at the end of the century the number of the cities went up to five hundred, of which many with more than ten million residents (Waldheim et al, 2006). The UN projects that 68% of the world population will live in urban areas by 2050 (UN Department of Economic and Social Affairs, 2018). Classes with less privilege in urban areas are prone to suffer from inequality, food insecurity, and the consequences of climate change.

The effects of climate change are observed more often as regular events. Urban agriculture (UA) could increase urban resilience by improving food security, social fabric, and sustainability, and reducing waste through composting and zero km food production. These aspects increase urban resilience. Urban resilience is defined as "measurable ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming towards sustainability" (Mariani & UN HABITAT, 2018).

Urban systems were built according to the constant of the era, and they are updated every time they face a crisis to withstand following changes. "The urban planning approach in which nature is opposed to culture, landscape to the city is an antiquated way of architecture and urban planning" (Waldheim et al, 2006, p. 28). It is time that the governing agencies adopt a new viewpoint towards the concept of the city, separated from

nature. Collaborating with the landscape instead of trying to dominate it could show humanity how to cope with the drastic changes the planet is facing. Urban agriculture has the potential to be a solution to increase the urban resilience of cities. At the same time, it can help mitigate the effects of the growing food crisis and other crises related to climate change.

Other than feeding a city, UA integrated into an urban plan, surrounding building blocks and covering unused areas, can improve the microclimate of the cities. Vegetation in the city is already used for its positive effects, such as "increasing humidity, lowering temperatures, introducing pleasant odors, capturing dust and pollution, breaking wind and solar radiation, and creating shadow and protected places" (Deelstra & Girardet, 2000, p. 48).

A "good practice" or "best practice" is an approach created by gathering sources of information and knowledge derived from practical experience that produces superior results and thus might become a standard way of doing things (UNDP, 2020). Every field has its good practices defined after trial and errors committed by various examples. A good urban agricultural practice should have at least three facets constituted by environmental, socio-cultural and economical practices.

3. ENVIRONMENTAL PRACTICES

The outdated dichotomy of nature and humans is a critical block both for bodies of legislation and researchers. The aim of "good environmental practices" is to incorporate urban and peri-urban agriculture techniques to not adversely affect the environment or promote the conservation of flora and fauna at the site. In some cases, increasing the biodiversity, rewilding the area partially, and incorporating local flora in the agriculture practice -such as food forests- is part of the project.

Some good practices provide the local urban population with the possibility to compost, neutralizing the methane gas which would have been emitted if the trash had been sent to a landfill. Meanwhile, this practice creates rich topsoil that is impossible to be replaced for a healthy crop.

The distribution of the crop among the gardeners or selling it in their community is a common practice. The socio-economic and socio-cultural benefits aside, less transportation means a significantly reduced carbon footprint. The global economy dictates many steps among sourcing the materials, packaging, and distribution until consumers buy the product. Medium-scale peri-urban agriculture that reaches the consumer through a CSA (Community Supported Agriculture group) in the same region or country is as valuable from the point of view of a carbon footprint as the micro scale gardens tended by a family or a community.

Food waste has a carbon footprint, too. At the supermarket, the product is regularly replaced. The neoliberal economy demands the product to be replaced periodically, even when it is in an optimal state. This product is often discarded in the trash container of the vendor, kept under lock and key, regarded as private property by law, covered with limestone in some cases to block dumpster diving, just to be sent to a landfill. Food contains an inherent value in urban agriculture separate from its price. Farmers collaborating with CSA groups often give away the unsold produce together with the sold boxes. Produce left in the garden turns into compost, and the cycle continues.

Agriculture in urban settings is often far from idyllic imagination. It is not common for urban gardens to be zero-waste and to have a closed cycle. Minimizing, treating, and recovering resources is a part of the measures taken by the good practice examples. However, the scale of waste is not comparable with industrial agriculture. Still, an urban garden needs to take into consideration recycling and input reduction to minimize waste.

Production that is rich in nutritional elements requires healthy soil. Urban soil is often contaminated with industrial waste, construction material, and heavy metals. Beyond the contamination issue, it is almost impossible for urban gardens to find healthy topsoil. Topsoil is the upper layer of soil that can reach a thickness of 13–25 cm. Most of our planet's biological soil activity happens here, where the highest concentration of organic matter and microorganisms is found. It is mined and sold for landscaping and construction projects at a rate faster than it reproduces itself.

3.1 Biodiversity

The variety and variability of flora and fauna in cities depend on the habitats reserved for them. Urban agriculture, and other forms of urban gardens may protect local genetic diversity, ecosystem diversity and species diversity within an ecosystem. In this chapter, the methods of Permaculture, food forest, seed bank and insect hotel will be discussed.

3.1.1 Permaculture

Permaculture is a method of settlement organization that applies principles of “whole-systems thinking” to create and regenerate permanent ecosystems. It is a term coined by Bill Mollison and David Holmgren in 1978 (Mollison & Holmgren, 1981). Since then, it has been used in various fields such as regenerative agriculture, town planning, rewilding, and community resilience. The authors advocate that learning from indigenous cultures is the focus of Permaculture, owing to their management of the relationship with their environment compared to newer experiments of civilization (Holmgren, 2010). While the lack of space in urban settings requires a more complicated design, urban Permaculture proposes solutions of efficient space utilization and time and energy optimization through

the collaboration of communities. Permaculture suggests that urban landscapes be designed with sustainable planning, self-reliance for resources, and grassroots-level participation in policy change. That's why Permaculture implemented in urban gardens could be one of the most effective good practices for the resilience of cities.

In recent years, agronomists have been investigating the circumstances of the feasibility of Permaculture as a new sustainable model (Ferguson & Lovell, 2017; Léger et al., 2018), and its impact on the communities as a prospective driving force has been documented (Ferguson & Lovell, 2014; 2015; Hathaway, 2016). Kennedy (1991) states that Permaculture could have a significant impact on sustainable urban planning combined with municipal action. On the other hand, Permaculture opens philosophical discussions on the Anthropocene (Roux-Rosier et al, 2018) and possibilities for mutualistic connections with nature (Centemeri, 2020; Puig de la Bellacasa, 2012). In the era of ethical questions such as "designing the living, designing indifferently to the living, designing in reverse of the living," Pignier (2017) suggests perceiving Permaculture as a chance to ponder about "designing with the living." The contribution of Permaculture to urban agriculture is implementing the knowledge of the garden to a more extensive human experience, cultivating not only plants but connections with "people, neighborhoods, and even cultures" (Hemenway, 2015).

Permaculture is built upon three critical ethics described as "care of the earth," "care of the people," and "setting limits to consumption and sharing the surplus" (Holmgren, 2010; Mollison, 1988; Rhodes, 2015). The philosophical structure of these ethical principles advocates a position of a mutually beneficial system, working in harmony with nature rather than against it (Mollison & Slay, 1991). The twelve design principles accompany the ideology in matters of energy, resources, waste, and diversity. These principles are: "Observe and interact," "catch and store energy," "obtain a yield," "apply self-regulation and accept feedback," "use and value renewable resources and services," "produce no waste," "design from patterns to details," "integrate rather than segregate," "use small and slow solutions," "use and value diversity," "use edges and value the marginal," "creatively use and respond to change" (Image 3.1). Whereas they are self-explanatory statements, researchers can find further descriptions and practical

implementation in Holmgren's summary of principles (Holmgren, 2007). Standard practices include suburban and urban Permaculture, rainwater harvesting, keyline design, fruit tree management, and composting.

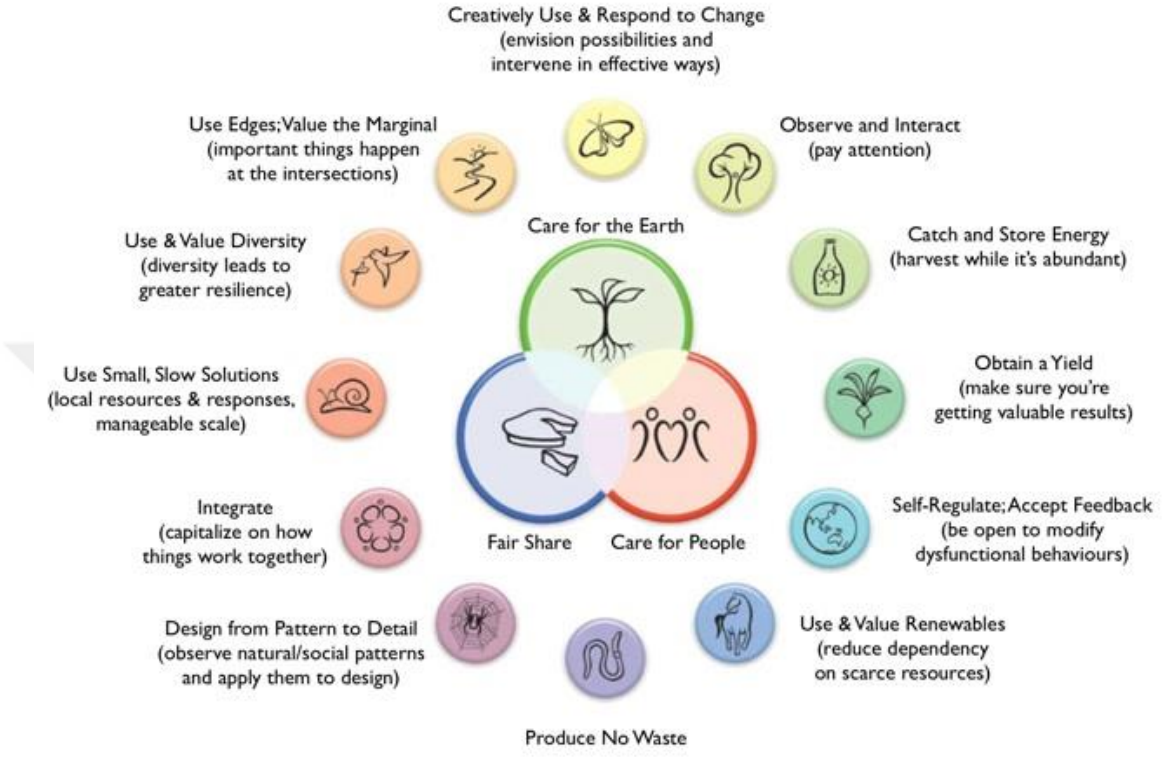

Image 3.1 Permaculture Ethics and Design Principles (Horvath, 2020)

Gürbey and Parlak (2021, p. 18) lists efficient Permaculture design indicators according to their priority: The most dominant ones are the prevention of air, water, or soil pollution, followed by energy efficiency, use of renewable resources, waste recycling in the ecosystem, minimized carbon and water footprint, use of natural and sustainable materials, minimized use of fossil fuels, reduced solid waste and wastewater, economic sustainability, support of flora and fauna biodiversity primarily through the use of introduced as well as local insects, positive impact on social ties, high resistance to natural disasters, use of native plant species, use of local and traditional construction methods, minimized cost, concluded with the visual quality as the most negligible crucial factor (Image 3.2).

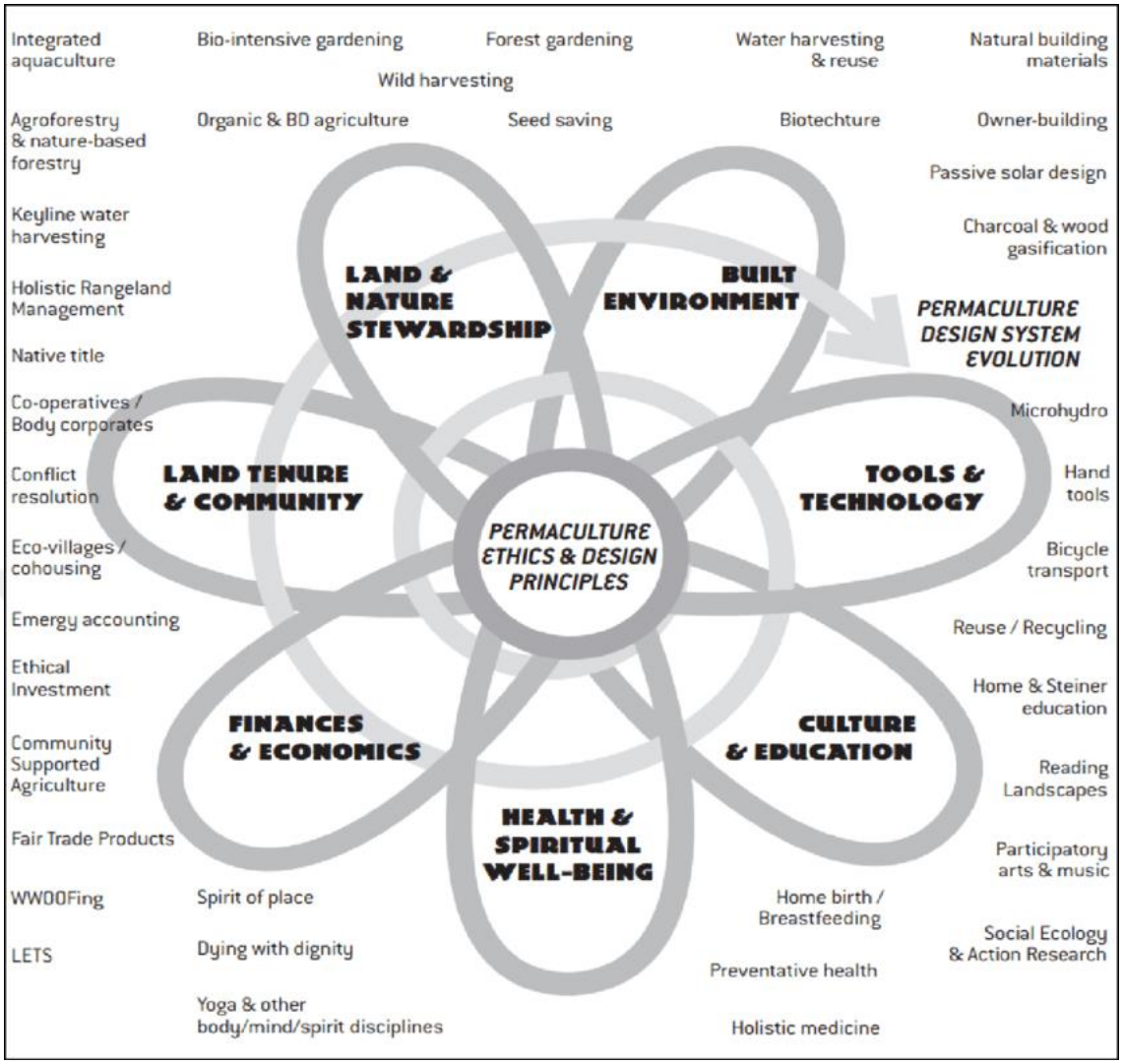

Image 3.2 Holmgren's 'Permaculture flower' shows the seven interrelated domains integral to sustainability (Holmgren, 2002).

Along with the expertise of Australian aborigines, and discoveries in landscape ecology in the 20th century, the philosophy and methods of the Japanese farmer Masanobu Fukuoka were a significant inspiration for the conception of Permaculture. Japan's traditional and indigenous characteristics of agriculture, food culture, and landscape design have been changing already with the technology and policy antecedents of the "Green Revolution" (or the Third Agricultural Revolution) following the end of the 19th century (Hazell, 2009). Following WWII, advances in technology and financial boosts propelled the movement. The methods include the invention of high-yielding cereal varieties, usage of monoculture systems, agrochemicals, chemical fertilizers, and mechanization of cultivation on huge landholdings.

Formerly a government laboratory worker on plant pathology, Masanobu Fukuoka distanced himself from the new agricultural advancements and founded the "natural farming movement" in Japan with his book "One-Straw Revolution: Introduction to Natural Farming" (Fukuoka, 1975/2009). The book has become a classical reference in the permaculture world. Today, urban farmers account for 25% of farming households in Japan. In Tokyo, local agriculture produces enough vegetables to feed almost 700,000 city dwellers potentially. Current urban planning policies, aging farmers, tax barriers, and the productivity shift are the everyday challenges of UA in Japan (Moreno-Peñaranda, 2011).

Nonetheless, Permaculture was not adopted in Japan to a sizable extent for decades. An "Urban Permaculture Course" was held in Tokyo in 2004, and the Tokyo Urban Permaculture group was assembled in 2011, shortly after the Fukushima nuclear accident (Chakroun, 2019). The small group of activists specifies that they want to "regenerate Tokyo into an urban culture that supports life rather than consuming it." The poor management of the catastrophe of Fukushima was a historical moment to fuel discontent and grassroots organization movements (Ogawa, 2016). Today the Japanese Permaculture Network is made up of 15,000 to 20,000 people.

On the other hand, most governmental organizations ignore the concept, except for the Ministry of Environment of Japan. They list Permaculture as "one of the strategies to revive traditional places of coexistence with nature." It is called "the Satoyama Initiative," inspired by the wisdom of Satoyama – "the traditional way of managing the surrounding forests and of living harmoniously with the natural elements" (Chakroun, 2019). For this reason, the Commune Community Garden in Tokyo was chosen for this chapter (Image 3.3).

Case - Commune Community Garden in Tokyo

Image 3.3 Commune Rooftop Garden on the map shown with a blue dot

The first Tokyo Urban Permaculture community garden project, Commune, was started in 2015 near Omotesando Station. The site was on top of the Commune 246, open-air space for distant workers with food stalls and a branch of the Tokyo Freedom University. The founder of Tokyo Urban Permaculture defines it as "a site for experimentation, community gatherings, and relief from the busy Tokyo world" (Sawyer, 2019) (Image 3.4). Besides setting up a vermicomposting container and beehives, the garden's founders gave courses here held by the university. The founder, Kai Sawyer, states further that real Permaculture can be seen "In older districts of Tokyo (...) where cramped wooden houses stand with impressive vertical gardens, rainwater harvesting systems, and elaborate fire prevention strategies" (Sawyer, 2013).

Image 3.4 Tokyo Rooftop Community Garden – Commune

Commune and other projects of Tokyo Urban Permaculture can contribute to the role of UA for the resilience of Tokyo and other densely built cities in Japan (Image 3.5). The network has published a Japanese Urban Permaculture Guidebook through a crowdfunding campaign (Sawyer, 2015) and a children's book on the same subject (Fukuoka & Sawyer, 2022). The reader can go through the possible contributions of Permaculture to UA in the chapters of the guidebook: Edible balcony gardens, use of compost in the city, and aquaponics could be implemented for ecological impact. The socio-cultural impact could be achieved through community gardens, guerilla gardening, portable earth oven-building, dome houses, use of pedal power, and the repair culture, but also by mindfulness and non-violent communication. The gift economy and "freeconomy" is possible to increase a city's resilience by reducing dependency on external factors. Permaculture encompasses many good practices, which will be examined in the following chapters; hence its contribution is substantial for the UA.

Image 3.5 The plan of Commune 246 with the rooftop garden

3.1.2 Food forest and agroforestry

The Earth system requires a sustainable balance. Identified ecological "planetary boundaries" give humanity a framework in order to exist in a safe environment. Industrial agriculture is a fundamental cause of four exceeded boundaries: "global warming, disruption of the nitrogen cycle, land-use changes and extinction of species" (Steffen et al, 2015). Edible forest gardens or food forests are edible ecosystems, a practice known in tropical regions worldwide as "homegardens." These agroecosystems do not only bring forth economic advantages and food security for local people, but they also help on-farm conservation of water, soil, and biodiversity (Kumar & Nair, 2004) (Image 3.6). This traditional knowledge of indigenous cultures has gained recognition since the 1980s in the Global North from an ecological perspective (Mulyoutami, 2009). Since then, there has been high interest from urban and suburban dwellers in temperate and high-income countries, both for self-sufficiency and profit (Björklund et al, 2018).

The structural layers of the complex multi-strata agroforests are designed to mimic the local ecosystem and avoid competition among plants. The layers vary depending on the

experts, and they may include high trees (the overstory), low trees (the understory), bushes (the shrub layer), herbs (the herbaceous layer), the soil or ground cover layer, tubers (the root layer), climbers (the vine layer), aquatic or wetland layer, mushrooms (the mycelial layer), topsoil, subsoil and substratum layers such as non-living materials (Toensmeier & Jacke, 2005, p. 70; Vargas Poveda, 2016a; Vargas Poveda, 2016b). Researchers can access materials for more in-depth knowledge about forest gardens and a list of the member gardens worldwide on the Agroforestry Research Trust.

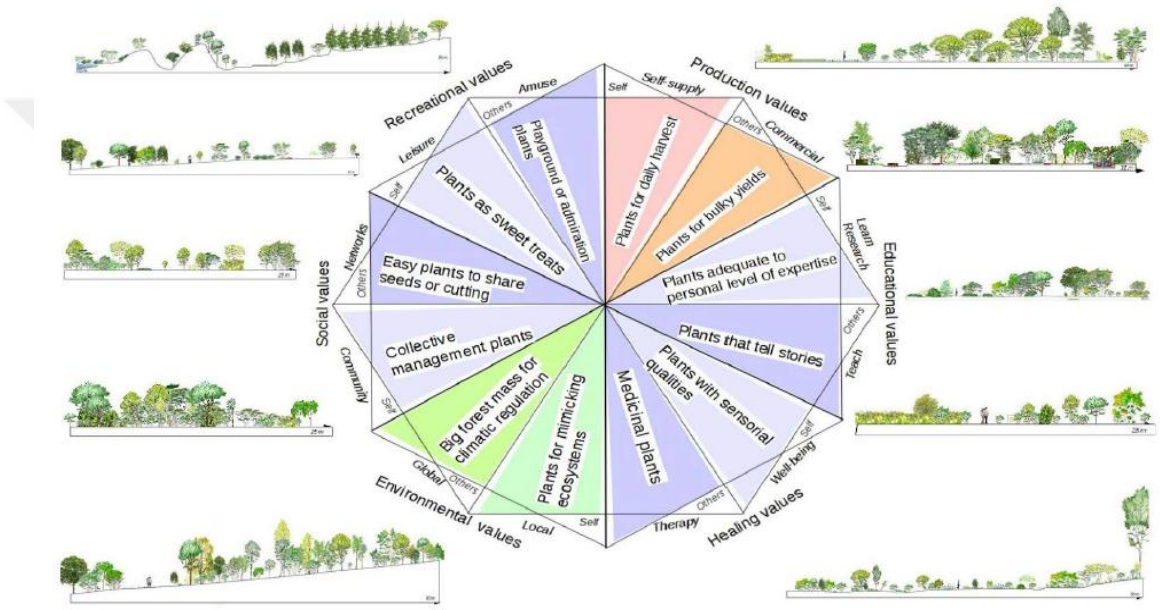

Image 3.6 Values from the Forest Gardens Archetypes booklet (Vargas Poveda, 2016b)

Case - Phoenicurus Forest Garden – Spain

Phoenicurus is an urban garden in Cardedeu, 40 km north of Barcelona, Spain (Image 3.7). When the EU regulations made it impossible for a dairy farmer family to be economically sustainable, their children started cultivating on a patch of the former farm in 2009. The garden became part of an association to give courses on natural farming, applied horticulture, and permaculture. Their aim is to combine small-scale, organic, and local food production and responsible consumption. Consequently, they work with the local CSA group of 30 families, Cardedeu Autosufficient Cooperative. In addition to the vegetable garden designed with Permaculture principles, and distinctly cured with the

“No-Till Farming” technique to increase the soil fertility, they are also growing a food forest with 300 perennials plants, and fruit trees, and other traditional varieties since 2014.

Image 3.7 Phoenicurus Forest Garden on the map shown with a blue dot

Their intentions were both to use the limited agricultural space to the maximum extent while going towards the exact opposite of monoculture agriculture. While they were struggling with the vegetable garden when unforeseeable events, such as hail storms occurred, the food forest keeps giving food through various strata of diverse perennial plants (Image 3.8). They also claim that the necessary work diminishes after the initial design and planting period, as the system sustains itself increasingly over time (Mir & Biffen, 2021).

Image 3.8 Photo of the Phoenicurus forest garden by the farmers

In April 2021, the founders of Phoenicurus, Gisela Mir and Mark Biffen published a book called "*Bosques y Jardines de Alimentos*" (Food forests and edible gardens). Their experience of the food forest practice adapted to the Mediterranean climate and species, and the language of the book, published in Castilian Spanish, makes the book a rare example on the subject.

3.1.3. Seed bank

In the last 500 years, human activity has forced 869 species to extinction (International Union for Conservation of Nature, 2007). A study conducted between 1903 and 1983 in the USA demonstrates that over 93% of commercial food seed varieties went extinct in 80 years (RAFI, 2011). The rise of monoculture and the loss of biodiversity has serious consequences on the world's food supply. When the varieties of a species are lost or not grown for commercial purposes, the remaining commercial variety becomes vulnerable

to a new bacteria or fungal infection, to be wiped out entirely, which leads to the use of chemical pesticides and fertilizers, creating the vicious cycle that we find ourselves in. Seed banks protect the genetic heritage of our food seeds, support habitat restoration, and therefore maintain biodiversity. The creation of a seed bank by an urban garden, or a group of urban gardens, is a significant innovation to build the resilience of the cities.

A seed bank is where seeds are stored to preserve genetic diversity. Traditionally villages preserve their seeds and exchange them during festivities before the sowing season. Urban gardens follow this tradition by keeping a part of the seeds after harvest. The seeds are usually preserved in a seed library, in which the seeds are stored for a limited time. Urban gardens hold annual events hosting other gardeners and exchanging their seeds to be planted for regeneration. Seed libraries can be found in public libraries, botanic gardens, or museums, besides some urban gardens. Preserving plant varieties, planting seeds, and further sharing seeds is an inherent function of any urban garden. However, urban gardens rely on self-organized citizens, unlike seed banks. Urban gardens with seed libraries save the seeds of their crops and share them by “seed swaps" in which gardeners exchange the seeds. Another function of seed libraries is to lend seeds and receive new seeds from the new harvest, which could promote local agriculture. Protecting local flora from hybrid seeds, avoiding buying seeds from industrial agriculture companies, and disseminating rare, local and heirloom varieties is the main goal of seed libraries. Unlike professional seed banks, urban gardens cannot rely on conventional storage facilities with fixed temperature and moisture levels.

Case - Llavors Orientals Association Garden Seed Bank - Spain

The case selected for the good practice of the seed bank is called “Llavors Orientals”. It’s an association that opened a seed bank with the support of the EU funds and by collaborating with local authorities, Slow Food Association, containing more than 100 local agricultural varieties. “Llavors Orientals” is formed by several urban gardens over the region of Vallès Oriental, in Catalonia, Spain (Image 3.9).

Image 3.9 Llavors Orientals Seed Bank on the map connecting UA in the valley

The association works for the recovery and reproduction of ancient seeds of the region. Their seed bank, Banc de Llavors del Vallès Oriental opened at the end of 2014, to save the agrarian heritage and local and traditional agricultural varieties of the area (Image 3.10). The exchange of seeds with other grassroots agriculture movements is part of their mission. The goal of the seed bank is to counteract the effects of genetically modified and patented seeds on the local flora, take control of the food sovereignty network, increase the resilience of the land, and protect the landscape and the culture (Guinart, 2014).

Banc de Llavors del Vallès Oriental is located in the underground level of the local museum La Tela. It is managed in collaboration with the Museum of Natural Sciences in Granollers and the Catalan Ministry of Agriculture, Department of Climate Action, Food and Rural Agenda. The stakeholders of the seed bank highlight the impact of legislation on urban agriculture.

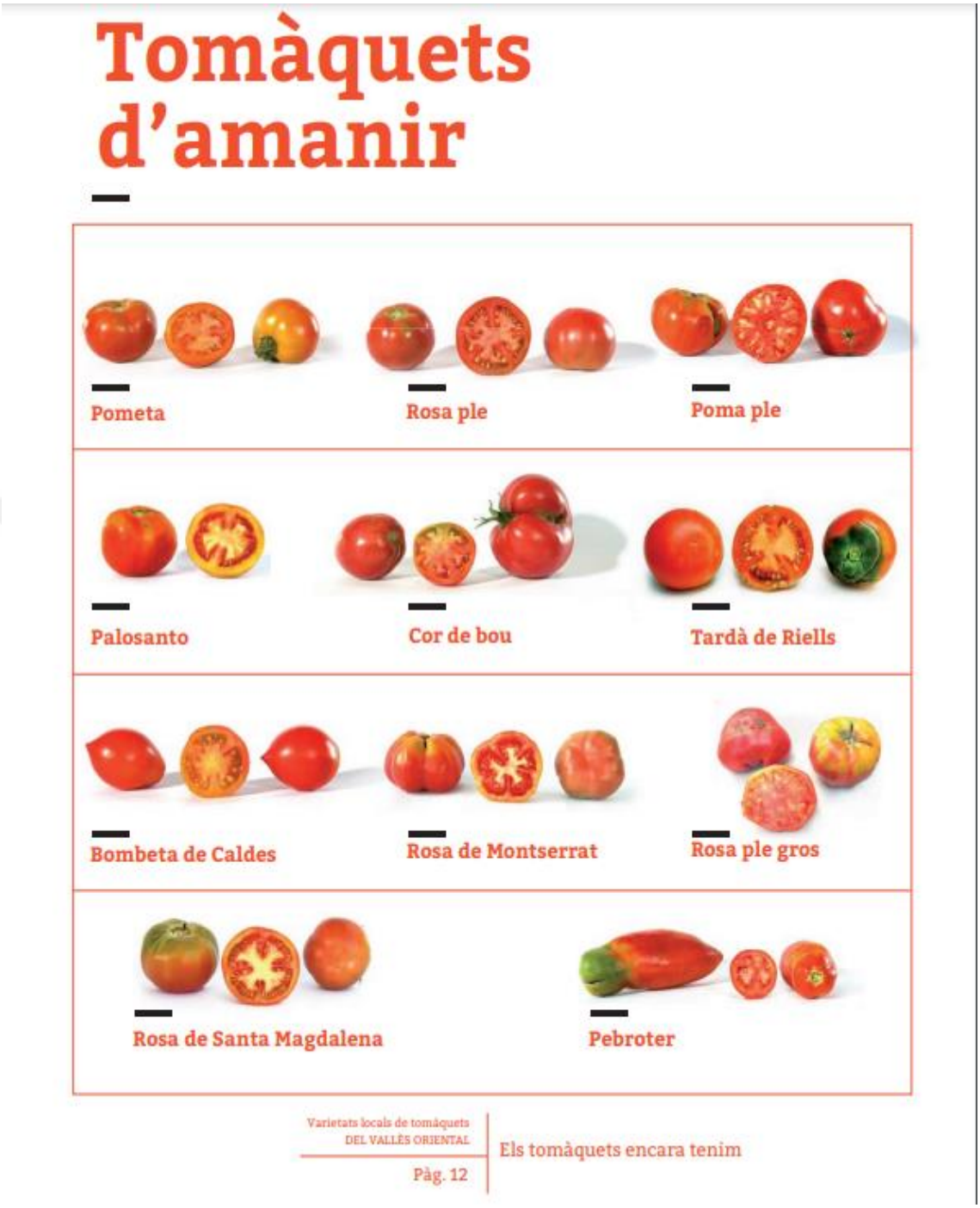

Image 3.10 Informative poster about local tomato varieties from the Vallès Oriental

Both the urban garden of Phoenicurus from the Forest Garden chapter and Llavors Oriental reside in the Barcelona Metropolitan Area (BMA). High unemployment rates, to a large extent for the young people, and the rising interest in organic and "km 0" agriculture in the area lead the Municipality of Barcelona to reevaluate its food distribution system and to plan to prioritize the principle of food sovereignty. No specific

laws define the urban and peri-urban agriculture in the area, whereas the use and protection of agricultural and protected agricultural land are defined on regional, metropolitan and municipal levels. In 2001, technical norms for agroecological production and labeling were regulated with the mandate of the Catalan Council of Ecological Agriculture Production (AGRI-MADRE, 2018).

The protocol of the seed bank created by the urban agriculture association documents in detail short, medium, and long term samples of seeds, which are kept up to -18ºC and up to 30 years, a database with a set structure, the costs of the bank and the staff required for the bank, and general rules for harvesting, drying, storing, controlling of the viability, regeneration, documentation, and redistribution. An important rule of the seed bank is that the petitioners cannot be charged for the cost of the seeds, but there may be set a fee to manage the costs of the seed bank (Llavors Valles Oriental, 2014).

In terms of environmental contributions, the seed bank gives us the possibility of creating and restoring ecosystems. From the human point of view, preserving agricultural varieties protects us from food crises. As regards urban/ economic contributions, this practice not only creates employment but also helps redefine the function of a Museum of Natural Sciences.

3.1.4. Insect hotel

In the last decades, entomologists and botanists have noted a great decline in various populations. A comprehensive study of nature-protected areas in a human-dominated landscape in Germany, between 1989 and 2016, revealed that total flying insect biomass declined more than 75 percent over 30 years (Hallmann et al, 2017). Even though the domesticated honey bee became the poster insect for the education of the masses, many flying insects are in danger. An insect hotel is a human-made structure built to give shelter to insects. In urban areas, the survival of the pollinator and predator insect species is more challenged than in rural areas. An urban garden hosting an insect hotel can offer the necessary shelter in densely constructed neighborhoods.

Insect hotels come in various shapes and sizes. They have different sections for several types of insects. The flying insects are responsible for more than pollination: Eating the plants and the dead biomass to create compost and topsoil, necessary for agriculture from the point of view of humans, but also being a food source for birds, mammals, and amphibians, regulation of forests production and other ecosystem processes. Therefore, cascading effects across species and ecosystems are expected. While pollution caused by synthetic pesticides and fertilizers, introduced species, and climate change are among the causes of this decline, the main driver seems to be “habitat loss and conversion to intensive agriculture and urbanization” (Sánchez-Bayo & Wyckhuys, 2019, p. 8). That’s why insect hotels became popular among garden owners, schools, and community gardens.

Case - Spitalfields City Farm - England

Spitalfields City Farm is a city farm near Brick Lane, London. The farm was opened in 1978. It is sited on a former railway goods depot, the farm was started in 1978 on a 1.3-acre (0.53 ha) wasteland site, in response to local people’s wishes to convert wasteland into allotments (Image 3.11).

Image 3.11 Spitalfields City Farm shown with a yellow dot on the map

Like all other agricultural lands in the area, lost in this period to developers, the farm has been under regular threat until it became a charity in 1980 (Spitalfields City Farm Association, 2018).

The bug hotel in Spitalfields was created in 2013 as a Ph.D. project by Sara Heitlinger, a human-computer interaction researcher, as a ludic design approach grounded in community-based Participatory Design. Heitlinger describes the project as "an experiment in interspecies cooperation, a place for rest, contemplation and education, and a living sound sculpture". This example of the artificial residency site gives humans the possibility to take time off and experience harmony with insects through 18 contact microphones (Image 3.12).

Image 3.12 Bug Hotel project at Spitalfields city farm

While many beneficial insects require shelter for overwintering, study shows that badly designed artificial nesting sites can cause contrarian effects such as loss of solitary bees by parasitism (MacIvor & Packer, 2015; Moenen, 2012). With the right approach of a good design destined for the local and intended insect population, and a regular maintenance cycle to prevent parasites, insect hotels can help the local fauna and flora (Carlton, 2020; David, 2014; Orlow, 2014).

In conclusion, well-designed examples of insect hotels can be considered a good practice under certain conditions. Nevertheless flying insects need permanent ecosystems rather than temporary insect hotels, which are not sustainable for longer periods.

3.2. Soil Fertility

"Soil fertility is the ability of a soil to sustain plant growth by providing essential plant nutrients and favorable chemical, physical, and biological characteristics as a habitat for plant growth" (FAO, 2022). The most important part of the soil is the topsoil. The top layer of the soil contains the most weathered mineral and organic materials, nevertheless, this layer declined drastically around the world because of "erosion, compaction, nutrient imbalance, pollution, acidification, waterlogging (hardening of soil), loss of soil biodiversity and increasing salinity" (Gray, 2019). Managing soil sustainably signifies working for food security and nutrition, aspiring for a healthy ecosystem and biodiversity, cultivating sustainable development, and improving climate change adaptation and mitigation (FAO-ITPS, 2020).

Concomitantly, assessing and improving soil quality is fundamental to the impact of UA to increase the resilience of cities, and UA practices restore the fertility of urban soil. In this chapter, two interconnected practices, composting and raised-bed gardening in UA will be assessed. Using these tools together enriches the soil, and allows intensive crop production while controlling the weed growth (Nones, 2010). Research on introducing compost use on farmland shows an increase in the organic matter and beneficial microorganisms, and a decrease in plant pathogens (Neher et al, 2015) (Bulluck III & Ristaino, 2002).

Composting in UA includes vermicompost, Bokashi compost, Hügelkultur, and composting toilets.

3.2.1. Vermicompost

Vermicompost is the practice of composting with various earthworm species to produce worm castings. These castings are one of the best compost products because they contain reduced levels of contaminants and a higher saturation of nutrients than the organic materials before vermicomposting" (Ndegwa et al, 2000).

3.2.2. Bokashi composting

Bokashi composting was developed at the University of Ryukyus, Okinawa and the word means "fermented organic matter." Kitchen scraps including meat and dairy scraps are layered in an air-tight bucket with a microbial inoculant such as wheat germ. The fermented process takes only 10 days but it needs to be dug in the garden or in spacious vases together with soil to finish its decomposition. It is easier to buy the airtight container and the inoculant ingredient rather than produce them, thence unlike other types of compost practices, it is widely commercialized. Nevertheless, a recent study concluded that bokashi is a pertinent compost alternative for small-scale farming like UA (Christel, 2017, p. 99).

3.2.3. Composting toilet

A composting toilet is a type of dry toilet, intended to function without water for flushing (Image 3.13). The system turns human excrement into compost material. The composting process is fulfilled by "microorganisms (mainly bacteria and fungi) under controlled aerobic conditions" (Tilley et al, 2014, p. 72). It is used as humanure, often together with animal manure, as a natural fertilizer in agriculture. Our contemporary sewage system diverts nutrients extracted from agriculture away from land, wastes considerable amounts of water, and carries these minerals together with other pollutants to shores, and other

water sources, including lakes, rivers, and underground springs. The composting toilet system is used all over the world in traditional dwellings and has recently been installed in modern buildings by private companies, such as the Bronx Zoo in New York (Price, 2009).

In many formerly industrial cities such as Detroit, Essen, or Rome, UA is practiced on former factory land or mining areas. Heavy metal contamination should be approached professionally, nevertheless, research brought to light that "maintaining a high pH with additions of plenty of lime, and high organic matter levels through additions of compost or manure helps to immobilize heavy metals in the soil" (Deelstra & Girardet, 2000, p. 47). Same paper remarks that improving soil quality in urban areas is possible through UA and its various practices. While in the Global North municipal and personal use of compost bins for kitchen and garden scraps is getting more common, many countries are still using the method of recycling and composting human and animal wastes. China is a great example that has industrialized cities with a great percentage of farmland such as Shanghai. Although the tradition of composting human and animal waste has diminished, upgrading to sewage-recycling technology is being inspected.

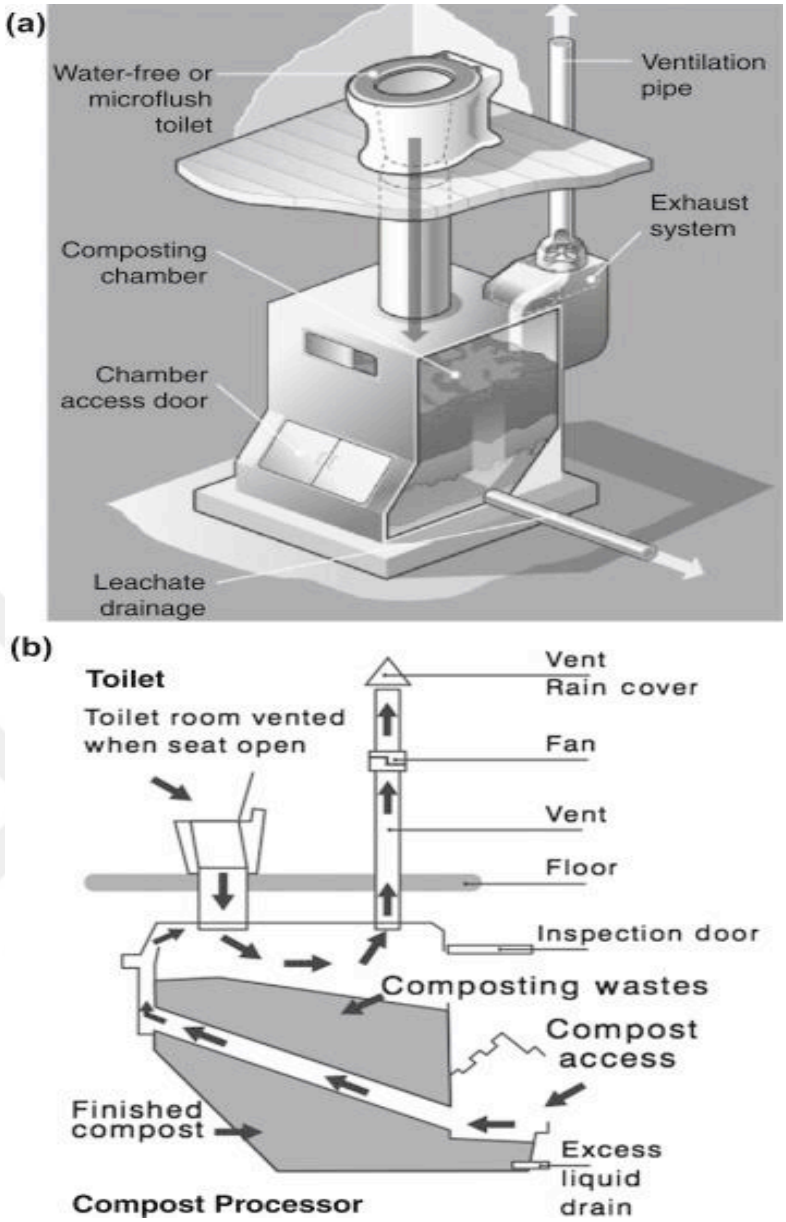

Image 3.13 Drawing showing how a Composting Toilet works

The waste that enters the toilets is over 90% water, which is evaporated and carried back to the atmosphere through the vent system. The small amount of remaining solid material is converted to useful fertilizing soil by natural decomposition. (Kubba, 2016, Fig. 8.2) Joseph Jenkins has been working on this subject for 30 years; he conducted feasibility reports and wrote research papers in post-earthquake Haiti, Nicaragua, and Mongolia as an alternative solution to pit-toilets. For further research, his books, the Humanure Handbook (Jenkins, 2005) and the Compost Toilet Handbook (Jenkins, 2021) can be consulted.

In conclusion, composting toilets could have a significant effect on cities' resilience. Apart from a system change for better waste management, compost toilets can provide a sanitation solution in urban gardens that are not connected to the city infrastructure, or when the garden chooses to make more compost while creating less environmental pollution.

3.2.4 Hügelkultur

Hügelkultur means mound culture in German and it is a Permaculture method that puts together composting and raised bed gardening. Logs are buried beneath soil and mounds are created on this wood decomposition process to cultivate at human height (Image 3.14). A quantitative study demonstrates its effectiveness in water holding capacity (Laffoon, 2016, p. 27), and Permaculture farmers state that it is a practical building method that increases agricultural yield useful for small-scale gardening.

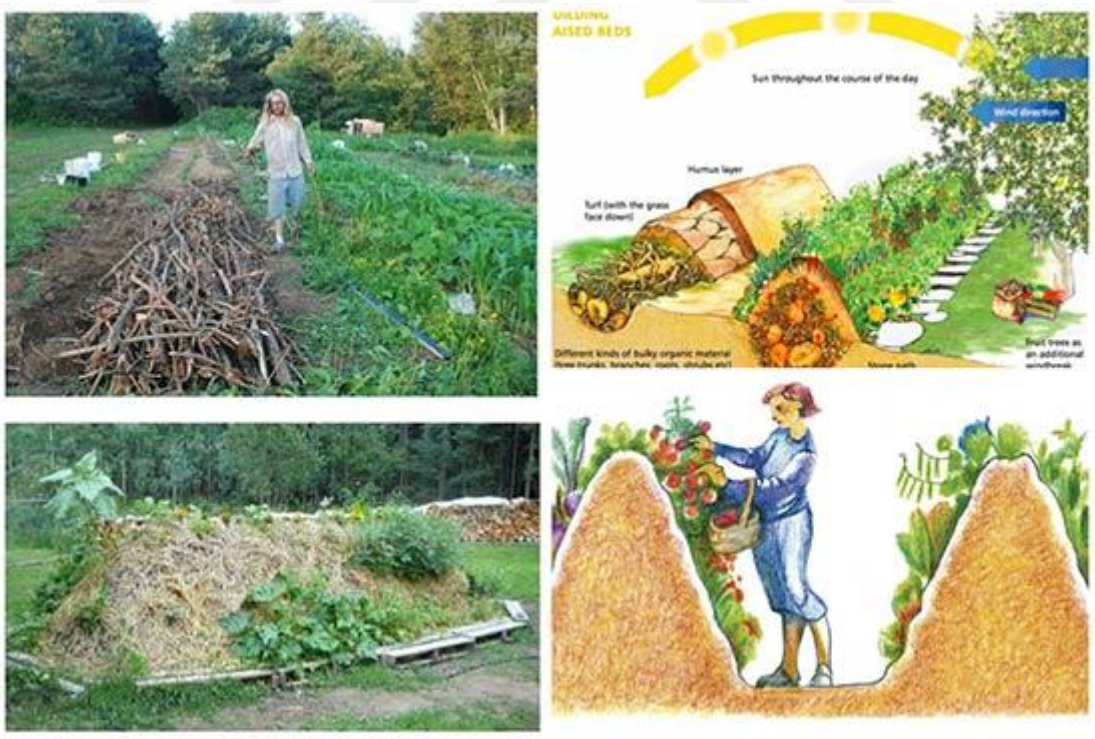

Image 3.14 Raised beds in Hügelkultur form

Other raised-bed gardening examples commonly used in UA are no-till farming, sheet mulching, lasagna gardening, and keyhole gardening.

3.2.5. No-till farming

No-till farming is an agricultural method for cultivating plants without disturbing the soil through tillage. It increases soil retention, nutrient cycling, and water infiltration, which in turn decreases the amount of soil erosion caused by tillage (Spears, 2018).

3.2.6. Sheet mulching or lasagna gardening

Sheet mulching is a permaculture method that combines the composting process with no-till farming. In contemporary field production, the soil is covered with various synthetic mulches; accordingly, widespread use of plastic without solutions for sustainable and safe disposal of the material creates great concern for its environmental effects (Haapala et al, 2014). In sheet mulching, the soil is covered in layers of organic mulching material similar to the natural soil-building process in forests. It can generate healthy, productive, and low maintenance ecosystems on a lawn, a dirt lot full of perennial weeds, an area with poor soil, or areas without soil such as a pavement or a rooftop (Hemenway, 2015, p. 61; Mason, 2003, p. 46). Practiced in deep containers, this method is also called lasagna gardening.

“Sheet mulch can be as simple as cardboard topped with a foot of straw, or it can be a more elaborate stack of soil-building layers” (Hemenway, 2015, p. 61) (Image 3.15).

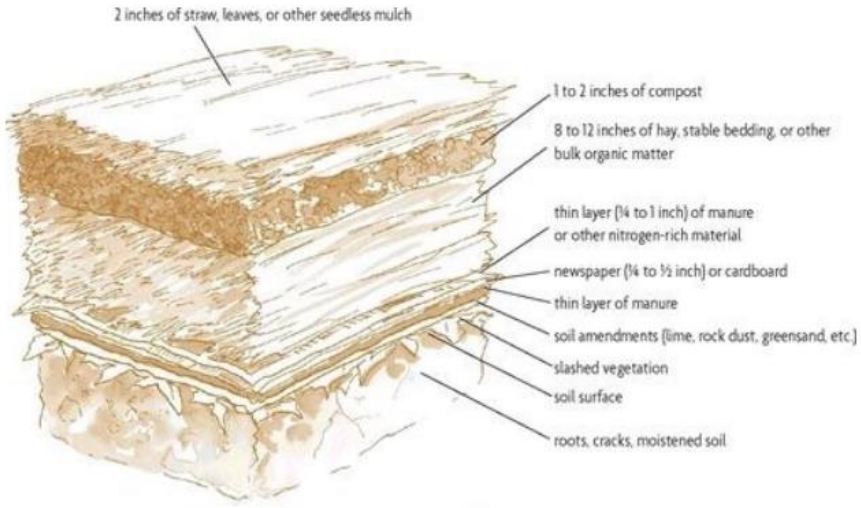

Image 3.15 Sheet mulch layering example

3.2.7. Keyhole garden

A keyhole garden is a circular raised garden with a keyhole-shaped indentation to access the center of the circle. At the center, a compost basket filled with vegetable scraps, manure, or greywater gives nutrition to the garden from below (Image 3.16). While building the keyhole garden, the sheet mulching method is recommended to enrich the soil. Commonly, walls are constructed with stone to give sturdiness and to trap moisture. The design was developed in Lesotho, Southern Africa, by the consortium for Southern Africa Food Security Emergency (C-SAFE) for chronically ill citizens, where a quarter of the population carries HIV (Conteh, 2013, p. 2). The C-SAFE keyhole gardening project in Lesotho had 13,000 beneficiaries and "91 percent were still maintaining their gardens two years into the project" (Billingsley et al, 2013, p. 4). Year-round production, labor-saving technology, low-cost materials, soil-enriching, and moisture trapping design made the garden popular among the rest of the population and then the rest of the world (Hoffman, 2009).

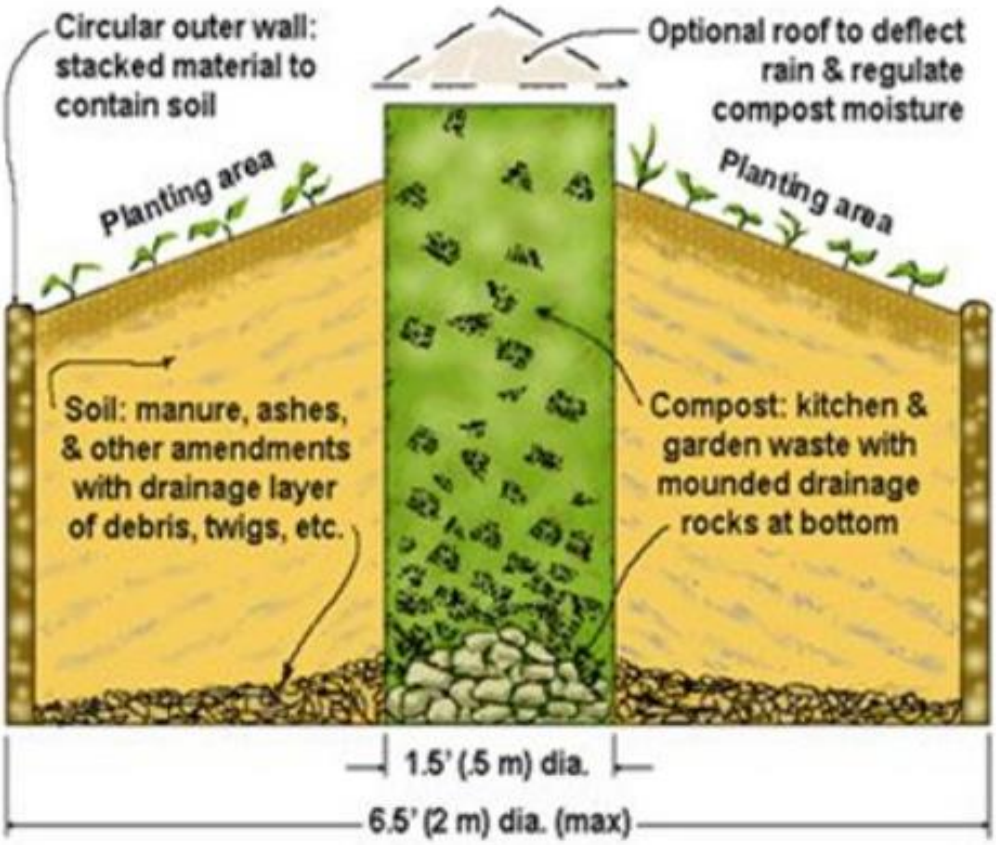

Image 3.16 Cross-section of a keyhole garden (Merrey & Langan, 2014)

Case - Nduta Refugee Camp – Tanzania (Image 3.17)

Image 3.17 Nduta Refugee Camp aerial view

All the UA examples mentioned in this thesis embed the composting practice in their garden; however, the example chosen for this chapter is the Nduta refugee camp in Kigoma, Tanzania. “Refugees often stay in camps for tens of years and gardening has significant environmental, psychological and social benefits, as well as contributing to food sovereignty and sustainable drainage” (Millican et al, 2019). By implementing keyhole gardens, the project combines a practical raised-bed gardening method with a composting and greywater management system (Image 3.18).

Image 3.18 Vanencia is harvesting vegetables from her keyhole garden in the Nduta refugee camp in the Kigoma region. Photo: © DRC/Christina John

As of 2021, there are over 240,000 refugees in Nduta Camp (UNHCR, 2017b) (Image 3.19). According to an article by UNHCR, food distributed in the refugee camps has been cut up to 30 percent after the Covid outbreak (UNHCR, 2017b) The UNHCR, the UN Refugee Agency, and the Danish Refugee Council are currently running projects for vegetable production that includes 1,300 families by the end of 2020. The projects distribute seeds, and tools, and give training on the good farming practice of keyhole

gardening. The projects help the residents to access a varied diet with fresh produce, ameliorate their nutrition, increase their well-being and independence, and empower women to form stronger community structures. Built with locally available and low-cost materials, the gardens support at least five varieties of vegetables at a time year-round even with harsh temperatures, without fertilizers, with less labor and less water than a traditional vegetable garden (Ogolla & John, 2020).

Image 3.19 Most recent camp profile published for Nduta Camp (UNHCR, 2015)

The contribution of soil fertility methods discussed in this chapter is threefold: In terms of environmental contributions, the natural composting and raised-bed gardening practices increase soil quality on which global crop production depends. These practices create fertile soil on the urban ground while decreasing greywater and nutrition-rich compostable waste. They give us the possibility of creating prolific urban gardens even between cement blocks. From the socio-cultural point of view, UA in refugee camps "contribute positively to social and cultural recovery, functioning to preserve memories,

knowledge and create sensory interactions vital for trauma recovery within communities" (Tomkins et al, 2019, p. 117). Keyhole gardens built by refugees to supply their own kitchen, gives them control over their lives. That being the case, soil nutrition methods discussed in this chapter are a great contribution to the effect of UA on the resilience of cities and urbanized areas.

3.3. Water Efficiency

Water harvesting and management practices in urban and peri-urban agriculture help restore the ecosystem by replenishing groundwater levels, providing drinking and cooking water (Amos et al, 2018), decreasing or eliminating the need for access to the urban water distribution network, increasing the resilience of the urban gardens when confronted with drought events, and notably increase the resilience of the cities by minimizing storm run-off and nutrient losses (Lupia et al, 2017). In an extended way, it improves the health of local water sources, namely groundwaters, springs, creeks, lakes, and rivers by reducing the extraction of water. Water management is a principal part of urban planning and UA. There are numerous good practices for water efficiency in UA that can be categorized as water harvesting, water reuse, and improved irrigation. Permaculture also underlines the role of conservation of resources including water.

3.3.1. Water harvesting

Rainwater harvesting is done by catching rainwater, slowing, spreading, and infiltrating the run-off, storing it on-site, and redistributing it. There can be a number of possible methods compatible with the existing structures and the landscape to fulfill the role of four components, "the catchment area, such as a rooftop, a diverting system, namely a gutter downspout, a storage facility, including barrels or cisterns, and a distribution method, by way of illustration, a simple hose used with the gravity of a sloped area, a drip irrigation system, channels, or pumps" (Nolasco, 2011). Stormwater, street run-off, condensate, dew, snow, and water carried by wind and fog can also be harvested by different methods including but not limited to mulched planted areas, climate-adapted multi-use native vegetation, vegetated infiltration basins, and rain gardens. For detailed

instructions, publications by Brad Lancaster may be consulted. (Lancaster, 2008; Lancaster, 2009; Lancaster & Marshall, 2013; Strassberg & Lancaster, 2011).

Greywater is a free, on-site wastewater that is produced after the use of tap water, such as sink, shower, and washing machine. The term excludes blackwater that has come in contact with sewage. Greywater harvesting directs this source towards the area below the soil surface, where nutrients and bacteria are filtered by plants and microorganisms without the use of chemicals or energy. Urban reuse of greywater is leniently regulated or promoted by many countries (Oron et al, 2014).

3.3.2. Water retention

Working with topography and using landscaping techniques as an integrated part of infrastructure improve water infiltration and retention, and decrease the amount of runoff. Controlled water retention increases the organic matter, thence the permeability, and quality of the soil. Infiltration practices such as cultivating vegetated areas like swales and rain gardens (a.k.a. Bioretention cells) can be cheaper and easier to maintain than traditional stormwater practices. Controlling the water runoff with properly designed and maintained water percolation not only uses a resource otherwise lost in storm drains but also avoids pooling and creating habitats for mosquito breeding (EPA - Office of Water, 2012).

Water retention methods such as mulching and crop cover in plots decrease the water use in UA (Egerer et al, 2018). The sheet mulching method, which was discussed in the soil fertility chapter, has also significant effects on water retention in UA. The sheets form a protective layer between the soil and the sun reducing evaporation, and diminishing the need to provide excess irrigation water (Elevitch & Wilkinson, 1998).

Another landscaping method is the formation of swales, berms, and basins to facilitate water capture in low-lying areas. This way water remains on the surface for a few hours, ideally between garden beds or around trees, before it seeps into the soil while being naturally filtered. Both simple trenches around raised beds in an urban garden, and a well-

designed passive water harvesting system integrated into urban planning can slow rainwater run-off, recharge groundwater sources, and help restore the water-cycle balance (Nolasco, 2011). They also ameliorate soil quality by accumulating hummus and trapping eroded sediment.

A well-designed water harvesting and retention system cooperates with nature; it grows, repairs, and reproduces itself. Such a system considers “the soil and its vegetation as the living 'tank'; and vegetation, mycorrhizal fungi, and other life as the living 'filters' and 'pumps' ” (Lancaster & Marshall, 2021).

Keyline design is a landscaping technique developed in Australia by P.A. Yeomans in 1954. A method similar to terrace landscaping, Keyline design observes and modifies topographic features of the land to work in harmony with the resources. From the highest point of an area, called the Keypoint, the natural flow of water reaches the contours of undulating land (Image 3.20). By designing the landscape to slow the rainfall run-off or redirect it, the garden can optimize the resources, and rapidly enhance the soil fertility in the process (Doherty, 2015). Keyline Scale of Permanence considers climate, topography, and water supply as more permanent elements, while other elements, such as roads and means of access, trees, structures, sub-divisional fences, and soil are considered less permanent and should be designed according to the primary elements.

Whilst the use of keyline cultivation is extremely beneficial for effective and inexpensive flood irrigation practices on larger lots of land (Mason, 2003, p. 71), many permaculture principles were also based extensively on Keyline design (Collins & Doherty, 2009). For detailed instructions, his books The Keyline Plan (Yeomans, 1954), The Challenge of Landscape (Yeomans, 1958), Water For Every Farm (Yeomans, 2008), and The City Forest (Yeomans, 1971) can be consulted.

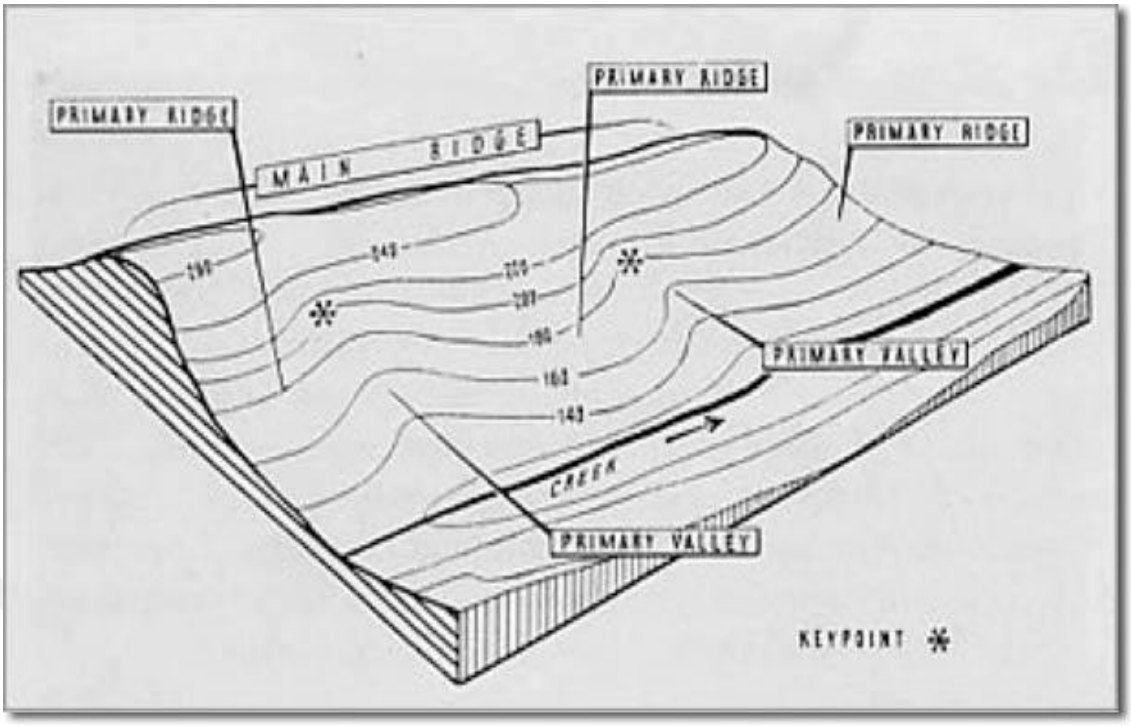

Image 3.20 the three primary landscape components to design the keyline plan

3.3.3. Irrigation

The choice of the irrigation method in UA depends on numerous factors. The urban garden should check water quality, affordability and availability of appropriate water hoses, tenure security, labor availability, and other production factors before choosing the appropriate system. Surface irrigation, drip irrigation, and sub-irrigation are the most used practices in UA.

Land and water conditions permitting, surface and flood irrigation is the most cost-effective method (Mason, 2003, p. 75). “Farmers in urban and peri-urban areas of nearly all developing countries who are in need of water for irrigation often have no other choice than using wastewater (from domestic sources)” (Qadir et al, 2010, p. 2). When contaminating crops with pathogens is a possibility, filtration methods should be taken into consideration. Surface irrigation is also the least resource-effective method. Water scarcity already affects every continent (UN-Water, 2018), thereby the water retention techniques previously discussed should be implemented when choosing surface irrigation.

Drip irrigation is a micro-irrigation method in which the water is applied to plant roots in a slow and accurate way through a network of emitters. It is sometimes combined with hose-end sprinklers to cover irregularly placed plants. Drip systems are more labor efficient than sprinklers and consume half as much as water by reducing water loss from canopy interception, wind drift, and evaporation. Even though drip irrigation seems to be the ideal method for urban gardens, the initial cost of drip systems, management of clogging, and high frequency of renewal can weigh against this method (Lazarova & Bahri, 2005, p. 119).

Sub-irrigation can both be installed as an expensive and sophisticated system or with simple and reused materials in UA. Wicking-bed and hydroponics are examples of sub-irrigation.

A wicking bed is a self-contained garden bed, separated with fabric from a reservoir at the bottom. Contrary to what the name indicates, there are no wicks but it is the capillary action that draws the water up to the plant roots. Moisture is distributed evenly through the soil, and evaporation is reduced, decreasing the need for water (Image 3.21). It was invented by Colin Austin for agriculture in dry regions while working with farmers in Ethiopia (Houbein, 2012, p. 104). It can be used in fields, in containers outdoors, and for indoor farming. Research indicates that, compared to best-practice surface irrigated pots, wicking beds perform “as well or better in water use efficiency, yield and fruit quality”. A shallow reservoir (150mm) and a shallow soil level (300mm) showed optimum design results, thereby this labor and nutrient efficient, “inherently low-tech, and scalable method is applicable to a variety of urban agriculture settings” (Semananda et al, 2016). In view of these facts, it can be deduced that wicking beds are a best practice for UA.

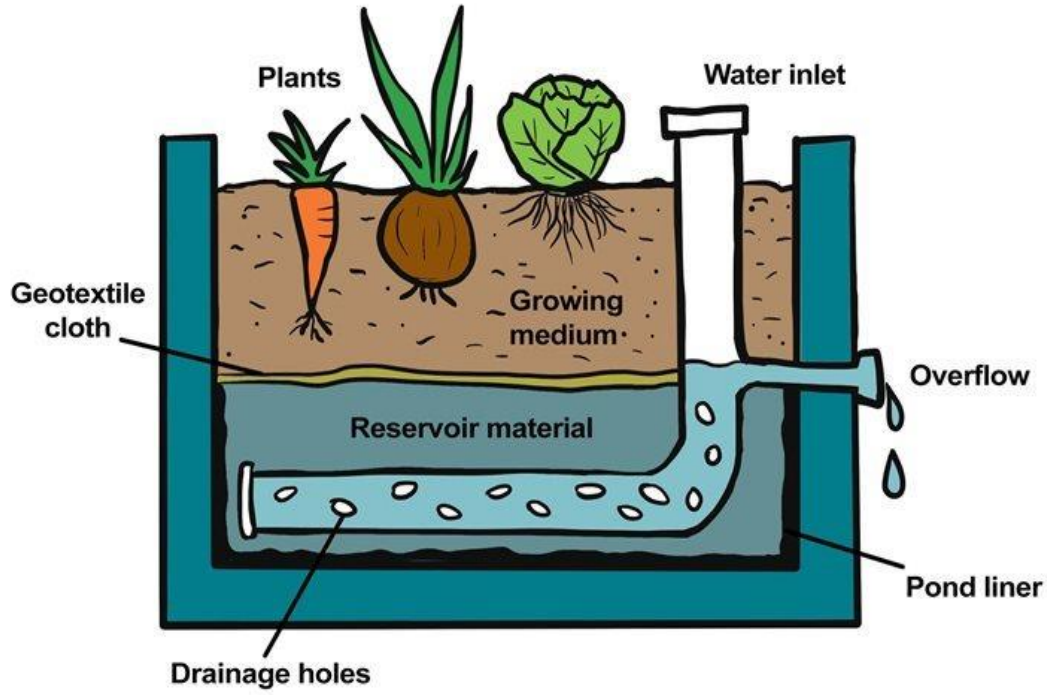

Image 3.21 A simple wicking bed cross-section (RBGSYD, 2017)

3.3.4. Hydroponics

Hydroponics is the science of soilless crop production. Both terrestrial and aquatic plants can be grown with their roots exposed to nutrient-rich solutions. Organic fertilizers can be used in hydroponics with necessary precautions, making this method suitable for a sustainable urban farming method. For detailed construction instructions, "A Practical Guide for the Soilless Grower" can be consulted (Jones, 2005).

Case - Zaatari Refugee Camp – Jordan (Image 3.22)

Image 3.22 Aerial view of Zaatari Refugee camp

Different types of moist inert material can be used instead of soil. In the example chosen for this chapter, used polyurethane foam mattresses are repurposed for a garden in the Zaatari Syrian refugee camp near Mafraq in Jordan.

Jordan is the world's second water-poorest country and the Zaatari camp is home to over 80,000 refugees, which evolved into a permanent settlement in time (Image 3.23). Among other possessions, UNHCR provides each refugee with a foam mattress. They are stored after the refugee moves out, although they cannot be used as a mattress by anyone else. In December 2017, academics from Sheffield University, UK, came up with the idea of repurposing used foam mattresses from the camp. The team included Chemistry Professor Tony Ryan, Soil Microbiologist Prof. Duncan Cameron, and their Ph.D. student Harry Wright, who is researching the use of polyurethane foams to grow high-value crops for food production. The researchers proposed cutting the mattresses and building a hydroponic system.

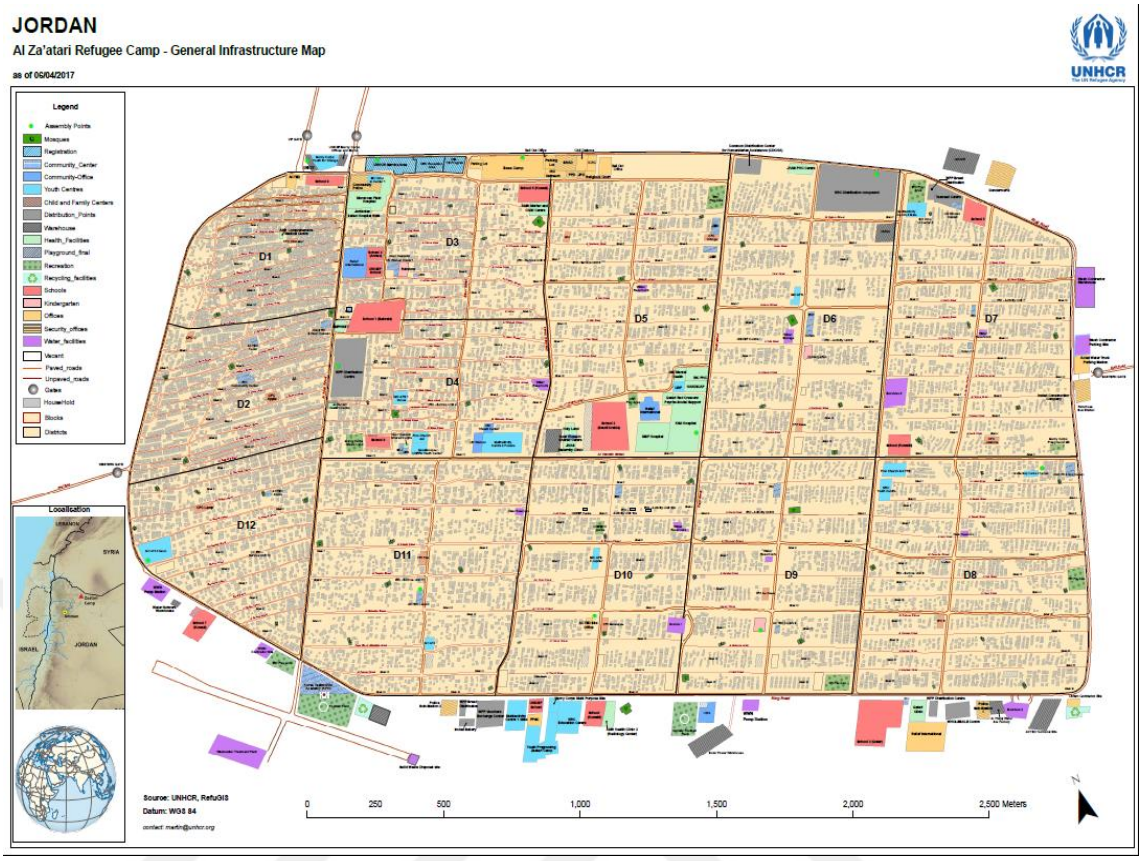

Image 3.23 The map dates before the beginning of the gardening project. The color violet shows water facilities. (UNHCR, 2017a).

> In normal agricultural processes, soil supports a plant's roots, but in a hydroponics system, plants are supported artificially and suspended away from the ground. [...] Nutrient solutions and water can then be pumped into the foam for the plant. (Shephard, 2019). Plants are artificially supported with solutions of ionic compounds serving as nutrients running through a recycled water-based system. (Un & Carlisle, 2019)

In the Zaatari camp, each refugee receives 37 liters of water a day, which is not enough for daily needs, and agricultural use with traditional methods, the hydroponic system consumes 70% to 80% less water. By using the foam instead of the salty and poor soil of Zaatari, Syrian refugees, among which many experienced farmers, can grow food for themselves and for the marketplace. The project started a year later and more than 1000 refugees were trained for the hydroponic system at the end of 2019 (Un & Carlisle, 2019). An area of approx. 260 m2 is covered for agriculture, where one refugee arrived in growing 200 plants. Over 1,000 residents in the camp received training in hydroponics

systems (Image 3.24). Although, according to the researchers, the refugees “taught the Sheffield team how to truly optimize plant growth in these systems and how to make it work on a community level” (Shephard, 2019). While the results of the research are being applied in another hydroponic project in an abandoned school back in Sheffield, the researchers are also looking into making biodegradable foam and other sustainable growing mediums. Meanwhile, the project in the Zaatari camp is being replicated in other “urban areas, including Mafraq and Ruwaished, bringing its benefits to Jordanians as well as refugees” (Un & Carlisle, 2019).

> Under the Nutrient Film Technique (NFT), crops are grown and supported in large nutrient tanks. Seeds are first planted in trays of soil for an average of nine days to allow the plants to start to grow. Afterward, the plants are washed and wrapped in cubes from recycled mattresses, which prevent contamination from outside bacteria. They are then transferred to the closed hydroponic system where recycled water is cycled through pipes ensuring that the plants are provided with an optimal amount of nutrients and water. Any produce grown through this method is subsequently distributed for free among refugees in the camp. (Un & Carlisle, 2019)

Image 3.24 Ahmed, a Syrian refugee who was previously a farmer in Daraa of Syria, introduces the hydroponics system in the Zaatari camp. ©UNHCRJordan

Water efficiency methods and the garden discussed in this chapter have various contributions to the UA to increase the resilience of urban areas. Environmentally, these methods raise awareness of water scarcity and the possibilities of greywater, and they offer sustainable solutions. Combined with soil fertility methods, prolific urban gardens are set up on urban terraces and in soil-poor refugee camps. Hydroponics also gives the option for vertical use, reducing space, as trays of plants can be stacked on top of each other. From the socio-cultural point of view, an urban garden in a refugee camp contributes to the psychological resilience of the residents. Firstly, it gives purpose and structure against the unpredictability of the camp (Tomkins et al, 2019), furthermore, it contributes to food sovereignty (Millican et al, 2019), lastly, the residents also receive training to cultivate their skills and apply them further. This example also shows that going around the regulations, and changing the legislation to work for the residents can make a great difference. The economic contribution is often calculated with the income a practice creates. On one hand, the hydroponics practice in the camp creates a semi-independence from external charities for food. Nevertheless, the fact that the crops are distributed free among refugees in the camp means equitable management of available resources. It is a system that sustains the more vulnerable, disabled, or old members of society.

4. SOCIO-CULTURAL PRACTICES

Besides cultivating a rich environment for biodiversity and nourishing people physically, UA nourishes the health and social fabric of urban communities. Urban gardens are places of belonging and socialization. Participating in community gardens helps develop relationship competencies, they facilitate intergenerational and intercultural dialogue. Urban gardening projects often open up to the neighborhood they reside in with inclusive events, which results in social relationships not only between gardeners but with the rest of the community empowering more vulnerable groups such as the elderly, immigrants, minorities, and socio-economically disadvantaged. They can help pass cultural knowledge between the members of a diaspora. They are spaces for the development of knowledge and know-how of plants and environmental education (Duchemin et al, 2009). They create the possibility to discuss anthropocentrism and build equitable relationships with the land, flora, fauna and non-human entities in our ecosystem. They are a leeway in urban chaos for our psychological needs; areas of "quiet space", nature experience, and outdoor play both for children and adults. Community gardens offer a system of values based on social support, solidarity, respect, dignity, and sharing. People gathering around an urban garden not only learn how to eat better and take better care of the local flora and fauna, but they also acquire soft skills such as resolving conflict, critical thinking, problem-solving, intercultural fluency, and teamwork. Together with an assembly-based management method, community gardens can be hubs for grassroots movements. All of these socio-cultural aspects of urban gardening help increase the resilience of cities and urbanized areas.

All cases presented previously are compelling examples of the socio-cultural effects of urban gardens. Commune Community Garden in Tokyo builds community by hosting gatherings and offers a quiet space on the terrace giving relief from the busy city. Phoenicurus garden in Spain is a hub bringing the citizens of Cardedeu together through Community Supported Agriculture (CSA). CSA is not only a method of the green economy but also a support system for a group of citizens living in the same area. In addition to their role in the local community, the urban garden is also hosting horticultural courses, workshops on sustainable living, and self-sufficiency (EUGO, 2012, p. 38).

While the founders of Commune published a guide on Permaculture in Japan for adults and one for children, the founders of Phoenicurus published the first book on Forest Gardens in Castilian Spanish to pass on the knowledge and know-how. The mission that brought Llavors Orientals to light was to have a socio-cultural impact on the culinary culture of the region; their aim is to educate people on the local varieties of fruits and vegetables and protect the heirloom seeds. Spitalfields City Farm in London was born from a grassroots movement by reappropriating wasteland and converting it into allotments. Today the charity gives workshops for children of different ages and abilities on farming, food, sustainability, and nature connection. In refugee camps, community gardens or farms cultivate a “community-based approach with social cohesion and welfare objectives" (Tomkins et al, 2019, p. 106). Both Nduta and Zaatari camps discussed before, and the Domiz1 camp that will be discussed in the chapter on the economic impact of UA, are urban and permanent settlements. The same article states that UA in camps is “healing spaces from trauma, and creative place-making practices", and “home gardening and agriculture [needs to be recognized] as a core response at the point of crisis” (Tomkins et al, 2019, p. 103). As stated before, UA in refugee camps contributes to social and cultural healing, to mending and passing of memories to the younger generation, and generating reciprocity crucial for the restoration of a community.

4.1. Education

Urban gardens propose educational programs both for children and for adults. Shared knowledge and expertise bring awareness and empowerment.

Case - Ecoterra de Institut Terra Roja – Spain (Image 4.1)

Image 4.1 Aerial view of the IES Terra Roja

Following the initiative of a teacher, a part of the school garden was turned into an organic vegetable garden in 2010 (Image 4.2). Despite the fact that the school garden is a small patch of land surrounded by cement walls, and notwithstanding intermittent vandalism acts, the project keeps being continued for more than a decade. The students learn to sketch and design the space according to the properties and characteristics of plants, to use horticultural tools and techniques, and to grow herbs and vegetables on clay soil with environmentally sustainable methods. They execute agrarian and teamwork skills, get a theoretical and practical food education, install and cure the community compost, and learn from each other by holding artistic and scientific workshops in the garden (EUGO, 2012, p. 40).

Image 4.2 The school garden with aromatic herbs, vegetable beds, a compost bin, and an insect hotel

Although the school garden is restricted by factors such as accessibility according to the school schedule, from autumn to spring, the impact of the garden grows exponentially through the education of students in various immigrant communities (Nexes Interculturals de Joves per Europa, 2012, p. 16).

4.2. Health

The UN Sustainable Development Goal number 3 is for “good health and well-being and it comprises to ensure healthy lives and to promote well-being for all at all ages”. While “providing more efficient funding of health systems, improved sanitation, and hygiene, and increased access to physicians” (UN, 2020) is the foundation of universal healthcare for all people, UA is part of the SDG3 strategies such as the projects in Nduta and Zaatari refugee camps.

Humans' health in relation to the natural environment is "discussed across the main four research fields: evolutionary psychology, environmentalism, evolutionary biology, and social economics" (Seymour, 2016). Seymour's article proposes an interdisciplinary approach toward physical, mental, and social health, "inclusive of all relevant characteristics of ecosystems, their continuously evolving synergies with human health as well as a balance between the biological, social, and spatial perspectives". Participating in an urban garden and caring for the plants and other participants have beneficial effects on our physical, mental, and social health. Therefore, integrating UA practices into our healthcare systems would assist in increasing the resilience of our cities.

Quiet spaces, outdoor play, and nature experience: often these activities are presented to children. Noise pollution hinders the ability of children to learn at school but also adversely affects the health and distribution of wildlife and the well-being of human populations (Nugent, 2016). Noise pollution has adverse effects on biodiversity. It changes animals' behaviors; it creates physical and psychological problems in humans.

City dwellers from higher classes go on retreats; lower classes visit their relatives outside the city. Nevertheless, escaping from the chaos of the city is an unsustainable solution. Since Kaplan's largely cited article (1973), there have been a number of studies showing the relation between psychological health and gardening. In addition to being spaces of sustainable land use and fostering nature and biodiversity, urban gardens boost air quality and subdue noise. An urban garden carves a quiet space in the city.

Quiet areas correspond with green areas, and a sense of aesthetics that increase the well-being of the inhabitants (Tzoulas et al, 2007; White et al, 2013). Quiet spaces in urban areas are often for the use of the privileged few, such as gated communities, golf courses, hotels, private school enclosures and other private establishment gardens, apartments with courtyards, or public spaces with paid access such as courtyards and gardens of museums. Integrating quiet spaces in urban planning aids "community preservation, improves road safety for more vulnerable citizens, creates and preserves recreational

spaces, and improves health and well-being of humans" (European Commission, 2018). This study of quiet space practices in the EU underlines the importance of public quiet spaces, accessible to everyone.

Case - Hortus Urbis – Italy (Image 4.3)

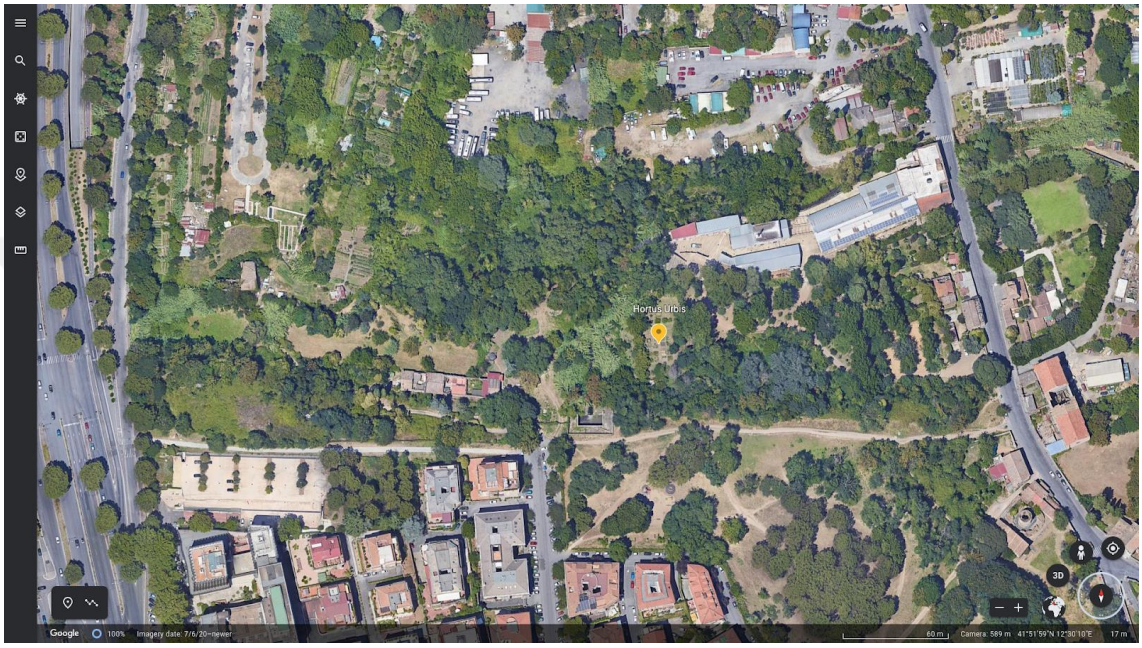

Image 4.3 Aerial view of Hortus Urbis with the Appia Antica road on the right

Hortus Urbis is an urban garden on the ancient road of Appia Antica in Rome. It covers an area of 1000 square meters, occupying the garden of Ex-Cartiera, a conference center that used to be a paper factory. The project started on March 25, 2012, with the initiative of an architecture studio called Zappata Romana. The project received funding from the municipality by proposing a unique gardening idea: Cultivating solely edible plants from Ancient Rome. The initiative brought together all the urban gardens of Rome that took part in contributing to Hortus Urbis, by gardening or leading art and horticulture workshops in the garden (Image 4.4). Sixteen square-shaped beds occupy a surface of about 225 square meters, and the plan for the rest of the space is to cultivate an orchard with ancient fruit trees, add an earthworm culture area, and a seedbed area. An irrigation system is installed and there is a compost bin, an adobe oven, an insect hotel, and a pergola around the vegetable beds.

Image 4.4 Photo of the Hortus Urbis community garden during an event

The garden is situated between the two arterial roads; the restricted traffic area of the ancient road starts further down. It is first and foremost a project on recovered public space and on biodiversity. Nonetheless, the urban garden and the surrounding green space are a refuge from the traffic noise in addition to its high recreational value as a public community garden.

4.3. Community Building

Community building practices create and enhance the sense of citizenry. UA practices help citizens work toward social equality, organize themselves and seek social justice, and increase individual and collective well-being. Marginalized individuals, disabled people, senior citizens, and otherwise disconnected people can find themselves useful through UA practices. Cultivating a community garden can give people a sense of belonging. Sharing the common interest of the survival of the garden, and participating in joint action gives citizens a sense of coherence and identity. (Brown, 2004). Nonetheless, community gardens compete with the interests of developers (Schmelzkopf, 1995).

Case - Dudley Street Neighborhood Initiative and The Food Project - USA

In the USA, Black neighborhoods in many cities have outstanding examples of urban gardens. Boston has a history of urban farming which gained popularity in the 90s. The reason for that was the gentrification projects in the Black neighborhoods, which caused conflicts and grassroots movements. Dudley Street Neighborhood Initiative (DSNI) in Boston is a “multilingual low-income community of color” changing the plot of the neighborhood’s story through strong community participation. Their efforts resulted in the inclusion of the residents in the planning process, together with the officials and other stakeholders. Besides affordable housing, commons, parks, and playgrounds, a community garden project was among the goals reached by the community initiative. The DSNI “resulted in the construction of 2,000 affordable homes, the creation of an urban village, and the end to the displacement of neighborhood residents” (Arnold, 2007) (Image 4.5).

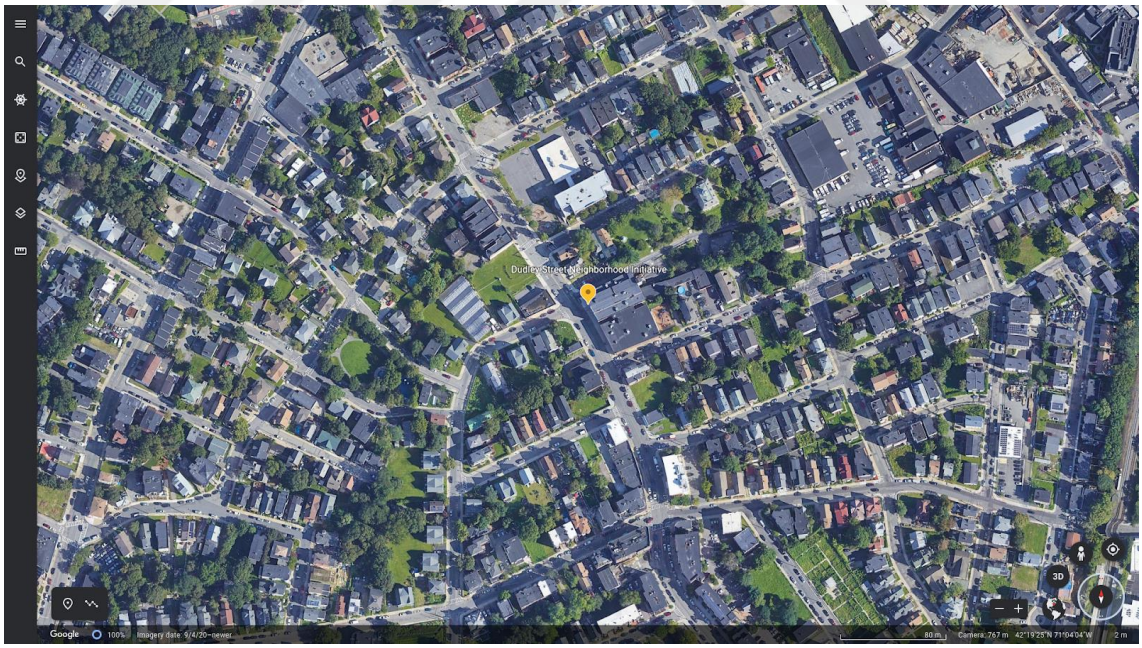

Image 4.5 DSNI center with several urban gardens in the neighborhood

Today, the city has an allotment garden program for urban farming, community gardens, and school gardens. In 2013 the city also passed a bill to support commercial urban farming (Boston Planning and Development Agency, 2014).

The Food Project was founded in 1991 in Boston, MA, born out of the friendship between a white farmer in Lincoln and a black pastor in Somerville. Currently, the non-profit organization employs 120 teenagers each year, involves 3,000 volunteers, and grows 90,000 kgs of fresh fruits and vegetables on 70 acres of urban and suburban land in eastern Massachusetts. The project is rooted in and still connected to Boston's Dudley Street Neighborhood Initiative (DSNI). The project includes 7 farms, a 10,000 square foot greenhouse, more than 1,400 raised bed gardens built through the urban garden launching assistance, CSA groups, food workshops, farmer's markets, a street kitchen, collaborations with local hunger relief organizations, and corner shops for free or accessible fresh produce (The Food Project, 2022) (Image 4.6). Their resources, books, and manuals on community building, suburban and urban farming, and management of the business side through farmers' markets are available in many languages spoken by the residents.

Image 4.6 The Food Project Greenhouse (Landry, 2013)

The Food Project connects neighbors from different minorities and immigrant backgrounds. It creates a hub for resource sharing and social support. The project facilitates passing on cultural knowledge and practice in the diaspora and strengthens collective efficacy.

Besides the Food Project, there are various sources for the citizens of Boston to reach affordable or free fresh food (Image 4.7).

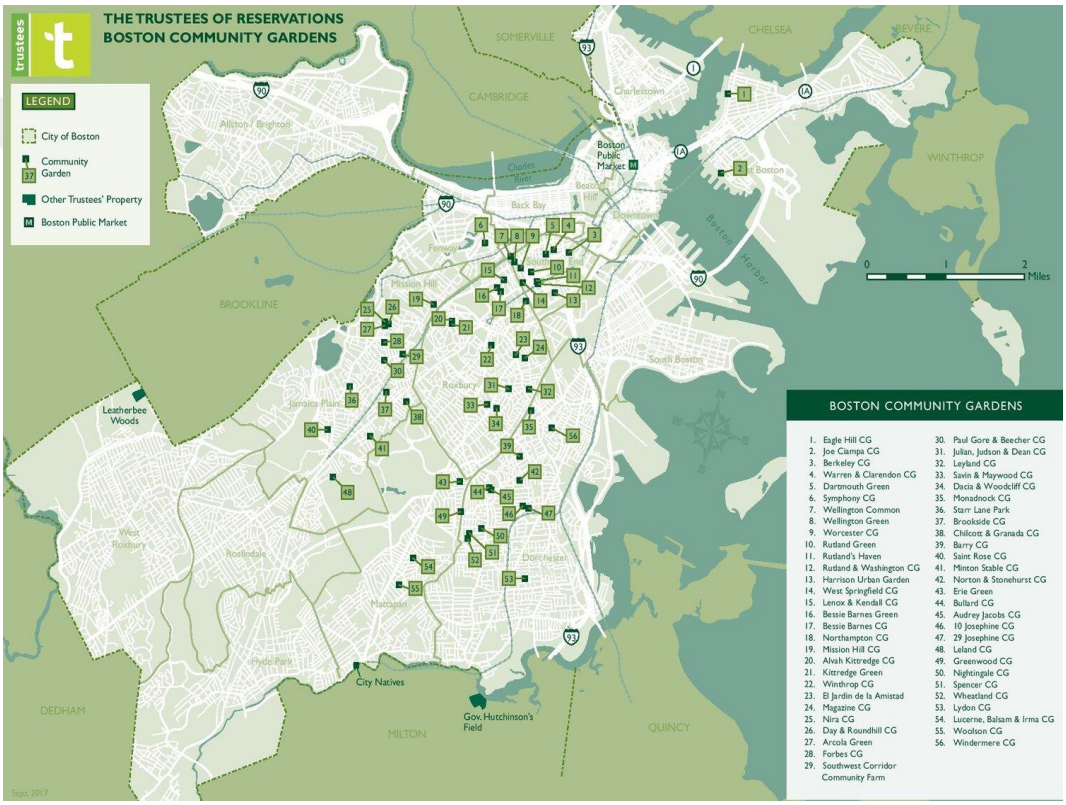

Image 4.7 Over 4,000 garden plots in 56 community gardens are spread out across eight Boston neighborhoods (The Trustees, 2020).

In 2017 a "Community Food Resources List and Map" was published, displaying: "free, low-cost, and emergency food outlets including food pantries and meals sites, affordable fresh fruit and vegetable sources, senior dining sites, economically accessible farmers market locations, and access assistance locations. The map has been printed in five initial languages including English, Spanish, Chinese, Haitian Creole, Russian and Vietnamese, and distributed in community locations" (Ragan, 2017).

4.4. Reappropriation of Space

The right to the city is not handed by the authorities to individual citizens, it is to be understood as a collective action. Apart from practices of growing food, collective UA projects cultivate collective identities and relationships. They exist concurrently as a "deeply political practice, and one that might also appear to reside outside the realm of politics" (Bach, 2016, p. 4). Differing from personal allotment gardens and municipal gardens, collective gardens are often informally established and maintained. Informal collective gardens face not only internal conflicts caused by differences in perspective and power. They also have external challenges to manage their relationship with the municipality or other governing bodies, related to property ownership, bureaucracy, and regulations.

> The right to the city is far more than the individual liberty to access urban resources: it is a right to change ourselves by changing the city. It is, moreover, a common rather than an individual right since this transformation inevitably depends upon the exercise of a collective power to reshape the processes of urbanisation. The freedom to make and remake our cities and ourselves is, I want to argue, one of the most precious yet most neglected of our human rights. (Harvey, 2008)

Case – Can Masdeu – Spain (Image 4.8)

Image 4.8 Aerial view of Can Masdeu occupied space and the food gardens

A former leper colony left in disuse for 35 years and reclaimed as a squat in 2001, the old hospital building and the gardens are situated at the edge of Barcelona, near the last metro station. It is surrounded by a valley of 35 hectares, part of the Collserola Natural Park (Image 4.9).

Image 4.9 Photo from the community garden of Can Masdeu

There are a total of 40 shared and individual plots for the citizens beside the community garden of the occupation. The gardens are cultivated without chemical fertilizers and pesticides. They give agro-ecological education. They teach how to procure and distribute water, manage soil, and manure, renovation and maintenance of water tanks, and ancient irrigation systems.

They collaborate with Architects Without Frontiers for the renovation of the building, including the garden terraces, and the irrigation system using Bio-construction methods.

The occupation has installed solar water heaters, compost toilets, wood stoves, and drip irrigation systems.

Both the gardens and the occupation is managed through assembly-based management. They help develop skills such as social and intergenerational dialogue, conflict resolution, and sharing concepts. They include the community with volunteer-based workshops.

5. ECONOMIC PRACTICES

At first glance, urban gardens connect food production to our consumption habits. Knowing what people eat gives them power over their bodies. A deeper understanding reveals our connection, to οἶκος, our physical environment, and the community it encompasses. Losing the connection to the practice of growing food alienates us first from our food, then from our community, and from the environment.

> From seeing farming as a process of nurturing the earth to maintain her capacity to provide food, a masculinist shift takes place, which sees farming as a process of generating profits. Ecological destruction is one inevitable result of this commercial outlook. Economic deprivation is the other because production for profits instead of needs excludes large numbers of women and peasants from food production and even larger numbers of women, children, and the poor from entitlements to food. The fact that larger numbers of the poor in the Third World are victims of hunger and famine today is intimately related to a patriarchal model of progress, which sees sales and profits as indicators of well-being and thus destroys the real well-being of people. (Shiva, 1988, p. 93)

5.1. Business Tools

Case - Domiz1 Syrian Refugee Camp - Northern Iraq (Image 5.1)

Image 5.1 Aerial image of the Azadi Garden in Domiz1 camp

The Azadi Garden in the Domiz1 camp was created in 2015 by a nonprofit called The Lemon Tree Trust (Image 5.2). They have been inspired by the garden of Aveen Ismail, who now has a formal role as a Pathway Facilitator within the group. She was cultivating a small patch of dry land next to the house they built and the nonprofit asked her to encourage others to garden so that the refugees could provide themselves with fresh produce daily. The founder of the nonprofit says that it is the openness of the local government "to ideas around tree planting, gardening, agriculture and landscape improvement" that makes the difference. “Obtaining permission from camp authorities to grow between houses legitimized these activities and opened the door for further gardening projects” (Re-Alliance, 2022).

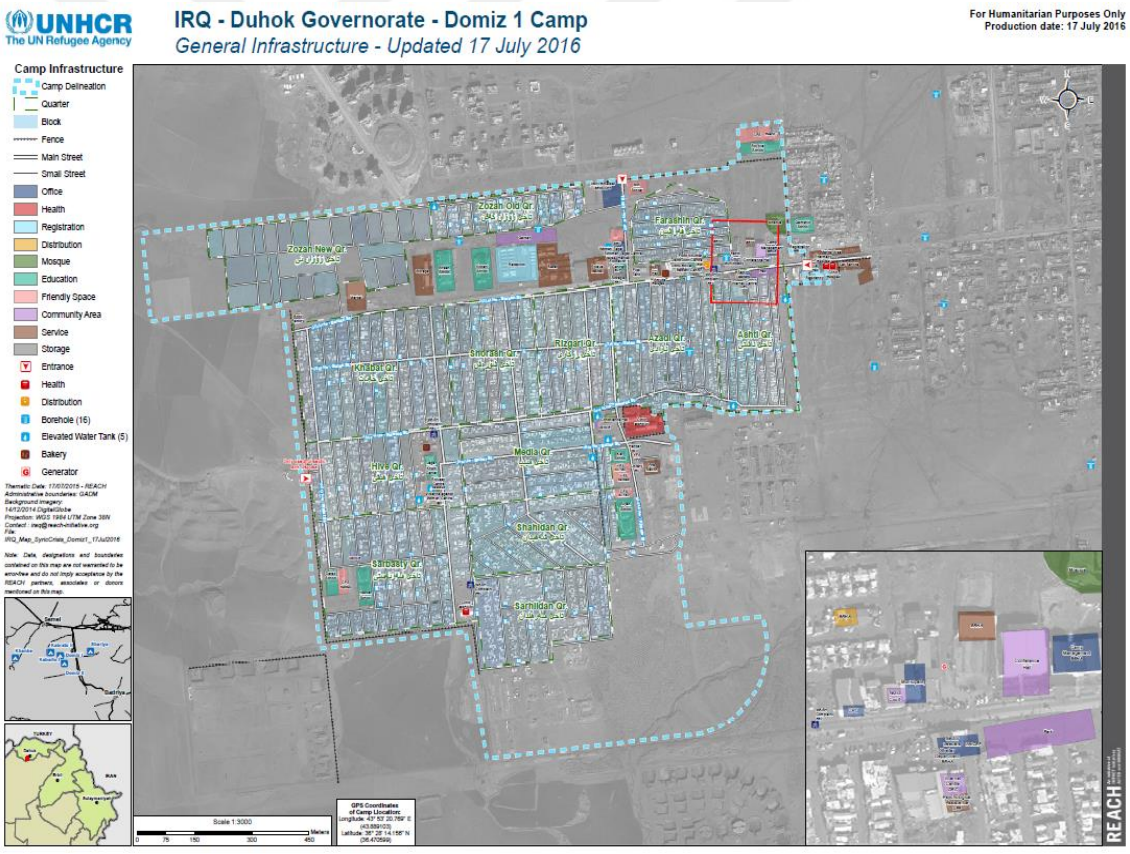

Image 5.2 Camp profile in which the Azadi Quarters are indicated

The nonprofit examined the prevailing green spaces, connected local gardeners and community members, funded a nursery in the camp, and hired refugees to manage the mapping, building, and maintenance of a demonstration garden. They started by

distributing seeds, trees, flowers, manure, and simple tools. They repaired a borewell and set up a greywater system that recycles the household wastewater, excluding toilet sewage. This had a twofold effect: irrigating the arid soil and diverting the water runoff. Their idea of the garden competition, with cash prizes sponsored by the Trust, became an annual event. Domiz camp covers approximately 1142 square kilometers and hosts 26,500 refugees. Since then 800 home gardens have been created and 7000 are directly benefiting. The demonstration garden became both an entrepreneurial economic activity and a community hub called *Azadi* (Liberation) Garden. The garden is built to provide education, community, food, dignity, and livelihood. It contains four main areas separated by trees planted for shade: A livestock area for rabbits and chickens, the tree and plant nursery around the borewell, greenhouses for growing commercial crops, greenhouses for growing community seedlings with space for men to hang out, and 24 raised beds with tables and chairs where women and children hang out (Image 5.3). A community oven lets the residents of the camp bake their own bread. A workers' cooperative is set up to build "Crisis Response Garden Kits, which provide new refugees with tools and seeds to begin growing food as soon as they arrive". The aim is to give the camp's inhabitants entrepreneurial tools by providing kits for other relief organizations.

Image 5.3 Photo from the Azadi Garden in Domiz1 camp

Refugee camps are usually set up as if the residents would move on in a short period, while in reality, they end up staying for decades. Giving the residents the tools to cultivate land helps them to accept the camp as their new home and to raise their living standards. Domiz1 camp receives pre-packaged and canned goods from the UN WFP and frozen meat. Other than accessing fruits, vegetables, and livestock, the residents are acquiring farming skills, keeping memories of home alive through planting similar gardens, building community, and feeling accomplished and productive.

> The practice of creating and inhabiting home gardens represents an important link to the past in Syria for many refugees, creating a sense of remembrance for home and country that many will not return to, as well to as their potential future by creating a sense of belonging and dignity to their new community and home in Iraq. (Tomkins et al, 2019, p. 117)

5.2. Empowerment of Women and Immigrants

Case – Quito, Ecuador

Since 2002, the local government of Quito, Ecuador, has been continuing "The Participatory Urban Agriculture Project, or AGRUPAR. Several community organizations are taking part in the project to improve the well-being of the citizens susceptible to economic instability through farming practices, mostly in urban settings. The aim is to "contribute to food security and sovereignty, the improvement of income, the generation of sources of employment, environmental management, gender equity, social inclusion and the generation of productive enterprises" (Pogrebinschi, 2017).

The ongoing project's results produced enough documentation for food to be covered in Quito's Resilience Strategy for 2040 (Image 5.4).

Image 5.4 One of the several micro gardens in Quito

Over the years, the project has made its intervention more technical through the implementation of alternative infrastructures of low cost and easy adoption, specially designed for the urban and peri-urban orchards in a participatory process. By 2014, the project recorded that 84% of participants were women and that this activity included young people and children. In that same year, there were approximately 3000 urban farmers in Quito supported by AGRUPAR, who also discussed the proposal for a municipal ordinance for urban agriculture in Quito (Pogrebinschi, 2017).

5.3 Local Economy

Urban agriculture can boost the local economy when used in the right context, connecting farmers to neighbors as in the example of the Phoenicurus Forest garden, or simple community supported agriculture groups. Technologically advanced examples of UA, such as hydroponics and Controlled Environment Agriculture (CEA) can be used for virtuous purposes such as in the Domiz 1 Refugee Camp or in the case of Boise Vertical Farm described in this chapter. Although the common use of these technologies serve

multi-national companies and high-end service industry, by occupying urban space and leaving the local communities outside the equation.

As Harvey argues, “the city has to appear as innovative, exciting, and creative in the realms of lifestyle, high culture, and fashion” (Harvey, 1989, p. 48). Controlled Environment Agriculture farms are getting very popular in the US, while the rest of the world adjusts their farming and planning laws to accommodate this type of urban agriculture. The CEAs can vary from greenhouses to vertical farming and plant factories. Repurposed structures, basements, and subterranean spaces can be used for hydroponics, aeroponics, aquaculture, and aquaponics. Local food systems are becoming a necessity in the city, foremost because of the inequality in the food system limiting access of lower classes to fresh produce.

In Japan, after the tsunami-sparked nuclear accident in 2011 the CEA became the only trustable source of fresh produce in the region. Around Fukushima, much of the region’s farmland was irradiated, and customers used to carry Geiger counters to the market to check the radiation levels. This disaster has led to innovation in vertical farming. The United States Department of Agriculture states in their report that Controlled Environment Agriculture “could be especially impactful for urban areas without reliable access to affordable and fresh produce” (USDA, 2019). On the other hand, CEA examples are factory-like cultivation systems reproducing the capitalist food production, by appropriating sustainability politics for elite consumption. Instead of the neighborhoods without reliable access to affordable fresh produce, corporate agriculture is the one that will really benefit from these forms of farming.

Some famous examples can be seen in New York (Gotham Greens, the first commercial-scale rooftop farm in the US, which began in 2008 on a 15,000 sq ft), New Jersey (Aerofarm), Chicago, IL (FarmedHere and The Plant, indoor vertical farms) and California (Plenty. Inc. and Local Bounti) and Den Bosch, the Netherlands (PlantLab, first farm but mainly focused on research and development, working with GMO producer Syngenta), Sweden (Plantagon, plans to export to Asian markets). Just the same, the fact that these are types of Urban Agriculture does not mean that they oppose the system. As

McClintock (2013) argues, some forms of UA perform a role of alleviation of the discontent with the capitalist food system and consequently replicate it.

Hallock (2013) discusses that there is a direct connection between “class struggle, devalued built environment (of low-income urban populations) and depressed labor markets” and Controlled Environment Agriculture in the form of commercial-scale, for-profit vertical farms. This type of CEAs uses labor displacing technology to hire fewer workers. They grow “thousands of pounds of food per day with little (or no) labor, which makes them large-scale”. This model requires “extremely high upfront costs, ranging from one to four million dollars depending on the size” (Hallock, 2013). This type of capital necessitates investments from outside of the local economy such as international private equity firms, thus moving the profits outside of the local circulation. From an ecological viewpoint, these systems don’t participate in strengthening local biodiversity, while some might promote heirloom seeds, others see their future in genetically modified organisms. The ecological benefits of technological systems such as hydroponics, become insignificant while “existing hydroponic projects mainly use industrial fertilizers to optimize yields”, “(these) practices are not in and of themselves sustainable” (Specht et al, 2013).

Case - Boise Vertical Farm – USA (Image 5.5)

Boise Vertical Farm was founded in 2018 with the mission to create a safe community that provides hope and employment for individuals in substance abuse recovery by growing local produce. It is a non-profit and hundred percent of the purchase goes to provide employment and benefits for the employees, who are former narcotic addicts.

Image 5.5 Boise Vertical Farm

5.4 Legislation

In most countries, allotment gardens are what the legislation offers most commonly. An allotment garden is a plot of land, available for individual, non-commercial gardening. Contrary to community gardens, they are cultivated separately by individuals or families, organized in an allotment association. In Europe and Japan, Office International du Coin de Terre et des Jardins Familiaux founded in 1926, represents three million allotment gardeners (Jardins Familiaux, 2021). Other countries such as Canada and Japan have similar entities. In most cases "the gardeners have to pay a small membership fee to the association and have to abide by the corresponding constitution and by-laws" (Drescher 2001).

Case - Germany

Allotment gardens make up a big part of urban gardening in Germany. Almost a million allotment gardens, regulated by an umbrella association, serve around 5 million citizens. While these gardens started as Armengärten or gardens for disadvantaged citizens, looking at the numbers reveals a certain privilege among the beneficiaries of allotment gardens: It is possible to recommend a person for an allotment, therefore the percentage of immigrants is quite low. The necessity of the constant upkeep of the garden requires a certain amount of free time; the average gardener is a retired German. Legally there is not any barrier for the welfare recipients to lease a garden, but covering the initial costs requires a certain capital. The ban on using the huts in the garden as living quarters means two monthly expenses. For many people, access to an allotment garden is impossible, whereas others illegally live on the lots they have leased, because they cannot afford a separate apartment (Lang & Fissner, 2019). Whom are the allotment gardens really for?

960.000 allotment gardens on 44.000 hectares serve around 5 million people. Promoted values are nature experience, outdoor play, environmental education, knowledge of plants, knowledge of healthy nutrition, and the access to domestic garden products. Long waiting lists and privileged access resulted in the Community Garden Movement with 450 urban gardens outside the allotment garden legislation.

Urban gardening in Germany can be traced to 1833 and since then the gardens have been in continuous use. Even though there are many differences in the use of Kleingarten between the eastern and western sides of Germany, the majority of urban gardening is regulated through BDG e.V. -Bundesverband Deutscher Gartenfreunde, Federal Association of German Garden Friends, and regional associations. “910,000 tenants in 14,000 associations manage 44,000 hectares of allotment gardens in almost 16,000 facilities. [...] Around 95% of the 960,000 allotment gardens are currently managed” (BBSR, 2019). Between families and friends, the number of users of Kleingartens amounts to 5 million people.

According to a survey conducted by the BBSR - Federal Institute for Research on Building, Urban Affairs, and Spatial Development demand is increasing in the big cities and among the young and international households with children. Since 2000, 64% of all tenants who have taken over a garden are younger than 55 years old (Buhtz, 2008).
While 72% of the new demand comes from people with a migrant background, only 7.5% of the current gardeners have a migrant background (BBSR, 2019; Buhtz, 2008). About 17% of the population is first-generation immigrants, while about 26.7% of the population has a migration background.

The allotments have annual fees and transfer costs, which can start from a few hundred euros in Eastern Germany where the demand is lower, to several thousand euros in big cities. In Berlin, there is a three-to-five-year-long waiting list of almost 12,000 people.

Larger municipalities are engaging in urban planning strategies by integrating allotment gardens into green infrastructure to mitigate the effects of noise and air pollution. Allotment garden organizations inform and encourage participants in the protection of biodiversity, and of soil quality. Big cities continue growing and their need for housing and surrounding facilities grow concurrently, increasing the pressure to use existing gardening spaces for construction. Nonetheless, garden organizations, managed by volunteers, take active participation in municipal decisions and enforce compliance with the *Bundeskleingartengesetz*, the Federal Allotment Act to protect or minimize the loss of allotment areas. Surrounding areas of highways in Hamburg and Freiburg are proposed to be incorporated into the allotment garden network to block the noise pollution, while a graveyard in Dortmund Hörde is dismantled to become an allotment garden. Daycare centers, schools, and senior citizens' facilities are receiving allotment gardens.

Managing the allotment gardens in an ecological way is a novelty of recent decades to be encouraged, which might mean an array of practices from discouraging the use of artificial pesticides and fertilizers, to permaculture and other ways of organic farming. The regulation requires that the garden must include fruit and vegetables for ⅓ of the size of the plot and states that the hut must be under a certain size and cannot be used as a residence (Image 5.6).

Image 5.6 Typical Kleingarten in the Federal State of Hessen (Photo: Evelyn Gustedt)

According to the BBSR, the benefits of allotment gardens, which are “nature experience, outdoor play, environmental education, knowledge of plants, knowledge of healthy nutrition, and the access to domestic garden products must be shared with other city dwellers who don’t lease gardens” (BBSR, 2019).

The allotment garden at its roots is private property. Having access to an allotment garden seems to be a privilege, even with almost a million gardens present. That might be the reason why new lifestyles and societal models have been tested here since the 1970’s when the guerilla gardening and urban gardening movement started to be practiced. “Adopting and implementing a transgressive, autonomous, activist and; therefore, insurgent publicness, guerrilla gardeners revive the right to the city” (Ateş, 2015).

In the 1990s, the Community Garden Movement started in Germany, and the first intercultural garden was founded in Goettingen in 1996. In the 2000s the first urban gardening projects were launched outside of the traditional Kleingarten regulations and more intercultural gardens were popping up, while movements such as Edible Cities, city farms, and school gardens were opening. Neighborhood gardens such as Rosa Rose in 2004 and mobile urban gardens such as Prinzessinnengaerten in 2009 were founded in Berlin and have been founded by occupying public space, without the strict contracts of the garden associations. Today around 450 urban gardening projects exist outside of the traditional Kleingarten model (Gustedt, 2017) (Image 5.7) (Image 5.8). The occupants of these urban gardens often face fines, dislocation, and clashes with the police force, even though the main goal is to use abandoned places for the common good.

Image 5.7 Berliner Gartenkarte - UA in Berlin (Halder et al, 2014)

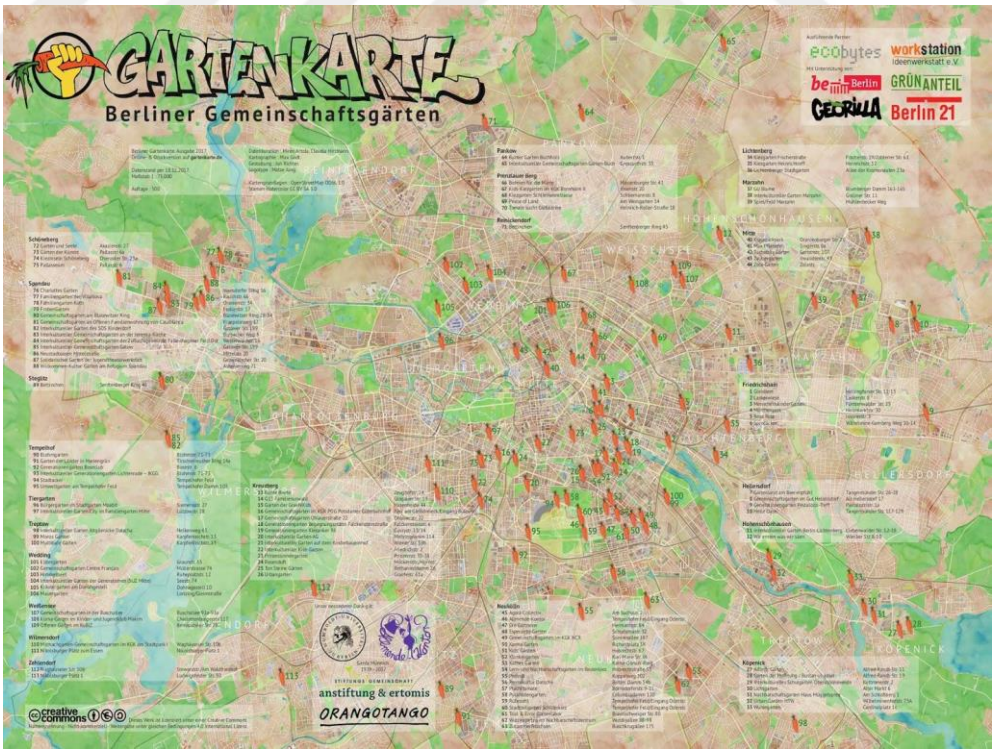

Image 5.8 Berliner Gartenkarte - updated map of Community Gardens in Berlin (Halder, 2018)

6. AN ASSESSMENT MODEL FOR A FUTURE METHOD

This thesis has studied several urban agriculture practices, urban gardens, and community gardens. It includes several examples deemed good practices for selected methods detailed in former chapters.

6.1. Assessment for Istanbul

This thesis has studied several urban agriculture practices, urban gardens, and community gardens. It includes several examples deemed good practices for selected methods detailed in former chapters. Following the study, it is possible to grade the impact of each method. Below in their prospective chapters are the tables of examples selected as good practice within the scope of this thesis (Table 6.1).

Nota Bene: This calculation is based on the significance of the examined methods. It is a qualitative rating; therefore, it is not a scientific standard. It is proposed as a preliminary test for a study in which a numerical calculation would be made.

Environmental – Biodiversity 10,5%	Environmental – Soil Quality 15,5%	Environmental – Water Efficiency 14%	Socio-Cultural 30%	Economic 30%
Permaculture 4%	Vermicompost 3%	Rainwater Harvesting 3%	Education 7%	Business Tools 7%
Food Forest 3%	Bokashi Compost 1,5%	Greywater Harvesting 2%	Health 8%	Empowerment of Women and Immigrants 8%

Seed Bank 3%	Composting Toilet 2%	Bioretention Cells or Swales 1%	Community Building 8%	Local Economy 8%
Insect Hotel 0,5%	Hügelkultur 2%	Keyline Design 2%	Reappropriation of Space 7%	Legislation 7%
	No-Till Farming 2%	Surface Irrigation 1%		
	Sheet Mulching 3%	Drip Irrigation 2%		
	Keyhole Garden 2%	Wicking Bed 2%		
		Hydroponics 1%		

Table 6.1 General calculation based on the significance of the examined methods

6.2 Case – Postane Teras Urban Garden

Postane is an incubation hub for social, cultural, and environmental associations working on urban impact. It resides in the historical British Post Office building in Galata, in the city center of Istanbul. The building was restored and designed with funding from the Bertha Spaces network (Postane, 2022). Events and associations hosted by *Postane* prioritize social justice, equality, and solidarity and work on innovative and creative solutions. Besides the cafeteria, the local and fair-trade shop, workspaces, library, studio, and event hall, the hub hosts a terrace garden for urban agriculture (Image 6.1).

Image 6.1 Aerial view of *Postane Teras* Urban Garden shown with a blue dot

Postane Teras is an urban garden designed to cultivate edible plants and implement a circular system with the kitchen of the building, but also a place to discuss food justice. The aim is to be a good urban agriculture practice; therefore, the garden focuses on research, experience, and education. The total space of the terrace is 105 square meters, of which the cultivated area occupies 11 square meters for aromatic herbs, vegetable beds, and fruit trees. There is a small greenhouse to sprout seeds, a compost station for the kitchen scraps from the cafeteria, a rainwater harvesting system, and a water reservoir for irrigation.

The hub has organized Open Garden days since August 2021 weekly. The gardening experts from *İyi Ekim* host a guided tour, discuss urban gardening, and work in the garden together with the guests. They conduct workshops and courses (Image 6.2).

Image 6.2 Photo of *Postane Teras* Garden

While evaluating this urban agriculture space as a good practice, the assessment criteria should consider the priorities of the terrace garden. Suggestions to improve the space are added according to the chapters.

Environmentally, the planning process deemed water harvesting and soil quality a priority. The architect of the building designed the terrace garden with fixed raised beds attached to the walls of the terrace, of which a couple is built with "the wicking bed" method and a few mobile raised beds in the middle. Obtaining a yield is one of the main principles of Permaculture. Even though there is enough space to host many more beds, the *Postane Teras* priority is hosting group events with up to 50 people and avoiding blocking the view from the terrace instead of having a substantial harvest. Only a tiny part of the food prepared in the cafeteria kitchen comes from the terrace garden; however, the hosts did not have any numbers to indicate the percentage. Adding raised beds would be a solution, but even with the soil surface the terrace already has, it is possible to increase the effect of the garden on biodiversity.

The high-quality soil and ideal sun exposure allow any garden to cultivate a substantial amount of vegetables and fruit. Planning with "square foot gardening," combining the right plants and edible flowers to squeeze in most plants possible, going vertical with hoops and trellises, and planting back-to-back never to have an empty slot would increase the effect of this urban agriculture practice. In addition, root plants can be grown efficiently in grow bags. Leaf plants and small fruits can be grown hydroponically in simple towers. The *İyi Ekim* duo manages the compost bin, and it is not open to the use of guests. Allowing guests to bring their food waste or fermented bokashi compost and inspecting it together to learn the common mistakes is a great way to raise awareness of kitchen waste. In addition to the basic seed saving and swapping practice, *Postane Teras* could bring together resources and connections to organize a seed bank.

Socio-culturally, the *Postane* collective could improve the garden's impact in multitudinous ways. The hub invites people interested in gardening through workshops and courses, but the participation remains for the privileged few, and it does not build a community for the neighbors. While the area is highly gentrified, serving mainly tourists, it is only a few streets away from the adjacent Tophane neighborhood. According to the map created by the Istanbul Studies Center, Kent95, Tophane is the only neighborhood left in this gentrifying area with a fair value of housing equal to other poor areas in Istanbul. Directing the educational and organizational activities toward these neighbors can help build a stronger community in this area of sharp divisions.

Moreover, Open Garden days are not a paid event; nevertheless, the participation is accessible only to people from certain classes. The streets around *Postane* are densely built, without any green spaces. Collaborating with people in the service industry working nearby, inviting them to enjoy a green and open space, could positively affect their health.

Economically, the choice of using the terrace as an attraction and a meeting place helps the economic sustainability of the whole *Postane* project, the existence of the terrace garden, and the regular care by the *İyiEkim* duo, thereby empowering women. *Postane*, on its whole, contributes to the local economy, sustaining small farmers around Turkey,

and creates business tool examples combining urban agriculture and practicing food sovereignty outside of the capitalist system, both on a symbolic scale.

Postane Teras Urban Garden has physical, financial, and human resources to improve. The garden uses only 10% of the available space for cultivating, and the *Postane* team can improve the garden by integrating vertical solutions to cultivate more plants that are edible. The *Postane* project received funding from the Bertha Spaces network, and it has built economic tools to sustain itself, such as the cafeteria, the two shops, and rental hosting spaces. Besides paid staff, the terrace garden receives volunteers to take care of the garden (Postane, 2022). *Postane Teras* has taken significant steps since its foundation. Building environmentally while respecting its formerly set physical boundaries and progressing socio-culturally while bending its invisible class boundaries would push the urban garden toward becoming a good practice in urban agriculture.

In conclusion, the garden could have a more significant environmental impact on the city's resilience by integrating more Permaculture and food forest methods and aiming to cultivate more plants. Participating in a seed bank project and opening the compost to guests in a controlled way would improve their environmental and socio-cultural impact. Using the practices of community building and education in an intersectional way could touch people whom -for reasons of class and gender- do not ascribe themselves to agro-ecology. Inviting people actively to go up on the terrace on their breaks while deconstructing class barriers could improve the lives of people working in the area and possibly improve the garden by exchanging expertise and knowledge. Following the criteria set in this thesis, there is room to improve in environmental and socio-cultural areas.

Below is the table of methods selected within the scope of this thesis (Table 6.2).

Environmental – Biodiversity 10,5%	Environmental – Soil Quality 15,5%	Environmental – Water Efficiency 14%	Socio-Cultural 30%	Economic 30%

Permaculture 4%	Vermicompost 3%	Rainwater Harvesting 3%	Education 7%	Business Tools 7%
Food Forest 3%	Bokashi Compost 1,5%	Greywater Harvesting 2%	Health 8%	Empowerment of Women and Immigrants 8%
Seed Bank 3%	Composting Toilet 2%	Bioretention Cells or Swales 1%	Community Building 8%	Local Economy 8%
Insect Hotel 0,5%	Hügelkultur 2%	Keyline Design 2%	Reappropriation of Space 7%	Legislation 7%
	No-Till Farming 2%	Surface Irrigation 1%		
	Sheet Mulching 3%	Drip Irrigation 2%		
	Keyhole Garden 2%	Wicking Bed 2%		
		Hydroponics 1%		

Table 6.2 Methods used by Postane Teras Urban Garden are highlighted

Regarding the highlighted methods used by the Postane Teras Urban Garden, the study reveals the effectiveness of each implementation below in the radar chart (Figure 6.1).

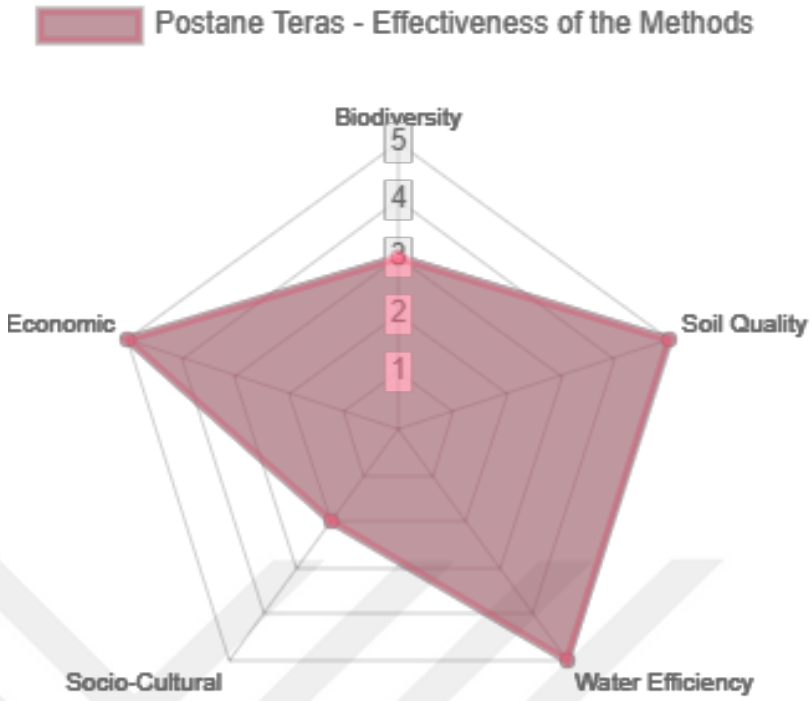

Figure 6.1 Postane Teras Urban Garden Garden effectiveness chart

6.3 Case – Üç Fidan Community Garden

The neighborhood community of Yarımburgaz founded the *Üç Fidan Bostanı* (Three Saplings Urban Garden) in May 2020 after the Covid-19 outbreak. The neighborhood is an old village near the Küçükçekmece Lake on the outskirts of Istanbul. The village was engulfed by the city when the high-rise gated communities were built across the village. Separated by the Turgut Özal Boulevard from the gated communities, the village continues to live in single-level houses with gardens or small apartment buildings. Farmers who sell their produce in local markets cultivate agricultural areas next to the lake (Image 6.3).

Image 6.3 Aerial view of *Üç Fidan* Community Garden

In the early 2010s, with the announcement of the Istanbul Canal project, the residents realized that they would be displaced, and they started to get organized. In 2015 they founded the "Association of Mutual Support and Protecting Yarımburgaz" to meet and resist legally. The same year the association created a children's workshop, "*Altınşehir Çocuk Atölyesi."* The group organizes donations for families in need in the neighborhood and currently supports 15 families from Turkey and Syria. Neighbors who received support in the past take part in giving a hand today by volunteering for others. Other than providing children in need with school supplies and children who have to work with after-work classes, they organize community meetings revolving around children, youth and education. The events vary from museum and theater visits to environmental workshops, dance and self-defense clubs, to movie nights. The women's network, where women meet for mutual support, produces and sells homemade organic dairy products for their empowerment. Finally, "*El Ele Aşevi*" (Hand in Hand Soup Kitchen) was founded by the same community in 2021. They supply the families in need with twice-daily mess tins, and they aim to integrate the produce grown in the urban garden into the soup kitchen menu.

The children's workshop group identified small gardens in Yarımburgaz and Bayramtepe. These gardens would be places where they would sow Non-GMO (avoiding genetically modified organisms) seeds, where the authority would fall under women's leadership, where they would cultivate vegetables with [the Turkish tradition of communal work], *imece,* to distribute the economic benefits equitably". As seen in many cultures, a village or community neighbors would gather to accomplish a task, which would then be repeated for other households or agricultural lands.

Covid-19 outbreak gave way to a wave of solidarity movements in Turkey, similar to the rest of the world. Many groups came together to form solidarity networks (*Dayanışma Ağları*). Solidarity networks of Atakent, Altınşehir, Yarımburgaz, and Bayramtepe, neighborhoods in the same geographical and socio-economic status, connected to cultivate gardens in April 2020, with heirloom seeds and saplings sent from different parts of the world. In spring 2020, 30 family gardens and a community garden with a water pump and a drip-irrigation system were formed. In spring 2022, they prepared the *Üç Fidan* Garden with organic manure and newly exchanged seeds. The community garden continues to gather the residents with their events (Image 6.4).

Image 6.4 Gardeners preparing soil during an event at Üç Fidan Community Garden

The impact of the *Üç Fidan* garden should be considered together with other urban agriculture examples in the neighborhood. The garden works as a place of convergence, connecting other urban gardens and farms in the neighborhood.

Environmentally, the community of the *Üç Fidan* Garden and other gardens in the neighborhood work with a rule of thumb approach. Using non-GMO, heirloom seeds, exchanging them with other gardeners, using manure as compost, and planning drip-irrigation systems are fundamental practices for protecting biodiversity, improving soil quality, and setting up infrastructure for irrigation. Nevertheless, composting consciously, connecting the gardens of the neighborhood with the principles of permaculture, and implementing a systematic approach to these aspects of environmental practices would improve the resilience of the urban garden.

Socio-culturally, the function of the garden is an accomplished good practice. Departing from a place of class struggle, opening space for women's authority actively, empowering immigrants, applying *imece*, the communal work concept in the city, and functioning both independently and in synch with other solidarity groups in the area are fundamental ideas that should be an example for other communities.

Economically, the most significant danger the urban garden faces is the insecurity of displacement. Various solidarity networks are working against the mega-project of the Istanbul Canal. Even though the community uses socio-cultural and economic good practices effectively, overcoming legislative obstacles requires collaborating with groups that are more powerful. TMMOB (The Union of Chambers of Turkish Engineers and Architects) and IstanbulSMD (Association of Independent Architects of Istanbul) are working for the exact cause, bringing together many independent neighborhood associations, which will be impacted by the same or similar mega-projects in Istanbul. The timeline and impact of the Istanbul Canal and other mega-projects can be seen on the map prepared by IstanbulSMD.

In conclusion, *ÜçFidan Bostanı* seems like a small and straightforward vegetable garden. Nevertheless, the applied and planned environmental ideals, the socio-cultural network it belongs to, and the economic pressure to survive while empowering the most fragile community members make the urban garden an exemplary good practice. The community garden and its network of urban gardens preserve biodiversity with Permaculture practices, even though the community does not use the terminology. We see a similar, unintentional pattern for the food forest practice because of the past of the neighborhood as a village. There is a variety of herbs, seasonal vegetables, bushes and fruit trees in the community garden and other neighborhood gardens, creating a drought-resistant edible plant layering. The garden sets a priority on avoiding genetically modified seeds, and exchanging heirloom varieties with other urban gardens. Nevertheless, the uncertainty glooming over the Istanbul Canal area makes it crucial to organize a professional seed bank by the urban agriculture practices covered in the plans of this mega-project. Composting regularly, using raised bed methods, mulching and no-till farming would increase the quality of soil. At the same time, integrating water harvesting and water retention methods would help the resilience of the community garden and its network against drought, and reduce the need for regular irrigation in person. While the neighborhood community works actively on the legislation problem the area is facing, the political climate makes it impossible to foresee the future. Following the criteria set in this thesis, there is room to improve in environmental and economic areas for the *Üç Fidan* Community Garden (Table 6.3).

Environmental – Biodiversity 10,5%	Environmental – Soil Quality 15,5%	Environmental – Water Efficiency 14%	Socio-Cultural 30%	Economic 30%
Permaculture 4%	Vermicompost 3%	Rainwater Harvesting 3%	Education 7%	Business Tools 7%
Food Forest 3%	Bokashi Compost 1,5%	Greywater Harvesting 2%	Health 8%	Empowerment of Women and Immigrants 8%

Seed Bank 3%	Composting Toilet 2%	Bioretention Cells or Swales 1%	Community Building 8%	Local Economy 8%
Insect Hotel 0,5%	Hügelkultur 2%	Keyline Design 2%	Reappropriation of Space 7%	Legislation 7%
	No-Till Farming 2%	Surface Irrigation 1%		
	Sheet Mulching 3%	Drip Irrigation 2%		
	Keyhole Garden 2%	Wicking Bed 2%		
		Hydroponics 1%		

Table 6.3 Methods used by Üç Fidan Garden are highlighted.

Regarding the highlighted methods used by the *Üç Fidan* Community Garden, the study reveals the effectiveness of each implementation below in the radar chart (Figure 6.2).

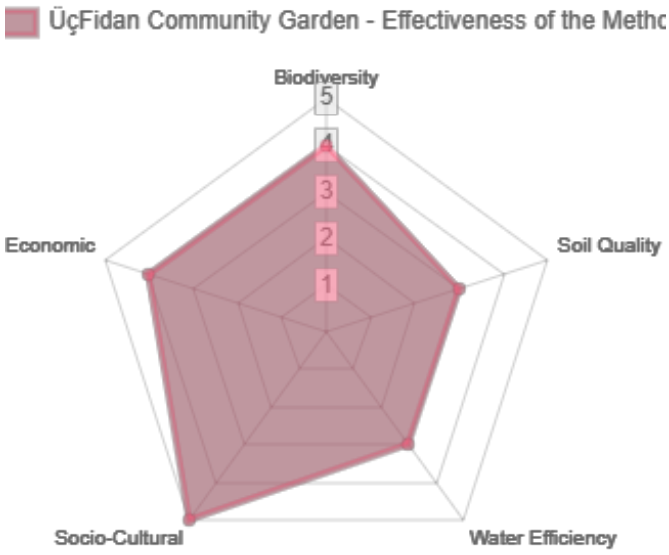

Figure 6.2 Üç Fidan Community Garden effectiveness chart

6.4 Case – Roma Bostan Community Garden

Rome Community Garden was founded in May 2015 to reappropriate one of the few remaining green spaces in the Taksim neighborhood. A community of environmental activists and neighbors gathered around the small urban garden looking over the Bosphorus and the historical peninsula (Image 6.5).

Image 6.5 Aerial view of Roma Bostanı Community Garden

In August 2017, the lawsuit filed by the Beyoğlu Neighborhood Associations resulted in the decision of the court to cancel the Beyoğlu Urban Conservation Plans, which promised the antonym of its name. “The plan was to tear down historical buildings from the last century to build high-rise hotels and reconstruct long-gone mock-ups of Ottoman-era monuments, but bigger and better at the commodification of the space” (Uygur, 2021).

Environmentally, the impact of The Rome Garden on resilience is substantial. The urban garden was designed with Permaculture principles. They aimed to create a self-reliant ecosystem including the garden and the neighborhood in mind. Their first action was to

increase the soil quality. Perennial and edible plants were planted to mimic the multi-layered structure of natural ecosystems. A secondary step was to create a Food Forest. Besides seasonal vegetables and herbs, the garden is hosting 9 fruit tree species and 19 supporting plants on different layers. The sloping topography of the ground and the raised beds situated on the terraced levels create a structure similar to the Keyline design, efficiently using rainwater and decreasing storm run-off (Image 6.6). The raised beds are built with the wicking bed method. The compost bin built on the ground attracts earthworms, composting through vermiculture. The flexible structure of the garden makes it possible to integrate Bokashi composting, bringing fermented kitchen waste and burying it.

Image 6.6 Roma Bostanı Community Garden (Photo: Mehmet Çağniş)

The socio-cultural impact of the Rome Community Garden on urban resilience is considerably high from all four points discussed in this thesis. The garden community organizes workshops on waste education and composting. All events in the garden aim to include the local communities; schools bring students to sow and plant seeds, and adults

learn how to make seed bombs by encapsulating different seeds with mud. During the events, the gardeners introduce the concept of food literacy by teaching healthy eating, choosing seasonal plants, and food preservation methods. The space reserved for greenery in the neighborhood consists of cement-covered parks and lawns covered with grass with no public access. The garden shows other possibilities for green spaces and agroecology by reappropriating this area.

The economic impact of the garden consists of its exemplary legislative battle and the support for local businesses on a minor level. Their legislative battle has been a big success because of the public engagement of the garden. Opting out of business tools seems to be a conscious decision against the commodification of community gardening. Nevertheless, the lack of business tools hinders the efficient use of the garden to grow more food regularly and show the community the possibility of alternative and healthy food sources. While the visitors can gather produce freely, the garden community used more significant harvesting events to connect with other food projects in the neighborhood, such as the Migrant Solidarity Kitchen (*Göçmen Dayanışma Mutfağı*) and Kuçe Food Collective.

In conclusion, Roma Bostanı uses the aforementioned environmental and socio-cultural methods effectively. Permaculture and food forest practices have been consciously planned from the beginning of the garden. We see a similar approach toward seed sovereignty. The garden's landscape is designed for the best use of the natural cycle of rain, and the wicking bed method allows constant irrigation, although methods that are more efficient would increase its resilience against longer periods of drought. Using raised beds, composting, and no-till farming allows for good soil quality. The possibility of bokashi composting increases its environmental effect by decreasing the waste amount if the neighbors appropriately use it. The socio-cultural practices and the battle of the garden for proper legislative protection makes the community garden an exemplary good practice. Notwithstanding a conscious decision, the lack of business tools leaves the garden exposed to periods of abandonment. Implementing a small-scale localized system could benefit both the garden and the community it feeds. Following the criteria set in

this thesis, there is room to improve in environmental and economic areas for the Roma Community Garden (Table 6.4).

Environmental – Biodiversity 10,5%	Environmental – Soil Quality 15,5%	Environmental – Water Efficiency 14%	Socio-Cultural 30%	Economic 30%
Permaculture 4%	Vermicompost 3%	Rainwater Harvesting 3%	Education 7%	Business Tools 7%
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	No-Till Farming 2%	Surface Irrigation 1%		
	Sheet Mulching 3%	Drip Irrigation 2%		
	Keyhole Garden 2%	Wicking Bed 2%		
		Hydroponics 1%		

Table 6.4 Methods used by Roma Bostanı are highlighted

Regarding the highlighted methods used by the Roma Community Garden, the study reveals the effectiveness of each implementation below in the radar chart (Figure 6.3).

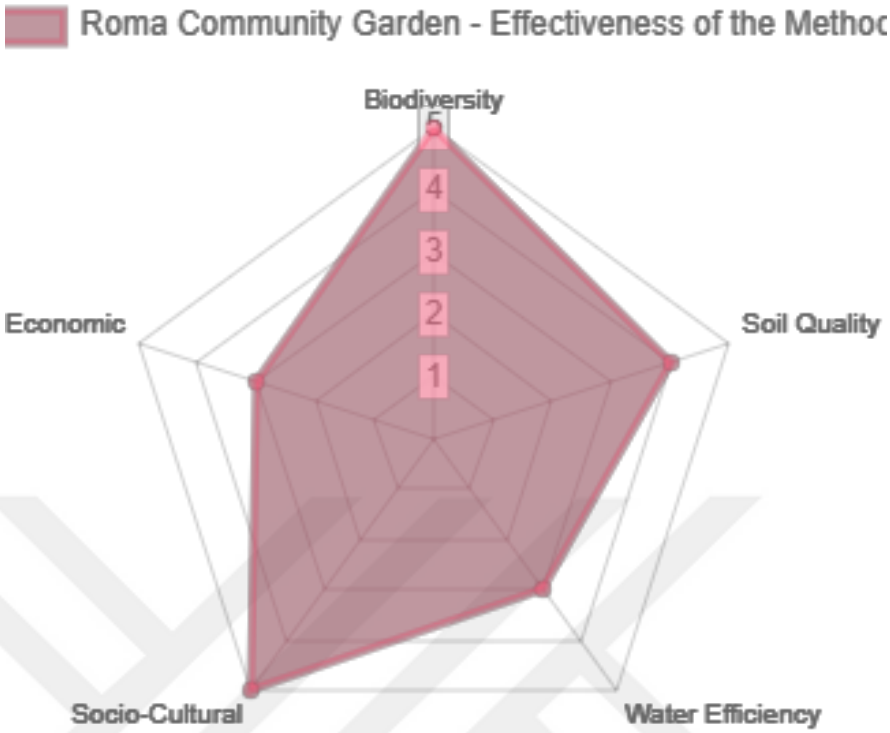

Figure 6.3 Roma Bostanı Community Garden effectiveness chart

7. CONCLUSION

The escalation of the food crisis and the gradual shift in perception toward climate change has brought UA into focus as a resilience strategy for urban areas. With major metropolitan cities introducing urban gardening programs, experts predict, "more cities will push urban agriculture policy initiatives forward" (Stephens & Landau, 2022). Urban agriculture supports food resilience in cities by providing families with an additional source of healthy, low-cost produce. Urban agriculture practices can help decrease food inequality, thus increasing urban resilience (Nicholls et al, 2020). In September 2015, the United Nations released a set of 17 global goals for sustainable development (SDGs) as their 2030 agenda. Adopted by 193 member countries, the focus areas of the goals are poverty reduction, urbanization, health, gender, and environmental protection. While UA cannot substitute rural agriculture for food security or compensate for carbon emissions for climate action, it can be an asset in confronting these issues.

By evaluating environmental, socio-cultural, and economic urban agriculture methods, this thesis aims to determine the impact of each practice, develop a guideline, and establish an assessment tool. The assessment tool is created with a typical five-level Likert scale, with the value assigned to each Likert item simply determined by the researcher based on the qualitative research. The study focuses on practical methods used in particular cases in urban areas from diverse climate regions and socio-economic circumstances. This tool constitutes a model to improve present urban agriculture spaces and establish new cases.

The contribution of urban agriculture practices discussed in this thesis is threefold: These methods increase biodiversity and soil quality in terms of environmental contributions. They help urban gardens prepare for water shortages and decrease the harmful effects of extreme water events in urban areas. They decrease compostable urban waste and the gasses released from poor waste management systems. From the socio-cultural point of view, UA allows citizens to access healthy, fresh, and local food. Citizens are encouraged to build communities around urban gardens. They empower women, immigrants, and refugees in terms of economic contributions.

The thesis aims to deduct an assessment criterion by examining various urban agriculture practices. Several studies in the urban agriculture literature create assessment tools for urban gardening in urban planning.

Creating an assessment tool for good urban agriculture practices is beneficial for designing new urban gardens that would work efficiently from the start. This thesis inspects which methods are critical from environmental, socio-cultural, and economic points of view. The thesis includes several urban agricultural practices from different geographical and socio-economic areas to achieve a broader perspective. The final chapter evaluates the assessment criteria deduced in the thesis through three urban gardening practices.

All three urban gardens have different aspects. *Postane Teras* Urban Garden belongs to a private building that hosts associations for social change. A private initiative working on agro-ecology consultation manages the garden. On the other hand, the space of Roma Community Garden belongs to the city, and a group of feminist ecology activists is managing the garden. Both gardens are situated in neighborhoods of class privilege. *Üç Fidan* Community Garden belongs to a member of a community from a lower social class, which survives through activism and solidarity. All three gardens are constructed on ideals of food sovereignty, people's right to healthy and culturally appropriate food cultivated with ecological and sustainable methods, and their right to define their food and agriculture systems by building social movements and empowering communities, as defined by *Via Campesina*, the International Peasant's Movement. All three of them recognize the importance of environmental practices of biodiversity, soil fertility, water efficiency, and other socio-cultural and economic practices discussed in this thesis. They have varied approaches to the methods listed under these practices in line with their different aspects. The suggestions for each garden are enumerated in their respective chapters.

The significance of this thesis for future studies is manifold. In the current world order, in the context of urban agriculture, urban areas must give space to urban gardening

practices that are sustainable from an environmental, socio-cultural, and economic angle. This thesis develops an assessment criterion as a guidance proposal for founding new urban agriculture practices and for refining existing practices. The assessment method opens up possibilities to benefit both governments of cities to increase their resilience against crises and the urban agriculture practices to benefit from various boosts, such as funding, space, tax deductions, and other resources. This thesis could lead to other research studies, mapping projects, and a doctorate study to advance knowledge in various fields.

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• Ortofficina Urban Vegetable Garden ExSnia, Co-Founder (Rome, 2011-2015)
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