

# CULTIVATING REFUGE: THE ROLE OF URBAN AGRICULTURE AMONGST REFUGEES AND FORCED MIGRANTS IN THE KURDISTAN REGION OF IRAQ

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## ABSTRACT

Refugee camps are born out of chaos and crisis, characterised as short-term responses with little in the way of planning for long-term living. However, it is becoming increasingly apparent that within protracted refugee situations, all too often these camps morph into ‘accidental cities’, where an accelerated everyday urbanism transforms tents into streets lined with self-built homes. Within the camps of northern Iraq, displaced Syrian refugees are finding innovative ways to incorporate urban agriculture and agroforestry into these unintended but now permanent settlements. Largely unsupported and often in conflict with the initial disaster response planning for camps, UA flourishes at a household level, providing access to fresh food, healing spaces from trauma, and creative place-making practices. Using lessons learnt from three years of practical fieldwork developing and supporting UA in camps located in northern Iraq, this paper demonstrates that with or without institutional support home gardens emerge at every stage of camp development as a vital yet little-discussed and even less planned practice. The paper argues that refugee settlements, home to millions worldwide, need to be seen as both urban and permanent, with home gardening and agriculture as a core response at the point of crisis, or risk developing, by default, into unsustainable – slum-like – cities of the future.

*Keywords: refugee camps, home gardens, Iraq, Syria, greening innovation, SuDS, urban agriculture, Kurdistan, agroforestry, ethnobotany*

## 1 INTRODUCTION

Worldwide geopolitical conflicts generate mass movements of internally displaced persons (IDPs), refugees and forced migration. In the context of the Syrian civil war, it has created one of the most complex and expansive humanitarian crises – that has displaced many Syrians across the neighbouring countries of Turkey, Jordan, Lebanon, and the Kurdistan region of Iraq (KRI). The landscape of the KRI, where Syrian refugees find themselves, is mountainous and located in a semi-arid zone with harsh environmental conditions (e.g. mean daily temperature from June to August exceeded 40 °C). Tents used in refugee camps exacerbate this heat: inside temperatures exceed 50 °C, making them uninhabitable. This is often compounded by frequent dust storms in the summer and flash flooding in the winter.

A large proportion of Syrians find their way to the camps in the Dohuk region, such as Domiz, which is the largest in KRI [1]. Some have travelled from the Mesopotamian Region of northeast Syria and find themselves in the upper Mesopotamian plains of the Kurdistan Region of northern Iraq. At the initial opening of Domiz Camp, in 2012, the landscape and area looked like a semi-desert with no signs of life, green spaces or trees. Today, thanks to agroforestry and UA it resembles other Mesopotamian towns, with gardens, parks, and all other necessary urban infrastructure.

Due to long term conflicts becoming more commonplace, it is now accepted that ‘refugees are spending longer periods in exile and increasing attention is now being paid to the rise of

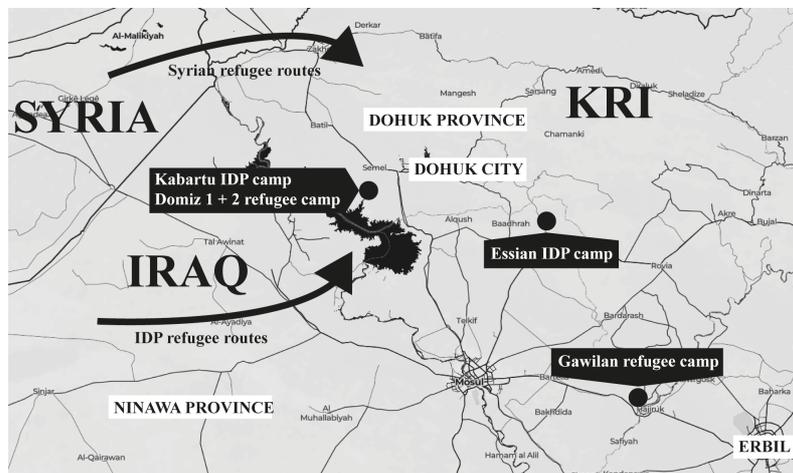
protracted refugee situations” [2]. A protracted refugee situation (PRS) is defined as a displacement for more than five years from the primary displacement where there is little chance of a long-lasting solution. Syrian refugees largely fit into this definition as the 2011 Syrian civil war enters its 8<sup>th</sup> year.

### 1.1 Project overview

Several international NGOs have recognised the importance of developing agriculture and greening in the context of migration and crisis [3]. For example, in 2000 UNHCR and FOA provided 15,000 families in Tanzania with seedlings [4], and in 2005 UNHCR distributed 200,000 seedlings as part of their Greening Camps Programme [5]. More recently, Save the Children alongside the World Food Program helped to develop gardens in Za’atari Camp, home to more than 70,000 Syrian refugees.

Building on such work, this paper will discuss UA project work in KRI from October 2015 to May 2018, focusing on Domiz Camp, together with supporting fieldwork in two additional refugee camps, namely Domiz 2 and Gawilan, all home to a majority of Syrian refugees. Furthermore, in the latter part of 2017 to May 2018, the team facilitated home garden development in three IDP camps, Kabartu 1 and 2 and Essian, with a majority Yazidi population (table 1). While the project developed a wide range of practices, including cultivating home gardens, building greenhouses and creating communal gardens, this paper will focus primarily on the aspects of home gardening and tree planting in Domiz, which is situated approximately 70km from both the Syrian and Turkish borders (fig 1). Opening in late 2012, with more than 34,000 Syrian refugees, it now contains approximately 29,000 residents (2018).

Figure 1: Regional map of Iraq and Syria show refugee and IDP camps.



The project team consisted of four researchers, two of which were based in the UK, one based in Iraq, and one based in the US. The work focused on the practical implementation of UA at a household and a communal level and was funded by a small international NGO, known as Lemon Tree Trust. The project was driven by the desire to advocate for and demonstrate the potential for UA as part of a crisis response as well as within permanent settlement development. Furthermore, an additional objective was the building of a sound

evidence base for UA in refugee camp settings which could then be up-scaled by other larger national and international NGOs.

It was also hoped to alter regional or international discourse and policy around UA or broader ‘Greening Innovation’ practises. The term Greening Innovation was used to encompass everyday spatially innovative practices that “use environmentally friendly, climate-smart technologies and practices to grow food, plant trees, and produce energy, and to convert our waste into resources using productive closed-loop systems that actually build rather than exploit their natural resource base” [6]. Greening Innovation can be linked to concepts of ‘spatial sovereignty’, which emphasise the need to have autonomy over space as a precondition for food security or even food sovereignty [7]. This distinction emphasises that food gardens require both the transforming and occupation of space prior to growing, something that disenfranchised and traumatised newly arrived refugees might struggle to embrace [8] [9].

Table 1: Ethnographic and population data of refugee camps (*source: Board of Relief and Humanitarian Affairs, private communication 2018*)

Camp name	Ethnicity	Population		Date of profile
		N° families	N° individuals	
Domiz 1	Syrian Kurds (Muslim)	5,721	29,100	August 2018
Domiz 2	Syrian Kurds (Muslim)	1,892	8,734	April 2018
Gawilan	Syrian Kurds (Muslim)	1,950	10,200	2018
Essian	Iraqi Kurds (Yazidi)	2,720	14,497	2018
Kabartu 1 & 2	Iraqi Kurds (Yazidi, Muslim)	2,541	13,511	April 2018

## 1.2 UA definitions in the context of forced migration

Within the context of the refugee camp, working definitions of UA may take on divergent and more nuanced definitions than those that focus on materials and productivity such as those offered by Mougeot [10]. For example, Perez-Vazquez notes UA should include not just material benefits but also take account of health, recreation, and relaxation [11], emphasising the non-productive aspects of UA outside of commerce, which can include ecological functions such as biodiversity and micro-climate regulation, and cultural aspects such as leisure, cultural practices, and creative place making [12].

UA in the context of refugees in Iraq therefore includes both vegetables and flowers, as well as creative acts such as sculptures and decorations. However, there is no guarantee that refugees will get a space to garden in despite guidelines that call for such spaces. For example, in 2017 UNHCR issued official planning standards where they suggest ‘A minimum surface area of 45 sqm per person, which includes 15 sqm allocated for household gardening which should be included in the site plan from the outset’ [13]. These standards for spatial provisions for gardening are also recognised within the Sphere Project Guidelines, where there is an endorsement for the provision of ‘limited kitchen gardens for individual households’ [14]. What is important therefore, is the need to support, create and safeguard the use of open productive space to preserve activities that bring resilience so that communities might be better prepared to absorb, recover or prepare for future eventualities. See table 2. This is critically important within the northern area of Iraq where conflict, in the form of Islamic State of Iraq and Syria (ISIS), was ever present.

Table 2: Urban agriculture classification area type within refugee camps

Area types	Comments
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Open spaces	Any safe unused open space
Camp boundaries	Areas immediately inside camp fences
Households	Home gardens from small container gardens to dense agroforestry plots
Green open spaces	Camps parks, roadside tree planting
Community gardens / farms	Community-based approach with social cohesion and welfare objectives
Tree plantations / orchards / woodlots	Community-based approach with linkages to energy and livelihoods
Flood plains	Includes wetlands which can be integrated with UA
Institutional spaces	Areas around offices, administrative spaces, warehouses
Schools	School gardens and farms; can be integrated into citizen science projects
Communal growing areas	Allotment type gardens that are cultivated individually
Peri-camp spaces	Areas immediately after camp fences (often associated with waterlogging) that may also include host community
Open but controlled spaces	Areas allocated for emergency responses such as cholera isolation areas
Temporary spaces	Areas allocated to future infrastructure but currently empty

## 2 PROJECT GOALS

During 2015, the team conducted several months of preliminary fieldwork with four primary goals: (1) Identify existing gardens and gardeners; (2) Recruit a refugee field team; (3) Understand land distribution and availability and; (4) Ensure that potential interventions do not disrupt local refugee development and businesses. Much of the groundwork was achieved through a simplified form of participant observation (PO) where the team would walk, and spend time, in the camp with minimal intervention. Broadly, PO requires the researcher to participate with people in their natural environment, working ‘with’ rather than ‘on’ the local community [15]. Through a process of natural integration in the camp, we were able to identify existing gardens, gain an understanding of regional and cultural gardening practices and gain the confidence of gardeners and families.

Through this trust building process, we were able to recruit future project team members as well as gatekeepers from within the refugee community. One such example was the identification of a small plant nursery, where residents would buy flowers, trees or seeds. It was evident that any distribution of seeds or trees would disrupt this nascent business. We therefore approached the owner, with a proposal for his business to become a UA distribution hub where residents could collect seeds and trees for the development of home gardens. The owner benefitted hugely from the influx of customers evidenced from the growth of his business into a thriving plant nursery. The project benefitted because we gained the trust of the community and because the continued distribution of trees and seeds did not depend on the presence of international team members.

### 2.1 The accidental city and accelerated urbanism

Spatially, Domiz Camp is largely built on a street grid format. However, settlement density is very uneven where some dwellings are crowded together and have no outside spaces, while others have extensive space. The original camp layout grew from tents in rows along streets of varying widths. However, as structures were portable, refugees could move tents or create extensions to a tent within the grids by using empty plots or creating extended family dwellings. By contrast, the dwellings in Gawilan Camp resemble that of rigidly planned housing developments, with almost identical spacing between houses and open space within

the walls. While this presented less opportunity for self-development, the garden spaces are reasonable and most households made use of the outside space with some form of planting.

The right of refugees to modify the dwellings stands in contrast to the camps that are home to internally displaced persons (IDPs), where the residents are forbidden to alter or augment housing plots. On the basic spatial point, we often found that IDP camps had fewer examples of UA (home gardens or allotment style gardens) than in refugee camps such as Domiz. IDPs as a rule stayed within the tent plot they were given, compounded by the fact that there was a greater expectation of them returning. As a result, Domiz Camp has rapidly transformed itself from a tent city in 2015 to a self-built informal settlement with no temporary dwellings by 2018. This process has been fully supported by UNHCR, Peace Winds Japan and the local government, but also driven by refugees themselves where they have the economic resources to build an improved structure.

From first-hand experience in Iraq (mid 2018), the conversation between UNHCR and local government is now centred on full integration of camps with host strategic planning, both structural and social, where there is little expectation of Syrian refugees returning to a post-civil war Syria. Specifically regarding UA, this process has been mapped out by VNG international in Jordan, whose report “Linking Urban Farming and Urban Planning in Times of Crisis” [16] examines the potential for a city region food system in Mafraq, the host town close to Za’atari refugee camps. As refugee camps continue to rapidly integrate with hosts, there are opportunities for innovative planners, architects and designers to contribute and learn from this process in the context of development under crisis (with food at its core) creating necessary feedback to questions that are being asked in the southern global context.

This accelerated or rapid urbanism in Iraqi camps presents both opportunities for UA and also challenges. The tension inherent in transformation is that competition for space will inevitably move away from food production to pressing matters of housing the growing population, largely because the camp itself is no longer in crisis mode. The rapid rate of construction favours market forces where refugees have decided to stay put and find jobs, and where birth rates are high. In this situation, living space is both an expression of income but also at a premium to house the next generation. Living space is finite while food provisions can be externalised to the markets and shops in the camp where fresh food is expensive but readily available.

### 2.1.1 Interviews with refugees

Data was collected in 2017 in the form of interviews and focus groups for a two-week period in January and again for a 10-day period in May 2017. Interviews were limited ( $n = 165$ ) due to time constraints although were representative of families that were deeply involved with the project, 26 of whom could be considered key informants. Interviews were tape recorded and translated into English from either Kurdish or Arabic and then transcribed. This data was reinforced by the door-to-door work of the team where interviews could be made regarding current gardening practices. The data-collection was approached with the goal of compiling both quantitative and qualitative information from refugees living inside Domiz Camp. Data collection was carried out using a mixed methodology composed of four tools: (1) Ground canvassing to assess the current state of urban agriculture and gardening inside Domiz Camp; (2) Qualitative focus-group discussions (FGDs) divided by gender ( $n=2$ ); (3) Key informant interviews with families ( $n=10$ ), refugee participants from the 2017 garden competition ( $n=16$ ); (4) Survey data collected from all 2017 participants concerning what their gardens contained and whether they had gardened previously ( $n=139$ ).

The interviews used open-ended questioning to ask about what gardening means for people, as well as specific questions to determine if people were new gardeners or had a garden back in Syria. We also asked, ‘Is there anything else you would like to say about gardening or agriculture?’ to allow for more open discussion about how people felt about gardening in refugee camps. Key themes that emerged from the interviews were fairly common to the practice of gardening, such as the therapeutic value of gardening, the use of space for health and privacy and community. People also used gardening as a release from frustrations or boredom.

For example, one male respondent (aged 53), states, “Gardens bring peace of mind: old men and women have a place to sit and talk, the war brought us many things and we need to remember and to spend time together talking it over”. A female respondent states, “I live with a lot of pressure here, my daughter is divorced, my husband is sick, I grow my garden and it makes me feel better.” Gardens also provided an outlet for meaningful activity, as many in the camp dealt with a lack of employment opportunities, as one male (aged 34) states, “Jobs are important, but cultivation is too, seeds and trees are better than free vegetables, give us seeds and trees.” Additionally, gardens often provided a reminder of home, “This garden reminds me of my childhood, my land, it also benefits me for food, essentially it connects me to my homeland,” said a female respondent, aged 48. Perhaps most significantly, people spoke of the need to make space and to create something beautiful within the confines of the camp, where the garden becomes a microcosm of the larger potentials. For example, “Gardening is a home thing, a chance to create my own place,” said one male respondent, aged 45. Through these interviews, the team were able to achieve greater empathy with refugees and their aims with their gardening practice. This understanding helped to balance the earlier discussion of definitions of UA, where there is less emphasis on the ‘production functions’ of UA, and encompass some of the more nuanced cultural functions such as recreation, cultural heritage, and place-making.

### 2.1.2 Summary of project outcomes

During the period October 2015 to May 2018, in the Kurdistan Region of Iraq, the following summary of outcomes will focus primarily on Domiz Camp, while also including less intensive fieldwork performed in additional refugee camps, namely Domiz 2 and Gawilan, and three IDP camps, Kabartu 1 and 2 and Essian. While the project developed a wide range of practices, including cultivating home gardens, building greenhouses and creating communal gardens, the outcomes are largely centered on aspects relating to the monitoring, facilitation and support of home gardening and tree planting in Domiz, along with the corresponding environmental and psychosocial impacts of these efforts. While quantitative evaluation of the project was achieved by a more straightforward analysis of the number of trees distributed, planted and the increase in actual garden space, the social impacts were largely evaluated by an analysis of ethnographic interview data, as well as detailed observations of community interactions revolving around new spaces of cultivation.

## 3 HOME GARDENS, TREES AND PLANTS

While a wide range of practices were developed, such as greenhouses and community demonstration gardens, the discussion will focus on the home garden development, as this was a key practice and one that brought the team in day-to-day contact with families. It also necessitated an interaction with the creation of ‘on street’ spaces, together with water management, and tree planting. The creation of gardens that face the street immediately

improve social interaction and can create a cascade within neighbourhoods as adjacent families follow suit. Moreover, potential home garden spaces or spaces around or close to tents are reasonably within peoples' everyday capacity to create, and require less permissions from the camp authority. From experience, larger practices such as communal or market gardens require people to seek permission, raise cash and negotiate with camp or local authorities and are therefore less likely to happen.

The majority of camp residents are Syrian Kurdish and historically Syrians have a deep connection to creating gardens – an attachment that seemed to be especially amplified in the precarious and desolate setting of a refugee camp. This inherent cultural and religious attachment to gardening emerged as a way to exercise some control of immediate surroundings at a time when control over broader events has been taken away, as well as a reflection of traditional belief systems. It was not uncommon while working in the camp, to meet refugees who had managed to bring seeds with them when fleeing Syria or had later managed to return to Syria and sourced seeds during these trips. Local seeds available were generally imported and generic to northern climates, with European brands such as Franchi, dominating.

### 3.1 The invisibility of garden spaces

While home garden space forms part of guidelines for camp design, its implementation is uneven, unenforced and in some cases, non-existent. This is compounded by the lack of spatial data in the form of maps. For example, initially, UNHCR might produce a map to support camp layout, along with intermittent updates as the camp develops. Such maps show significant structures such as large buildings, schools, medical centres, bore wells and roads. However, the scale of such maps does not record the spaces around tents (and later permanent dwellings) that might support household food production. The invisibility of these spaces from official documentation adds to their precarious nature. For example, during surveys in regional camps, it was not uncommon to hear camp management or staff comment that “no one gardens in the camp”, despite gardens being in evidence in the camp.

This invisibility is at both the level of everyday life but also at an institutional level. Regarding the former, households might make a decision to initially have a garden to create a sense of home or for a place to relax, provide shade or for basic food production. Later this garden space will be subsumed as the need for extra rooms for expanding families becomes a priority. The appearance and disappearance of these domestic, fragmented and intimate spaces remains unrecorded. Regarding the latter, camp management may disregard the importance of everyday household food production and gardening as a practice not only because it remains largely invisible, but because they are tasked with providing the larger pieces of infrastructure, and maintaining a flow of goods and services in the camp in relation to UNHCR and NGO funding. Thus, the everyday practice of ‘cultivating refuge’, whereby refugees through spatial innovation create much of the public realm, and street design goes unacknowledged and recorded.

The project work pursued during the period from 2015 to 2018 therefore sought to contribute to the process of building and cultivating already established by refugees rather than to bring in design professionals or impose constraints around aesthetics. The team focused on providing basic tools, seeds, and trees to refugees to supplement and encourage the home gardens already underway or provide a level of advocacy. Despite northern Iraq having a volatile economy, the team found it reasonably easy to access gardening supplies in local agricultural shops. Hand tools were variable in quality but essential given the lack of

resources available to refugees and the poor soil quality within the arid landscape of northern Iraq.

### 3.2 Categories of home gardens

Water features were common because they provided a focal point in the garden and essential cooling in the hot summer. The fountains are often constructed from found materials left over from camp construction such as pipes and tiles and used small pumps to recirculate water. Infrastructure created to support gardening used concrete to a large extent to create beds, water features of sculpted walls with patterns or images. These could be extensive, covering an entire face of a single storey house or garden and incorporated water features or raised beds for flowers or food. Decoratively painted, such homes create a contrasting street scene of differing patterns and development furthering the act of creativity and autonomy in camp place-making.

In all, the team recorded 16 categories of garden spaces, although these are not mutually exclusive as families may incorporate different practices within one space. Also, practice may be dependent on size where some families had extensive space for incorporating different aspects and others responded to spatial constraints by limiting themselves to one category of garden (table 3).

Figure 2: Decorative and productive food garden, Domiz Camp (copyright Mikey Tomkins 2016).



Table 3: 16 categories of home garden types recorded in northern Iraq

Home garden type	Main Characteristics	Main benefits
Trees	Tree planting around dwelling or plot.	Increase shade with <b>kiught</b> weight dwellings, provide shelter from elements, privacy, food, amenity.
Innovation	Imaginative transformation of often limited materials, space and plants.	Creative and therapeutic practice providing a greater sense of home
Biodiversity	Use of local and companion plants to maximise biodiversity without necessarily providing an aesthetic dimension.	Benefits are often <b>external</b> to the dwelling, where such gardens might become educational or aid local biodiversity.

Single planting (e.g Rose)	Exclusive cultivation of a significant plant (e.g. roses or calendula).	Reconnecting with and symbolic of home or cultural practice such as a ceremony or medicinal requirement.
Container	Gardening on hardstanding.	Using containers (often recycled) to grow when no soil bed is available.
Vegetable	Exclusive cultivation of edible plants.	Provide nutrition, bridge food security and food sovereignty issues, potential income.
Ornamental (mixed planting)	Ornamental planting without food.	Creating a leisure space which may remind people of home or create a new sense of place.
Decorative	Decorative garden might contain structures and decorative elements without the use of plants.	Creates amenity space that may have no immediate food output but creates spatial potential in future.
Recycling	Use of found or scavenged materials.	Helps reduce waste in camps and also demonstrates an affordable use of materials where resources are scarce. This is also linked to innovation garden above.
Neighbourhood	Linked gardens between dwellings or tents that provide a visual continuum or shared resource.	Improved public realm, often create feeling of overall design initiative, and help with shared resources and biodiversity if plants.
Limited space	The use of vertical or walled space, incorporated in dwelling structure for example.	Maximise small use of space.
Water feature	Use of fountains or integrated water flows.	Cooling in summer with emphasis on leisure and healing. Potential for recirculation systems such as aquaponics or hydroponics.
Ecological	Use of greywater or recycled matter such as compost.	Contributes to environmental sanitation.
Intensive growing	Planting a high diversity of trees, shrubs, and ground plants within a small area.	Improved resilience through broad range of plants. Potential to act as a local resource site for other households.
Cash crop	Single cultivated crop for home consumption or market place.	Production of crops on large scale barter or cash.
Street garden	Use of sites outside but close to home.	Externalise production when the dwelling does not provide enough space. Provide a public statement to help inspire others.

Some of these categories are self-evident such as trees or a rose garden where gardens feature several trees used for shade or shelter. Roses are particularly prized by Syrians and several households chose to grow a single rose bush, which would be tended and pruned to produce a show of flowers. Beyond the ornamental, the potential economy for rose petals for the production of either rose oil or rose water was felt to be undervalued. Rose oil is a valuable cash crop which is made from rose petals. However, extensive planting, tending, and watering is required to produce the volume of petals for commercial scale production. One solution, which is currently being pursued in Domiz Camp, is to distribute thousands of damask rose bushes at a household level, creating a type of atomised farming within and across camps with centralised harvest and distillation.

### 3.3 Details of home garden categories

These kinds of solutions aim to bridge the divide between household practices and potential livelihood strategies, whereby the everyday tactics of domestic gardening can connect within broader strategic interventions. Tree planting presents another example, whereby single trees planted at a household level for shade or fruit begin to aggregate into wider agroforestry solutions. These have the potential to remediate poor water drainage, improve the overall streetscape and reduce the need for extensive cooling in summer due to the lightweight nature of refugee homes. Neighbourhood gardens are another example of a bridging practice. These are categorised as gardens where families have deliberately created continuous and connected spaces through social cascading. These are sometimes in harmony with neighbours where similar materials and styles are adopted, are more fragmented, where each family has embraced a distinct style and planting system. Where these are on public show, they create a streetscape which immediately transports one out of the confines of the camp environment, and would not look out of place in less impoverished suburban cities.

Figure 3: Left, one metre by five metres garden. Right, concrete container garden (copyright Mikey Tomkins 2016).



Gardening in limited spaces was very common where residents might only have a metre-wide strip or concrete walkway to grow on. Such spaces are closely linked to the categories of innovation and container growing. One such example shows a front garden measuring one metre by five metres (fig 2, left). In this space, the family has used recycled guttering to create a vertical garden to grow onions and garlic. On the floor it grows salad and herb crops, while the front section, decorated by recycled wooden crates, has decorative flowers, shaded on the roof by more flowers and vegetables. Fig 2 right shows a concrete walkway edged with container grown plants and trees which aim to provide decoration and some privacy which is hard to achieve in the camp due to the lightweight nature of the buildings. Also, evident here is the juxtaposition of a wall made from UNHCR branded tarpaulin that creates a curtain with a wall of the neighbouring house, which is built to a higher standard of development.

Food gardening was widely evident but not dominant in camps. Food production ranged from one family that was growing a single garlic crop for cash in a limited space, to micro-allotment gardens of multiple vegetables, or leafy vegetables interspersed with ornamentals. While displaced people suffer from endemic poverty, refugees in particular, who may not be able to work or have bank accounts, food, both fresh and processed, is widely available yet restricted by cost and uneven distribution. Food growing therefore, while it might be critical

to some families, is generally supplementary rather than primary. This was evidenced by the intercropping growing of herbs, salad, or alliums rather than staple crops or long seasonal field crops. Within the category of food gardens, we should also include livestock, which was largely represented by rabbits and chickens but again this is unlikely to be primary and would largely provide occasional meals.

Street gardens describe families who have created garden spaces outside their dwellings and occupied a patch of ground close to home, often with neighbours. These gardens were not evident during the 2015-2016 season but began to emerge from 2017 onwards. This may be indicative of families settling in to camp life and making more long-term investments in gardens. Street gardens are more precarious because camp management can remove them without notice if they conflict with broader strategic planning for infrastructure. One garden the team visited in the category of intensive growing demonstrated the capacity of a small space to contain multiple planting schemes ranging from a canopy, to shrubs, to ground level growing. This small plot measuring five metres by twenty metres, contained 54 species of plants (table 4), including 16 trees, one of which was a banana plant which was quite an innovation for the region.

An important aspect of the project, was the need to work with the community rather than on the community. Some tree planting was already evident in the camp, the work of an early inhabitant of Domiz, Sami Youssef. Sami is a refugee but also a lecturer-researcher at the Faculty of Agriculture at the local Duhok University. His personal initiative sought to encourage other refugees and IDPs to plant fast growing shade trees that can symbolise home and encourage place-making within “ordinary” life, representing a future that many refugees have lost through the war. The main objective was to improve the urban greening urban inside the camp via creating shaded spaces surrounding tents and thus creating a more clement urban microclimate. More than 2,000 fast-growing trees were bought from public nurseries (from University of Duhok and Directory of Agriculture) then distributed inside the Domiz Camp.

Unfortunately, diverse voices were reluctant to encourage the initiative. Refugees and local authorities alike viewed tree planting as a sign of permanence – saying for example that “*the camp is a temporary stage in our life and here is not our home, we will go back to our home in a very short time. Why should we plant trees here...*”. Moreover, the lack of understanding of the functional roles of the trees in urbanised areas has created inertia, partly explained by the limitation of space and water sources inside the camp. The continuation of this project by Sami Youssef, complemented by the implementation of projects discussed in this paper, alongside the French Red Cross and Mercy Hands, has made Domiz a regional forerunner in the use of UA and greening innovation. While Domiz Camp is out of crisis, refugees are also recognising that the Syrian conflict will not be resolved in the near future. Consequently, they are investing in the construction of their home and gardens, planting olives, mulberry, lemon, fig, grapes, and some medicinal plants such as mallow, mint, balm, marshmallow, and rosa, together with flowering ornamental plants such as roses, and jasmines.

Table 4: Home garden with 54 trees, vegetables, herbs, ornamental and wild plants

Trees (n = 16) (common names)	Herb/ vegetable (n=17) (common names)	Ornamental (n=18) (common names)	Wild (n=3) (Latin names)
Grape	Lettuce	Dog rose	Bermuda grass ( <i>Cynodon dactylon</i> )
Mulberry (white)	Basil (purple)	Damask rose	Medick or Burclover ( <i>Medicago sp.</i> )

Mulberry (black)	Basil (green)	Rose sp.	Sow thistle ( <i>Sonchus olearaceus</i> )
Olive	Mint (wild)	Marigold (purple)	
Fig	Mint (cultivated)	Marigold (yellow)	
Banana	Rocket salad	<i>Calendula</i> (yellow)	
Chinaberry and/or Umbrella tree	Garlic	Dawedia	
Prune	Onion	marvel of Peru ( <i>Mirabilis jalapa</i> )	
Apple	Parsley	Lily (white)	
Orange	Green pepper	Lily (red)	
Lemon	Green paper (long)	Lily (yellow)	
Pomegranate	Chili	Sunflower	
Fern	Aubergine	Diantus sp.1	
Palm nut	Cucumber	Diantus sp.2	
Peach	Maize	Honeysuckles ( <i>Lonicera</i> )	
Ornamental tree <sup>1</sup>	Tomato	Ornamental shrub <sup>1</sup>	
	Camomile	Chrysanthemums or Chrysanths	
<sup>1</sup> Unidentified		Ivy	

### 3.4 The role of agroforestry

According to the Food and Agriculture Organization of the United Nations (UNFAO), 1.5 billion people worldwide benefit from trees in a direct or indirect manner [17]. Directly, trees are an important source of food through the supply of nuts and fruits. Indirectly, they supply various materials such as fuel wood, timber, oils, resins, tannins, pigments, latex, fibres, wax, honey, medicine, pesticides, and fodder. Incomes generated can make a significant contribution for households that are food insecure because of low employment opportunities. Despite their various benefits, such as fodder and shade for livestock, trees are not always included when designing interventions in camps that aim to contribute to food security and livelihoods. Trees are often overlooked because they do not provide instant relief when compared with food aid. However, while food aid assists in the short-term it generates dependency and hinders long term host development and solutions. The benefits of planting trees should therefore be considered as a long-term strategy for both the immediate refugee beneficiaries, and the local host communities. The work of Sami Youssef above, clearly demonstrates this. Sami's expertise in understanding the regional plant species means that the correct type of tree is planted. Whatever might happen to Syrian refugees in the future, the host communities can be certain to inherit several thousand trees.

### 3.5 The role of sustainable drainage systems (SuDS)

Further related developments include the implementation of SuDS in Gawilan Camp (figure 1). SuDS is designed to convey water from its source, such as domestic greywater and/or rainfall, through a number of 'devices', which at each stage contributes to control and reduction in flow rates, while improving the water quality through pollution reduction, and in the case of Gawilan Camp, also reducing erosion as surface runoff is reduced. SuDS are important because all homes in camps produce greywater and refugees are allowed to use

this water directly on plants. Conversely, they are not permitted to use greywater once it joins a communal flow in open street drainage channels that sometimes forming large waterlogged areas.

Devices incorporated in SuDS can aid community-based urban agriculture. These include initial filtration stages, with 'oil traps' and 'sand filters', which then feed the flowing wastewater into sub-surface aggregate-filled 'trickle trenches', which continue with levels of treatment, while also irrigating 'tree pits' located along the trenches as off-shoots. At the end of the 'trickle trenches', any remaining water then enters the main 'swale', which conveys the treated water into a retention pond which adds to the aesthetics and biodiversity of the system. The community played an active role in the site design and a Syrian farmer has been recruited to maintain the urban agriculture and amenity component of the project. The example of the development of SuDs in Gawilan Camp is a clear way in which UA concepts can interlink with and influence wider structural developments, creating a mutual discourse that supports both improvement within refugees' everyday lives and institutional responsibilities for long-term development.

### 3.6 The role of wild edible plants

WEP ensure food and livelihood security for countless vulnerable families worldwide. Moreover, wild edible diets reflect the regional identity of local communities, and their traditional ecological knowledge like in the Zagros Region [18]. The majority of refugees in Domiz Camp come from the Mesopotamian Region and they combine their experience in agriculture and cultivation with WEP. Refugees (principally women) have the knowledge to still harvest wild edible plants from the Mesopotamian steppic plains surrounding Domiz Camp. The elders also transmit this remarkable ancestral ethnobotanical knowledge of plant nutrition to the young members.

In this steppic grassland habitat, Sami Youssef has catalogued 40 wild edible plants that are used as sources of foods by Syrian refugees which they add to traditional recipes and dishes. These plant species, which are commonly collected by the refugees, are: *Alcea kurdisca*, *Allium* sp., *Anchusa* sp., *Centaurea* sp., *Crocus* sp., *Eminium spiculatum*, *Echium* sp., *Geranium tuberosum*, *Gundelia tournefortii*, *Malva* sp, *Silybum marianum*, *Sinapis arvensis*, *Tragopogon* sp. In the context of forced displacement, the ethnobotanical practices should be considered as an important issue related to enhancing food security and places of hope and dignity.

## 4 SUMMARY CONCLUSION

Urban agriculture and greening innovation is a powerful force that can help refugees and forced migrants to take control over their lives and local environments. The creation of home garden spaces and UA practices can contribute positively to the architectural process of rapid urbanism in refugee camps, which should be integrated into top-down strategic development. Such integration will be limited if local authorities lack the spatial data and community involvement in preserving smaller fragmented areas that are vital for local domestic and semi-economic UA. Upscaling is also vital, where larger plots suitable for intensive agriculture should be designated for UA and not lost to general development. Moreover, agriculture needs to be considered a vital crisis response strategy throughout the humanitarian and development pipeline, from immediate response to local social cohesion and integration. Building a sound evidence base for UA is vital as we enter a stage of rapid development where professionals and authorities are able to understand how everyday practices and strategic planning shape each other rather than the latter dominating.

Home gardens have also been shown to contribute positively to social and cultural recovery, functioning to preserve memories, knowledge and create sensory interactions vital for trauma recovery within communities. 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 a home and country that many will not return to, as well as their potential future by creating a sense of belonging and dignity to their new community and home in Iraq.

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