Transforming Land, Transforming Lives

Greening Innovation and Urban Agriculture in the Context of Forced Displacement

LEMON TREE TRUST

Contents

Cover image: A green oasis – a small refugee home garden in the middle of Azraq Camp, Jordan.

Long view of Azraq Camp, Jordan. Located in a hot desert environment, Azraq has no electricity, and refugees have to walk long distances for water and food. Despite these limitations, Azraq has space and the potential for large-scale greening innovation and urban agriculture.

FOREWORD

Redefining what's possible: Lemon Tree Trust

There are more refugees in the world today than ever previously recorded. If the displaced were the population of one country, it would be the 24th largest in the world.

In the face of this unprecedented challenge, the world is tasked with finding durable solutions that require common purpose. We need bold and inclusive leadership, deep understanding, and ambitious plans with decisive actions. Change calls for the innovation and nimbleness more typical of lean start-ups. It calls for an approach rooted in a network of talented professionals who believe grassroots movements can change the world.

At Lemon Tree Trust, we believe that urban agriculture – the tangible manifestation of ecology, greening and cultivation – creates new and unrealised value to achieve dignity, empowerment and sovereignty for those living in under-resourced communities, such as refugee camps.

A lemon tree serves not only as something physical to be nurtured, but also functions as a symbol for agricultural solutions for displaced persons – trees and gardens provide beauty, shelter, food and economic security.

At the Lemon Tree Trust, we envision refugee camps where residents are engaged in the design of sustainable and innovative urban agricultural practices while ensuring yields that benefit all.

This report details the vision, mission, strategies and tactics for how we will undertake this greening innovation in refugee camps. We invite you to join us in our effort to assist the globally displaced – one tree, one garden, one life at a time.

Sincerely,

Stephanie Hunt and Mikey Tomkins
Co-Founders, Lemon Tree Trust

In the Dohuk Governorate of the Kurdistan Region, we have 22 formal refugee and IDP camps with a combined population of 229,000 displaced people. A further 356,000 displaced people live in our towns and cities. In Dohuk Governorate, the pressure on our infrastructure and natural resources is immense.

That is why at the Board of Relief and Humanitarian Affairs, we look for innovative solutions to address these problems.

Greening refugee camps and urban agriculture – planting trees, turning wastes to resources, creating livelihoods, protecting the environment – is one innovative example that we strongly endorse.

We welcome the initiative of the Lemon Tree Trust and urge other partners to embrace their visionary approach by making life for the displaced dignified and green for the benefit of all humanity.

Laylan Mohamed Salih
Program Manager of Refugees and IDPs, Board of Relief and Humanitarian Affairs, Dohuk Governorate, Kurdistan Regional Government

Innovative use of vertical space for growing vegetables in Domiz Camp, Iraq.

Summary

Greening innovation and urban agriculture

- Today, over 60 million people are living under forced displacement conditions. In the face of this unprecedented challenge, we need bold, inclusive leadership, deep understanding, ambitious plans and decisive action to find sustainable solutions. Greening innovation and urban agriculture can be a key part of this.
- Greening innovation makes landscapes and living spaces ecologically resilient and sustainable. It uses environmentally friendly, climate-smart technologies and practices to grow food, plant trees, produce energy, and convert waste into resources using productive closed-loop systems that build rather than exploit their natural resources base.
- Urban agriculture – the growing of plants and raising of animals in and around cities and settlements – should be integrated into urban ecosystems, with food sovereignty as the goal.
- Together, greening innovation and urban agriculture can bring dignity, empowerment and food sovereignty to refugee communities. Simple technologies and waste recovery make these techniques cost effective and adaptable. Both should be central to designing, implementing and sustaining both refugee camps and overcrowded urban areas.
- This report examines current and potential use of greening innovation and urban agriculture in refugee camps, cities and rural settlements in four countries. Together, these examples demonstrate how the scaling up of greening innovation and urban agriculture could transform twenty-first century thinking around refugees with regard to food security, landscape ecology and waste recycling.

Practical examples

- **Iraq:** In Domiz Camp, by supporting home gardens, seed, tree and tool distribution, and running a garden competition, we are demonstrating how refugees use home gardening to create ownership of their immediate space, and how these gardens can make a vital contribution to food security. Infrastructure such as greenhouses or plant nurseries should be integrated in camp planning, as should strategies for resource recovery and reuse of wastewater and organic solid wastes.
- **United States:** In Dallas, work with resettled refugees shows how urban agriculture can be a vital part of sustainable growth, helping to eradicate local food deserts and developing livelihoods in under-resourced communities. Mapping has been used to identify unused land suitable for growing food.
- **Uganda:** The example of Nakivale Refugee Settlement demonstrates how growing food in refugee settlements is part of the solution to food insecurity, contributing to city and regional food systems and enhancing farming systems in host communities. In Nakivale, projects range from home gardening to the development of lakeside buffer zones using agroecology to protect natural water resources.
- **Jordan:** In Za'atari Refugee Camp, we will create community gardens, introducing compost production, polytunnels, rabbit production, and hydroponics. In Azraq Camp, resource recovery and reuse will transform both organic solid and liquid waste into valuable resources, and we will also support food production in home and market gardens.

Mainstreaming greening innovation and urban agriculture

- Greening innovation and urban agriculture can bring enormous benefits to refugees and host communities, as well as to those with a duty of care.
- Existing guidelines, frameworks and research papers on integrating innovative natural resource-based sustainable livelihoods into refugee camp planning and design are seldom applied.
- Camps can no longer be planned around the unsustainable linear model of inputted resources and discharged waste.
- Significant change is needed before greening innovation and urban agriculture are adopted more widely as part of the solution to the forced displacement crisis. However even where the permanence of refugee camps has not been conceded, the closing-the-loop model can still be developed and greening innovation and small-scale food production can still be supported.

Walking around Azraq Camp, occasional gardens like these punctuate the otherwise endless sandy landscape.

Definitions

GREENING INNOVATION

is change; a breathing, growing, living process that makes our landscapes and living spaces ecologically resilient and sustainable. It uses environmentally friendly, climate-smart technologies and practices to grow food, plant trees, produce energy, and to convert our wastes into resources using productive closed-loop systems that actually build rather than exploit their natural resources base. It also learns from the local experience, respecting the everyday inventive responses of people and communities, and their original contributions to greening.

URBAN AGRICULTURE

is the growing of plants and the raising of animals within and around cities and other settlements. Its most striking feature is how the practice is integrated into the urban economy and fabric itself and thus embedded in – and interacting with – the urban ecosystem. In the context of forced displacement, urban agriculture (UA) has a clear role to play from the earliest stages of a crisis, through refugee camp and crisis-city settings, to resettlement or returnees, but whatever the case, facilitating the transition from food insecurity, to food security, then food sovereignty is always the goal.

FORCED DISPLACEMENT

refers to the situations of people who leave or flee their homes due to conflict, violence, persecution or human rights violations. Globally, there are now almost 20 million refugees and 40 million internally displaced persons (IDPs) – and most are hosted in developing countries. Many of these refugees and IDPs don't have access to land, property, housing, livelihoods, urban services and accountable and responsive governance. In this report we use the term 'refugees' synonymously with IDPs.

"My motivation for starting gardening here is that it's living within me, moving in my blood. Wherever I go, I don't feel comfortable until I plant something and take care of it."

A gardener stands in a large garden in Za'atari Refugee Camp, Jordan. This garden, which grows everyday vegetables and herbs, is a collective space, open to all neighbours.

Introduction

Lemon trees in Domiz Camp, Iraq, ready for distribution to households.

"I dream that I will be able to go back to my country but while I am living here I want to improve my situation, especially by growing plants because plants are alive for everybody."

By the time they reach the safety of a refugee camp, or find a new home in a city, most refugees have already suffered enormously. But for many, this is only the start, as they try to rebuild their lives in cramped shelters, often in harsh, unforgiving environments, with poor sanitation, poor quality food and few opportunities to earn a living.

The reality is that one-third of refugees – over 20 million people – live in protracted refugee situations in 30 countries. These situations present some of today's most compelling humanitarian challenges as refugees find themselves in long-lasting, intractable states of limbo for years on end. With restricted movement or confinement in camps, refugees often cannot build livelihoods or achieve self-reliance. The struggle to fulfil basic needs – food, shelter, education, health care – take a deep toll. Refugees deserve better.

At the Lemon Tree Trust, we consider greening innovation and urban agriculture to be key to making refugee camps healthier, greener and more productive. Rather than viewing camps only as spaces that confine and control, we believe they can become spaces of hope and reconstitution. From years of working with refugees across the world, we know that camp greening and supporting refugees to produce food works. Even in crisis, refugees often improve their homes and livelihoods through gardening or agriculture, from home gardens and composting to keeping rabbits or chickens.

At the moment, greening innovation and urban agriculture are often the work of individuals, unsupported by UN agencies, NGOs and government bodies, or, at worst, are discouraged and eradicated because they contradict water use or land planning policies.

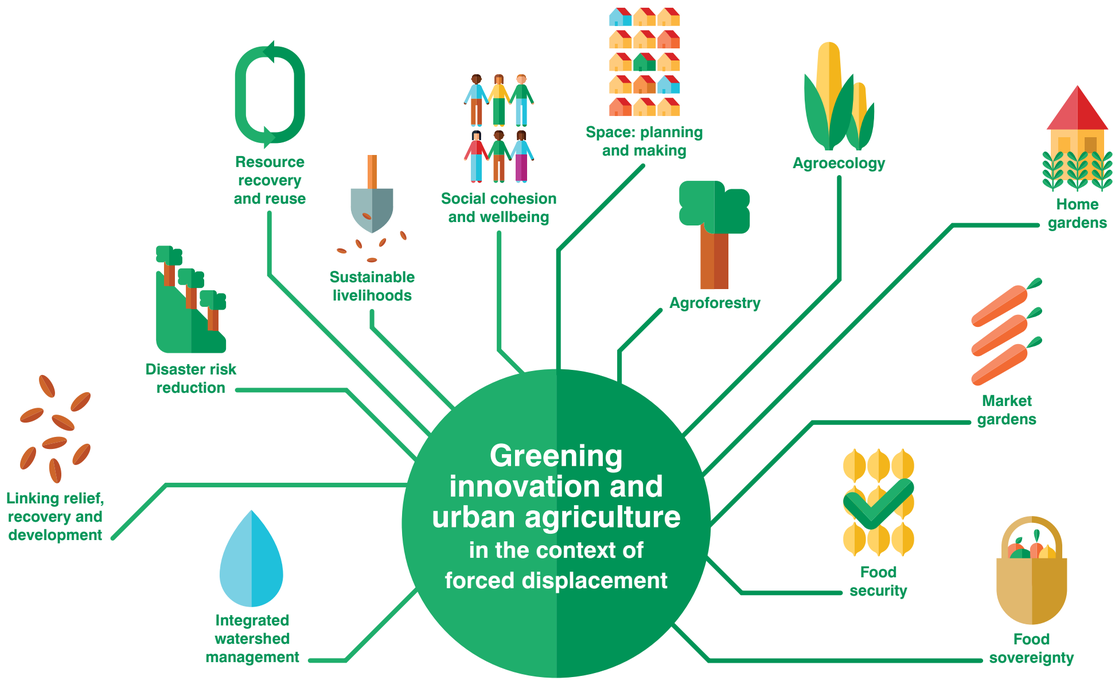
We must aim higher: greening innovation and urban agriculture should be central to designing, implementing and sustaining the accidental city that is the refugee camp or tomorrow's overcrowded urban areas.

Simple technology and waste recovery make greening innovation and urban agriculture cost effective and easily adapted to different settings, meaning they are key to a sustainable response to the refugee crisis. And on a human level, they represent much of what's important in all our lives: an attractive, clean environment; fresh, nutritious food; the chance to become self-reliant; and a place we can call home.

This 'call to arms' illustrates clearly the steps needed to make the scaling up of greening innovation and urban agriculture a reality, as we aim to transform twenty-first century thinking around refugees with regard to food security, landscape ecology and waste recycling. We also give an insight into the lives of some of those who are making these accidental cities their home, so they can tell their stories and share their dreams of transforming the world around them. We hope we can do them justice. Every day, refugees use ingenuity, creativity and determination to rebuild their lives and define their futures. We want to be part of this – we hope that you will too.

Greening innovation explained

Over these two pages, we will look at some of the concepts, institutions, processes and practices which make up greening innovation, many of which we are piloting in our projects in Iraq, the US and Uganda.



Concepts behind greening innovation

Integrated watershed management covers a defined area within which water flows to a common point. Refugee camps can have both positive and negative effects on the watershed so need an integrated approach which tackles water-related issues and reduces flooding risks, while conserving groundwater and protecting the watershed from wastewater.

Linking relief, recovery and development (LRRD) builds stronger links between emergency relief and longer-term development. In the refugee context, LRRD looks beyond food security towards food sovereignty, ensuring that refugees have greater political engagement in food, land, seed and water issues.

Disaster risk reduction (DRR) is a planning and policy tool to address vulnerability while building capacity and resilience to natural and human-induced disasters. Greening innovation and UA can be used for zoning fragile areas like steep slopes and flood plains next to refugee camps, while contributing to food security and environmental protection and sanitation.

Resource recovery and reuse (RRR) is the change from seeing waste as a linear problem that needs disposal, to recognising it as a valuable resource that can produce energy or fertilisers, thus closing the nutrient loop. Closing the loop benefits farmers, generates income, creates sustainable livelihoods, and contributes to food security and environmental sanitation.

Sustainable livelihoods in the greening innovation and UA context occur when growers have the technical capacity, access to land and farm inputs, and social resources to make a living from growing food. This becomes sustainable when it has a degree of resilience, and can cope with, and recover from, stresses and shocks, and maintain or enhance its systems without undermining its natural resources.

Social cohesion and wellbeing exists when all members of a society work together to eradicate exclusion and marginalisation and create a sense of community and belonging, building trust and offering creative, productive and sustainable livelihood opportunities for all. By bringing together refugees, IDPs and host communities, UA promotes social inclusion.

Space – planning and making: following a crisis, camp infrastructure (shelters, water and sanitation facilities, health centres, schools, roads) is implemented for immediate protection. This does not take into account refugees' own innovative place-making processes. Greening innovation and UA integrate these everyday practices with conventional top-down planning.

Processes and practices in greening innovation

Agroforestry is the integration of trees or shrubs with crops or pasturelands to create more resilient farming systems, while increasing biodiversity and improving soil and water conservation. In refugee camps, trees are aesthetically pleasing but also provide construction materials, energy, foodstuffs, timber, and protection (as shade or windbreaks).

Agroecology builds sustainable agro-ecosystems based on ecological and socio-economic perspectives that encompass the whole food system. In both refugee camps and urban settings, it allows IDPs, refugees and host communities to grow food using safe organic methods.

Home gardens – or backyard or kitchen gardens – are small plots of land close to homes, and are traditionally used to grow herbs, fruits, and vegetables for home consumption. They are frequently characterised by use of vertical spaces, high biodiversity and use of domestic wastewater for irrigation and organic kitchen waste for compost.

Market gardens are small-scale food production enterprises intensively managed to produce herbs, ornamental flowers, fruits and vegetables from small urban and peri-urban plots ranging from a half to five acres. Market gardens produce for local markets and often use a high degree of organic inputs to maintain soil fertility and structure, thus conserving soil moisture and irrigation water.

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences. Greening innovation and UA contribute to food security through improved access to fresh foodstuffs, income generation and increased food supply for local markets.

Food sovereignty in a refugee camp recognises food as a basic human right rather than as a commodity for distribution to dependent refugees. This requires the reforming of 'food relief', for example by integrating food provision within city region food systems that allow refugees to grow food while protecting the natural resource base.

Urban agriculture explained

Here, we outline some of the key components of urban agriculture, and explain why these are ideally suited to helping to develop sustainable livelihoods in refugee camps.

Domiz Camp, Iraq

Economies

Beyond family food provision, UA can create economies through, for example, selling crops direct, and developing the supporting industries of processing food to add value, or supplying compost, seeds and tools. All of this begins to create a viable food production chain. These activities also add to the employment or entrepreneurial opportunities available. Within refugee settings, UA practices have a local customer base, so culturally appropriate food can be grown. Market gardens in housing areas are close to customers and local markets, meaning that home carers can be economically active, selling produce or growing vegetables.

Domiz Camp, Iraq

Small livestock

There are numerous examples of refugees raising small livestock like chickens, rabbits, goats, sheep and pigeons. Eating mainly waste material, these birds and animals are excellent feed-to-meat converters. Rabbits in particular take up small domestic spaces, like courtyards and the under-space of raised prefabricated housing units. They don't need extensive infrastructure, breed easily, and grow quickly. Larger spaces can be used for goats or sheep, building resilience through diversity.

Domiz Camp, Iraq

Vegetables

Vegetable growing is the mainstay of UA. Any small patch of earth or container can become a food-producing space. Simple inputs like seeds and compost bins can accelerate the adoption of food gardening to complement food aid. Food production also aids home making and creates a sense of dignity through autonomy, allowing refugees to draw on their existing knowledge and life stories. As vegetables start to grow, refugees transform themselves from passive recipients of aid to active producers of food and agents of landscape change.

Nakivale Refugee Settlement, Uganda

Field crops

Within refugee camps there are often large areas suitable for field-scale growing. With water an issue, choice of site is critical: next to run-off greywater, or close to standpipes, is ideal. Field crops draw on traditional knowledge and can employ large numbers of people. Urban agriculture can add intensity through intercropping, giving farmers greater resilience if one crop fails. Crops should also be planned in and around dwellings to reduce transportation requirements and enable farmers to use domestic waste streams.

Domiz Camp, Iraq

Trees

Trees can transform urban areas from bleak desolate spaces into productive microclimates offering respite from urban sprawl. While the combined effect of trees can reduce the urban heat island effect, even planting single trees in a home garden, allotment plot or hedgerow brings additional benefits to the food and timber they produce. Trees also provide modified microclimates, a reduction in stagnant surface waters, soil and slope stabilisation, nitrogen fixation, livestock fodder production, and an increase in biodiversity that benefits wider urban ecosystems.

Gawilan Camp, Iraq

Greenhouses

Using greenhouses means urban farmers can extend the growing season, increasing production through a second or third harvest, and allowing a competitive edge as a grower can bring their first harvest to market and gain an economic advantage while crop prices are still high early in the season. Greenhouses can also be integrated with aquaculture or hydroponics (or a combination known as aquaponics). In all cases, greenhouses provide growers with a way to control a closed-space microclimate, enhancing plant growth and food production.

Water

In this section, we will explore how water, soil, seeds and space are crucial to developing sustainable livelihoods and look at how, through greening innovation and UA, these can become central to the lives of refugees living in difficult circumstances.

In Domiz Camp, one gardener used greywater to such an extent that no wastewater streams ever left her plot. She planted extensive sunflowers outside her dwelling, so her plot was kept clean and dry, and as a result her garden had fantastic sunflowers and luscious vegetables. The garden won third prize in the Lemon Tree Trust's Domiz Camp Garden Competition.

Greywater flowing in Domiz Camp, Iraq. Concrete drainage channels are built but where these end, wastewater pools. These pools are typical of wasted resources which greening innovation seeks to capture as inputs for food and trees.

Water is the essence of life, and a vital, life-sustaining component of any humanitarian response, whether in a refugee camp, a settlement or an urban area.

According to an internationally agreed minimum, every refugee must be provided with 20 litres of water each day. In practice this figure is much higher and is likely to reach a few hundred litres per day per family, particularly in hotter climates.

However, despite the clear water supply guidelines, refugee camp planners constantly underestimate the amount of wastewater a camp produces once it is fully populated and receiving its daily supply of potable water. This supply leads to very high volumes of wastewater being produced from relatively small surface areas due to very high population densities, and results in the overload of wastewater on surrounding fragile eco-systems. During heavy rains, camps can quickly become quagmires, adding to the dire environmental conditions. For example, it is not uncommon to see children playing in wastewater streams. Refugee camps do not yet use the principles of sustainable urban drainage systems (SuDS), which offer safer, more appropriate solutions to the drainage issues found in many rapidly expanding refugee camps.

However, the continuous availability of wastewater in refugee camps is itself a golden opportunity if an RRR approach is applied. The safe use of wastewater can maximise the greening infrastructure of refugee camps by using greywater to irrigate crops and trees in nurseries, agroforestry (windbreaks/shelter belts/orchards), home gardens and market gardens. Agroforestry can also be used in the design of DRR by using vegetation to control flood waters and stabilise fragile slopes. Greywater is domestic wastewater that has not been contaminated with faecal matter. If water becomes contaminated or is mixed with human waste then it is known as blackwater, and requires treatment, depending on its intended use. Even blackwater, or faecal sludge, can play a role in a well-designed and implemented RRR project, for example for the irrigation of (non-edible) fuel-wood trees or in the production of energy briquettes or pellets, respectively. Applying an integrated watershed management (IWM) approach to refugee camp management would not only save lives through flood prevention, but also ensure surface and groundwater is conserved within a watershed but also protected and sustainably managed.

Greywater can safely be used by households to water trees or home gardens. The amount that an average family produces per day is enough to supply a home garden, particularly if washing and bathing water is diverted for this purpose. The Lemon Tree Trust is advocating these techniques in Domiz Camp in Iraq.

Soil

In urban areas the availability of good agricultural soil should never be a prerequisite for starting a UA project. In fact, lack of fertile soil should rather serve as motivation to put in place RRR techniques to produce compost from organic urban wastes.

This same principle can be applied to refugee camps and settlements, with the tonnes of solid organic waste produced each day diverted into compost production, thus harvesting valuable nutrients. Compost also contributes to soil's physical structure, increasing its water holding capacity and conservation. In refugee camps, RRR strategies are ideal as the basis of a 'greening the camp' programme. Organic solid waste is decomposed to create compost, which is used as a growing medium for tree nurseries, transplanting of tree seedlings, home gardens and market gardens, for example. You can never apply too much compost so projects should aim for full organic waste recovery from the flow of solid organic waste.

In Azraq Camp in Jordan, for example, this would also reduce the landfill tariffs that are to be introduced by the local authorities. The added advantage is that wet organic waste is the heaviest component in domestic solid waste, and so implementing simple organic waste composting plants would substantially reduce the total weight of solid waste sent to landfill. A simple composting plant requires a low investment and uses simple technologies. In such a programme organic waste separation occurs at the household level, allowing collection teams to collect waste and deliver it to the plant. The plant consists of a roofed compost production area where waste can be sorted, shredded and formed into windrows for decomposition, before quality checking and, if required, bagging into sealed plastic sacks for transportation or even selling to outside markets.

At the Lemon Tree Trust we see soil as the foundation for any greening innovation and UA; moreover, we see the production of compost through RRR as the most appropriate model for refugee camps and urban areas in general. By creating livelihoods and generating income from what is traditionally perceived as waste, these greening innovations benefit both refugee and host communities, contributing to social cohesion.

Small scale compost production in Za'atari Refugee Camp, Jordan.

In 2010, during the Israeli blockade on the Gaza Strip, the International Committee of the Red Cross operated a cash-for-work composting programme, supporting over 1,500 unemployed people with 10,000 dependants. Beneficiaries were paid to bring donkey carts of organic farm wastes to a composting plant, where it was composted, sorted and bagged for local markets. This compensated for fertiliser shortages caused by the blockade. In conflict areas, fertilisers are often restricted as they can be used to make explosives, so composting programmes should always be supported as an ecological alternative to inorganic fertilisers.

In Za'atari Refugee Camp, Jordan, a disused WASH block has been turned into a walled community garden by NGO ACTED.

Seeds

If soil is the critical layer on which food gardening rests, then seeds are the building blocks from which it emerges. Specifically, the use of local or saved seeds offers affordable, appropriate and local crops for farmers.

This builds in greater food sovereignty for growers, outside of the commercial seed market, while also reducing their costs. It also embeds knowledge at a community level, and helps to create independence. At the Lemon Tree Trust we argue that seeds, as part of a food sovereignty approach, should be seen as an essential part of food aid and offered to all who seek them. This builds a stronger link between food security and the transition to food sovereignty.

During 2015-2016 we distributed thousands of seeds to refugees in Domiz Camp using a network of refugee-supported assistance. These were then used at the household level to turn often barren areas of land around individual shelters into vibrant, productive home gardens. Such practices on their own do not have a major impact on food security, but they help develop the idea that with a small amount of appropriate support, refugees can regain their dignity and create their own solutions that benefit themselves and their communities.

Regardless of the plot size, growing food, such as these onions outside Diyar's tent, brings normality, itself a form of social and horticultural therapy.

In even in the bleakest environments, refugees use what little space they have to nurture plants. Diyar, a young Yazidi boy, lives in the sprawling Khanke IDP camp in north Iraq. He showed us his brother's well-kept onion patch, right beside the family tent, protected by a string fence.

In other cases, families use seeds they rescued as they fled their homes. Some buy coriander or sunflower seeds from spice stalls and plant those. Once families have access to seeds, many start seed saving and distribution, creating the basis of a vital, sustainable, local food sovereignty network.

Planting vegetable seeds, Domiz Camp, Iraq. As seeds were not readily available in the camp, we initiated a seed distribution network. However, local seed saving is the preferred option and should be encouraged.

Space

Food growing requires space, yet in the accidental city of the refugee camp, planned top down as an emergency response, vital infrastructure – water, roads, power – takes precedence. These large-scale technical and planning strategies are rightly dealt with as priorities, around which dwellings are placed.

However, this means that residents often feel excluded or inhibited in using space beyond their dwellings, stifling the potential use of space to meet family needs, food or otherwise. In Domiz Camp, residents sometimes move their tent to be near family or friends, meaning that they themselves creating meaningful spatial arrangements. By contrast, in Azraq Camp, dwellings are cemented to the ground and aligned in identical rows, meaning that residents cannot 'make their own city'. Gardening and food growing, even if it is only one tree, provide a duty of care for refugees within the camp landscape, a place where top-down planning can mingle with everyday needs and aesthetics.

Greening innovation enables us to focus on this often neglected area of research and practice. For example, understanding the impulse to plant and grow plants comes firstly from a desire to beautify and create meaningful landscapes, and secondly to benefit from eating fresh produce. A stewardship approach to refugee camps and settlements means empowering refugees through 'spatial sovereignty' as a crucial part of food sovereignty. This approach would build multiple linkages like the composting of domestic organic waste for soil production and the recycling of greywater for irrigating crops, thus lifting a responsibility from camp management and in the process empowering refugees themselves.

An understanding of greening innovation, UA and place making applies within all the spatial settings where displaced people live. While we have often highlighted the isolated refugee camp in this report as one example, this understanding also applies to peri-urban refugee camps, urban refugees, integrated refugee/host community camps and returnees. Within our Dallas work, we aim to help resettled refugees, developing UA amongst the apartment blocks, empty lots, and green spaces of the city's refugee population (see pages 32-37).

We asked refugees in Domiz Camp to tell us what greenery, growing plants and having space to garden means to them. They talked about what makes them want to create a home garden, and imagined how greening innovation and UA could transform the camp. In the next column, you can read some of their ideas.

Why did you decide to make a garden at your home?
"Beautiful scenery for the eye and heart." "For the enjoyment of living." "It's spectacular and comfortable – and an old habit." "Beautiful smells and soothing for the nerves." "It's calming and reassuring."

What are the main benefits of having a home garden?
"Saving money by growing vegetables and citrus fruits." "Growing vegetables so we eat better." "Teaching children to plant and care for vegetables." "Putting empty areas to good use."

How do you think the camp environment could be improved?
"Setting up parks." "Planting along main roads and alongside shops and markets." "Providing areas for gardens." "Distributing as many trees and roses as possible all around the camp." "Running an awareness campaign on the importance of plants in our lives."

A young girl watering one of the winning home gardens in the Lemon Tree Trust's garden competition in Domiz Camp, Iraq. Families take great pride in such spaces, providing beauty, food, and a space to relax in.

"In our sector, we only have a small space around our plot but even if it is just a small garden, I will come out of my house and feel fresh and happy to start my day."

Jeena and Aveen at the refugee garden competition award ceremony and exhibition.

Voices from Domiz Camp, Iraq

The stories below show how the issues of water, soil, seeds and space impact on refugees' everyday lives, and touch on some of the creative ways many try to find solutions and transform the world around them. All of those featured below live in Domiz Camp; all have had to leave behind their homes in Syria to seek refuge here.

As they try to build new lives, greening innovation and UA can make an enormous difference. These stories highlight the importance of many simple but crucial things we take for granted. From the water that sustains us all, to soil and seeds to grow food and feed our family, and a space to call our own, these things are fundamental to life.

'Greenery and growing vegetables represents life'

"My name is Jeena and I lived in Damascus. There were a great deal of bombs and a lot of shooting in our area. We were really afraid so we ran away. By bus we went from Damascus to Al Qamishli and then came to Domiz in February 2012. We lived with my husband's brother for four months, until we got our own tent and plot. We had a large garden back home, and so when the Lemon Tree Trust came here and started the project, distributing trees and the idea of the garden project, I wanted to help. Being involved has helped me feel good.

"People would like to see trees in the roads as they walk along. It will help change the look of the camp. It will make us feel like we live in a beautiful area and not something like a desert. There are many empty yards in between shelters, and lots of people say they would prefer these messy areas to be changed into gardens so we could rest in them.

"People want trees and flowers; vegetables are less important. Flowers give you a different view for the house and space. People are so interested and if they are given tools and plants they will volunteer. They will also take care of the gardens after they have been made. On a larger scale, and with help, people would grow vegetables. We would like to share a greenhouse and the space to help all families involved.

"We felt scared in Syria. And now, here, we still feel scared because of Daesh attacking. So we don't feel stable and we hope that the war will end and we can go home. But, since we are here, I would like to develop the camp like a city, with proper facilities for the families here."

Jeena, Domiz Camp

Jeena and Aveen at home sorting vegetable and flower seeds ready for door-to-door distribution.

"The greenery is changing the way I feel for the better. So I would like to show people by example that they should start planting, so life will be green."

Aveen talking to a group of school children about local plants in Domiz Camp, Iraq. Aveen, alongside Jeena, works as a pathway facilitator, calling door to door around the camp to raise awareness of camp greening and food growing.

'A dream come true'

"My name is Aveen, and I come from a village outside Damascus. The Assad regime entered our village; there were many people they wanted and some were my relatives. Some of them were killed. We were afraid for our lives and decided to leave. We went by bus from Damascus to Al Qamishli and walked until we crossed the border to Iraq. We arrived in November 2012. We came to Domiz, and there was nothing, no water, no sewage, no facilities, only tents. I live here with my family: my husband and my three children. My husband was working in oil. He joined the Peshmerga army a year ago, to fight Daesh in Iraq.

"My father worked in a nursery and in the fields and he was very happy, so I get this interest in green things from him. In our house in Damascus we had a small garden with olives and vegetables. As I've stayed here for a long time, I want to help people to plant things, because it looks like we live in a desert. The other thing that encouraged me to plant is when I found you walking between the houses asking people if they were interested in planting lemon trees. This seemed like a dream come true! So I caught you and brought you to my small garden. And when you saw my small garden you were excited. This support helped me to feel confident.

"This project to plant trees, flower and vegetables gives people so much support and encouragement. Before you came here, there were only a few families planting gardens. But now, with the garden competition, and the lemon tree gifts, people are thinking: 'Why don't I make my garden better? Plant more flowers? Tidy up and enter the competition, make myself proud and make the space around the house much nicer?' Your work is encouraging many, many families to do greening in and around their homes. Also, many people are asking to be volunteers for the Lemon Tree Trust. If you can get trees, they will plant these in roads, paths and empty spaces.

"Many people are saying they want a nursery to help create communal and community gardens for households to work together. Vegetables are not as important as flowers in this sense to create something beautiful.

"If I have the chance, I will go back to Syria, back to my village. But if the situation doesn't improve, I would prefer to stay here. I don't want to go to Europe. I will improve things here, wait for the war to end – then I can go back home."

Aveen, Domiz Camp

Aveen calling door to door to talk to families about the benefits of home gardens.

Aveen in a refugee garden.

"The greening has helped people feel happy, to see greenery near their home – they love it."

Sayed outside his nursery. He sells a variety of seeds, plants, and vegetables, as well as providing a hub for distributing lemon trees and seeds for our project.

'Greening brings positive feelings, nothing negative'

"We were living in Syria where I worked as a construction contractor. Because of security problems, there was less work in 2011 – all the government contracts stopped. I decided to leave because of the violence, and brought my whole family.

"In the beginning I worked out of the camp here, doing tiling, but after Daesh started fighting in Iraq, that work stopped. I decided to create work for myself inside the camp. I chose to run a nursery as this doesn't require a large amount of capital to start up. But it was difficult to promote the business. Then when the Lemon Tree Trust came with the project for planting trees and vegetables and improving gardening opportunities, you helped me to promote my business. People came here to collect seeds and plants and this has really helped me.

"Greening helps sick people to get better. And people here would like more agriculture. The Lemon Tree Trust's garden competition has encouraged people to plant. Once people heard about it, lots more – maybe two or three times as many – came to ask for plants. Many hesitate though, because of lack of space, but also because of the economic situation. People are cutting back a lot, and a reduced income makes people think twice. Or they decide they need the money for food.

"So, first of all, if there is a chance to get plants cheaper, this will really help people to plant. Secondly, we need job opportunities. Thirdly, if we have larger plots we could build greenhouses and encourage people to grow their own food, or something that's useful for them.

"As for the future, the big problem is limited land to plant. I can't employ more people because my plot is small. So to develop the project we need bigger land or spaces, and to make bigger greenhouses. We need to create more productive spaces so that people can get food from their own labour. People will grow vegetables if there is an income for them from it."

Sayed, Domiz Camp

Sayed outside his small greenhouse, built with Lemon Tree Trust funds.

Basil seedlings ready for sale.

"My motivation for starting gardening here is that it's living within me, moving in my blood. Wherever I go, I don't feel comfortable until I plant something and take care of it."

Adnan stands with his son in his home garden. In the garden, activities include small livestock rearing (rabbit and pigeons), vegetable growing, a greenhouse nursery. Adnan also practises seed saving. Due to its diversity, aesthetics and use of recycled materials, this garden won first prize in our refugee garden competition.

'Planting gives hope'

"I came from Al Qamishli, in northern Syria. I came here to be secure and to feed my family. By September 2012 the situation in Syria was too bad, it was unsafe and we couldn't stay there any more. I have three daughters of marrying age and I was worried about them being kidnapped or held hostage – bad things happen. I have one son, and I was worried he would be forced into the military. So I took all my family: we walked to the border of Iraq and then to the refugee camp. Before, I was working as a painter and decorator and nurseryman for people from the Gulf who owned a big villa, so I have practical skills and gardening skills. Now, I am jobless.

"I am Volunteer Mayor for one section of the camp. Since I became a mayor, I've been trying to improve people's understanding of greening and food growing – kids especially.

"I dream that I will be able to go back to my country but while I am living here I want to improve my situation, especially by growing plants because plants are alive for everybody. If you find green things you will have positive feelings… if it is desert you have negative feelings. So if Domiz Camp is greener it will be a positive life even if it is temporary.

"My idea is if we set up a greenhouse we will create jobs for a lot of people. If it is shared between many people it will produce food for many of the families here. Also, planting gives hope to the people who live here. As you take care of a small baby that grows up between your arms, planting gives you hope for life but also produces food. A successful project would be a greenhouse for home use and to sell the food. If there is a piece of land we can make a greenhouse on it: there is much empty space in the camp we can use."

Adnan, Domiz Camp

Adnan holds coriander seeds, harvested from his small vegetable garden.

"I found you walking between the houses asking people if they were interested in planting lemon trees. This seemed like a dream come true! So I caught you and brought you to my small garden. And when you saw my small garden you were excited. This support helped me feel confident."

Adnan and Akram stand in an empty plot in Domiz Camp, Iraq, which will become a new communal garden. In partnership with camp management and the Red Cross, we have employed Adnan's skills at home gardening and construction to provide the refugee lead in the design of this new green space.

Moving on from stories of individual lives, we will now focus in greater detail on how the Lemon Tree Trust is demonstrating best practice in greening innovation and UA in our pilot projects in Iraq, the US, and Uganda, and then look at how we hope to develop similar projects in refugee camps in Jordan.

Domiz Camp, Iraq: greening innovation in practice

Domiz Camp is situated in the north of the Kurdistan Region of Iraq, between Mosul and Dohuk. It was opened in 2012 to accommodate approximately 29,800 Syrian refugees. In 2015 it was home to 40,167 refugees.[1]

The Lemon Tree Trust was invited to work in Domiz by the camp manager, who was particularly open to ideas around tree planting, gardening, agriculture, and landscape improvement through greening. Also encouraging was the fact that many refugees had planted home gardens, sometimes hidden away in small courtyards, other times spilling over into public spaces. There was also a nascent plant and seed nursery along the main camp high street, alongside the many market stalls and shops. Overall there was an acceptance that the camp was a city in the making, an evolving urban entity that would be home to thousands of refugees for much of their lives.

Our approach here was a street-by-street familiarisation with people and their environment. If a garden was visible from the street, we would ask permission from its owners to visit, and they would then in turn lead us to other residents or friends' gardens. What emerged was a quiet and gentle practice of home gardening with food and ornamental flowers. Refugees described this as coming from a desire "to beautify the house", or to create "beautiful scenery for the camp". In refugees' hands, home gardening becomes a decisive tool to create ownership of their immediate space. As one refugee said, camp management should "allow families to contribute to the environment in planting the gardens".

Using what we have learned from existing refugee practices, we set about encouraging and developing gardening from the ground up, rather an imposing a master plan. For example, although there was limited access to seeds, trees and tools in the camp, we worked through an already established small nursery, providing capital to expand the range of trees, seeds, and seedlings it provided. In exchange, the owner distributed seeds and trees to households, and acted as a focal point for our greening and UA project. From our previous door-to-door research we also recruited two women as 'pathway facilitators' to distribute seeds and encourage home gardening.

This engagement within residents' everyday life at a household level was complemented by a more strategic approach at the level of camp management, involving other NGOs. This involved drawing on the mainstream humanitarian sectors already set up, such as the water, sanitation and hygiene (WASH) programme run by the French Red Cross.

[1] Domiz 1 Camp Profile December 2015. Available at http://data.unhcr.org/syrianrefugees/region.php?id=63&country=1032

Domiz Camp, Iraq: urban agriculture in practice

The lemon tree became a symbol for our movement because it has particular importance for Syrians. Lemon trees are not just a food item but create a sense of remembrance for the home gardens that many refugees have lost through the war, and represent the hope that they may one day return home. Because of their importance, we distributed hundreds of lemon trees to households throughout the camp to raise awareness about the benefits of gardening.

These trees became a visible symbol of home and place making. We were supported by a refugee from Damascus, Dr Sami Youssef PhD, who had handed out over 2,000 trees here, independent of any institutional support. Our combined efforts, while making some impact on the camp skyline, really serve to show that these accidental urban spaces need tens of thousands – if not millions – of trees to make a significant impact and bring the full benefits that could be gleaned from greening a refugee camp.

The home gardens support we provided in Domiz Camp focused on seed and seedling distribution. Seedlings – ornamental flowers, and vegetables such as spinach, cucumber, peppers, and salad leaves – were raised in two greenhouses designed and built by two families with a small grant from the Lemon Tree Trust. These greenhouses demonstrate that a camp the size of Domiz (1.143km^2)[2] could support as many as 24 small greenhouses dedicated to seedling and plant production.

The conclusion of this project was a 'Best Refugee Garden" competition in April 2016. We spent several months advertising the competition door to door, offering three main cash prizes, which grew to 22 cash prizes in different categories for the most outstanding examples of home gardens. These prizes highlighted, for example, the best use of greywater, tree planting, recycled material, or limited space, all of which sit at the core of greening innovation and UA. We gave very few guidelines, leaving families themselves to create their own spaces. The outcome was a myriad of garden spaces that were implicitly innovative. The final awards event, shown on Kurdish TV and attended by camp and government officials, validated the efforts of refugee families, giving them respect within their own communities (see pages 30-31 for more about the garden competition).

At the Lemon Tree Trust we argue that home gardens, for those that want them, should be seen as a vital contribution to food security. Having seen the benefits, even early on after an emergency, we are developing a 'garden in a box' approach to disaster response. This would provide the basics for a garden during the initial response stage – tools, seeds, water can – and local gardening, soil and climate information. Following on from this, other infrastructure such as greenhouses or plant nurseries should be integrated in the camp master plan, as should strategies that integrate organic liquid and solid wastes through RRR. In other words, seeing UA not as an afterthought or retro fit, but embedded as a core strategy, alongside shelter, energy, food and water, sanitation and hygiene.

[2] 1,142,500 m^2 – Domiz 1 Camp Profile December 2015, p2. Available at http://data.unhcr.org/syrianrefugees/region.php?id=63&country=103

"People encouraged themselves and their neighbours – they were excited when they saw their neighbours' gardens and it encouraged them to garden too."

Planting lemon trees in Domiz Camp. We distributed several hundred lemon trees to households in the camp in 2015. The distribution helped spread the word about our home garden competition and open offers of seeds and plants.

Domiz Camp, Iraq: Garden competitions as an assessment tool

In any refugee camp, if you look long enough, you will inevitably find some form of food growing. By necessity, refugees are innovative and productive, and will often find their own solutions to improve their food security, and growing food is one such strategy. Refugees also bring invaluable knowledge and experience covering agriculture, aquaculture, horticulture and livestock.

Some even bring their own seed stocks, contributing to seed security during times of conflict and devastation. Assessing the 'gardening capacity' of a camp and its residents can be an immensely useful resource when designing and planning a greening innovation project.

Running a gardening competition can quickly identify the level of expertise, potential demonstration sites, and trainers and future pathway leaders. It also helps create public awareness about the benefits of gardening and the role that refugees can have in improving their immediate environments through greening innovation.

This shows that you can grow food, plant flowers, and create a beautiful and innovative garden within even the smallest of spaces.

"Before you came here, there were only a few families planting gardens. But now, with the competition, and the lemon tree gifts, people are thinking: 'Why don't I make my garden better? Plant more flowers? Tidy up and enter the competition, make myself proud and make the space around the house much nicer?' Your work is encouraging many, many families to do greening in and around their homes."

"The garden competition makes people feel excited. They go to the nursery and buy flowers, and are looking forward to winning."

This family won best container garden for their use of recycled pots to grow a huge variety of plants on a concrete walkway outside their home.

Dallas, USA: greening innovation and urban agriculture in the city

An example of several acres of empty space, suitable for commercial scale UA, at the heart of Vickery Meadow.

Example of a typical small home garden planted by refugees in an apartment block, Vickery Meadow.

In the unused alleys and vacant lots that dot the asphalt-laden urban landscape of Dallas, Texas, a quiet revolution is growing. Small-scale urban farming has begun to emerge as a vital part of sustainable growth in the city, bringing with it answers concerning how to eradicate local food deserts while also providing a much-needed solution to develop the economic livelihoods of Dallas' under-resourced communities.

Since 1975, Dallas has resettled more than half a million refugees from all corners of the globe, many of whom now call Texas home. In recent years, refugees from Burma, Nepal, Bhutan, Iraq, Afghanistan, Syria, Sudan, Ethiopia, Eritrea and Somalia have all come to Dallas in the hopes of finding a life that will allow them to live in peace and, most importantly, dignity. It is within these communities that Dallas has seen some of the most creative and innovative uses of space to pursue urban agriculture. Vertical walls of micro peppers and long beans thrive in the Texas sun while balcony gardens full of bright tomatoes and emerald-hued basil bring light to the otherwise decaying apartment blocks. Meanwhile, Lagos spinach from Somalia grows side by side with Goa beans from Burma, serving as a poignant reminder of just how far these gardeners have come, and how they are all connected to each other through a mutual love of growing, preparing and eating their own food.

Recognising the talent and entrepreneurial spirit encompassed in these small spaces is one of the key missions of Citizen D, a non-profit enterprise aimed at encouraging community development from a grassroots level. Citizen D, the sister project of the Lemon Tree Trust, works to support those who have emerged as visionaries and community leaders in under-resourced neighbourhoods. By providing seed funding or physical space to grow food, Citizen D empowers economic sustainability through farming. Creating jobs that provide a living wage through food production benefits not only farmers themselves, but the wider Dallas community as well. In local farmers markets, the customers tend to be as diverse as the produce for sale. Many are newly arrived refugees who speak with each other in their native tongues – Nepali, Burmese, Arabic – all excited to find crops familiar from their home countries, while others are lifelong Dallas residents, eager to try something new. In this sense, urban agriculture in Dallas has become a way to bridge a gap, to bring people together and create a sense of shared community which, at the most basic level, is what ultimately creates the fabric of a liveable city.

A Bhutanese gardener tends his plot at Ridgecrest Garden in Dallas.

Dallas, USA: urban agriculture for resettled refugees

© Joanna Pinneo

Bhutanese gardeners in Dallas show their harvest of chili peppers and chayote squash.

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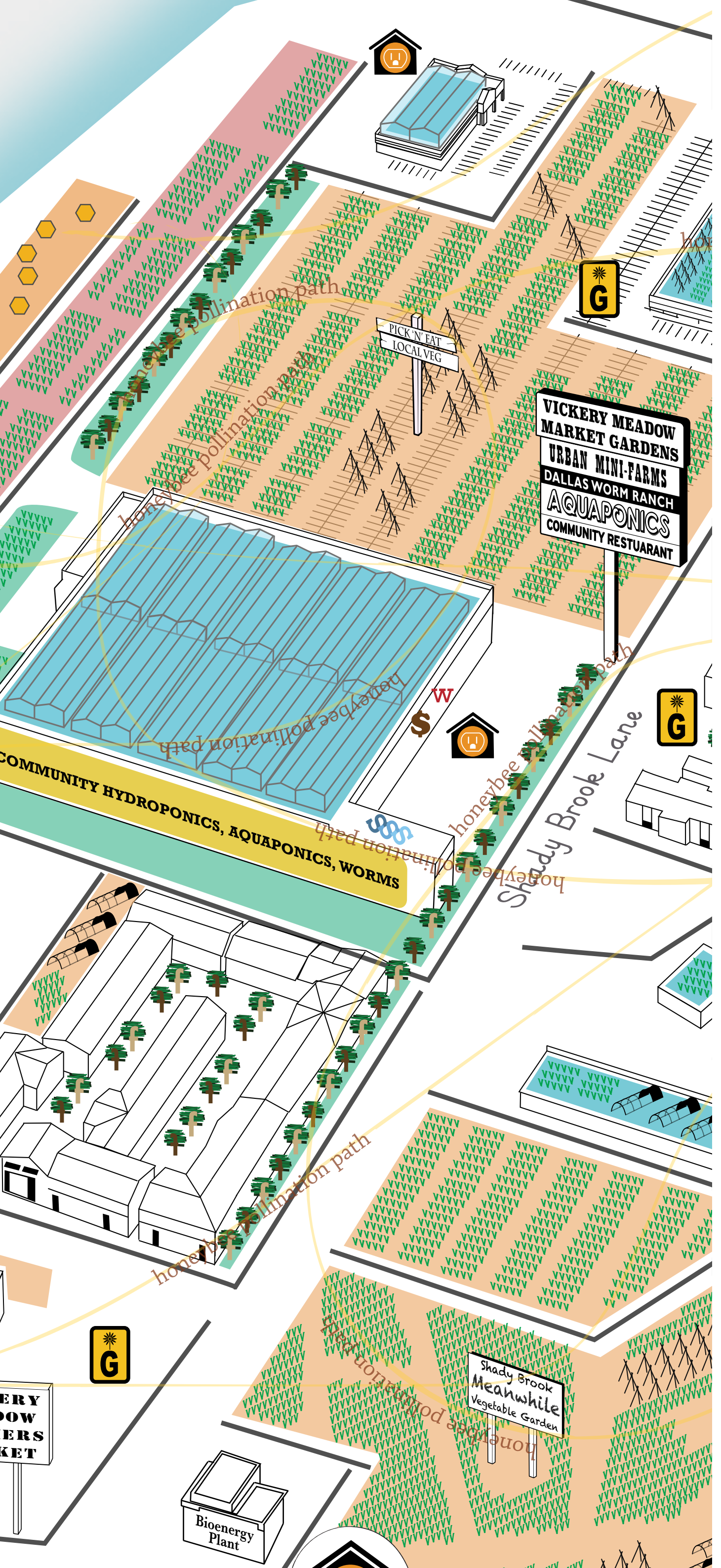


Dallas, USA: Key barriers to urban agriculture

When Citizen D, the Lemon Tree Trust's sister organisation, first began to undertake urban agriculture projects in Dallas in 2014, one of the key obstacles we found was a lack of accessible spatial data that could help us locate suitable land for growing food. In response, we began to map the city by looking for vacant lots, open green space, rooftops, and disused indoor space.

We began this process in Vickery Meadow, an under-resourced neighbourhood in central Dallas, which is home to a significant proportion of the city's resettled refugee population. Our challenge was clear: we needed to create a map that identified all of the space not being used in the community. By looking at the unused space, a powerful picture emerged of just how much viable land exists hidden in plain sight. When added together, these unused spaces account for hundreds of acres of land, which are suitable for growing food. Our next task was to activate this spatial data in a practical way.

Our work in Dallas continues to expand by incorporating additional layers into our mapping efforts including neighbourhood demographics and land ownership. This additional information has allowed for a more in-depth analysis of where urban agriculture will be most beneficial to the community.

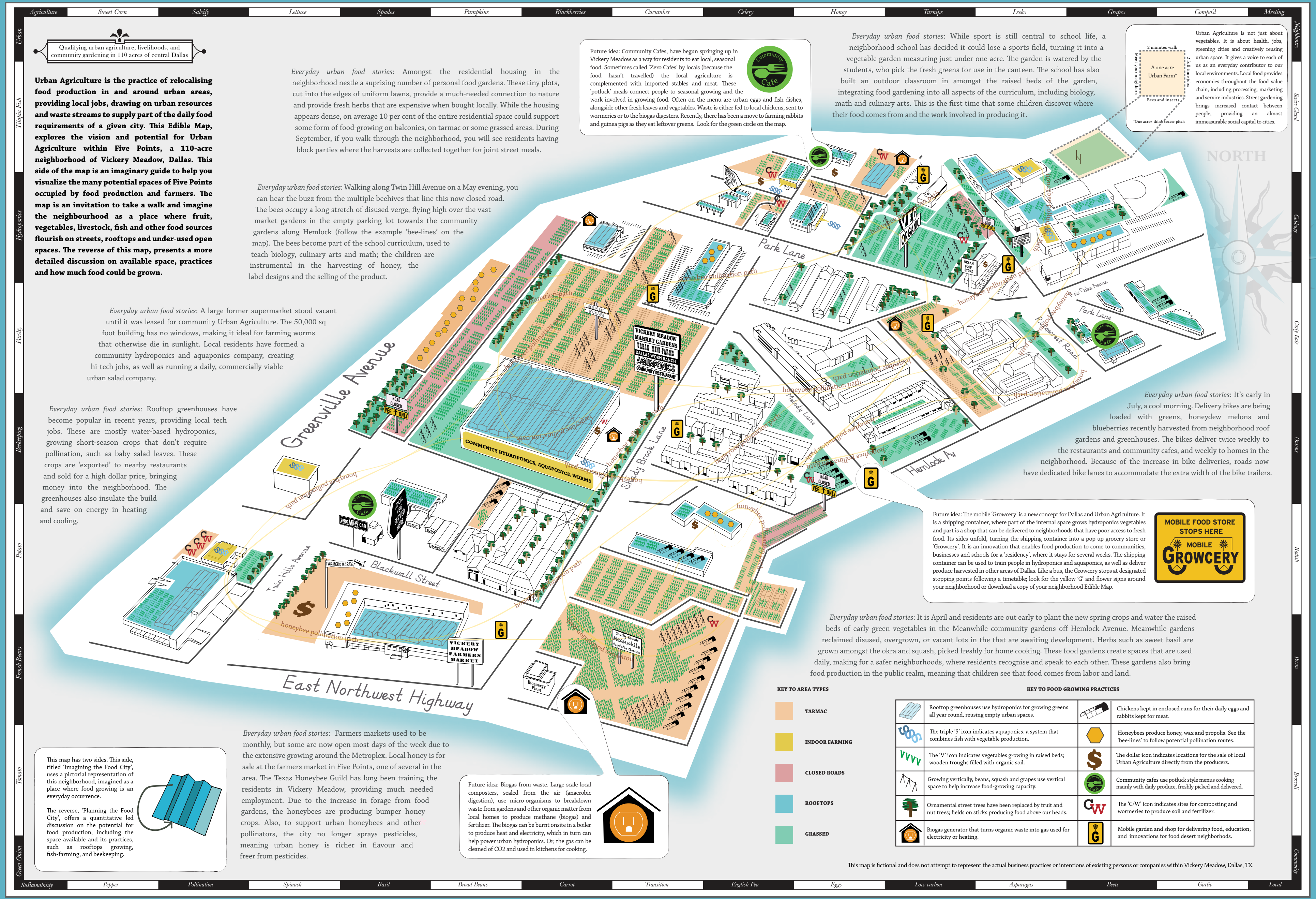
We are also working to translate the benefits of urban agriculture into economic terms that spell growth and development for the city. The benefits of urban agriculture have been widely reported in major urban centres across the world, including promoting community development, creating employment opportunities and increasing access to healthy, local food. Bringing Dallas into this emerging market has been essential to our mission of advancing human development in urban centres.

Through our work in the Middle East, we have learned the inherent difficulties involved in maintaining spatial maps that are both productive and current. Refugee camps by nature are rapidly evolving spaces. The constant movement of people and reimagining of space create a unique challenge to those trying to create meaningful infrastructure. In this way, we see a direct correlation between our work in camps and our work in urban centres such as Dallas. In neighbourhoods where space is limited and demographics continually shift, it is vital that infrastructure and strategic resources are planned with primary food production in mind so that, within the accidental city of the refugee, urban agriculture is not itself an accident but a deliberate and strategic practice aiming at recovery and development.

Close up section of the edible map (right) of Vickery Meadow, Dallas. The large upper area represents the acres of empty space shown in the photograph on page 32.

This map illustrates all the potential space available to green and grow food in the centre of Vickery Meadow, Dallas. It includes suggested practices, such as vegetable gardens, beekeeping, and rooftop gardens.

IMAGINING THE FOOD CITY: A VISION FOR URBAN AGRICULTURE IN FIVE POINTS DALLAS



Nakivale Refugee Settlement, Uganda: building livelihoods in a rural environment

Nakivale was founded in 1958 and is one of the oldest and largest refugee settlements in Uganda. It is made up of 79 villages, each with about 800-1,000 inhabitants, and the whole settlement measures around 185 km².[3]

Over the decades Nakivale has welcomed many influxes of refugees, and in February 2016 was home to 104,463 people.[4] Around half are from the Democratic Republic of the Congo, with many others from Somalia, Rwanda, or Burundi. Many young people have grown up here and are unlikely to return to their homeland in the near future.

In Uganda, growing food in refugee settlements has been adopted as part of the solution to food insecurity. It also helps to develop and enhance farming systems in host communities, and this is critical in building social cohesion. Despite these clear benefits, very few governments have developed policies promoting food production in refugee camps: the Ugandan government is an important exception.

Nakivale provides a practical demonstration of the importance of growing food in refugee camps and shows how this can contribute to city and regional food systems. The Ugandan government, supported by UN agencies and international and local NGOs, runs projects which support refugees to earn a living so that they can build a sustainable livelihood. Crucially, refugees have the legal right to work both inside and outside Nakivale. In rural refugee settlements like this, each household receives a piece of land on which to build a shelter and grow food. Other sustainable livelihoods that enhance food security, such as food processing and handicrafts, are also supported.

Despite challenges such as depending on seasonal rainfall for irrigation, and limited extension services to help farmers to increase the amount they can produce, refugee camp food production still adds value to local and regional food systems, and even contributes to food security in the distant capital Kampala by providing staple crops.

In Nakivale, the Lemon Tree Trust is developing projects to increase greening innovation and sustainable food production. One priority is organic waste composting, which will assist with waste disposal and also provide a sustainable source of compost for home gardens. Through pilot projects, we will also demonstrate that intensive home gardening should be integrated into village planning. Another priority is helping farmers develop the capacity to grow more food than they need for their own family's subsistence, and show them how to generate income and profit from agroecology and agroforestry. Small-scale aquaculture – the use of fish ponds – is another exciting possibility, as this could provide food and profit at both communal and commercial levels. Protecting the lake next to the refugee settlements from silting up and becoming contaminated is important, and so the Lemon Tree Trust will help to develop agroecology-based systems to improve designated green buffer zones around the lake (see page 44 for more on Uganda).

A family's vegetable plot sits beside their shelter in rural Uganda. In many cases the plots are worked before the shelters are constructed, so important is food production. These small plots provide a variety of greens to supplement food aid.

[3] Nakivale Factsheet 2014. Available at http://data.unhcr.org/drc/download.php?id=1048

[4] UNHCR – Uganda – Monthly Refugee Statistics Update (February 2016). Available at data.unhcr.org/burundi/download.php?id=546

A community gardener stands in a well-maintained walled garden in Za'atari. As the camp evolves, these spaces are formed from otherwise derelict infrastructure, in this case a communal washing facility. We spent some time in the camp with the help of ACTED, mapping disused infrastructure, and found many such examples. Retrofitting them as garden spaces would remove blight from the camp. Ideally, such spaces would be planned into the initial designs for refugee camps, to include access to waste resources such as waste bore well water and compost facilities.

A community gardener in Za'atari.

Za'atari Refugee Camp, Jordan: greening an accidental city

In Za'atari Refugee Camp in Jordan, the international NGO ACTED has developed a walled community garden in the converted shell of a former sanitation block. This block once housed sanitation facilities but with these now removed, it provides an ideal micro-environment for growing food within the dense confines of the camp.

Each of the 13 families taking part in the project has been allocated a small plot of three by three metres, and given a compost bin so they can make their own compost at home. Inside the walled garden a large recycled water storage reservoir has been converted into a compost container to safely produce more compost. Manure tea – liquid fertiliser – is also being brewed with livestock manure in a hessian sack left to soak in a barrel of water. The crops being grown include tomatoes, aubergines, spinach, aromatic herbs, chickpeas, and ornamental flowers.

Despite the success of this community garden there have been some teething problems which, with improved planning and a degree of capacity building, can be resolved for future gardens. For example, to avoid the cultural problem of men and women gardening together, a future garden may be allocated to women only. There are high costs involved in turning previous sanitation facilities into gardens as the concrete floors have been removed, but had raised beds been used then this removal would not have been necessary. Currently, knowledge on composting is poor, so if the domestic compost bins become putrid and give off foul odours then participants may be discouraged from continuing home composting. Issues with water access across the camp mean that gardening isn't fully supported, and this is compounded by a lack of knowledge of greywater use in gardening.

The Lemon Tree Trust is now planning to work in partnership with ACTED to scale up the walled gardens in Za'atari. Some additional walled blocks will be converted to new community gardens, diversifying the gardening methods and production systems that are used. For the next phase, different ideas are being developed with refugees themselves that include better use of divided compost bins, the use of small polytunnels as plant nurseries, rabbit production, and hydroponic units to produce crops and fish to provide better nutrition and increased protein.

Spice shop, Za'atari, Jordan, providing informal access to seeds for refugees.

Azraq Camp, Jordan: rebuilding lives in the desert

Azraq Camp is a city built from scratch to house up to 100,000 Syrian refugees. The camp is in central-eastern Jordan, about 60 miles east of Amman and in March 2016, was already home to 20,338 people.[5]

In 2015, the Lemon Tree Trust carried out a needs assessment and in 2016, is starting working here in partnership with UNHCR. Our approach uses local capacities to build sustainability and resilience in areas from WASH to food security, nutrition, and settlement planning.

Azraq's exposed semi-arid location experiences hot winds during dry months and heavy rains during the wet season. Lack of vegetation adds to the harshness. At present, the camp receives inputs of food and water, and its solid waste and wastewater are collected and taken to distant disposal sites. Through RRR, both organic solid and liquid waste could be transformed into valuable resources.

Every day, around 30.8 tonnes of solid waste is produced in Azraq, ending up in landfill. We will set up a community-based waste management service – separation, collection, transportation – and a low-tech processing plant, using solid waste to produce compost, providing a rich growing medium for nurseries, home gardens and market gardens.

In this water-stressed region, water conservation should be a priority but each day, a minimum of over 560m^3 of wastewater is produced, sometimes double this figure. Domestic water used for cooking and washing is discarded around dwellings; instead, we will enable refugees to use this for home gardens. Larger volumes of treated wastewater will be used to irrigate trees and fodder crops in sites around the wastewater treatment plant.

We will contribute towards food sovereignty by helping families produce their own food in home gardens, as well as by supporting larger-scale food production in market gardens, and sharing best practice through demonstration gardens. All these gardens will benefit from the composting and wastewater projects.

Agroforestry – the planting of trees on a large scale as windbreaks and shelterbelts, as well as orchards – will help to prevent wind erosion and mitigate flash flooding. Tree nurseries supported by the Lemon Tree Trust will also provide tree seedlings to improve refugees' living areas.

Refugees themselves are an often undervalued and underutilised resource, but they represent a pool of labour with invaluable knowledge, skills and expertise in agriculture and horticulture. Syrian refugees living in Jordan do not have the legal right to work, but within the camp, they can take part in cash-for-work projects. The Lemon Tree Trust will set up greening innovation and UA projects using refugees' existing skills and knowledge and expanding their employment opportunities, while carrying out work benefitting the wider community. We'll also set up a social and therapeutic horticulture project for traumatised refugees, and train young people in agroecology, agroforestry and horticulture.

[5] UNHCR Jordan – Azraq Camp Fact Sheet – April 2016. Available at http://data.unhcr.org/syrianrefugees/settlement.php?id=251&country=107&region=73

A small home garden breaks the line of repetitive metal shelters in Azraq Camp, Jordan.

Leading the way: examples of best practice

Throughout this report, we have illustrated how the Lemon Tree Trust's pilot projects are demonstrating best practice in greening innovation and UA, from home gardens and greenhouses, to nurseries, small livestock projects and tree planting schemes. Later on in this section of the report we will consider in more detail how we plan to move forward. However, we would first like to highlight more of the many examples of best practice which are currently providing models for new ways to embed greening innovation and UA in some very different refugee settings.

Urban agriculture demonstration garden and farm

In the Kampala district of Kyanji Kawempe sits a 31 acre Urban Agricultural Resources Centre, developed by Kampala Capital City Authority (KCCA). Given a guided tour by Esau Galukande, we walked amongst the greenhouses, keyhole gardens, agroponics, and pigs that give urban Kampala's residents access to traditional and innovative technologies tailored to urban settings. At one end are several pigsties where Mr Galukande is breeding pigs suitable for urban settings as well as designing pigsties with microorganisms that reduce the smell. In all, the resource centre would not be out of place in the UK or the US. More relevantly, this is precisely the type of centre that each refugee camp should adopt, drawing on local knowledge and resources around food gardening and agriculture, so that refugees can swiftly and efficiently develop primary food production practices. This would also create links between host and refugee knowledge, building resilience across communities.

Polytunnels

Growing food in polytunnels can be highly productive and in refugee camps can contribute to local food security. The cost of polytunnels and the necessary tools and equipment used for growing foods is relatively low considering the potential high returns from growing lucrative crops. However, polytunnels require good management to ensure nutrients are not lost, pests and diseases are mitigated and ecological footprints are kept to a minimum. This requires good growing practices based on sustainable irrigation and fertilisation strategies and integrated pest management. In a refugee camp when these are all in place, growing food in polytunnels can not only be highly productive but also carbon neutral and climate-smart.

Greywater irrigation

"At water points and washing and bathing areas, the creation of small gardens to utilise wastewater should be encouraged where possible." These words of encouragement are given in the Sphere Handbook[6] (see page 47 for more on this handbook). Domestic wastewater or greywater, which often runs freely from the dwelling, is very suitable for irrigating home gardens, or trees planted outside the homestead. Densely packed dwellings will soon produce small streams across camps, pooling in low areas to create insanitary muddy areas. Adopting tree and shrub planting or designing food gardening in these areas will ameliorate these issues while also tapping into otherwise unused waste water.

Biodiversity

Agroecology embraces biodiversity. In fact, growing many different plant species in a home or market garden has numerous symbiotic benefits, as seen in integrated pest management (IPM). In Domiz Camp, Dr Sami Youssef, a refugee from Syria, has brought a whole new meaning to 'biodiversity in the home garden'. Before the war, Sami worked in Damascus as an agronomy, biotechnology and biodiversity conservation expert. Now, he lives in Domiz Camp and lectures at the University of Dohuk. For many, becoming a refugee is daunting and frightening, but Sami has embraced his new environment, conducting research in Irano-Turanian flora, the ethnobotany of the Kurdish people, and ethnodomestication of wild edible plants. His small home garden, bustling with rare mountain orchids, is testimony to his work collecting, cataloguing and publishing on local flora. And if all that wasn't enough, Sami has also been the driving force behind planting over 2,000 trees in Domiz Camp – yet another inspirational example of home-grown greening innovation.

Supporting marketing chains for small-scale producers

In the Gaza Strip, the RUAF Foundation and Oxfam Italia are jointly implementing the Gaza Urban and Peri-urban Agriculture Project (G-UPA) with funding from the Swiss Agency for Development and Cooperation (SDC).
The project supports the local market by organising marketing chains for selected products – such as olives, dates and vegetables – at local level and for export. It helps small-scale urban producers to establish value-adding microenterprises and builds the capacity of value chain actors, such as extension agents and other supply services to the urban agriculture processing sector (e.g. solar based cold storage; processing equipment and product quality control and improvements, packaging and labelling). The project will also set up a Gaza Strip-wide Platform for Urban Agriculture that will ensure the formulation and implementation of longer-term policies and programmes.

One of the winning home gardens, Domiz Camp, Iraq. This garden formed part of a set of continuous neighbourhood gardens that transformed an entire street corner.

[6] The Sphere Project (2011) Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response, p122.

A small home vegetable garden, Domiz Camp, Iraq.

Overview of current guidelines

UN agencies, research institutes and NGOs have developed several guidelines, frameworks and research papers on integrating innovative natural resources-based sustainable livelihoods, including small-scale primary food productions systems, into the planning and design of refugee camps and settlements, yet despite the availability of these rich resources they are seldom applied.

From a research perspective, a useful overview entitled 'Role of urban agriculture in disasters and emergencies' is provided in the book Cities and Agriculture: Developing Resilient Urban Food Systems, published by Earthscan. Also, the Humanitarian Innovation Project at the Refugee Studies Centre, University of Oxford has produced two excellent research reports that not only highlight the importance of recognising informal refugee innovation but also force us to rethink 'popular assumptions' by embracing refugee innovation through supporting refugees at the grassroots where innovation is flourishing.

The Livestock Emergency Guidelines and Standards (LEGS) provide a set of international guidelines and standards for the design, implementation and assessment of livestock interventions to assist people affected by humanitarian crises. Guidelines for developing and protecting primary food production are given in the Sphere Handbook (2011), which also contains planning and design recommendations for allocating small plots of land for use as home gardens in refugee camps (page 257). Also related, the RUAF Urban Agriculture Magazine Issue Number 21 featured Linking Relief, Rehabilitation and Development (LRRD) and the role for urban agriculture. In addition, UNHCR, along with different partners, have produced a range of guidelines for refugee camps tackling environmental management, cooking and energy, livelihoods programming, agriculture, livestock keeping and animal husbandry, forest management and permaculture. Finally, the World Fish Centre has produced a report on aquaculture in refugee camps and settlements, based on lessons from Zambia.

Despite all these guidelines and manuals the mainstreaming of greening innovation and urban agriculture in the context of forced displacement is still woefully inadequate, resulting in lost opportunities to protect and promote, and when necessary rehabilitate, local food production systems thus building resilience even in emergency settings. However, the old conventional models of delivering humanitarian aid remain strong despite the high costs that these entail. This situation is unlikely to change until responding donors, UN agencies and international NGOs show vision, leadership and technical capacity by facilitating greening innovation and urban agriculture that empowers refugees and builds local resilience.

Moving forwards

In this report we have discussed how greening innovation and UA can transform refugees' lives. From our work in Dallas, USA, to Nakivale, Uganda, and in the Middle East we are demonstrating the enormous value and benefits these practices can bring to refugees and host communities, as well as to those with a duty of care including host governments, donors, UN agencies and NGOs. Currently, we are working through small-scale home and community gardens to bring dignity and create opportunities in homes and local neighbourhoods.

Moving forwards, we will expand our programme in Iraq, Jordan and Uganda. Here, we are developing large-scale food gardens and UA schemes so these projects can move to a more entrepreneurial footing. This increased scale also means that we will be building our greening innovation network by partnering with other NGOs, government bodies and UN agencies. Through this, we will build the evidence base we need to make the clear argument, through applied practice, that refugee camps can no longer be planned around the old model of modernist cities. This linear model, consisting of inputted resources and discharged waste, has been identified as unsustainable for global cities: it is also unsustainable for the accidental city of the refugee camp.

However, while we are excited about developing new projects as we move forward, we know that significant change is needed before greening innovation and UA are adopted more widely as part of the solution to the refugee crisis.

In many counties, local authorities will not concede the permanence of refugee camps but we should not let this distract us from developing closing-the-loop models for refugee camps, where waste becomes the new resource through RRR. Even if camps are politically controlled as temporary sites, we can still plant trees, encourage home gardens and support small-scale food production which will preserve the natural resource base, because host communities also benefit, particularly when the remnants of a long-gone refugee camp become agroforestry. This closing-the-loop model needs to be widely adopted to support and underpin greening innovation and UA. In this model, scarce resources such as water and organic waste are valued throughout their life cycle, feeding directly into creating gardens, landscapes, jobs, energy and food. Such a paradigm shift needs to support innovation at all levels of the humanitarian system, from UN agencies to respecting the everyday creative practices of refugees themselves.

We hope that donors and NGOs will start their own pilot projects and then take them to scale, from greenhouses and seed distribution, to garden competitions, so that greening innovation and UA can transform the lives of more refugees across the world. We are also creating partnerships, building capacities, researching best practices, and implementing exemplars in the field. As we seek to mainstream greening innovation and UA, we need more partners, more data, and new opportunities to demonstrate how these concepts can bring dignity, empowerment and food and space sovereignty for those who are building new lives in under-resourced communities. If you feel you can offer such a partnership, we would be delighted to hear from you.

Redefining what's possible

Imagine walking down a street in a camp where refugees have used greening innovation and UA to transform their environment and create a place where they can thrive.

You can hear the sound of shouting and laughter from where children are running and playing outside in clean, green open spaces.

Along the tree-lined streets, people take a moment to shelter under an olive tree, or to enjoy sitting in one of the communal gardens while they rest or catch up with friends.

A rich variety of colours lights up the camp, from the green of the trees to the flowers filling communal gardens or peeping out from hanging baskets and containers in home gardens. When the wind blows, the perfume of roses and tulips drifts across the camp.

Men and women walk along with a sense of purpose as they have a job or voluntary work that uses both the skills they brought with them to the camp, and the new skills they learned here, and enriches their lives. And when they get home, they can relax by tending a garden which they have been able to establish because they have been allocated an adequate plot of land. They can cook and enjoy a meal made of fresh vegetables and herbs, grown using wastewater as well as homemade organic compost.

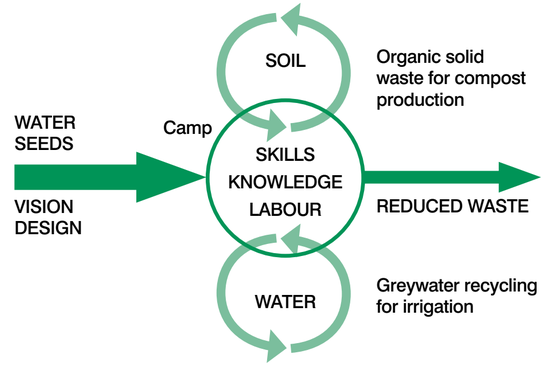
A lemon tree grows in spring in Domiz Camp, Iraq.

Life here is very different from the current harsh conditions in many refugee camps, but we believe the picture described above represents what is possible. The strategies and simple technologies that can transform the camp environment already exist: all that is needed is the will and the funding to put them into practice.

This is our vision. With your help, we can make it a reality.

Greening innovation and closing-the-loop for refugee camps

The diagram below represents the potential of the closed-loop model for refugee camps. On the left are inputs and, crucially, on the right are the reduced waste outputs. This reduction is achieved by drawing on local skills, knowledge and labour to help recycle wastes to produce new resources such as compost and irrigation water.



"Planting gives hope to the people who live here in Domiz Camp. As you take care of a small baby that grows up between your arms, planting gives you hope for life but also produces food."

A family sit in their small terraced home garden in Domiz Camp, Iraq. The advantage of these spaces is that many people decide to plant them outside their homes so that they become a shared beautified space for passers-by.

Useful guidelines, manuals and publications

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The Sphere Project (2011) *The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response.*
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UNHCR (2002) *Refugee Operations and Environmental Management: A Handbook of Selected Lessons Learned from the Field.*
http://www.unhcr.org/406c38bd4.html

UNHCR (2002) *Cooking Options in Refugee Situations: A Handbook of Experiences in Energy Conservation and Alternative Fuels.*
http://www.unhcr.org/406c368f2.pdf

UNHCR (2012) *Livelihood Programming in UNHCR: Operational Guidelines.*
http://www.unhcr.org/4fbdf17c9.html

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http://www.unhcr.org/406c2fae7.html

UNHCR and IUCN (2005) *Livestock-keeping and Animal Husbandry in Refugee and Returnee Situations: A Practical Handbook for Improved Management.*
http://www.unhcr.org/4385e3432.html

UNHCR and IUCN (2005) *Forest Management in Refugee and Returnee Situations: A Handbook of Sound Practices.*
http://www.unhcr.org/438724c42.pdf

UNHCR and SAFIRE (2001) *Permaculture in Refugee Situations: A Handbook for Sustainable Land Management.* Southern Alliance for Indigenous Resources (SAFIRE), Harare, Zimbabwe and UNHCR, Geneva, Switzerland.
http://postconflict.unep.ch/liberia/displacement/documents/UNHCR_SAFIRE_Permaculture_Refugee_Situations.pdf

World Fish Centre (2011) *Fish Production in Refugee Camps and Settlements: Lessons from Zambia, Policy Brief 2011-31.*
http://www.worldfishcenter.org/resource_centre/WF_2830.pdf

Help us transform spaces like this into gardens full of flowers, trees, and places where children can play

▲ *Here we highlight a large empty space contaminated with wastewater in the middle of Domiz Camp, Iraq. Such spaces are formed as refugees get moved to new camp areas with improved facilities.*

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All unattributed quotations used in this document for illustrative purposes are drawn from interviews contained in the 'Voices from Domiz Camp' section, or from short interviews carried out by the Lemon Tree Trust in Domiz Camp in 2015 and 2016.

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A family in their innovative home garden on the edge of Domiz Camp, Iraq.

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UNITWIN Network in Global Pharmacy Education Development

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