

# **Assessment Report:**

## **Urban Agriculture in Ninawa Governorate**



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**Cover Photo:** Hajj Ali IDP Camp, Ninewa

A well maintained home garden for herbs and green vegetable leaves that are harvested daily for household consumption thus providing fresh nutritional food stuffs. The seeds are sourced from local markets. The garden could be improved from increasing organic matter (compost) in the soils and adding some trees to provide shade thus conserving soil moisture and reducing evaporation.

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## **Executive Summary**

This assessment report explores the potential role of urban agriculture in the post-conflict Ninawa Governorate in north Iraq, arguably the historical home of agriculture in urban settings. The report contains three main parts: 1) an introduction to the theme of urban agriculture, livelihoods and resilience; 2) an examination of urban agriculture in Ninawa, Iraq and; 3) suggestions for the development and implementation of an urban agriculture programme in Ninawa Governorate.

Urban agriculture is a multifaceted livelihood-based activity that can also enhance urban resilience when appropriately designed and implemented in post-conflict settings. Urban agriculture is the production, processing and distribution of food, fibre, fuel and medicines, through the cultivation of plants and the practice of livestock husbandry, in and around urban areas, such as villages, towns and cities. The practice is particularly suited to post-conflict cities or accidental cities, such as camps for refugees and/or internally displaced persons (IDPs). However, despite the multiple benefits and functions from urban agriculture it also brings risks that require management and mitigation.

This assessment report evaluates those risks from the context of developing an urban programme in post-conflict Ninawa. In this process, urban agriculture is examined from a historical perspective to the modern-day status of urban agriculture in Ninawa, arguably, a journey from the golden period of urban agriculture to its current post-conflict status, high with potential but missing a bold urban vision, deprived of strong and enlightened leadership and severely lacking in human and technical resources.

In an attempt to reverse this current status so urban agriculture can reach its full potential, this report provides a road map for the development and implementation of an urban agriculture programme. This is achieved by providing guidelines on the following four aspects: 1) urban agriculture assessments and analysis; 2) institutional capacity building for urban agriculture extension; 3) capacity building for urban farmers and; 4) integration of urban agriculture in refugee and IDP camps.

### **A future with urban agriculture**

In essence, urban agriculture should also be seen as an opportunity to develop and implement long-term, self-sustaining solutions – not designed as response to a one-off crisis, but as support for ongoing urban development efforts, whether by local, national or international actors.

In responding to the current crises, urban agriculture will be an important part of the answer, because it can provide many of these crucial innovations, from vertical gardens to nutrient recycling. Investments into ‘low-space agriculture’ will be key to providing food security, resilience and safety to not only the thousands of people currently on the move, but to future generations across Ninawa.

## **1.0 Urban Agriculture, Livelihoods and Resilience**

Urban agriculture is a multifaceted livelihood-based activity that can also enhance urban resilience when appropriately designed and implemented in post-conflict settings. The same concepts equally apply to emergency camps for refugees and internally displaced persons (IDPs). This section provides an overview of this notion and the relevant concepts and linkages in the context of urban agriculture in post-conflict settings. In Section 1.1, an overview of urban agriculture is presented to establish the multifaceted nature of urban farming which in practice covers a range of urban topics from environmental sanitation to urban planning. This is followed by two sections that provide further details into the subject matter, with the relevance or suitability of urban agriculture in post-conflict settings being presented in Section 1.2, followed by the risks and benefits of urban agriculture covered in Section 1.3. In Section 1.4, the relevance of refugee and IDP camps is considered, and while these unique urban spaces, or accidental cities, carry many urban characteristics they actually offer unique opportunities to maximise the positive synergies that can be made in urban agriculture-based livelihoods leading to enhanced urban resilience.

### **1.1 Introduction to urban agriculture**

Urban agriculture can be defined as the production, processing and distribution of food, fibre, fuel and medicines, through the cultivation of plants and the practice of livestock husbandry, in and around urban areas, such as villages, towns and cities and including post-conflict cities or accidental cities, such as refugee/IDP camps. This broad definition makes no attempt to identify specific urban food production systems, as the approach can consist of, or more preferably be a combination of, agroecology (ecological-based farming), agroforestry (integration of trees and crops), aquaculture (rearing of aquatic animals/plants), hydroponics (soilless cropping systems), livestock rearing, horticulture (crop/vegetable production), mushrooms, bees and forestry. Some common, or in some cases potential, features of urban agriculture – setting it aside from its rural farming counterpart – include:

- The innovative use of urban spaces, including small spatial areas that can contribute to household food security, while the accumulative effect can bring urban resilience;
- Resource recovery and reuse (RRR) (also referred to as the circular economy) of organic wastes (for example urban organic solid wastes and/or household-generated greywater);
- The close proximity and access to urban markets, thus making the practice particularly suitable in post-conflict settings due to its contribution in the regeneration of urban markets.

Urban agriculture is not only multifaceted in the different food production systems that are practised under the broad urban farming banner, but it is also multifaceted in its spatial scales, particularly as it can be implemented at a range of vastly-differing scales, each bringing different levels of production (see Table 1). For example, from the small traditional kitchen and rooftop gardens in the city of Mosul to the large open urban green spaces of the city, such as the centuries-old urban farms on the banks of the River Tigris that flows straight through the city of Mosul, dividing the historical city into east and west. From an urban agriculture perspective, all these practices, and production scales, are equally important and relevant, because urban agriculture also serves multiple-functions and thus brings with it multiple benefits (these are discussed in detail in Section 1.3).

In essence, urban agriculture is all about diversity; diversity in urban food production systems, diversity in spatial and production scales, diversity in the functions and the benefits and even diversity in the practitioners – the actual urban gardeners and farmers themselves. This agricultural diversity weaves a rich tapestry that is metaphorically overlaid on the urban form and from this synthesis emerges an integration of urban food systems along with their associated symbiotic relationships that when combined contributes to environmental protection and sanitation, food security and resilience.

## **1.2 Risks and benefits from urban agriculture**

Urban agriculture brings both risks and benefits. For example, urban areas are subject to contaminants and effluents that result from industrial processes or from liquid and solid wastes that are generated in urban areas. These potentially harmful contaminants and effluents pose risks to human health and likewise to any urban food production systems. However, the benefits from urban agriculture far outweigh the potential risks, and this balance can be maintained through a risk management process. This ensures the associated risks from urban agriculture are minimised to a manageable level while at the same time the potential benefits are maximised.

**Table 1** Urban agriculture classification system (adapted from Adam-Bradford, 2010)

Broad function	Defining feature	Social organisation	Spatial location
<b>Aquaculture</b>	Artificial ponds	Conventional	Urban / peri-urban
		Ecological	
		Wastewater	
	Natural ponds	Cooperative / private sector	Urban / peri-urban
<b>Horticulture</b>	On-plot (Enclosed-space production)	Allotment	Various locations consisting of municipality / private property / refugee & IDP camps / prison
		Community garden	
		Market garden	
		Urban farm	
		Orchard	
		Home garden	Backyard / rooftop / refugee camp
	Off-plot (Open-space production)	School garden / farm	School grounds / property
		Cooperative / private sector	Open field
			Coastal / lakeside / river bank
			Along drainage / wastewater channels
			Sustainable drainage systems (SuDS)
			Roadside / roundabouts
<b>Forestry</b>	Agroforestry	Cooperative / private sector	Urban / peri-urban
	Dispersed	Local authorities / private sector	Urban / peri-urban / roadsides
	Plantation		Urban / peri-urban
<b>Livestock husbandry</b>	Enclosed field	Cooperative / private sector	Peri-urban
	Enclosed structure (pen / stall)		Urban / peri-urban
	Free open roaming		
	Staked in open space		
<b>Miscellaneous</b>	Beekeeping	Cooperative / private sector	Urban / peri-urban
	Mushroom production	Local authorities / private sector	Urban / peri-urban / rooftop
	Hydroponics / aquaponics		

## Urban agriculture risks

The main urban agriculture hazards and risks can be grouped under land cultivation and livestock husbandry (see Table 2). In post-conflict settings, the number of hazards may be higher, as during conflicts the delivery of routine urban environmental sanitation services is stopped and the regulation and enforcement of hazardous waste management is also curtailed.

**Table 2** Main types of hazards in urban agriculture

Activity	Hazard source	Probability	Impact
<b>Land cultivation</b>			
Pathogens	Wastewater	Low	High
Heavy metals	Wastewater / contaminated soils	Low	Low
Persistent organic pollutants (POPs)		Low	Low
<b>Livestock husbandry</b>			
Pathogens	Dung / manures / products	Medium	High
Zoonoses	Livestock / dung / manures	Low	High

From Table 2, the only probability with ‘medium’ or ‘high’ levels is the risk of pathogens in animal dung, manures or products. Animal dung will always carry some levels of pathogens but the risk from this can be reduced with good hygienic management of the livestock pen/stall and field, along with good handling practices of the produce derived from livestock, such as eggs or milk, to prevent any exposure and subsequent contamination to the pathogens found in animal dungs.

Also relevant from Table 2, is the issue of wastewater. Urban wastewater is not suitable for use in urban agriculture due to the risks from industrial effluents (heavy metals / POPs) and untreated sewage (pathogens). The levels of contamination in urban wastewater can be constantly changing so it is safer to assume that urban wastewater is likely contaminated and thus unusable. Whereas the health impact from heavy metals / POPs is low and any plant uptake is also low, this is not the case with the health impact from pathogens, as pathogens can have a serious impact on public health. For this reason, urban wastewater should not be used for irrigation in urban agriculture. However, there is one exception to this rule, and that is the use of domestic sullage (greywater). Sullage is waste from household sinks, showers and baths but not toilets. In the WASH sector this is commonly referred to as ‘greywater’. Greywater is safe to use as irrigation in urban agriculture but one must always know the source of the sullage so users know that it is not contaminated. The soaps



in greywater also pose no risks to plants, rather benefiting plant growth, due to traces of phosphorus that can be found in detergents and soaps. If the sullage contains fats and oils, for example after washing kitchen pans and utensils, then avoid using the greywater as this clogs up soils. The safe use of greywater also reduces surface wastewater and the total volume of urban wastewater thus providing a useful environmental service. Safe greywater reuse often requires good public awareness to promote the practice.

### ***Urban agriculture benefits***

The benefits from urban agriculture are numerous and can be grouped under physiological, nutritional, psychological and environmental (see Table 3). Urban agriculture can also play a role in conflict resolution and have a key function in urban disaster risk reduction (DRR) programmes. For example, at the landscape-level, urban agriculture fields in Mosul mitigate impacts from erosion and flash flooding from the River Tigris. Agroecology initiatives can build ecological resilience in urban farming systems that are becoming vulnerable to weather variability. Urban agriculture can yield benefits beyond food, including resilience to hazards and even disasters. Promoting urban agriculture as a driver of resilience is especially important now that climate change-related extreme weather events are compounding the situation for forcibly displaced people, and in some cases even triggering the conflict and political instability in the first place.

**Table 3** Potential Benefits from urban agriculture-based interventions

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***Physiological***

Multi-muscular exercise—improving cardiovascular function

Load bearing—reduced osteoporosis

Bending and stretching—increased general muscle tone

Outdoor exercise—‘fresh’ air, sunshine

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***Nutritional***

Fresh produce rich in vitamins and trace elements

Green leafy vegetables high in folic acid, iron and ascorbic acid

Brassicas (cabbage, cauliflower, broccoli, Brussels sprouts, curly kale) rich in glucosinolates—implicated in preventing cancers

Legumes (peas, beans) are key components of the health protecting ‘Mediterranean diet’

Berry fruits rich in anthocyanins, flavonoids and vitamin C

Apples rich in anti-oxidants—implicated in cancer prevention

Sunlight exposure—leading to increased vitamin D synthesis in skin

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***Psychological***

Sunlight exposure—increased serotonin (less winter depression)

Sense of achievement and wellbeing—improved psychological health

Empowerment—independence/self-sufficiency (income generation and less food expenditure)

Nature and greenspace interaction—increased wellbeing

Enhanced social networks and community interaction—increased wellbeing

Sense of community and belonging—increased wellbeing

Social cohesion—improved relationships between refugees / IDPs and host communities

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***Environmental***

Improved microclimates—through trees planting, which reduces the urban heat island effect in hot seasons and lowers the wind-chill factor in cold seasons

Reduction in total amount of discharged wastewater—as greywater is diverted for irrigation

Reduction in total amount of solid waste—as organic waste is diverted for compost production

Reduced flood risk—due to conservation of surface areas for water infiltration

Flood protection—creation of buffer areas in low-lying flood-prone areas including river banks

Fire protection—use of fire-resistant vegetation to improve fire breaks

Improved drainage—through sustainable drainage systems (SuDS)

Reduction in food miles—as locally produced food travels less than imported food aid

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Adapted from Millican et al., 2017 and Leake et al., 2009.

### **1.3 Urban agriculture in post-conflict settings**

In the context of post-conflict settings, there are four main reasons why urban agriculture provides a suitable option as a programme intervention from the stabilisation phase to the later early recovery period. The four relevant areas can be grouped under: 1) cash-for-work applicability; 2) therapeutic applicability; 3) food security applicability and; 4) durable solutions applicability.

### ***Cash-for-work applicability***

The cash-for-work modality is particularly suited to an urban agriculture programme. There are no requirements for major infrastructure development in urban agriculture, although the provision of seeds and basic tools are required, and when establishing larger community-based facilities, such as market gardens, then irrigation equipment and poly-tunnels are necessary. Otherwise, the cash-for work modality is ideal, as this can be used to fund beneficiaries to carry out specific urban agriculture techniques and practices, from composting (soil building), building a nursery, planting out crops, to harvesting and crop processing. As cash-for-work is used to establish income generating activities, over time those profits then replace the cash-for-work income bringing a level of sustainability to the programme. An added advantage of using a cash-for-work modality is that this then removes the risks associated with the development of a new livelihood while building the confidence and capacity of the urban farmers at the same time.

In Iraq, as soon as the Iraqi Government forces, with US air support, had pushed the Islamic State of Iraq and the Levant (ISIL) out of previously held cities and towns, stabilisation activities were implemented at the earliest possible opportunity, using cash-for-work and cash-grant modalities with funding from the United Nations Development Programme (UNDP). One of the primary objectives of the stabilisation programme was to contribute to immediate economic stabilisation through the provision of 'cash injections' that were designed to stimulate livelihoods and start an initial process of economic activity. However, some of the funded cash-for-work activities included quite mundane tasks, such as street cleaning and sweeping, rubble removal and the painting of walls on which offensive ISIL graffiti is present. Within the context of stabilisation, urban agriculture can provide far more suitable activities that also bring long-term economic impact rather than focussing on an 'immediate cash-injection' approach. Likewise, urban agriculture is equally suitable during the early recovery phase using the cash-for-work modality.

### ***Therapeutic applicability***

Urban agriculture also provides an ideal platform for the development of social and therapeutic horticulture (STH) based projects. Applying a STH approach brings added value when working with traumatised and vulnerable groups, as are commonly found in post-conflict settings. In addition, such interventions can be designed to maximise the STH benefits, for example, through the capacity building of women and youth focussed groups. Urban agriculture also provides a platform for the building of social cohesion through joint group activities that can bridge cultural and religious divides, for example, linking host communities with IDPs and/or returnees.

### ***Food security applicability***

In post-conflict settings, the levels of food insecurity may be high thus requiring urgent food assistance-based interventions, sometimes in the form of 'food baskets' or more commonly through cash-for-work based interventions as mentioned above. If cash-for-work is used to establish urban agriculture interventions then the same initial levels of food security can be achieved, attained through cash payments which provide beneficiaries with the means to purchase food items. If beneficiaries are able to produce and consume their own food products then this too can reduce the daily cost for food,, or if sold in local markets, households can generate an income which contributes to household food security by providing the means to purchase other food products, thus extending food access.

### ***Durable solutions applicability***

Population density and the high levels of urban and human waste produced as a result, is another commonality between urban settings and refugee camps. While initially always considered a challenge – to the health and well-being of people – these waste streams represent an opportunity to implement durable solutions in innovative drainage infrastructure and sanitation technologies, such as rainwater harvesting, sustainable drainage systems (SuDS) and resource recovery and reuse (RRR).

Drainage – or a lack of it – is a huge problem in many post-conflict urban settings and IDP camps. Conventional systems are often only rehabilitated as an afterthought many years down the line. However, the principles of SuDS are equally applicable in post-conflict settings and to IDP camps so that surface water is utilized where it lands or flows, replicating the drainage patterns of natural

systems. This can eliminate stagnant water and reduce risks of disease, while remaining more cost effective than the repair of conventional urban drainage.

Resource recovery and reuse includes the safe utilization of liquid and solid organic wastes, such as converting solid organic waste into compost that can be applied for soil amelioration. An example can be found in Za'atari Refugee Camp in the semi-arid areas of north Jordan, where treated wastewater from the camp is used to irrigate fodder crops for livestock. Such systems can also be designed to enhance the environmental conditions of post-conflict urban areas and IDP camps, both settings that are often bleak and harsh, yet could flourish by supporting the growth of gardens, trees and foliage through urban greening and the development of urban agriculture.

Humanitarian funding streams can then be used to implement durable solutions such as SuDS and RRR projects, turning post-conflict urban settings and IDP camps into showcases of innovative technologies. This can increase the potential for uptake of durable solutions by local authorities that previously might have had limited or zero exposure to SuDS and RRR.

#### **1.4 Urban agriculture in IDP camps**

Forced displacement is often correlated with food insecurity. Often people are forced away from their lands, and food production declines as harvests and farmlands are lost. In host communities in Iraq, the sheer numbers of internally displaced people (IDPs) and refugees seeking refuge across the country has placed huge strains on local resources, jobs and markets. But some form of urban agriculture can always be found in an IDP camp. When refugees and IDPs are forcibly displaced they often carry with them livestock and seeds. Once settled in a camp, residents will inevitably start growing plants around their plots. These small gardens may consist of ornamental flowers or vegetables, or a combination. Hence, in camps varying forms of land cultivation and livestock husbandry can be commonly observed. In some cases, the camp gardens can be elaborate and highly productive. In addition to kitchen gardens, camps may also contain school and/or community gardens, like the Liberation Garden in Domiz Camp, outside Dohuk.

It is in these settings that 'low-space' and 'no-space' agriculture is uniquely placed to serve as a durable and innovative solution to reduce the huge strain on local resources, jobs and markets.

'Low-space agriculture' is a concept known from urban areas where space is very restricted, and farming is very small scale such as in the form of home gardens, also known as kitchen gardens.

Urban agriculture concepts can be applied to refugee camps at different stages of structural consolidation and settlement, from tents to low-income/high-density urban suburbs. These solutions can contribute to food and nutritional security, income generation and social cohesion. Low-space food production, processing and distribution all offer opportunities for livelihoods creation that can actively involve host communities, IDPs and refugees.

Camps are quite distinct urban spaces, or 'accidental cities', as Bram Jansen referred to them in his research work from Kakuma Camp in Kenya (Jansen, 2009). In this sense and from an urban planning perspective, they offer good opportunities to integrate urban agriculture during the planning stage, although this vision is seldom achieved. The refugee settlements in Uganda are an exception to this rule. In most cases, urban agriculture is developed through retrofitting and simply overlaid on existing camp infrastructure as the camp is habited, evolves and expands.

## **2.0 Urban Agriculture in Ninawa, Iraq**

This section examines the context of developing an urban programme in post-conflict Ninawa. In this process, urban agriculture is examined from a historical perspective through to its modern-day status, arguably a journey from the golden period of urban agriculture to its current post-conflict status, high with potential but missing a bold urban vision, deprived of strong and enlightened leadership and severely lacking in human and technical resources.

### **2.1 Historical development of urban agriculture in Ninawa**

Elizabeth Snodgrass (2013) stated that the “legendary Hanging Gardens of Babylon are exactly that: legendary. And they may not have been located in Babylon”, but rather in Ninawa. As Snodgrass highlights the “gardens, famous as one of the Seven Wonders of the Ancient World, were, according to Stephanie Dalley, an Oxford University Assyriologist, located some 340 miles north of ancient Babylon in Nineveh, on the Tigris River by Mosul in modern Iraq”. This misinterpretation has been put down to incorrect translations in early sources, which according to Dalley (2013) also explains why years of excavations never yielded any credible evidence of the fabled gardens in Babylon (Snodgrass, 2013). The location of the hanging gardens in Ninawa is just an interesting theory from an urban agriculture perspective but there is no questioning that the early urban forms in Ninawa were characterised with green spaces, orchards, parks and home gardens for the growing of both fruits and vegetables. Agriculture in the Fertile Crescent gave rise to urbanisation, particularly to the urban centres in Mesopotamia that benefited from irrigation from the Euphrates and Tigris river systems.

The management of natural resources was integrated in these early ‘cities’, including urban and peri-urban agriculture. Simon and Adam-Bradford (2016: 57) have highlighted how “archaeological evidence illustrates the pivotal role that that peri-urban zones once played in the survivability of ancient urban centres”. In many ways these urban settlements developed an approach akin to a modern day city region food system (CRFS). According to FAO, a CRFS approach “aims to foster the development of resilient and sustainable food systems within urban centres, peri-urban and rural areas surrounding cities by strengthening rural-urban linkages”. Historically, urban and peri-urban agriculture would have evolved during the development of city spaces in Ninawa, resulting not only in the hanging gardens of Ninawa, but contributing to what could be termed the golden age of urban agriculture in Ninawa.

Interestingly from the ancient literature, tradition, and the environmental characteristics of the area, the following plants, listed in Table 4, have been identified as likely to have been grown in the hanging gardens of Ninawa (PBS, 2014). Thousands of years later, many of these plants are currently grown inside Domiz Camp near Dohuk, in the same region.

**Table 4** Plants grown in the early and modern forms of urban agriculture

Latin name	Common name
<i>Olea europaea</i>	European olive
<i>Cydonia oblonga</i>	Quince
<i>Pyrus communis</i>	Common pear
<i>Ficus carica</i>	Fig
<i>Prunus dulcis</i>	Almond
<i>Vitis vinifera</i>	Common grape vine
<i>Phoenix dactylifera</i>	Date palm
<i>Tamarix aphylla</i>	Athel tamarisk
<i>Pistacia atlantica</i>	Mt. Atlas mastic tree (pistachio)

## 2.2 Current status of urban agriculture in Ninawa

There is no questioning the devastating effect the recent conflict has had in Ninawa Governorate, as in many of the other governorates in Iraq. The urban infrastructure in many areas have been totally devastated with mounds of rubble left in place. Roads, drainage channels, human settlements, and commercial buildings have all been left damaged, and in some cases are totally unusable. As well as the urban damage, peri-urban sites that were characterised by farming have also been left unusable. In peri-urban sites these problems stem from the construction of battle defences such as earth mounds using agricultural soils thus damaging farmland surfaces and creating deep erosion, and from the loss of electricity supply lines and transformers that provided electricity to run the irrigation pumps. In addition, many of the farm lands were overgrown with weeds and shrubs and farmers no longer have access to suitable equipment, farm inputs (fertilisers/seeds), tools and labour to work the lands. In many of the smaller villages and towns there is debris and rubble scattered around, with solid waste continuing to add to the piles, and with local authorities unable to deliver any services such as debris removal and solid waste management. Under these conditions urban farmers have continued to try and farm small plots, but with the limited resources evident, cultivation has been far from productive.

In the more urban areas, even where traditional gardening was a common practice, they have also negatively impacted. Urban green resources such as open green spaces and plant and tree nurseries



have not been left untouched by the conflict. Urban sites are plagued with rubble mounds and waste dumps which often block surface water, creating quagmires and squalid living conditions. In most urban centres the need for greening programmes is clearly evident. The state of urban agriculture in Ninawa is probably at its lowest point ever, but this provides a major opportunity to address these challenges with innovative urban agriculture practices and durable environmental solutions.

### **2.3 Potentials of urban agriculture in Ninawa**

This assessment report examines the context of developing an urban programme in post-conflict Ninawa. In this process, urban agriculture is examined from a historical perspective to its modern-day status, arguably, a journey from the golden period of urban agriculture to its current post-conflict status, high with potential but missing a bold urban vision, deprived of strong and enlightened leadership and severely lacking in human and technical resources.

#### ***Bold urban vision***

If urban agriculture is to be realised, then a bold urban vision is required. This vision requires political ownership, followed by communication to the wider public, local authorities, municipal departments, funding bodies, urban farmers and most importantly to the wider urban population. The vision becomes a road map and the plan of action to transform urban spaces into productive landscapes. The requirement for a bold urban vision equally applies to IDP camps, only the scale of the vision will be smaller, but nevertheless clear as to what is possible.

**Figure 1**

Urban agriculture vision of Domiz Camp



### ***Strong and enlightened leadership***

A bold urban vision requires political ownership, namely the backing of strong and enlightened leadership. In a post-conflict setting this becomes paramount as resources are scarce and allocation of these limited resources is hotly contested. While strong and enlightened leadership can be found at the community and grass roots level, the political will to not only support change and development but also push a bold urban agenda, is critical for urban agriculture to reach its full potential at the municipal level.

### ***Human and technical resources***

A bold urban vision and strong and enlightened leadership provides the strategic scope to transform towns and cities into urban agriculture landscapes, however, the operational level is totally dependent on the human and technical resources. Technical resources allow innovation, energy efficiency and water conservation. Sophisticated methods of agroforestry can be developed using traditional dryland farming practices, simply with seed, soil and irrigation water, even with the traditional plants identified in Table 4. However, this kind of innovative practise still requires human expertise to design a traditional agroforestry system and build the capacity of the farmers to grow it, so Section 3 continues this theme and focuses on capacity building and human resource development for developing and implementing urban agriculture programmes.

## **2.4 Urban agriculture in IDP camps in Ninawa**

IDP Camps such as the Hajj Ali, and the Qayyarah-Jad'ah and Airstrip complexes can bring a range of environmental, resource and social challenges, such as insanitary conditions, flood risks and (youth) unemployment. Mapping these challenges is the first step towards developing a holistic approach to camp management, which integrates a range of innovative urban agriculture techniques to convert problems into opportunities. Obvious examples include the separation, collection and processing of organic waste to produce fertilizer and/or energy and the use of greywater to irrigate trees and crops. Such programmes can be innovatively designed to reduce youth unemployment, strengthen local economies and supply local markets within the IDP camp.

The IDP camp Hajj Ali, scheduled for imminent closure, has seen a number of IDP-led urban agriculture initiatives at the household scale involving vegetable production. One of these gardens was developed by a former Department of Agriculture extension officer, which highlights the potential skills to be found in the camps. Other gardens involved the cultivation of green leafy vegetables by women to ensure they had access to fresh green leaves for cooking purposes. The International Organization for Migration (IOM) have also developed a number of pilot projects using recycled tent frames to make supporting frames for shade nets, which when cultivating in the hot summer conditions, reduces the amount of plant transpiration and soil moisture lost to evaporation during the summer periods. In these conditions, the mitigation of soil salinity problems can be managed by ridging the vegetable lines, which was a practice clearly evident on the IOM pilot projects. While these vegetable units used piped water for irrigation, it was being conserved through good soil and water conservation practices, making the system water efficient.

Even in the water-challenged camps of Qayyarah-Jad'ah and Airstrip complexes, urban agriculture can still be found; on one site, a fully established garden was functioning despite the limited access to irrigation water. In such water-sparse sites, kitchen gardens can still be supported through the safe reuse of greywater. A water survey should be carried out to identify other sources of irrigation water such as rivers and water storage facilities. Moreover, a cost-benefit-analysis can be made to evaluate the benefits of drilling a deep borewell, digging a shallow well, using a piped water or tank water, as potential irrigation sources in highly-profitable urban agriculture projects, such as the development of a market garden project for the intensive production of vegetables.

### **3.0 Development and Implementation of an Urban Agriculture Programme**

This section outlines three important aspects that should be considered during the development and implementation of an urban agriculture programme. The first is based around understanding the current urban agriculture settings, often referred to as a 'situational analysis', and involves conducting an urban agriculture assessment and analysis of the current practices and systems. The following two sections involve capacity building of institutional extension services and urban farmers, and the last section examines the integration of urban agriculture in IDP camps.

#### **3.1 Urban agriculture assessments and analysis**

##### ***Assessment Preparation***

The first activity is a desk review of all urban plans and related documents including articles, project documents, technical reports, project evaluations, photographs, maps, remote sensing images and Google Earth images, with the following objectives: i) build an understanding of local agroecological zones; ii) identify current urban food production practices and; iii) identify potential interventions and food production opportunities, considering land availability and access to irrigation water.

##### ***Urban orientation***

Become familiar with the local urban context and management systems through site visits to all local authorities and infrastructures including: 1) municipality, including sanitation department and agriculture department offices; 2) urban centres and markets; 3) residential areas; 4) waste collection and disposal points; 5) wastewater treatment facilities; 6) natural landscape features (topography, soils, vegetation, watershed) and; 7) IDP settlements or camps.

##### ***Current urban agricultural activities***

During urban orientation we should look for any signs of food production and processing (regardless of scale), including container growing, kitchen gardens, fruit trees, aquaculture, livestock rearing, food processing/storage, dairy production, bread making, formal and informal markets. Where examples exist request to speak with the owner and conduct semi-structured interviews to identify: i) type of food production systems; ii) inputs/outputs including crop yields, water sources, seeds, fertilisers, pesticides etc; iii) production constraints such as lack of inputs; iv) farmer capacity

gaps; v) carry out a greywater audit at the household level to identify the potential qualities of greywater for irrigation.

### **3.2 Institutional capacity building for urban agriculture extension**

Agriculture extension is the application of scientific research, new knowledge and innovative practices to agricultural practices through farmer education. In Ninawa Governorate, the agriculture extension services are delivered through the Ministry of Agriculture with the head office located in Mosul. In the past, the Ministry of Agriculture has delivered extension services in kitchen gardening. However, as shown in Table 1, kitchen gardening is just one practice that is found within the broader scope of urban agriculture, hence a number of measures may be required to build institutional capacity.

#### ***Urban agriculture curriculum***

As urban agriculture is not just about kitchen gardens, or just food production itself, any curriculum used in training and education needs to reflect the full potential and scope of urban agriculture. This takes the content beyond basic land cultivation and livestock husbandry techniques into new subject areas that are relevant to the urban agriculture context, including the following topics: i) hygienic production of food; ii) better management of urban wastes and greywater (resource recovery and reuse (RRR)); iii) working with urban producer groups; iv) improving access to resources and urban land; v) information exchange and partnerships; vi) managing growth and; vii) enhancing legitimacy.

#### ***Urban agriculture teaching materials***

As diversity is ever present in urban agriculture, the teaching materials should also be developed with an understanding that the audience is also likely to be diverse in terms of gender, age and education. Rather than developing text-based resources, an emphasis should be made on developing visual tools that impart urban agriculture principles and techniques through simple picture-based manuals and laminated flip-charts. The teaching materials needs to be developed with consideration of the local urban agriculture sites that will be used as the training and learning facilities (known as urban agriculture hubs). This will ensure that the teaching materials are relevant to the local context.

### ***Training of urban agriculture extension staff***

Once the curriculum and training materials have been developed and the training venues and sites have been selected then the training of urban agriculture staff can commence. This training of trainers is an important process in ensuring that the capacity of local institutions – agriculture departments, NGOs, community organisations – are ready to deliver extension in urban agriculture.

### **3.3 Capacity building of urban farmers**

The main capacity building process of farmers occurs through the delivery of agricultural extension services. Agriculture extension is the application of scientific research, new knowledge and innovative practices to agricultural practices through farmer education. In rural areas the distance between farms and agricultural communities may be considerable making the delivery of extension services and the capacity building of farmers a logistical challenge. In an attempt to overcome these logistical challenges and make agriculture extension more effective and efficient, several low-cost approaches and methodologies have been developed such as farmer-to-farmer extension (F2FE). In urban agriculture, the close proximity of urban farmers within a defined urban area, such as a neighbourhood, bring multiple opportunities for the capacity building of urban farmers.

#### ***Urban farmer-to-farmer extension (UF2FE)***

In urban areas, and even refugee and IDP camps, there are always examples of urban agriculture being practised. These may take the form of any of the multiple urban farming practises listed in Table 1. One only has to survey an urban area, or an IDP camp, and one will find gardens, livestock, sometimes roaming, or in pens, and patches of urban spaces under cultivation, from small pockets to open fields. Surveying the current urban agriculture practices provides a useful opportunity to identify best practices along with suitable urban farmers that can be recruited as extension staff to form an urban farmer-to-farmer extension (UF2FE) network. This removes the need to use external extension agents that may lack knowledge of the urban and local market context. When these opportunities allow, urban agriculture programmes should always be designed around local urban farmers and practitioners.

#### ***Urban agriculture hubs***

The development of an UF2FE network can be enhanced through the establishment of urban agriculture hubs. This can take the form of a community or school garden, an urban farm or even a home garden if it demonstrates sufficient best practices in urban agriculture. An urban agriculture hub is essentially a training and learning site, where innovative practices can be demonstrated. In the early phase of an urban agriculture programme it may be easier to select an ongoing urban agriculture site as an urban agriculture hub. The site can then be enhanced and developed to include any innovative urban agriculture practices. This process then also builds the capacity of the on-site gardeners and farmers and in turn they can be recruited as extension staff in the UF2FE network. This is the most effective and efficient way to build an urban agriculture programme, from the roots up.

### ***Community mobilising and scaling-up***

Depending on the local capacities and urban agriculture practices, the initial training of urban farmers should be focussed on the basic principles of urban agriculture relevant to land cultivation and livestock husbandry. For example, this may involve training in soil preparation, compost production, greywater utilisation, seed collecting and storing, integrated pest management (IPM), crop harvesting, processing and marketing. These examples are all activities that can take place on an individual urban plot. However, urban agriculture has great potential for scaling-up at the community level. Pooling resources and mobilising communities to engage in urban agriculture can multiply the benefits through the establishment of a market garden approach, which is based on the intensive cultivation of relatively small urban spaces. Community-based projects can take the form of a market garden, or individual allotments on a communal plot, but regardless of the specific approach that is adopted, a community platform provides strong peer support and allows the development of a marketing brand which then reduces the economic risks that urban farmers may face when working in isolation. Forming community-based groups also allows urban farmers to mobilise in terms of funding options, and in applying for livelihood grants and funding opportunities as small and medium enterprises.

### **3.4 Integration of urban agriculture in refugee and IDP camps**

The ideal time to integrate urban agriculture into a camp is at the camp planning stage. In accordance with Sphere Guidelines, the full allocation of space for the settlement allows the dwellers to create a kitchen garden on the plot. In addition, camp planners can use topography to minimise surface water while maximising the benefits of productive drainage by incorporating sustainable drainage systems. Then spatial areas can be allocated for resource recovery and reuse projects, designed around decentralised compost production units that serve different camps

zones. Other green infrastructure can include allotments, community gardens, parks, and small farms on the camp periphery. Two aspects which can contribute to the integration of urban agriculture in camps are the inclusion of urban agriculture in camp management and integration of urban agriculture into the UN cluster system.

### ***Integration of urban agriculture in camp management***

The management of an IDP camps is the responsibility of the national government through ministerial representation at the governorate level. UNHCR also provides support through good management processes and camp coordination. Other international agencies such as the IOM, may also be involved depending on the local context and arrangements. The camp manager may belong to local government, UNHCR or a third agency, such as an NGO. For urban agriculture to successfully work in the camp context it is crucial that all levels of management approve of the approach and give it their full support. Likewise, the implementing agency must be able to provide support to camp management by providing the necessary technical support to avoid conflicts and respond to concerns and cross-cutting issues such as the use of wastewater in urban agriculture.

### ***Integration of urban agriculture in the UN cluster system***

Urban agriculture can be applied during the emergency phase when the UN cluster system is engaged to manage different humanitarian actors. The obvious home for urban agriculture is the emergency livelihood and social cohesion clusters. Variations of these cluster groups may exist but the linkages of urban agriculture from a livelihoods perspective are well established. In addition, urban agriculture can cut across other cluster groups. In Table 5, the potential urban agriculture linkages to the cluster sectors are given, through a list of probing questions to highlight potential relationships.

**Table 5** Potential urban agriculture linkages to cluster sectors

<b>Sector</b>	<b>Potential food production linkages</b>	<b>Check</b>
<b>Water, Sanitation and Hygiene Promotion</b>	How many litres of water are being provided per person and how is water being managed at the household level (conduct household water audit to identify the inputs and outputs)?	
	How are communal WASH facilities being managed (greywater water quantity/disposal)?	
	What are the surface water drainage patterns and can these be exploited for different types of irrigation such as spate irrigation, ridge and furrow irrigation and agroforestry?	
	Are greywater and faecal sludge being kept separated or is it being combined for disposal?	
	How is faecal sludge managed and disposed? Can sludge be co-composted or briquetted?	
	What are the quantities and components of solid waste and how is it being disposed?	
	What are the resource recovery and reuse opportunities (e.g. co-composting/biochar)?	
	Are cash for work or community-based programmes running in the WASH sector?	



	Is there scope for retrofitting sustainable drainage systems (SuDS)?	
<b>Food Security and Nutrition</b>	Are there any mechanisms to support local primary food production?	
	Are following items being distributed: seeds; tools; fertilisers; greenhouses; drip irrigation kits; livestock; livestock feed; fish stocks; fishing equipment; hunting implements?	
	Are any of the following services provided: credit and loan facilities; agricultural extension; food processing plants; market information and; transport facilities?	
	Are there opportunities to integrate food production projects with host community farms and agriculture or to develop joint host and refugee primary food production projects?	
	How can primary food production be developed to supplement then replace food aid?	
	What type of food aid is being distributed (e.g. food vouchers/hot meals/fresh rations)?	
	Are cash for work programmes running in the food security and nutrition sector?	
<b>Shelter, Settlement and Non-Food Items</b>	Is there sufficient space around individual accommodation units for kitchen gardens?	
	Are there opportunities for food production on communal plots within the camp?	
	Are there opportunities for food production on plots downstream of wastewater flows?	
	Have recycling facilities such as compost plants been incorporated into the camp design?	
	Can agroforestry be used for camp windbreaks and woodlots for cooking energy?	

## **4.0 Conclusion and Recommendations**

### **4.1 Conclusion**

The financial, institutional and technical challenges resulting from delivering humanitarian assistance and early recovery support in Ninawa Governorate are substantial. The limitations of the current model are affecting the efficiency and effectiveness of recovery programmes because durable and rapid responses require funds, resources, political leadership and time. In reality, the humanitarian sector needs to do more, but with less, which is almost impossible. What is needed is a paradigm shift towards innovation and a new mind-set in how to assist the most needy and vulnerable in the complexity of what is a post-conflict urban setting.

It is therefore important to reiterate that urban agriculture must be seen as an opportunity to develop and implement long-term, self-sustaining solutions – not designed as a one-off response to the conflict, but as support for ongoing urban development efforts, whether by local, national or international actors. In responding to the current crises, urban agriculture will be an important part of the answer, because it can provide many of these crucial innovations, from vertical gardens to nutrient recycling. Investments into ‘low-space agriculture’ will be key to providing food security, resilience and safety to not only the thousands of IDPs on the move, but to future generations across Ninawa.

### **4.2 Recommendations**

#### ***Next steps for the development and intervention of an urban agriculture programme***

- Confirm the locations for the urban agriculture interventions;
- In each location, formally introduce the project to the municipal mayor for their support;
- In IDP camps, formally introduce the project to the local authorities and camp manager;
- Form a local management committee in each site location;
- Carry out urban agriculture assessments and analysis to build institutional knowledge and develop networks at the local level;
- Carry out urban orientation visits and find urban agriculture sites and urban farmers;
- Identify the knowledge gaps and the potential synergies and linkages;
- Establish urban agriculture hubs for training and learning purposes;
- Prepare and deliver urban agriculture training workshops.

## 5.0 References

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## Annex 1 Household Greywater Audit

Time	Sources of Greywater			
	<b>Personal hygiene:</b> bathing, showers, washing	<b>Kitchen:</b> food preparation / washing of cooking & eating utensils	<b>Utility:</b> washing of bedding & clothing	<b>Other sources:</b>
00:00 - 01:00				
01:00 - 02:00				
02:00 - 03:00				
03:00 - 04:00				
04:00 - 05:00				
05:00 - 06:00				
06:00 - 07:00				
07:00 - 08:00				
08:00 - 09:00				
09:00 - 10:00				
10:00 - 11:00				
11:00 - 12:00				
12:00 - 13:00				
13:00 - 14:00				
14:00 - 15:00				
15:00 - 16:00				
16:00 - 17:00				
17:00 - 18:00				
18:00 - 19:00				
19:00 - 20:00				
20:00 - 21:00				
21:00 - 22:00				
22:00 - 23:00				
23:00 - 23:59				

## Annex 2 Briefing Document on Urban Agriculture Rules and Regulations

## **Overview**

In Iraq there are no specific rules and regulations governing the management of urban agriculture. Urban agriculture is also not included as a policy component by any of the ministries although kitchen gardens have been promoted by the Ministry of Agriculture and Water Resources. As this specific urban agriculture activity remains limited in scale and scope and is easily managed there has not been a requirement to provide detailed rules and regulations controlling the activity.

From a broader urban agriculture perspective, there are limited rules and regulations that have the potential of impacting on urban agriculture such as the restrictions on the use of wastewater in agriculture. And while this restriction is acknowledged at the ministry levels it is not enforced at the local level so cases can be found for example of pomegranate plantations being irrigated with urban wastewater. In this context when policy controls are limited to restrictive controls but fail to offer alternative management practices coupled with limited enforcement, than informal irrigation practices will occur which is a common pattern in low- and medium-resource countries.

## **Wastewater in Agriculture**

To provide improved policy guidelines and management practices of wastewater in agriculture the Hyderabad Declaration was developed in 2002. This aims to “safeguard and strengthen livelihoods and food security, mitigate health and environmental risks and conserve water resources by confronting the realities of wastewater use in agriculture, through the adoption of appropriate policies and the commitment of financial resources for policy implementation”. The full declaration is included (see box below) to highlight how the development of appropriate policies with farmer participation can have a greater impact than ineffective restrictive controls that are rarely enforced.

In the context of the UNDP-funded Urban Agriculture Project in Ninewa, in lieu of relevant irrigation policies for the urban context the project can follow four simple recommendations to guide wastewater use during the development and implementation of the project, as follows:

1. Treated or untreated sewage (black-water) is not to be used for the irrigation of crops.
2. Domestic sullage (greywater) can be used for the irrigation of crops at the household level but urban farmers will require awareness training on the safe use of domestic greywater (see Section 1.2).

3. Sullage (greywater) that is flowing in communal drains or in surface water ditches is not to be used for the irrigation of crops as the source of the greywater is unknown and consequently the quality may be cross-contaminated with black-water. .
4. The only form of wastewater that can be used in greywater at the household level as the users can verify the source and content of the greywater.

### **Development of Urban Agriculture Policy**

Effective urban agriculture policy occurs across ministries and with an integrated approach to the subject. During the UNDP-funded urban agriculture project there is great scope to assist Ninewa Governorate with the developed of an urban agriculture strategy or also known as a city food policy. Such a policy would incorporate inputs from a full range of stakeholders including urban farmers and traders, and at the ministry level including the Ministry of Agriculture and Water Resources, Ministry of Municipalities and Public works, Ministry of Health, Ministry of Planning, Ministry of Sate-Environmental Affairs and the Ministry of Finance.

The aim of developing an urban agriculture policy is to maximise the benefits and manage and mitigate the associated risks. Urban agriculture policies are developed using a multi-stakeholder platform that captures inputs from the urban farmer to the policy maker. This is achieved through the completion of a number of steps that captures the local context and urban agriculture situation rather than imposing a top-down approach that fails to create the required enabling environment to unsure urban agriculture can safely flourish. The policy is likely to include issues around land planning, local economic market integration, livestock husbandry in urban areas and the safe recovery and reuse of waste resources such as wastewater and solid organic wastes.

### The Hyderabad Declaration on Wastewater Use in Agriculture

1. Rapid urbanisation places immense pressure on the world's fragile and dwindling fresh water resources and over-burdened sanitation systems, leading to environmental degradation. We as water, health, environment, agriculture, and aquaculture researchers and practitioners from 27 international and national institutions, representing experiences in wastewater management from 18 countries, recognise that:

1.1 Wastewater (raw, diluted or treated) is a resource of increasing global importance, particularly in urban and periurban agriculture.

1.2 With proper management, wastewater use contributes significantly to sustaining livelihoods, food security and the quality of the environment

1.3 Without proper management, wastewater use possesses serious risks to human health and the environment.

2. We declare that in order to enhance the positive outcomes while minimising the risks of wastewater use, there exist feasible and sound measures that need to be applied. These measures include:

2.1 Cost-effective and appropriate treatments suited to the end use of wastewater, supplemented by guidelines and their application.

2.2 Certain activities to take place where wastewater is insufficiently treated, and until treatment becomes feasible:

(a) development and application of guidelines for untreated wastewater use that safeguard livelihoods, public health and the environment;

(b) application of appropriate irrigation, agricultural, post-harvest, and public health practices that limit risks to farming communities, vendors, and consumers; and

(c) education and awareness programmes for all stakeholders, including the public at large, to disseminate these measures.

2.3 Health, agriculture and environmental quality guidelines that are linked and implemented in a step-wise approach.

2.4 Reduction of toxic contaminants in wastewater, at source and by improved management.

3. We also declare that:

3.1 Knowledge needs should be addressed through research to support the measures outlined above.

3.2 Institutional coordination and integration together with increased financial allocations are required.

4. Therefore, we strongly urge policy-makers and authorities in the fields of water, agriculture, aquaculture, health, environment and urban planning, as well as donors and the private sector to:

***Safeguard and strengthen livelihoods and food security, mitigate health and environmental risks and conserve water resources by confronting the realities of wastewater use in agriculture, through the adoption of appropriate policies and the commitment of financial resources for policy implementation.***

