

FOOD, CLIMATE CHANGE AND THE CITY

1. Overview

Climate change will bring new pressures to food systems and exacerbate existing ones. Responding to the challenges of climate change will therefore necessitate a 'food systems transformation' in urban areas. This necessary transformation will require decision-makers to take leadership, recognizing that:

- **Urban food systems are major contributors to climate change.**
- **Urban food systems are highly vulnerable to climate change.**
- **Action is needed now to ensure urban populations can access sufficient, sustainably-produced, affordable, safe and nutritious food in a changing climate.**

- **95%** of the global population growth over the next 30 years will occur in urban areas. By 2050, around 70% of our global population of over 9.2 billion will be urbanised.
- The size and power of urban centers mean that **how urban people eat and what they eat has huge impacts on food systems** and can also make a significant contribution to how we tackle climate change.
- Cities can be **drivers of change**. They take up less than 2% of the earth's surface but generate 85% of the world's GDP, consume 76% of the world's energy and produce more than 70% of all carbon dioxide and significant amounts of other GHGs.

2. Introduction

Challenges associated with feeding urban populations are rising on the international agenda, but the issues associated with feeding urban areas in a changing climate receive somewhat less attention. Indeed, *“while the connections between food security and climate change have been examined extensively at the national and regional scales, the urban scale has been largely neglected in both fields as have the connections between the two”* (Battersby, 2012, p. 38). Yet the challenges associated with feeding urban dwellers in a changing climate over the coming years will

be significant. Our food systems are already under huge pressure to deliver sufficient, safe, affordable and nutritious food to a growing global population. Climate change and a rapidly growing urban population will only exacerbate many of these pressures.

For this reason, and in the follow-up of the COP21 agreement that set stringent targets for international climate action, this paper aims at positioning the challenges associated with feeding cities in a changing climate as a strategic area for action in the future.

CLIMATE CHANGE URBAN FOOD INITIATIVE

The Climate Change Urban Food Initiative (CCUF) was launched in late 2015 by Fondation Nicolas Hulot (FNH), the International Urban Food Network (IUFN) and the United Nations Environment Programme (UNEP). The aim was to highlight the strategic links between Sustainable Food Systems, Sustainable Urban Development and Climate Change, and to showcase successful mechanisms and approaches to help respond to the challenges of achieving sustainable urban food systems in a changing climate. The CCUF was envisioned as a focused short-lived

project designed to spark interest and discussion on the critical issues around food systems, climate change and urban populations. With that in mind, the Initiative has deliberately employed a variety of interactive communications to reach out to stakeholders, including:

- **4 webinars** (2 in English, 2 in French) featuring international experts and practitioners highlighting linkages between climate and sustainable food systems, as well as potential actions. Annex 1 provides a copy of all the presentations from the webinar series.

- **2 short movies**, which present a fast-paced, fact-filled look at why there is an urgent need now for action towards more sustainable food systems. You can view both movies at <https://youtu.be/Vcl3BQeteCc> and <https://youtu.be/zoBhghBVGhA>

- **Joint IUFN-FNH-UNEP Policy Perspectives Paper** to challenge local and national decision-makers to consider urgent action towards more sustainable food systems. This policy perspective paper draws on the expertise that was shared by the experts during the webinars. ■

3. Framing the Issue

3.1 Urban Food Systems

An urban food system includes all the elements relating to the production, processing, distribution, preparation, consumption and waste disposal involved in the provision and consumption of food for urban populations. This includes all the inputs into these activities, as well as the broader outputs, like social, economic, health and environmental outcomes. This ‘food systems’ approach recognizes that both rural and urban areas are connected in a larger system characterized by dynamic flows of information, finances, resources and people. Urban food systems are therefore very diverse and include a variety of complex interactions and relationships.

3.2 Urban food systems are major contributors to climate change

Urban populations are a major driving force for global food demand and they will continue to be so in the future. Over 54% of the 7.2 billion people in the world today already live in cities and towns, and this is projected to rise to over 66% of the global population by 2050 (UNDESA, 2014). Urban populations and areas are expanding fast with 95% of global population growth over the next 30 years in urban areas. Urban populations are projected to increase by 2.4 billion people by 2050, with nearly 90

What is an urban area?

UN-Habitat defines it as “*the built-up or densely populated area containing the city proper; suburbs, and continuously settled commuter areas. This may be smaller or larger than the metropolitan area.*” (UN-HABITAT, 1995). Cities take a variety of shapes, from megacities to small rural towns, and this diversity should be taken into account when exploring the relationships between urban areas and food as this diversity echoes that of the food systems that bring food to a city.

per cent of this increase concentrated in Asia and Africa. As well, urban areas are key drivers of economic growth generating over 70 per cent of the world’s Gross Domestic Product (GDP) (UNHABITAT, 2012).

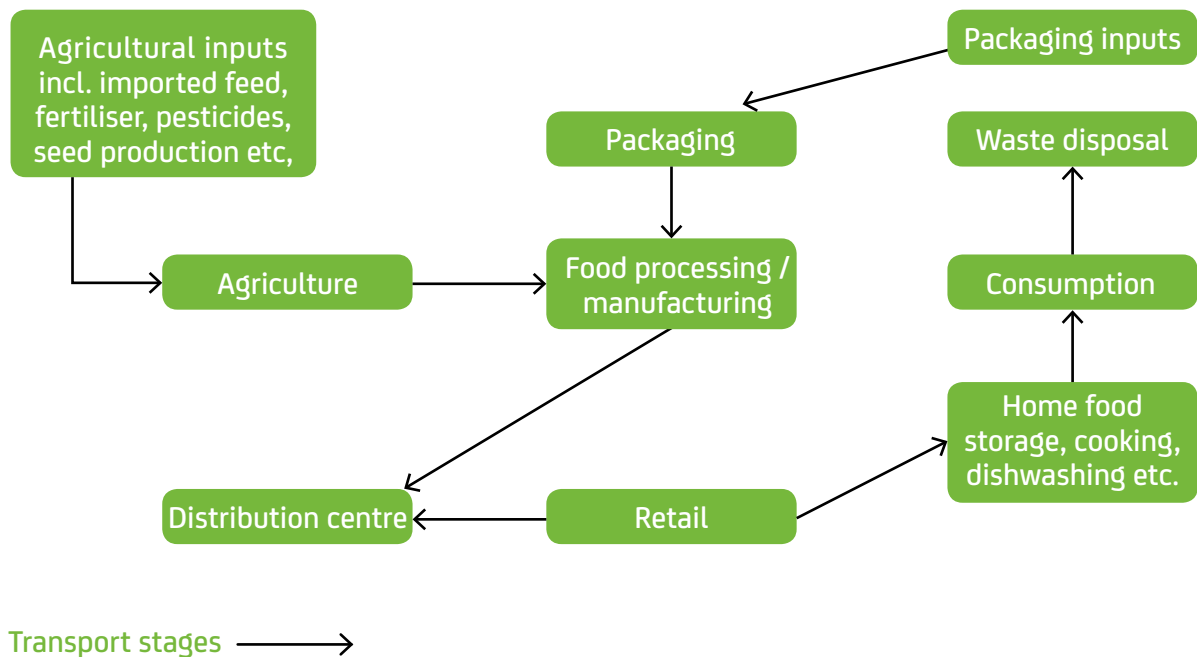
The consumption and production of food produces significant greenhouse gases. All the activities that go into feeding urban populations generate significant greenhouse gases. It is estimated that food system emissions—from production to consumption—contribute 19-29% of global greenhouse gas emissions

(Vermeulen et al, 2012). An assessment by the Greater London Authority in 2009 found that food consumed in the city equated to around 19 million tonnes CO2 equivalent per annum (11 million of which was CO2) across production to retail, foodservice, storage, preparation and disposal.

UN-HABITAT notes that “urban centres rely on inward flows of food, water and consumer goods that may result in GHG emissions from areas outside the city” (2011, p. 33). For example, the production phase of food is often the largest contributor to the GHG footprint of a product and this phase is often carried out outside of the urban boundaries. At the European level, it is estimated that

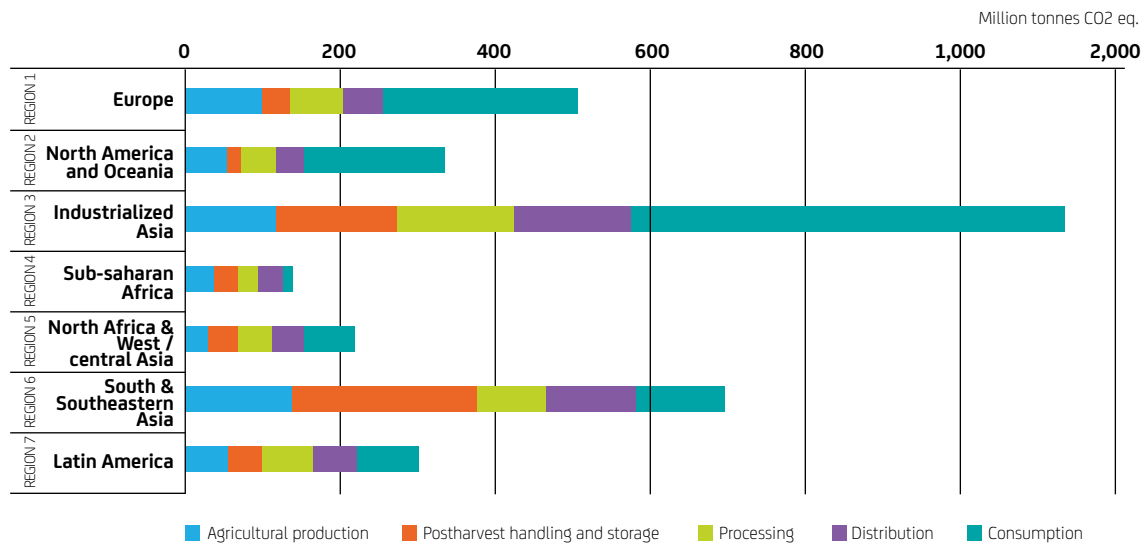
the agricultural production phase accounts for 67% of GHG emissions caused by the food consumed by the average EU-27 citizen in 2013 (Joint Research Center, 2015). Similarly, in the United States, around 60% of GHG emissions from the food system come from the production phase. Food processing (10%), distributing (7%) consuming (15%) and disposing of waste (8%) also contribute to US emissions profile (Institute for Agricultural Trade and Policy, 2009). Regional or national studies are difficult to compare with one another, as methodologies do not always compare, and it is not possible to extrapolate these figures to other countries.

EACH STAGE IN THE FOOD SYSTEM CONTRIBUTES EMISSIONS



Source: Garnett, 2008

CARBON FOOTPRINT OF FOOD WASTAGE, BY REGION AND BY PHASE OF THE SUPPLY CHAIN



Source: FAO, 2013

Urbanization can change food consumption behavior leading to diets associated with increased GHG emissions. Changes in diet patterns can be a consequence of a number of factors, including increases in income for many urban dwellers and cultural changes associated with different social patterns of urban life.

Urbanization is often associated with increases in income, and higher urban incomes are correlated with more GHG intensive diets. Urban populations tend to eat more animal products as well as processed food where “refined products and products of animal origin generally need an amount of energy several times larger than vegetables, fruits and cereal products” (Joint Research Center, 2015, p. 7). In countries with rapid urbanization, meat consumption is increasing rapidly. For example, from 1995-2015,

kilograms per capita consumption of meat (sheep, beef, poultry & pork) has increased by 51% in BRIC countries, with an 7% increase in OECD countries (OECD, 2016). This is predominantly due to increased pork and poultry consumption. OECD countries are on average already highly urbanized with around 80% of the total population of OECD countries residing in urban areas (World Bank, 2016). Meat consumption is also on average very high at 65.4kg per person in OECD countries, compared to 33kg per person in BRIC countries in 2014 (OECD, 2016). As Stage et al. (2009) point out, it is important to note that “the driving force behind the shift in diet is not the urbanization per se; the driving force is the higher income that households secure by moving into cities” (p. 20).

Cultural changes are also a significant factor. For instance, urbanization can lead

to “dietary shifts towards more processed and pre-prepared foods, in part in response to long working hours” (Satterthwaite, McGranahan, & Tacoli, 2010, p. 2815). Urban populations are also “highly networked into global information, communication and trade networks. This is driving rapid changes in regional cultural values, which are, in general, becoming more homogenized and modeled after Western, high-consumption lifestyles” (Deutsch, Dyball, & Steffen, 2013, p. 519). And, “the high proportion of urban households with electricity in middle-income and some low-income nations also means far more households with refrigeration and this supports shifts in food demand” (Satterthwaite, McGranahan, & Tacoli, 2010, p. 2815).

Urban populations can also generate significant food waste which contribute to GHG emissions, for example through the methods of disposal of such waste (incineration, landfill) and by the fact that the production of food that is never consumed emits unnecessary GHG emissions in the first place. According to Liu (2014, p. 7) “municipal solid waste in China grew on average 8-10% in the later part of the last decade with food waste estimated to contribute roughly 50% to 70% (Tai et al. 2011) of this waste, most being eventually incinerated and landfilled (for example, on a national average 56.6% was landfilled in 2009) (Hu et al. 2012)”. Behavioural changes associated with urbanization, such as increased “eating-out” can also be a factor in generating more food waste.

3.3 Urban food systems are major contributors to climate change

Climate change will bring many serious challenges to urban food systems. It will affect all four components of food security: availability, access, utilisation and stability (FAO, 2009; Vermeulen et al., 2012). Assessing the vulnerability of an urban food system will thus entail understanding both the projected physical impacts of climate change on the food system and the capacity of urban actors to respond to such impacts. Gregory, Ingram & Brklacich (2005) emphasise that “vulnerability of food systems is not determined by the nature and magnitude of environmental stress per se, but by the combination of the societal capacity to cope with, and/or recover from environmental change, coupled with the degree of exposure to stress” (p. 2143).

95% of the urban expansion in the next decades will take place in the developing world. This urban growth will be accompanied by rapid growth of highly vulnerable urban communities living in informal settlements and will place urban food systems under considerable pressure. Today, 828 million people live in slum conditions and lack access to basic services. This number will grow by 6 million each year (UN-Habitat, 2010).

Climate change will have the greatest impact on the poorest and most marginalized populations, who commonly live in the highest-risk areas (for example, 72% of the African urban population live in informal settlements). The impacts of climate change on poverty are expected to be regressive and differential, affecting most significantly the urban poor (net food consumers) and highly vulnerable countries in sub-Saharan Africa and South Asia (World Bank, 2013).

3.3.1 Factors outside the urban boundary

Unsurprisingly, urban food systems will be affected by climate change impacts that happen outside of the urban area. Cities mainly rely on food that is produced in other areas. Indeed, it is estimated that only 15 to 20% of the world's food is produced in cities (Armar-Klemesu, 2000). Therefore, urban areas are particularly vulnerable to what happens in the places where the food they consume is produced, transformed and stored. And climate change will have serious impacts on the provision of food to urban populations, for example through:

- Cumulative impacts from changing climate which, when added together, have large scale negative impacts on the food system;
- Climate-related events (e.g. hurricanes, droughts) which have the potential to destroy crops and critical food production and storage infrastructure;
- Destruction of transport infrastructure such as access routes into urban areas (e.g. from intense storm events);
- Ongoing changes in climatic conditions which will (and already have) affect the production of crops, for example changes in rainfall levels that will affect both crop quality and quantity;

- Rise in disease or pest attacks destroying or impacting crop yields or animal health;
- Increased storage and refrigeration costs;
- Volatility in food prices (due in part to unfavorable climate conditions for food production) that may lead to increased social unrest and migration which can have significant flow-on effects.

3.3.2 Factors within the urban boundary

Climate change may seriously impact food system infrastructure and activities within the urban boundary. This can originate from key food assets being physically impacted by climate events. For instance, analysis carried out in New York after Hurricane Sandy found that a third of the city's wholesale food market, through which around 60% of the city's produce and half of its meat and fish pass, as well as 700 food markets were at risk of flooding (Cohen, 2014). This vulnerability can also originate from the way food actors are currently organized and from their capacity to evolve. For instance, a review of climate vulnerability in Australia found that the country *"has one of the most concentrated food supplies of any country, being dominated by two large supermarket chains... [in which] the food logistics system is built around the principle of just-in-time movement of freight reducing inefficiency under normal circumstances but which leaves no margins in the event of a disaster"* (Edwards & Mercer, 2010, p. 20) quoted in (Burton, et al., 2013).

Urban infrastructure can be particularly vulnerable to climate change impacts due to rising sea levels and storm surges, heat stress, extreme precipitation, inland and coastal flooding, landslides, drought, increased aridity, water scarcity (Urban Climate Change Research Network, 2015). "Conventional food

systems are tightly bound together with other vulnerable urban systems like transportation, electricity, water, wastewater, financial systems, social systems and physical infrastructure” (Cohen, 2014). Any disruption in other systems can therefore induce disruption in the urban food system. For instance, “the Sandy storm highlighted many of New York City’s transportation vulnerabilities. Several tunnels and bridges, including the critical George Washington Bridge, were closed, disrupting food deliveries. (...) After Sandy, food distributors coordinated with traffic enforcement officials to bypass bridge closures” (Initiative for a Competitive Inner City, 2015, p. 7).

Cities may therefore need to adapt their existing infrastructure (Urban Climate Change Research Network, 2015) to address projected climate change impacts, such as increased flooding and heat waves. However, not all cities have the capacity to invest in such upgrades, and “the problems identified are likely to be worse in countries where there is no regular maintenance and transport infrastructure is already old and under strain” (Tacoli, Bukhari, & Fisher, 2013, p. 5).

Some urban areas and populations will be particularly vulnerable to climate change. Food systems will come under intense pressure in these places. For example, the population in large cities exposed to cyclones is projected to increase from 310 to 680 million during 2000–2050. South Asia is expected to see most of this increase, where 246 million residents of large cities will be exposed to severe storms by 2050 (Lall & Deichmann, 2012). 60 percent of the world’s 39 metropolitan areas with more than five million people are located within 100km of the coast, including 12 of the world’s 16 largest cities.

Climate change could increase the prices of major crops in some regions leading to huge pressures on vulnerable communities who need to access affordable food. This can have a knock-on effect on calorie intake, particularly in areas where chronic food insecurity is already a significant problem. “A high proportion of low-income urban households—especially those reliant on wage labour—are particularly at risk from climate change induced food shortages or staple food price rises (Ahmed et al. 2009)” (Satterthwaite, McGranahan, & Tacoli, 2010, p. 2818).

The limited capacity of informal traders in Southern Cities to cope with extreme events can also be an issue. A study carried out in Cape Town shows that “the projected increase in temperature (...) will reduce the shelf life of many food stuffs. Given the limited cooling and temperature regulation capacity of most informal traders, this will impact the availability and the prices of food” (Battersby, 2012, p. 49).

Poorly planned urban expansion can increase food system vulnerability. “Urban centres often expand over their nation’s most productive agricultural land since most urban centres grew there precisely because of highly fertile soils” (Satterthwaite, McGranahan, & Tacoli, 2010, p. 2816). The increasing competition between urban land uses and agriculture land can impact on the ability of surrounding peri-urban and rural areas to provide food to urban areas and compromise their role as a complementary safety-net or buffer when external food markets become volatile. Loss of farmland to cities is estimated at 1.6-3.3 million ha per year between 2000 and 2030 (UNEP, 2012).

4. Recommendations

The challenges for urban food systems in a changing climate are great. Our urban food systems need urgent attention to ensure they will be able to supply food that meets the nutritional needs of their future populations. This will require holistic systems-based approaches to the development of urban policies and actions that consider food systems both as a major contributor to climate change as well as a significant feature of resilience and adaptation.

As urban areas concentrate most of the food demand globally, urban populations have a very strong impact on what, how, where, and how much food is produced. Urban areas can therefore take a leadership role in driving more sustainable food systems. And while not all the levers to make changes to complex global food systems will be available to urban decision-makers, there are a number of actions that can be taken. The webinar series has highlighted many different perspectives that need to be considered when addressing the

serious challenges facing urban food systems in a changing climate. Food systems are very diverse, and climate change will also have very diverse impacts on our urban food systems. Therefore it is important that decision-makers develop responses that are relevant and appropriate for their own populations and urban regions. Based on the presentations and discussions in the webinars and the contribution of experts, a menu of potential actions is presented below. This is not intended as an exhaustive list but as a starting point for action.

Lastly, the necessary transformations required for attaining sustainable food systems in a changing climate provide an enormous opportunity to help achieve more resilient and sustainable city-urban-regions across all sectors and services. The central role of food in society means that efforts to improve the sustainability of our food systems will have multiple benefits.

OVERVIEW OF KEY RECOMMENDATIONS

AT INTERNATIONAL & REGIONAL LEVEL
Increase knowledge, information sharing and understanding of the impacts on climate change on urban food systems as well as potential mitigation and adaptation strategies
AT THE CITY-REGION SCALE
Integrate food and climate change in urban policy, planning & actions
Encourage multi-stakeholder participation
Evaluate the environmental, social, economic and health impacts of the consumption and production of food by urban populations
Assess the vulnerability of the urban food system to climate change
Promote policies, projects, and citizen actions that decrease the environmental impacts of all the activities of the urban food system
Develop Urban Food System Resilience Plans

AT INTERNATIONAL & REGIONAL LEVEL

4.1 Action: Increase knowledge, information sharing and understanding of the impacts of climate change on urban food systems, as well as potential mitigation and adaptation strategies

While there is considerable work on climate change and urban policy or planning there appears to be a lack of focus on the interlinkages between urban food systems and climate change – from both mitigation and adaptation perspectives. Given the importance of providing adequate quality nutrition to rapidly growing urban populations, and the potential serious impacts of climate change on urban food systems over the coming years, it is necessary to place more efforts in this area.

In the follow-up of the COP21 agreement that set ambitious targets for international climate action, local authorities should put particular emphasis on this issue that is still to be given proper consideration at both the international and local level.

AT THE CITY-REGION SCALE

4.2 Action: Integrate food and climate change in urban policy, planning & actions

“Cities must embrace the triple challenges of reducing the vulnerability of their population to climate change, of mitigating their GHG emissions and of providing sufficient and nutritious food for their residents” (Dubbeling, 2015).

Sustainable food system action is an under-developed area in most existing local government climate change plans, and climate change is rarely taken into account in local sustainable food actions (Marceau, 2015). However, there are a large number of actions that can be taken to exploit synergies between sustainable food systems and climate change actions, as well as to broader urban planning objectives. “Using a food system approach means recognizing the interconnectedness of all parts of the system” (Burton, et al., 2013, p. 19). The Milan Urban Food Policy Pact signed in October 2015¹ by over 100 cities from around the world acknowledges that the relationship of food policies to many other urban challenges and policies means that it is essential for cities to adopt an approach that is comprehensive, interdisciplinary and inter-institutional (Milan Urban Food Policy Pact, 2015).

1. <http://www.foodpolicymilano.org/en/urban-food-policy-pact-2/>

4.3 Action: Encourage multi-stakeholder participation

Local government actors cannot act alone. The establishment of long-term partnerships with the other food system stakeholders is critical. These could include working with:

- Citizens and civil society to support bottom-up initiatives and to foster community engagement.
- Urban and peri-urban farmers to support their activity, and to work to decrease environmental impacts associated with food production and transport (Raton, 2015; Berger, 2015).
- Private sector stakeholders to encourage them to integrate climate change issues in their strategies, and to develop innovative ways to respond to these challenges.
- Researchers to produce more robust evidence and evaluation of action.
- Other cities, such as the Milan Food Pact which brings together over 100 cities to promote action towards more sustainable urban food systems.
- Central government actors and initiatives. Further, it is important to ensure that actions cut across sectors (Barles, 2015). Climate, food, and urban planning and development are rarely joined up at the moment. Initiatives that aim at bringing together stakeholders from across these policy silos should be encouraged. For instance, a specific committee can be set up, such as a Food Policy Council, which can strengthen coordination across urban areas on food policy, climate change and wider urban development objectives.

4.4 Action: Evaluate the environmental, social, economic and health impacts of the consumption and production of food by urban populations

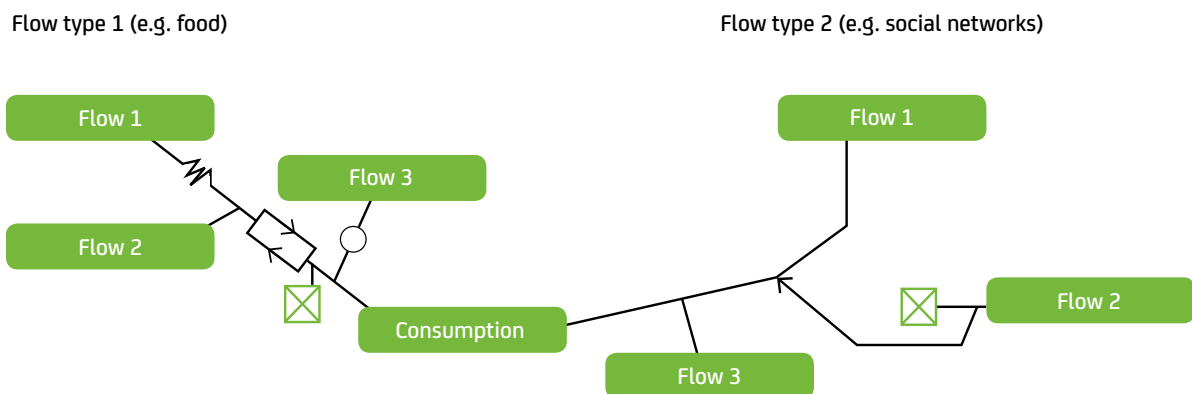
Developing an understanding of the impacts of food consumption and production for a specific city-region is an important first step. Urban food systems are very diverse and developing any plan to build resilience and improve sustainability in the food system will need to take into account the specific nature and peculiarities of the city-region under investigation. There are various examples, of cities that have started this work. For example the Greater London Authority (GLA) decided to assess the GHG emissions associated with food consumption in London. The initial Report completed in 2009 then inspired the Greater London Authority to commission further work to better understand food consumption impacts, including on the Scope 3 (Indirect) Emissions. This led to the development of a technical specification (PAS 2070) to help provide guidance to measurement of GHG emissions (GLA, 2015). As well, the GLA has been implementing a broader London Food Strategy² designed to take a holistic view to improving the sustainability of the London food system.

2. https://www.london.gov.uk/sites/default/files/the_mayors_food_strategy_2006.pdf

A MODEL TO ASSESS CLIMATE CHANGE RELATED URBAN FOOD SECURITY RISKS

This model relies on a view of “urban food security as the connection of a series of resource flows each with their own sets of vulnerabilities and resilience” (Battersby, 2012, p. 36). These flows are not only food flows, they can also be cash, people or social network flows. “These types of flow are drawn on concurrently by households to ensure food security (...), and each is potentially impacted by climate change in different ways at different times. It is essential to understand the connections between these diverse flows and the capabilities of households to draw on these flows to access food. The model as proposed therefore argues that it is important not just to understand the dynamics of the food system, but also how households are able to use their asset base to optimise navigation of these diverse flows”.

THE CONNECTION BETWEEN DIFFERENT FLOW TYPES AND SITE OF CONSUMPTION



Source : Battersby, 2012

4.5 Action: Assess the vulnerability of the urban food system to climate change

This can be done in various ways. The key message being that a “lack of climate change projections and [the presence of many] uncertainties should not discourage action” (UN-Habitat, 2015, p. 50). For example, decision-makers can introduce food issues as part of their Climate Vulnerability Assessments (UN-Habitat,

2015). This requires documenting the variety and complexity of the supply chains that bring food into urban areas (“where food is coming from and who main suppliers and distributors are” (The Bristol Partnership, 2009, p. 47)). Assessment should be carried out at each stage of the food system. “Food production, processing, transport, storage and retail are all potentially impacted by climate change. (...) Similar foods, even food emanating from the same source but taking different paths to the site of consumption,

may be impacted by climate change in different ways” (Battersby, 2012, p. 47). Such an assessment should also include the analysis of the vulnerability of the regional food-shed to avoid wrong decisions about re-localisation of climate-vulnerable crops (Cohen, 2014). And consider the energy security levels of areas where activities in the food chains are located (Garnett, 2008). Given the high level of uncertainty, and the potential lack of data, such assessments can use scenario development and act as a focal point for stakeholder involvement (Ingram, Ericksen, & Liverman, 2010).

4.6 Action: Promote policies, projects, and citizen actions that decrease the environmental impacts of all the activities of the urban food system

The focus should not be solely on the reduction of GHG emissions but include the aim to reduce all negative environmental impacts across the urban food system, where possible. The goal is to improve the overall sustainability and resilience of the food system so that urban populations have ongoing access to sufficient safe, nutritious, affordable food.

For example, cities can encourage the adoption of more sustainable diets that ensure the adequate nutrition of urban dwellers while reducing the environmental footprint. Local authorities can also implement activities to raise awareness and change behavior about food waste.

Urban policies in areas such as planning, housing, transportation also have a large role to play in driving more sustainable food systems that have lower GHG emissions and which are more resilient to climate change. For instance, adequate planning can “help customers to be able to walk, cycle or use public transport to buy food, or to provide efficient deliveries, such as to people’s homes or in bulk to a drop-off point or food co-ops” (Making Local Food Work, 2010, p. 12). The development of renewable energy sources or policies that aim at increasing the energy efficiency of urban food activities (retailers, transport...) can help meet both climate and sustainable food systems goals (Garnett, 2011). Urban planning can also encourage more sustainable local food production and encourage backyard and community gardens which can have multiple benefits. Examples of 130 initiatives across 10 cities can be found in the *Handbook on Creating Space for Sustainable Food Systems in Urban Communities* (URBACT, 2015)³. Promising local practices to develop low-carbon and resource-efficient urban food systems, as well as policy evidence collected in the implementation of Local Action Plans, is shared by the ten participating cities.

3. <http://www.sustainable-everyday-project.net/urbact-sustainable-food/the-handbook/>

4.7 Action: Develop Urban Food System Resilience Plans

The Milan Food Policy Pact calls for cities to “develop a disaster risk reduction strategy to enhance the resilience of urban food systems, including those cities most affected by climate change, protracted crises and chronic food insecurity in urban and rural areas”. A comprehensive Food System Resilience Plan can help address food system vulnerabilities and can create a coordinated system of response to shocks affecting food supply (Neff, 2015). Existing coordination is likely to be low as food system risks are not high on the political agenda. However, city governments need to establish a food-related “chain of command” and procedures to cope with potential shocks. This could include a system for identifying areas with the greatest potential need, placing stores of emergency food in neighborhoods through the city, and developing specific plans to provide food to identified vulnerable populations in the event of crisis (Neff, 2015).

The diversity and resilience of food supply chains should be considered. Urban areas receive food from a variety of supply chains, or, in other words, from “several systems operating at different levels” (Tacoli, Bukhari, & Fisher, 2013, p. 2). This diversity can be the key to resilience: “in the longer term, the multiple sources of food and the multiple means by which food reaches the city, through the formal and informal trade systems as well as local and distant production, generate a more systemic resilience. If an extreme weather event destroys either local crops [...], or crops from more distant production locations,

it is still possible to get those products from elsewhere. If food prices in the formal sector spike because of fuel price increases, or as a result of climate change negatively affecting crop yields, the local networks of the informal traders may mitigate against these price shocks. To return to the metaphor: having eggs in multiple baskets creates some form of resilience in the food system” (Battersby, 2014, p. 12).

Food System Resilience Plans can aim at increasing safety nets: “the need for social safety nets will increase as a result of climate change, at the same time as the ability of communities to provide these informal safety nets decline. There is therefore a need to reconfigure the functioning of this flow to introduce new forms of safety nets that can respond to needs to households when access to food through other flows fails” (Battersby, 2012, p. 52). This could mean working with Food Banks to make sure their activity is not disrupted by climatic events, or “consider models for the support of vulnerable communities for when sudden price rises in food and fuel outpace benefit adjustments” (The Bristol Partnership, 2009, p. 46).

Food System Resilience Plans can aim to protect and promote urban and peri-urban agriculture. It is essential that good quality agricultural land be kept to ensure a diversity of growing areas. “Regional food procurement can support regional food economies, and in doing so enable farmers to have the financial wherewithal to invest in mitigation and adaptation” (Cohen, 2014). Urban agriculture should also be considered as a key asset for both climate change adaptation and mitigation (Dubbeling, 2015).

**EXAMPLE OF RESILIENCE PLANNING:
BOSTON FOOD RESILIENCE STUDY: KEY RECOMMENDATIONS**

FOOD AVAILABILITY	
VULNERABILITY	RECOMMENDATION
Local food system initiatives are not incorporated into resilience planning	Incorporate a resilience perspective into the City's efforts to expand local food production, processing and distribution
I-93 and secondary streets are vulnerable to flooding and closure	Identify road network vulnerabilities to natural disasters Identify contingency delivery methods (e.g., using the port) and alternate routes for major food products
Fresh food distributors are clustered in locations vulnerable to flooding	Mitigate flooding risks for distributors in flood hazard zones.
Fresh food distributors and The Greater Boston Food Bank have limited capacity to serve an increasing population and limited storage capacity	Expand storage capacity for food in Boston, including cold storage
Weak public-private coordination with suppliers, distributors, and retail outlets in the food system	Strengthen formal coordination across public and private food system organizations
The Greater Boston Food Bank does not have capacity, or financial resources, to meet increased demand for longer periods of time	Clarify private and nonprofit sector reliance on The Greater Boston Food Bank for resilience plans Establish longer-term funding plans or sources to support The Greater Boston Food Bank in the event of natural disaster
Insufficient data and information to effectively address food availability issues	Identify optimal mix of local, regional and national food production
FOOD ACCESS	
VULNERABILITY	RECOMMENDATION
Many residents in Charlestown, Dorchester, East Boston, Mattapan, Mission Hill and Roxbury currently experience food access issues	Develop a food security action plan for targeted neighborhoods in Boston Increase the capacity of food pantries and soup kitchens to handle sustained increased demand
Insufficient data and information to effectively address food access issues	Identify strategies and best practices to increase food access in Boston

Source: Initiative for a Competitive Inner City, 2015

References

- Armar-Klemesu, M. (2000). Urban agriculture and food security, nutrition and health. Dans M. D.-K. Eds. N. Bakker, *In Growing cities, growing food: Urban agriculture on the policy agenda. A reader on urban agriculture*. GTZ/DSE.
- Barata, M., Ligeti, E., De Simone, G., Dickinson, T., Jack, D., Penney, J., et al. (2011). Climate change and human health in cities. Dans C. Rosenzweig, W. D. Solecki, S. A. Hammer, & S. (. Mehrotra, *Climate Change and Cities: First Assessment Report of the Urban Climate Change Research Network* (pp. 179-213). Cambridge, UK: Cambridge University Press.
- Barles, S. (2015, 21-October). Alimentation, changement climatique et villes : des enjeux entrelacés. *Climate Change Urban Food Webinar Series*.
- Battersby, J. (2012). Urban Food Security and Climate Change: a System of Flows. Dans B. Frayne, C. Moser, & G. Ziervogel, *Climate Change, Assets and Food Security in Southern African Cities*. London: Earthscan.
- Battersby, J. (2014). The Need for a Diverse and Responsive Food System. *Urban Agriculture Magazine*(27), pp. 10-12.
- Berger, B. (2015, 4-November). Systèmes alimentaires locaux : Trajectoire environnementale des producteurs. *Climate Change Urban Food Webinar Series*.
- Burton, P., Lyons, K., Richards, C., Amati, M., Rose, N., Des Fours, L., et al. (2013). *Urban food security, urban resilience and climate change*. National Climate Change Research Adaptation Facility.
- Cohen, N. (2014, September 11). Consulté le December 2, 2015, sur Urban Food Policy: <http://urbanfoodpolicy.com/2014/09/11/increasing-the-resilience-of-nycs-food-system-to-climate-change/>
- Deutsch, L., Dyball, R., & Steffen, W. (2013). Feeding Cities: Food Security and Ecosystem Support in an Urbanizing World. Dans T. Elmqvist et al. (eds.), *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment* (pp. 505-537). Springer Netherlands.
- Dubbeling, M. (2015, 10-November). Urban agriculture as a city climate change adaptation and mitigation strategy. *Climate Change Urban Food Webinar Series*.
- Edwards, F., & Mercer, D. (2010). Meals in Metropolis: mapping the urban foodscape in Melbourne, Australia. *Local Environment*, 15(2), 153-168.
- FAO (2013). *Food Wastage Footprint Study Impact on natural resources Technical document*.
- Garnett, T. (2008). *Cooking up a Storm. Food, Greenhouse Gases and our Changing Climate*.
- Garnett, T. (2011). Where are the best opportunities for reducing greenhouse gaz emissions in the food system (including the food chain)? *Food Policy*(36), PP.23-32.
- Gregory, P., Ingram, J. S., & Brklacich, M. (2005). Climate change and food security. *Philosophical Transactions of the Royal Society*, 360, 2139–2148.
- Ingram, J., Ericksen, P., & Liverman, D. (2010). *Food Security and Global Environmental Change*. London: Earthscan.
- Initiative for a Competitive Inner. (2015). *Resilient Food Systems, Resilient Cities: Recommendations for the City of Boston*.

- Initiative for a Competitive Inner City. (2015). *Resilient Food Systems, Resilient Cities: Recommendations for the City of Boston*.
- Institute for Agricultural Trade and Policy. (2009). *Identifying our Climate 'Foodprint': Assessing and Reducing the Global Warming Impacts of Food and Agriculture in the US*. Minneapolis.
- Joint Research Center. (2015). *Energy use in the EU food sector: State of play and opportunities for improvement*. Luxembourg: European Union.
- Lall, S. V., & Deichmann, U. (2012). Density and Disasters: Economics of Urban Hazard Risk. *World Bank Research Observer*, 27(2), 74-105.
- Liu, G. (2014), "Food Losses and Food Waste in China: A First Estimate", OECD Food, Agriculture and Fisheries Papers, N°66, OECD Publishing, Paris.
- Making Local Food Work. (2010). *Local Food and Climate Change. The Role of Community Food Enterprises*.
- Marceau, A. (2015, October 21). Quelle place pour le changement climatique dans les politiques alimentaires soutenables? *Climate Change Urban Food Webinar Series*.
- Neff, R. (2015, 10-November). Planning for Climate-Resilient Urban Food Systems: Baltimore and Beyond. *Climate Change Urban Food Webinar Series*.
- OECD. (2016). Meat consumption (indicator): doi: 10.1787/fa290fd0-en (Accessed on 31 March 2016).
- Raton, G. (2015, 4-November). Circuits courts alimentaires et enjeux logistiques. *Climate Change Urban Food Webinar Series*.
- Satterthwaite, D., McGranahan, G., & Tacoli, C. (2010). Urbanization and its implications for food and farming. *Philosophical Transactions of the Royal Society*, 365, 2809–2820.
- Stage, J., Stage, J., & McGranahan, G. (2009). *Is urbanization contributing to higher food prices?* International Institute for Environment and Development.
- Tacoli, C., Bukhari, B., & Fisher, S. (2013). *Urban Poverty, Food Security and Climate Change*. Human Settlements Working Paper n°37, International Institute for Environment and Development.
- The Bristol Partnership. (2009). *Buiding a Positive Future for Bristol after Peak Oil*.
- UN-HABITAT. (1995). *Indicators Programs. Monitoring the City. Vol 2. Urban indicators Review. The Survey instrument*.
- UN-Habitat. (2010). *State of the World's Cities 2010/2011: Bridging the Urban Divide*. London: Earthscan.
- UN-HABITAT. (2011). *Global Report on Human Settlement 2011. Cities and Climate Change*.
- UN-Habitat. (2015). *Integrating Climate Change into City Development Strategies. Climate Change and Strategic Planning*.
- Urban Climate Change Research Network. (2015). *Climate Change and Cities. Second Assessment Report of the Urban Climate Change Research Network. Summary for City Leaders*. New York: Columbia University.
- White, R., Stewart, B., & O'Neill, P. (2013). *Access to Food in a Changing Climate*. Global Environmental Change and Food Systems, Environmental Change Institute - University of Oxford.
- World Bank. (2016). Retrieved 7-February 2016 from <http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS/countries/1W-CN-OE?display=graph>

Acknowledgements

The authors would like to thank the speakers of the Climate Change Urban Food Initiative:

Mark AINSBURY, Greater London Authority

Sabine BARLES, Professeur, Institut de géographie, Université Paris 1 Panthéon Sorbonne

Jane BATTERSBY-LENNARD, University of Cape Town

Blaise BERGER, FRCIVAM Bretagne

Paul BURTON, Griffith University

Yuna CHIFFOLEAU, Chargée de recherche INRA

Marielle DUBBELING, RUA Foundation

Tara GARNETT, Food Climate Research Network (Oxford Environmental Change Institute)

Alizée MARCEAU, Soil Association, Sustainable Food Cities Network

Roni NEFF, Johns Hopkins Center for a Livable Future, and **Erin BIEHL**, who provided comments on the document

Gwenaëlle RATON, IFSTTAR

David SATTERTHWAITE, International Institute for Environment and Development (IIED)

Cecilia TACOLI, International Institute for Environment and Development (IIED)

Matthew THOMAS, Greater London Authority

How to quote this document

Watson, Alison ; Gaspard, Albane ; Lebreton, Amandine (2016), *Climate Food and the City*, FNH-IUFN-UNEP Climate Change Urban Food Initiative Policy Perspectives Paper

The Climate Change Urban Food Initiative team was made up of:

Marketa BRAINE-SUPKOVA, International Urban Food Network (IUFN)

Albane GASPARD, International Urban Food Network (IUFN)

Edouard MARCHAND, Fondation Nicolas Hulot (FNH)

Amandine LEBRETON, Fondation Nicolas Hulot (FNH)

Alison WATSON, United Nations Environment Programme (UNEP)

THE NICOLAS HULOT FOUNDATION FOR NATURE AND MANKIND: A SOLUTION DEMONSTRATOR

Fondation Nicolas Hulot pour la Nature et l'Homme, founded in 1990, approved as being of public interest, apolitical and non-confessional, works for an ethical and supportive world which respects Nature and the well-being of Mankind. It has set itself the goal of accelerating changes in individual and collective behavior by developing and highlighting solutions in favor of the ecological transition of our societies. For the Foundation, ecology should no longer be one issue among others, but should be the focus of public and private action.

In order to perform its role, the Foundation combines thinking with action and awareness raising.

It works out new ideas and brings proposals to political and economic decision makers, with its Scientific Advisory Board and its network of high-level multi-disciplinary experts.

It identifies and assists the stakeholders in change by supporting and highlighting, in France and internationally, promising initiatives for the future so as to deploy them on a larger scale. This field reality inspires and nurtures intellectual production.

And so that everyone may be a driver of the ecological transition, it prepares socially responsible motivation tools and campaigns.

The Foundation is also a representative environmental NGO. As such, it sits in several

advisory organizations such as the Conseil économique, social et environnemental (Economic, Social and Environmental Council) and the Comité national de la transition écologique (National Committee for Ecological Transition).

Further information on Fondation Nicolas Hulot can be found at:



fondation-nicolas-hulot.org/

INTERNATIONAL URBAN FOOD NETWORK

IUFN (International Urban Food Network) is an international platform which promotes food systems for urban regions.

IUFN plays an intermediary role between the research community and local authority decision makers to make them aware of positive effects of local sustainable food systems as a new paradigm of territorial development.

IUFN supports local authorities in their first steps towards a territorial food system by facilitating the transfer of knowledge and the creation of a common food culture between the local participants of the territory.

Further information on IUFN can be found at:



UNITED NATIONS ENVIRONMENT PROGRAMME

The United Nations Environment Programme (UNEP) is the leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment. UNEP work encompasses:

- Assessing global, regional and national environmental conditions and trends
- Developing international and national environmental instruments
- Strengthening institutions for the wise

management of the environment

The Mission of UNEP is: “To provide leadership and encourage partnership in caring for the environment by inspiring, informing, and enabling nations and peoples to improve their quality of life without compromising that of future generations.”

Further information on UNEP can be found at:



www.unep.org/

With the support
from

Fondation
de
France

Copyright © United Nations Environment Programme, 2016

This publication may be reproduced in whole or in part and in any form for educational or non-profit purposes without special permission from the copyright holder, provided acknowledgement of the source is made. UNEP would appreciate receiving a copy of any publication that uses this publication as a source. No use of this publication may be made for resale or for any other commercial purpose whatsoever without prior permission in writing from the United Nations Environment Programme.

Disclaimer

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the United Nations Environment Programme, the Fondation Nicolas Hulot or the International Urban Food Network concerning the legal status of any country, territory, city or area or of its authorities, or concerning delimitation of its frontiers or boundaries. Moreover, the views expressed do not necessarily represent the decision or the stated policy of the United Nations Environment Programme, the Fondation Nicolas Hulot or the International Urban Food Network, nor does citing of trade names or commercial processes constitute endorsement.

DTI/1979/PA