ROTTERDAM | BERLIN | LONDON | MILAN | LJUBLJANA | NAIROBI

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SYNTHESIS REPORT 2015

FOOD METRES
Food Planning and Innovation for Sustainable Metropolitan Regions

CONTENT SYNTHESIS REPORT 2015

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FOODMETRES

INTRODUCTION

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WELCOME TO THE FOODMETRES project whose main aim was to foster a spatial approach to food planning and innovation for sustainable metropolitan regions. Funded by the European Union over three years, the project involved 18 academic and SME-business partners who engaged in a variety of research, tool and capacity-building exercises. The project incorporated an international dimension as well as focusing on concrete case studies in and around the cities of Rotterdam, Berlin, London, Milan, Ljubljana, and Nairobi.

CONTEXT The launch of the FOODMETRES project coincided with growing societal concerns about the way food chains affect life on our planet. Advances in production, logistics, processing and retail mean that ever more people have access to consistent quality, safe and affordable food. Yet serious concerns remain about, for example, the environmental impacts of food chains, the marginalization of small-scale farmers, inequalities in access to affordable, healthy food and the longer-term resilience of food chains in the face of natural resource depletion, climate change and global population growth.

In Europe's metropolitan regions, there is an increasing trend towards large-scale food production geared towards export markets, while cultural landscapes and ecological resources are under pressure both urbanisation and agricultural intensification. At the same time, there is a trend towards smaller, but highly popular urban agricultural initiatives boosting technical innovations and social cohesion by means of community gardening projects. The latter also create new opportunities for citizen, entrepreneurial and policy engagement in debates and innovations to improve sustainability, challenge unethical practices and address diet-related health inequalities. Cities are becoming increasingly important drivers of change in food chains. In particular, through exerting demand for shorter food chains, local food and community food production, cities are increasing the amount of food grown inside their boundaries and in their associated metropolitan regions. Some cities build on existing traditions and cultural practices, whereas others create new structures and practices in order to increase the amount of urban and metropolitan food production. Responding to these issues, FOODMETRES has focused on metropolitan food governance and innovation as reflected in the project's full title: 'Food Planning and Innovation for Sustainable Metropolitan Regions'.

PROJECT ACHIEVEMENTS FOODMETRES has combined quantitative and qualitative methods and engaged with a variety of actors in metropolitan regions including food producers, civic food organisations, and government bodies. FOODMETRES defines metropolitan regions in the context of the land use impacts of cities on their surrounding areas. It hence considers phenomena such as urban food consumption patterns, recreational behaviour and preferences, infrastructure and urbanisation processes as drivers that shape and define the surrounding metropolitan regions. Metropolitan regions are therefore dynamic in terms of size and character, and are not defined by sharp boundaries but soft transition zones. FOODMETRES has applied a spatial zoning concept for metropolitan regions that is based on the notion of regional food zones and urban recreational needs (like

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IN1 World Food Festival poster in Rotterdam (Source: D.Wascher)

IN2 Specialized in quality and wide varietal tomato supply: sustainable greenhouse production in nutrient flow technique near Rotterdam (Source: D.Wascher)

IN3 Greenhouses in The Netherlands, using non-fossil energy such as geo-thermal sources (Source: D.Wascher)

IN4 Peri-urban agriculture near Berlin (Source: D.Wascher)

IN5 Algae experimentation site at the University of Wageningen (Source: D.Wascher)


IN 6

green buffers, corridors or nature reserves).

FOODMETRES has developed a series of decision support tools allowing stakeholders from urban and peri-urban agriculture, food business, governance and civil society to enter a knowledge-driven debate on how to optimise the regional food supply of metropolitan areas around cities, by means of sustainable and innovative food chain planning and governance. The project's novel approach lies in the combination of two distinct yet inter-related strands of metropolitan agro-food systems: first, the spatial dimension of regionally grown food in terms of 'local footprint hectares' necessary to feed urban populations and second, the concrete innovation potentials for short food supply chains linking consumers with regional producers. In practical terms, FOODMETRES has drawn upon European as well as regional datasets, allowing cross-scale assessments at different resolutions. It also means that we have engaged with food chain stakeholders during regional workshops in which knowledge brokerage tools have been applied to enable mutual learning processes and capacity building.

One of the project's novel contributions is to enable the visualisation of metropolitan supply and demand scenarios through interactive mapping tools, which help stakeholders to better understand the possibilities for increasing metropolitan food sufficiency. Central to these efforts has been attention to different types of food chain innovation, namely product, process, governance and various social forms of innovation. Rather than suggesting one single form of sustainable food chain innovation, FOODMETRES has applied its evidence-based assessment tools to a wide range of food-chains ranging from community-supported agriculture in London, Ljubljana or Berlin and subsistence farming methods in Nairobi, to large-scale greenhouse glass production such as in Rotterdam-Westland. Offering new ways of framing regional food supply capacities, food chain innovation strategies and stakeholder interaction by means of sustainability impact assessment tools, FOODMETRES invites the agro-food sector, civil society, planners and policy makers to address the full scale and resource potential of metropolitan regions for making urban food systems more sustainable and self-sufficient.

KEY RESULTS

- The application of ecological footprint tools such as the Metropolitan Foodscape Planner demonstrates that the land available around large cities such as London, Berlin, Rotterdam, Milan or Ljubljana offers sufficient productive land for feeding the respective urban populations (with the food that can be grown in their biogeographic zone).

- The assessments show that increasing food self-sufficiency will require substantial land use changes in order to balance demand and supply as well as higher resource efficiency along the full food chain, which should result in significant reductions in food waste. Changes to healthier diets and more sustainable consumption can offer a 'win-win' scenario to support more sustainable production methods around cities.

- Our tools allow local stakeholders to assess the metropolitan food production capacities with regard to local hectare surplus and deficits for ten major food groups: rotation crops, other cereals, vegetables, fruit, oil-seed plants, fodder, grassland, rice, wine and glasshouse crops.

- Our research shows that the Metropolitan Agro-food System (MAS) is able to simultaneously respond to the challenges of meeting domestic food supply, to compete in the global context and to meet citizens' demand for a direct relationship with food producers through the development of Local Agro-food Systems (LAS).

- Different types of short food chain are based on different forms of organisation, professionalism, and regional and social embeddedness. All of these short food supply chains in urban situations can contribute to the LAS and MAS. Our categorisation and sustainability impact assessment has helped to understand them better and can assist stakeholders and food planners to develop them further.

- In London, Milan and Ljubljana we have specifically studied the short food chain of urban gardening and conclude that its economic impact today is very similar, despite different post-war histories. However, the biggest impact is through its contribution to sustainable behaviours, consumption, and healthy lifestyles in the heart of all cities studied.

- Production of healthy food requires avoiding excessive accumulation of undesirable – or even harmful – substances like heavy metals or nitrates in food products, which can be a problem in urban agriculture. Most food produced in cities is consumed directly by the growers themselves, without having passed any safety assurance system. More analyses, more evidence, targeted professional advice to practitioners, and better media information are crucial on these issues.

- In order to develop food policies able to deal with the challenges of urban food supply, adequate cognitive, simulation and planning instruments are needed.

- From our research into the new Rural Development Programme (RDP) of the Common Agricultural Policy, we conclude that it should include new areas like metropolitan regions and new groups, not only farmers. The RDP should consider and support new food chain models, particularly short food chains, which benefit from a great interest in civil society.

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Acronym	Full name
AP	Agroparks
CDDA	Common Database for Designated Areas
CSA	Community Supported Agriculture
FAO	United Nations' Food and Agriculture Organization
GAS	Global Agro-Food Systems
KB	Knowledge Brokerage
LAS	Local Agro-Food Systems
MAPS	Metropolitan Area Profiles and Scenario
MAS	Metropolitan Agro-Food Systems
MFC	Metropolitan Food Clusters
MFP	Metropolitan Foodscape Planner
SFSC	Short Food Supply Chain
SIA	Sustainability Impact Assessment
SME	Small and Medium Enterprise
SPG	Solidarity Purchasing Group


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IN 10

IN6, IN8 Delfland dairy farm near Rotterdam (Source: D.Wascher)

IN7 Concentration of production units still face concerns and low acceptance by consumers and inhabitants of peri-urban and rural regions (Source: DieAusloeser.net, Berlin)

IN9 Example for large-scale greenhouse production of tomatoes (Source: D.Wascher)

IN10 Robots transporting tomatoes (Source: D.Wascher)

Dirk Wascher, Leonne Jeurissen, Ingo Zasada, Alexandra Doernberg, Annette Piorr, Guido Sali, Stefano Corsi, Federica Monaco, Ulrich Schmutz, Jaap de Kroes, Gustavo Arciniegas, Moya Kneafsey & Laura Venn

TOOLS & METHODS

Central to the FOODMETRES approach is the development of a set of complementary tools, namely:

- ***Metropolitan Economic Balance Assessment for a multidimensional characterization of the metropolitan agro-food systems and the assessment of their potentialities to be food self-reliant.***
- ***Innovation Storylines* that link food chain spatial and functional characteristics with different innovation domains and performance indicators,**
- ***Short Food Supply Chain typology* as reference for:**
  - **A Food Policy Check List on the future impact of rural development policies with particular focus on food and food (supply) systems.**
  - **A Sustainability Impact Assessment (SIA) making use of specific food system impact areas at a qualitative level.**
- **Ecological Footprint Assessment tools:**
  - **A regional 'Metropolitan Area Profiles and Scenario' demand tool (MAPS) on the basis of regional food demand and supply data, specified for the case study regions,**
  - **A European 'Metropolitan Footprint Planner' (MFP) that allows performance of land allocation for 9 different food groups on the basis of zoning rules around urban cores, that is also used in the interactive knowledge brokerage workshops in each city region.**
- **Knowledge Brokerage (KB) tools for stakeholder interaction in support of food chain innovation during regional workshops as well as by means of an internet-based KB-Platform.**

METROPOLITAN ECONOMIC BALANCE ASSESSMENT

Given the simultaneous presence of several factors affecting the productive potential of a metropolitan context, the 'reconnection' between demand and supply emerges as an important element to deal with.

A simple and replicable methodology has therefore been applied to the MAS of each case study area. The approach is based on a comparison between food supply and demand, expressing the potential food self-reliance of the region according to different points of view:

- **Compliance of food supply with food habits**. The analysis reveals the supplied and consumed amounts of primary agricultural products, reflecting on one hand the consumption pattern, and on the other hand the specialization of the productive system (fig. 1).

A further aggregation of primary products into wider staple food groups and the use of a "quantity index" reveals how much the local production pattern fits with local food habits. It describes the regional food supply capability in a comparative and more comprehensive way, providing information about the specialization of the primary sector and the fulfilment of food requirements (fig. 2). Similarly, the relationship between the relative importance of each food category on both total demand and supply, allows them to be distinguished according to their potential for commercial exports or, conversely, orientation to local markets (fig. 3).

- **Level of food security**, meant as the regional capability in ensuring nutritional and caloric requirements expressed by the population dietary pattern. This element is related to the level of fulfilment of dietary caloric intake per macronutrient (fig. 4).
- The **economic balance** of the territory and the main exposure of agricultural products to global or local markets. The economic dimension is focused on quantifying the production value corresponding to the diet and the generated agricultural value, both by food and non-food production (fig. 5).

Finally, the simultaneous assessment of the previous aspects, allows for a definition of the multidimensional profile of the MAS. In fact, the relationships between their respective supply-demand-ratios at diet-level reveal the peculiar profiles of each productive system and their overall performance and potentialities in complying with demand (fig. 6).

INNOVATION STORYLINES

Innovation storylines are focussed on specific innovation domain(s) that are relevant to regional stakeholders (mainly entrepreneurs) for developing more sustainable food chains. Beyond product innovations, these may emphasise process innovation such as the use of alternative energy sources or different forms of logistical arrangements. They could also be targeted at social innovation by involving the consumers in an early stage of the food chain – e.g. during the harvesting of the food, or at governance innovation integrating new stakeholders into local food planning strategies. The storylines follow a pre-designed script book as outlined in Table 1, in order to make sure that food chains for different commodities can be compared on the basis of a set of

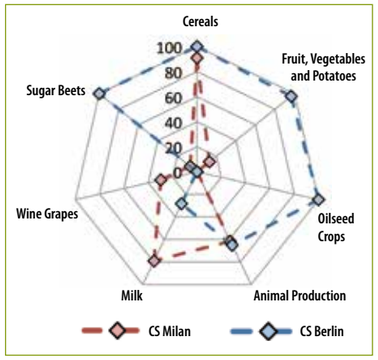


Fig. 2: Quantity index (%) of each staple food group

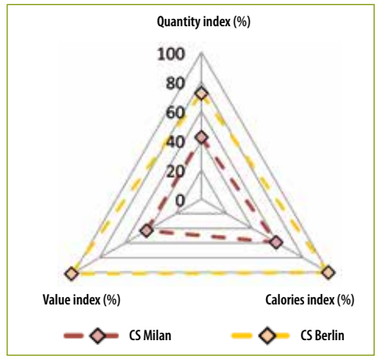


Fig. 6: Multidimensional profile of the MAS

METROPOLITAN ECONOMIC BALANCE ASSESSMENT

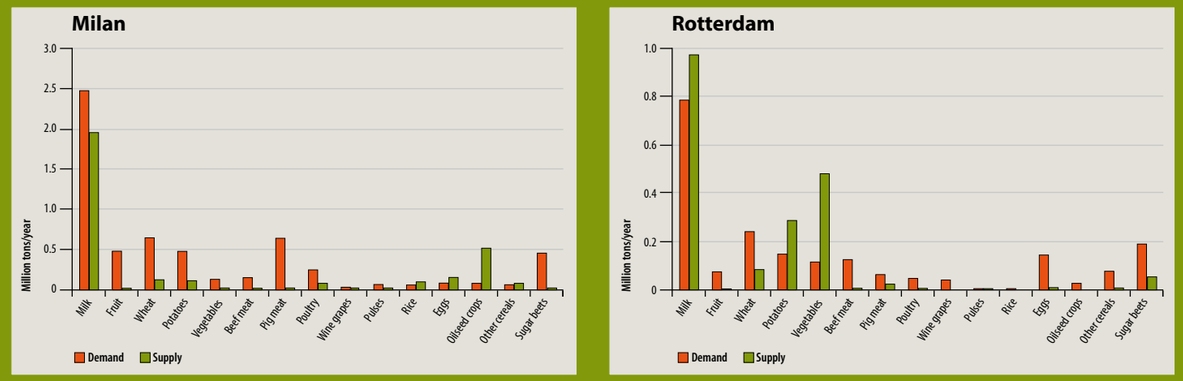


Fig. 1: Supplied and consumed amounts of primary agricultural products in Milan (left) and Rotterdam (right)

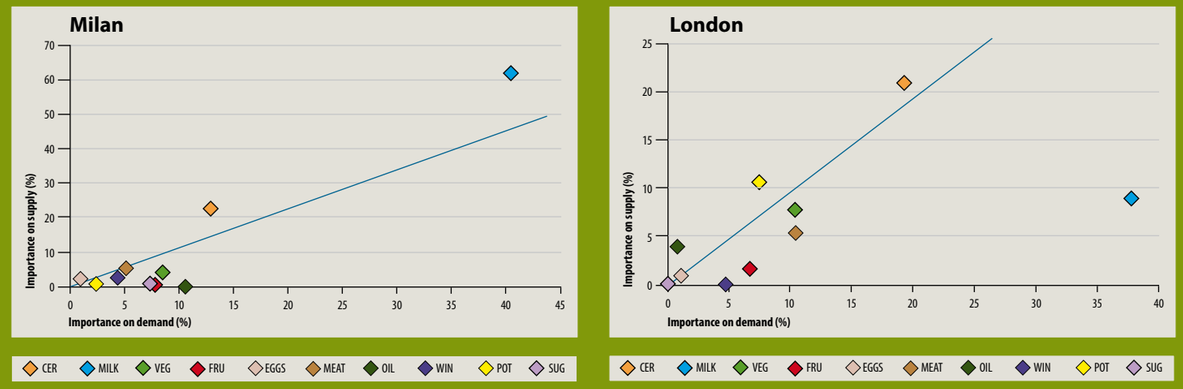


Fig. 3: Market orientation of food products in Milan (left) and London (right). Plots above the line show potential for commercial exports

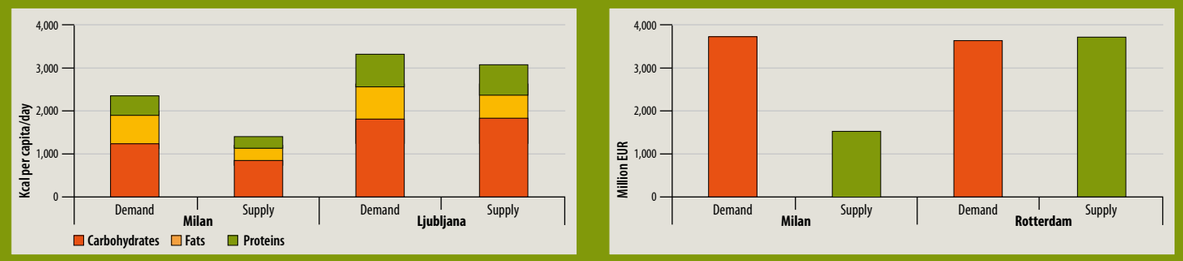


Fig. 4: Demanded and supplied calories per energy source

Fig. 5: Elements of the economic balance of the region.

Commodity Group	Innovation Domain (see Fig. 7)	Spatial scale: local (LAS), metropolitan (MAS) or global (GAS) agro-food systems	Generic Supply Chain Management Redesign Principles (marked in **bold**)	Performance Indicators	Benchmark information for scenario derived from conventional food chains
Milk in The Netherlands 18,500 dairy farmers producing 11.8 billion kg milk total (6.5 billion cheese, 0.5 consumption milk, 1.7 milk powder)	General greening of the milk production (PRODUCT) On-farm thickening of milk (PROCESS) Re-optimization of the milk processing facilities (PROCESS) Closing nutrient cycles, reducing foodprint (grasslands) (PROCESS/ GOVERNANCE) An efficiency tool at farm level (PROCESS)	**GAS** 89% milk export in The Netherlands In total, cattle is responsible for roughly 13.8 million tons of dry matter concentrate. In concentrates a wide diversity of raw materials is used, 54% are grains and grain products and 11% consist of soya (especially soya is being questioned with respect to the ecological footprint).	**1** Redesign the roles and processes in the supply chain **2** Reduce customer order lead times **3 Synchronize all logistical processes to the consumer demand process** **4** Co-ordinate logistical decisions **5 Create information transparency in the supply chain** **6 Jointly define objectives and performance indicators for the entire supply chain** *Kringloopwijzer* (annual nutrient cycle) a new tool that calculates efficiency at farm level;	N, P and C efficiency kg concentrate/kg milk (this can be calculated as external hectares) % Energy (MJ) used of own land feed kilometres CO_2 emission in the Dutch dairy chain % soya imported	Dairy Sector: -20 % import of soya On farm: > 40% of N efficiency > 80% of P efficiency > 80% produced MJ of own land Transport kilometres (Nevedi = Dutch organisation that calculates feed imports)

Table 1: Storyline Structure for the example of 'milk in the Netherlands'(Global Agro-Foodsystem)

agreed-upon indicators. The storylines have a strong scenario dimension because the corresponding food chains are still in the process of development (i.e. business cases). In the different case studies we selected commodity groups such as dairy products, potatoes, fruit and vegetables. Concrete food products associated with these groups include tomatoes, cabbage, herbs, spinach, kale and bananas (the latter for Nairobi) as well as many others.

The urban context at the interface between LAS and MAS represents a domain of high consumer concentration. Producers can also be found here, practising urban and peri-urban agricultural activities that, however, may not realize an individual food chain (non-professional producers and consumers may overlap, i.e. self-consumption in urban gardens), but contribute to the sustainability and supplying capacity of a city. Consequently all identifiable food chains, whether short or long, are directed to this area, in order to satisfy the demand and the requirements of consumers, or equivalently, of the urban population.

Generally in the agro-food system, technological innovation is still considered as the main driver for creating a competitive business advantage, rather than focussing on more sustainable forms *of global resource efficiency* and being directed towards social, economic and environmental sustainability. Building on the work by Avermaete et al (2003) we see added value in incorporating these innovation domains in an integrated approach which we call *system innovation* (see Fig. 7). System innovation is a non-linear learning process, that is, the process occurs in a manner which builds in feedback loops enabling constant re-evaluation and revision. This is a fundamental change from the formerly prevalent top-down model of knowledge transfer from scientific experts to practitioners.

By filling in Innovation Domain Storylines for each of the selected FOODMETRES commodity groups we established a kind of 'quick-scan' procedure that allows users to access a standard data set for communicating the key characteristics in a systematic way. These standard data sets allow cross-comparisons between food chains and positioning these food chains when undertaking sustainability impact and metropolitan footprint assessments.

SHORT FOOD SUPPLY CHAIN TYPOLOGY

When dealing with practical examples of regional food supply in metropolitan regions it is useful to address the length of chains and use the criteria of the spatial and social proximity (see also Galli & Brunori 2013). Therefore, we characterize the regional chains according to their length regarding the number of involved actors into:

- **Long Regional Food Chains (occurring in MAS):** means regional purchasing of food, where the food is regionally grown, processed, sold and consumed within a certain territorial unit=region (no matter how the region is defined). In comparison to global food chains the total transport distance is shortened (as physical and time distance). Long regional chains include a number of intermediaries/chain steps like wholesale and retail etc. within this region. Long regional chains are connected with the spatial concept of the Metropolitan Agri-food System (MAS).

- **Short Regional Food Chains (occurring in LAS):** means local purchasing of food, where the food is regionally grown, *(processed),* sold and consumed within a certain territorial unit=region (no matter how the region is defined). By reducing the number of intermediaries, SFC allows a closer/personal interaction between producer and consumer (social proximity). Short regional food chains are connected with the spatial concept of Local Agri-food System (LAS). They are comparable with concepts like "alternative food chains" and "local" food (systems).

FOODMETRES has taken the Committee of the Regions (2011) as a starting point for categorizing food chains because it focuses on the market-relation and allows the integration of the new emerging phenomenon of Urban Gardening etc., where consumers become (co-)producers. We differentiate between four main categories of market relation between consumer and producer as well as related commercial transaction schemes:

- Consumers as producers (transaction scheme: consumer-to-consumer or own consumption)
- Producer-consumer partnerships (transaction scheme: business-to-consumer)
- Producer direct sales to consumer (transaction scheme: business-to-consumer)
- Producer direct sales to intermediates / no direct consumer-producer relation (transaction scheme: business-to-business and business to administration).

These four main categories for chain types have been further broken down on the basis of chain length, the kind of intermediate chain actors (retail, hospitality industry, public procurement) and the location of the point of sale LAS/MAS/GAS affinity (see Table 2). Finally, we differentiated between eight main types of regional and short food chains and related subtypes and venues. The place of production can be urban, peri-urban or rural. As for the place of consumption, we considered only the urban area. Each of them has been checked, if they exist within the six case study regions and if they were part of more detailed case studies.

The developed SFC typology represents mainly chain types, which are associated with "alternative food networks / geography", but also integrates with the AgroParks/ MFC, an example from the "hypermodern food geography". But following Wiskerke (2009) one can conclude that most of the real food chains in the current food system combine both paradigms and create a "hybrid food geography".

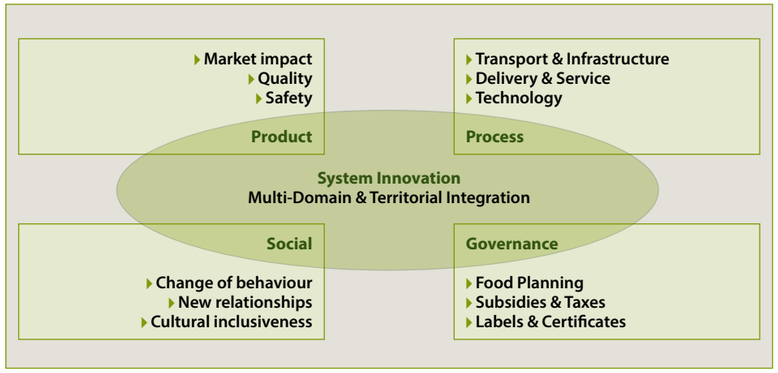


Fig. 7: Innovation domains as put forward by FOODMETRES

Table 2: Food Chain Typology

I.	Urban gardening for self-supply / private consumption (subsistence): food production in the urban setting for own consumption. ► Relation type: Consumer as (co-)producer ► Subtypes: allotments, community gardens, self-harvesting gardens (offered by a farmer).
II.	Urban gardening for commercial purposes: profit-oriented food production in the urban setting. ► Relation type: business-to-business.
III.	Consumer-producer-partnerships/cooperatives: network or association of individual consumers who have decided to support one or more local farms and/or food producers/processors. ► Relation type: Consumer-producer-partnerships/cooperatives ► Subtypes: Community Supported Agriculture (CSA), Ethical Purchasing Groups (EPG) , Solidarity Purchasing Groups (SPG), and food-coops.
IV.	Direct sales/marketing on-farm to the private consumer: farmers sell directly their products on their farm. ► Relation type: business-to-consumer. ► Subtypes: farm shops and stands, pick-your-own.
V.	Direct sales/marketing off-farm to the private consumer: direct selling of products from a farm on the market in the urban area. ► Relation type: business-to-consumer. ► Subtypes: farmers and weekly markets, market halls, home delivery….
VI.	Sale to regional enterprises like retail or hospitality industry (e.g. restaurants, hotels, pubs), which provide food for urban population. ► Relation type: business-to-business
VII.	Sale to public procurement and public catering: Preparation and delivery of meals for collective consumers in the urban area. Include intermediaries like wholesale. ► Relation type: business-to-business
VIII.	AgroParks / Metropolitan Food Clusters (MFC): are spatially clustered agro-food systems in which several primary producers and suppliers, processors and/or distributors cooperate to achieve high-quality sustainable agro-food production… MFC are oriented towards the markets in the Metropolitan Region providing food for the urban population, but also to the world market. ► Relation type: business-to-business

THE POLICY ANALYSIS TOOL

The policy analysis tool measures the impact of European Rural Development Policies (RDP) on sustainability in the Metropolitan Agro-food System (MAS) and on the Short Food Chains Typologies (urban garden, direct sale, AgroPark, etc.). The tool consists of questionnaires involving experts and stakeholders of five of the Case Studies (Milan, Rotterdam, Berlin, Ljubljana and London) in order to cross theoretical

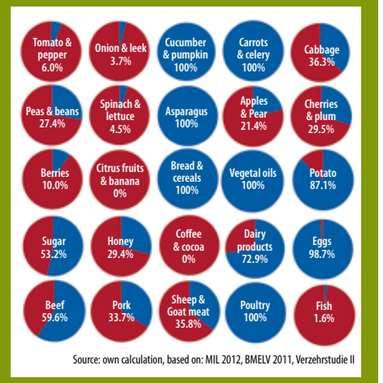


Fig. 8: Theoretical regional fulfilment of demand for individual commodity types for Berlin metropolitan region. Based on figures for population 2012 and agricultural production 2006-2010. Source: Zasada et al. unpublished.

knowledge and locally based operative experiences.

The output of the tool is a series of very flexible and adaptable assessment matrices which analyse:

- the impact of a specific policy on local Short Food Chains and the sustainability issues,
- the impact of the policies on different local Short Chains in the context of a specific sustainability issue (environmental, economic, social),
- the relationship between policies and sustainability on a specific Short Food Chain.

The results can be analysed for each case study and/or as a general instance for the European Rural Development Policies (RDP). The tool can help local administrators to adapt the RDP in order to respond to the needs of local stakeholders and (public bodies, farmers, consumers, associations, etc.) with respect to the sustainability of the Metropolitan Agrifood System. The tool also provides relevant information for European politicians about the impact of RDP on Local Short Food Chains in urban and metropolitan contexts.

LOCAL HECTARES FOOTPRINT ASSESSMENT TOOLS

When reviewing existing footprint assessments and references we came to realize that using 'global hectares' as the dominant communication tool for addressing the impacts of urban food consumption on the one hand did succeed in raising the awareness regarding the limitations of our Earth resources at an abstract level, but on the other hand failed to help people understand the practical opportunities and capacities regarding regional food supply as these exist in the landscape of the cities they live in.

In response we developed two distinct, yet complementary footprint assessment tools:

(1) a regional Metropolitan Area Profiles and Scenario (MAPS) demand tool that uses a geo-statistical approach to produce *demand* scenarios at the level of administrative units on the basis of different food production, food waste and food consumption patterns (Zasada et al. unpublished); and

(2) a European *Metropolitan Foodscape Planner (MFP) supply tool* based on GIS-technology, that allows stakeholders to make land use change decisions when re-allocating a total of 9 food groups by using a digital maptable that monitors the respective food demand-supply balance at the level of homogenous landscape units (Wascher et al. 2015)

These two tools are in many ways complementary: using exclusively national census data on food consumption and national land use statistics, MAPS is dependent on the accessibility of these data sets at the national or even regional level. MFP, on the other hand, mainly uses European data, making it – to a certain degree – independent from national/regional data sources. The latter must be considered as a pre-requirement for European-wide applications at virtually all metropolitan regions with the European Union. The other complementarity is the MAPS' stronger focus on projecting demand while MFP can just be used for identifying supply areas. While MAPS is static, but more accurate with regard to the underlying national data sets, MFP is dynamic in terms of allowing real-time data manipulations and footprint assessments. MAPS works with administrative boundaries; MFA uses landscape units and a footprint-based metropolitan zoning scheme associated with regional planning instruments. Applied together, the two tools offer a wealth of spatial data assessment and communication power for metropolitan food planning at different scales. MAPS can inform spatial modelling approaches, such as the MFP, which addresses the actual land use allocation and land use changes, by providing input data about area quantities and development targets.

THE REGIONAL 'METROPOLITAN AREA PROFILES AND SCENARIO' TOOL (MAPS)

The approach takes into account fodder demand in livestock farming through the application of a fitted model (Woitowitz 2007, Wakamiya 2010). The food supply shows regional variations in terms of commodities produced and their quantity, depending on climatic and bio-physical conditions, such as soil fertility. The food demand is determined by the quantity of the regional population as well as average food consumption patterns (diets), which are also characterised by substantial differences, e.g. between countries or urban and rural areas (see Gerbens-Leenes & Nonhebel 2002, FAO Stat 2015).

Figure 8 depicts the result of a commodity-specific demand-supply calculation for the Metropolitan area of Berlin-Brandenburg (Zasada et al., unpublished), comparing the actual food consumption with the actual food production. However, the estimation of supplied quantities is only of a theoretical nature, as many commodities, such as rice, coffee, tea or tropical fruits cannot be produced in temperate regions and require import.

The comparison of demanded and supplied quantities in a given case study region represents a simplified model to determine the food balance, without considering demand of water and other natural resources required for food production. Its purpose is to identify the agricultural production area necessary to feed the regional population, for the overall food consumption, but also commodity-specific, per capita, municipality or aggregated for a defined area. As Fig. 9 illustrates, the area demand (here: for Berlin and London Metropolitan region) can be represented as buffer around each unit of analysis. This analysis suggests that the regional food supply in both cases can be accomplished within regional boundaries for all food suitable to produce in the regional climate zone and by local or proximate agricultural production, due to poor soil conditions and limited availability of agricultural

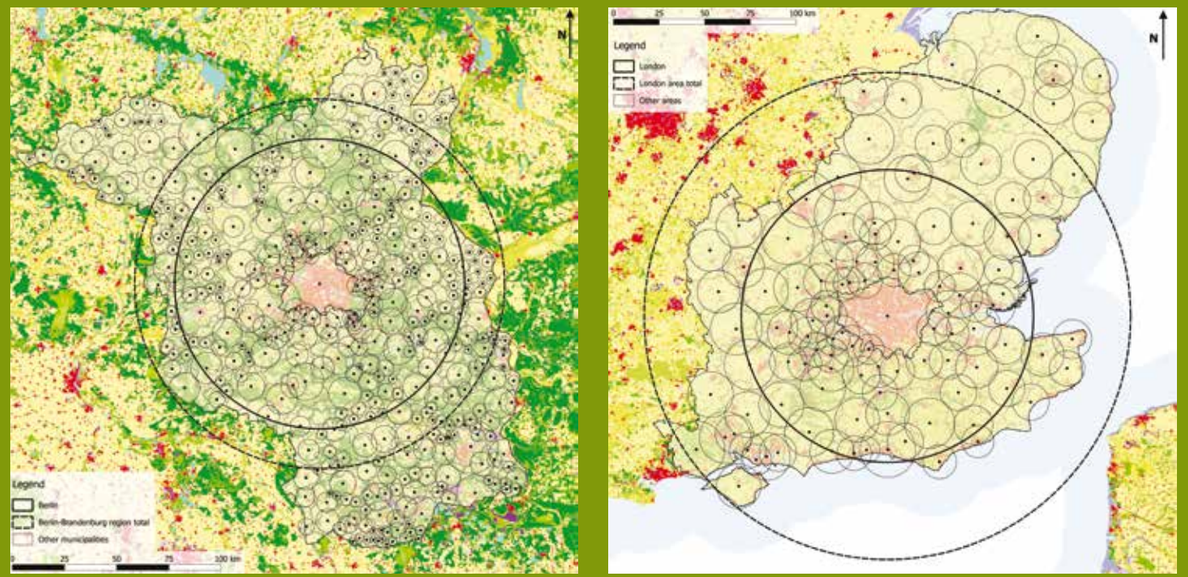


Fig. 9: Area demand of conventional food production for Berlin (left) and the London Metropolitan region (right). Based on population figures for 2012. Source: Zasada et al. unpublished.

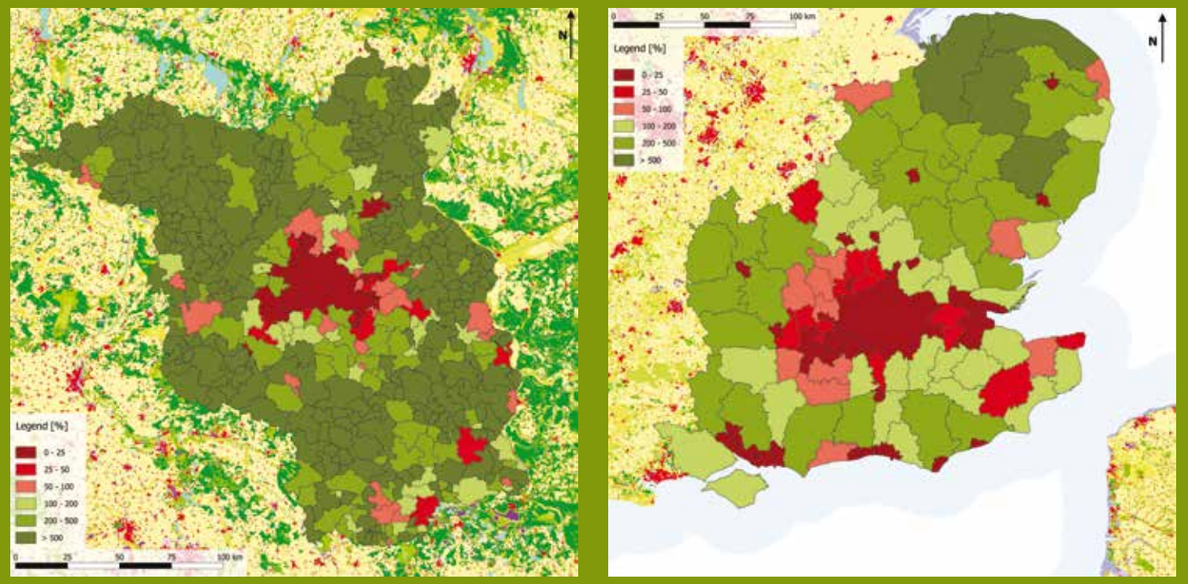
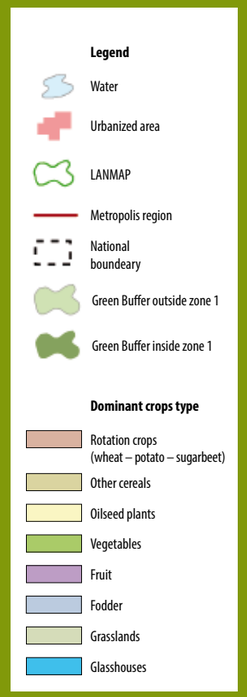
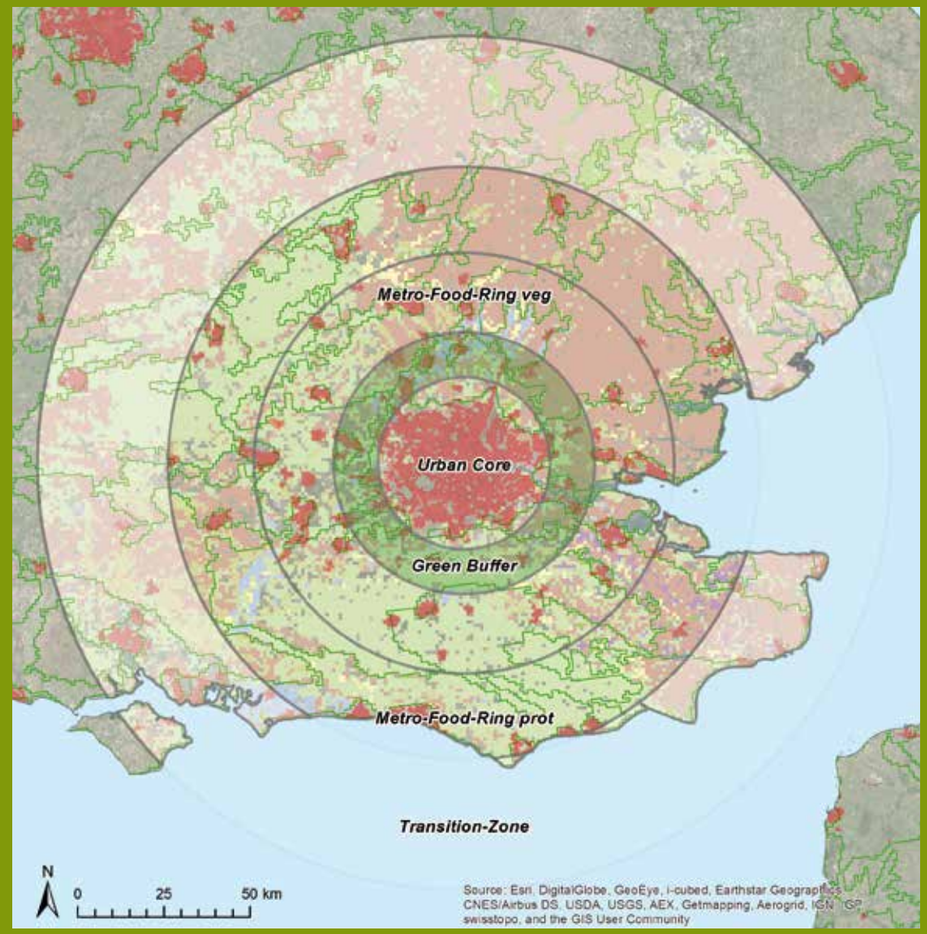


Fig. 10: Self-sufficiency level at municipality level for Berlin (left) and London Metropolitan region (right). Red colour indicates under-supply, green colour over-supply. Based on population figures 2012. Source: Zasada et al. unpublished.





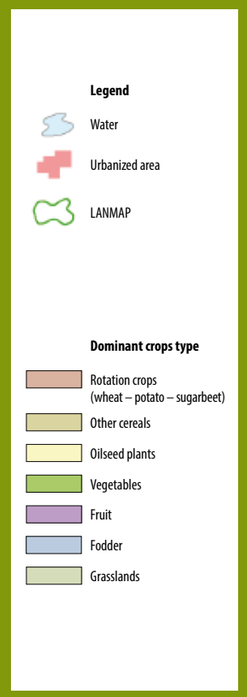


Fig. 11: Application of the MFP supply tool for the metropolitan regions of Rotterdam (left) and London (right); inset: Landscape Units for defining land use allocation rules

land (in the Berlin case) or population quantity (in the London case).

Another application of the MAPS tool is the analysis of the local/regional self-sufficiency level, i.e. the percentage ratio between supply and demand expressing the extent of a territorial unit to meet its own food requirements. The analysis of the spatial distribution for each individual locality provides indications about their food self-sustainability and the possibility to satisfy urban demand through proximity agriculture. It gives therefore indications of local hotspots of possible future food stresses. Fig. 10 reveals for instance for the Berlin Metropolitan region that food demand is very much concentrated in the centre, leaving the periphery with large food surpluses. Whereas in the London region, the core city faces a strong food deficit, but the majority of urban places can be easily supplied by the near surrounding.

However, despite its spatial representation, the purpose and functionality of the MAPS tool is less a spatial analysis as such, but should be rather understood as a means of communication of the spatial dimension of food consumption and production. It can raise awareness among stakeholders and decision-makers in urban and regional food planning and policy about the agricultural area required. It also provides the opportunity to assess the effects of future changes in either food consumption, e.g. healthy or vegetarian diets or population changes, reduction of food waste and loss or changes in the agricultural production systems, such as organic and extensive production or different sustainable intensification or extensification scenarios. In this sense the MAPS tool can be used to explore different regional scenarios and future pathways.

THE EUROPEAN 'METROPOLITAN FOODSCAPE PLANNER' (MFP) SUPPLY TOOL

The Metropolitan Foodscape Planner (MFP) allows users to detect *concrete spatial locations* and the available amounts of suitable farmland (supply) around cities for the most essential food groups on the basis of urban population figures (demand). Unlike MAPS, MFP is a dynamic tool in the sense that users can directly undertake – by drawing with a pen on a digital table – land use changes in response to the footprint assessments which are provided by a geographic information system. MFP allows the spatial allocation of 8 to 9 food groups (depending on the respective case) making use of the following European data sets:

- national food consumption census data compiled by the European Food Safety Authority (2011);
- geo-referenced distribution data for food groups as recorded in the Homogenous Soil Mapping Units (HSMU), deriving from the European Commission's main agricutural land use model CAPRI (Kempen et al. 2005).
- a European Landscape Typology (LANMAP) combining in itself exclusively European and global data sources such as CORINE land cover, the elevation model GTOP030, the European Soil Database and climate data from a European stratification (Metzger et al. 2005).

The Common Database for Designated Areas (CDDA) showing all nationally and internationally protected landscape and nature conservation areas.

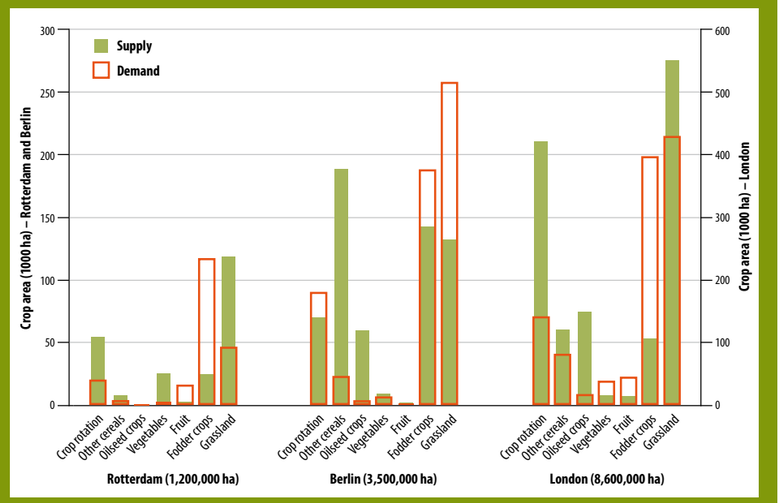


Fig. 12: Comparison between supply and demand figures for the cities of Rotterdam, Berlin and London in global hectares as defined in the Ecological footprint methodology as produced by MFP.

Though less accurate than the national land use survey data, HSMU is available for the whole of Europe, allowing direct top-down assessments without resource-consuming data gathering procedures. The concept of spatially allocating specific food groups for which a certain supply deficit has been recognised – e.g. vegetables or oil seeds are typically underrepresented in the metropolitan surroundings of cities – to areas with clear food supply surplus coverage, for example grasslands, points at the need to guide such stakeholder decisions by offering additional land use related references. MFP is doing so by the means of two support mechanisms:

- a metropolitan zoning concept that suggests an agreed-upon sequence of food-zones following each other inspired by von Thünen (1826);
- a series of food group allocation rules specifically designed for each metropolitan region on the basis of landscape-ecological references (LANMAP)

Building upon the classic market-centred von Thünen (1826) model, but translating it into contemporary agri-environmental and spatial planning strategies, we developed the following concept of metropolitan zones: (1) urban core area, followed by (2) a green buffer reserved for nature and recreation, (3) a metropolitan food production zone differentiating a plant-based and a protein-based supply zone, and (4) a transition zone which is meant to provide food also for adjacent urban areas.

Making use of the figures for urban food demand, MFP projects the corresponding land demand figures in the form of 'local hectares' to those areas of land that can be considered to be eligible for farming. We hence excluded all land covered by urban areas, waterbodies (sea, lakes & rivers), nature and landscape conservation sites, forests and other non-farmlands such as rocks, beaches and swamps. Around urban centres we reserved a 'green buffer' zone mainly for biodiversity and recreational functions – but without investing into further elaborations. Here we obviously included all lands to have this potential function. The guiding principle for introducing such a green buffer was based on the assumption, that (1) urban dwellers will appreciate short travel distances to enjoy these functions, and (2) there is a basic need to offer micro-climatic compensation for high-density urban zones in terms of air quality and circulation.

Following the green buffer, we gave full priority to the supply with plant-based food groups such as rotation crops (wheat, sugar beet, potatoes), other cereals, oil seeds, vegetables and fruit, taking the total hectare requirements for calculating the width of the plant-based metropolitan food-ring, as we call it. This means that the amount of available farmland within this ring matches exactly the total amount for land needed for all plant-based food groups, but that actual distribution of these food groups within this ring shows of course large deficits and surpluses, thus the type of expected imbalance we consider as an important reference when exploring potentials for optimizing the supply of regional food on the basis of the available land.

Following the plant-based food production ring, we dedicate the next zone exclusively to land cover types such as fodder and grasslands for livestock keeping. We called this the protein-based metropolitan food ring. The rationale behind the concept of an inner plant- and an outer protein-based production zones is related to the von Thünen economic theory according to which perishable food should be located closer to the city. Another aspect has been the environmental and social conflicts associated with livestock keeping as a pressure on human health and wellbeing (odours, bacteria, manure issues).

We are aware that introducing clear spatial demarcations for different food groups in the forms of zones is drastically contrasting with the everyday situation in our current metropolitan regions. However, rather than intending to reflect the agricultural status quo, the MAPS-concept offers a quantitative look at agricultural resource potentials in which key issues such as the impacts and location of protein consumption, human requirements for recreation and nature, as well as availability of land to provide regional food is visualised in one scheme.

Making use of the digital *Maptable* technology, stakeholders can engage in 'serious gaming' exercises and develop proposals for increasing the supply with regional food for the 8 food groups on the basis of the urban consumption needs. In order to provide further guidance during this process, MFP offers the spatial references of the European Landscape Typology (LANMAP) to ensure that stakeholders receive 'alert' messages if the changes they propose are in conflict with the allocation rules laid down as part of the landscape-ecological references.

Both the MFP-zoning concept as well as the LANMAP-based allocation rules are in principle open to stakeholder revisions prior to engaging in the Maptable exercise. This way, a high level of tool transparency and flexibility can be achieved – the basis for gaining trust and ownership throughout the process.

KNOWLEDGE BROKERAGE TOOLS

Faced with increasingly complex challenges to ensuring sustainable and secure food systems, it is vitally important to find ways of sharing information amongst diverse actors who are engaged in food chain innovations and planning. In order to address the overall aim of the project, 'knowledge brokerage' has been implemented, not only to enable the effective sharing of data and information, but also to build relationships and networks which facilitate knowledge exchange, innovation, and the stimulation of new research.

Knowledge brokerage is more than simply the transfer and management of information. In contrast to conventional science-policy interactions which are often perceived as 'one way', knowledge brokerage aims to create dialogue between the 'producers' or creators of scientific information and the users, or decision-makers (Sheate and Partidário 2010). FOODMETRES has facilitated knowledge brokerage by reaching out to a diverse mix of stakeholders most relevant to each regional context (including farmers, policy makers, community food activists, and campaigning organisations) from the very first stages of the project. The stakeholders were able to interact with the SIA, and the MAPS and MFP tools, and to offer critical feedback to the research team. At a local level, stakeholders also influenced the direction and focus taken in the case studies, through regular dialogue with the researcher teams through the life of the project, who in turn responded to local stakeholder challenges and priorities. In this way, the city based case study agenda was co-produced through researcher-stakeholder dialogue. In order to facilitate communications, the project produced a knowledge brokerage 'toolkit' containing an A-Z of activities which can be used in knowledge brokerage settings such as workshops. The project has also fostered active knowledge brokerage through the inclusion of a number of small and medium sized enterprises in the consortium: through their interactions with the researchers, these have played a vital role in ensuring that the case study work has been responsive to local innovation issues. In addition, the FOODMETRES project will leave as a legacy a 'knowledge brokerage portal' (www.foodmetres-kp.eu), which will enable users to access project outputs and information, as well as being able to interact online with the Sustainability Impact Assessment Tool and the metropolitan footprint tools MAPS and MFP.

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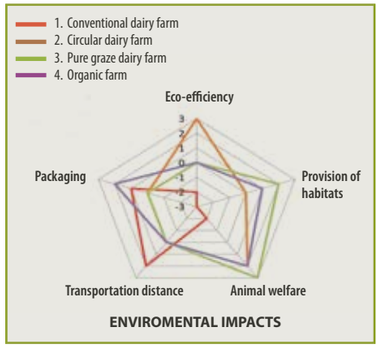
Dirk Wascher
Jeroen Kruit
Leonne Jeurissen

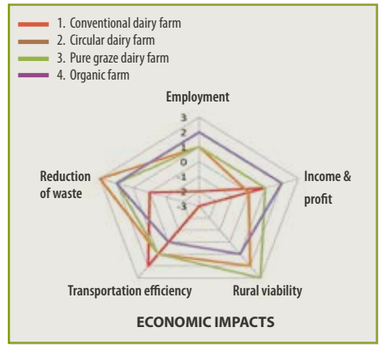
ROTTERDAM

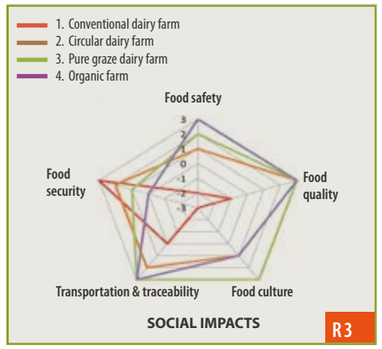
Circular economy, innovations in regional marketing strategies and metropolitan food clusters for sustainable food chains

R1

R2







R3

INTRODUCTION Despite Rotterdam's top position in the world's agro-food economy, the city and its metropolitan region is facing major challenges:

- Achieving social, economic and environmental sustainability;
- Facilitating the transfer from a volume-based, traditional food industry to a knowledge-based processing industry;
- Providing a high degree of rural-urban integration and liveable landscapes;
- Innovating the social, technical and governance aspects of food by introducing new (cluster) services.

Producing sufficient, high quality food while preserving soil organic biodiversity, using less fertilizers, water, and fossil fuel energy – reducing the environmental and climate impact – while maintaining a high quality of life and a highly competitive economy, are key assets for metropolitan regions all over the world. A wealth of relevant knowledge regarding Rotterdam's agro-food sector is available but not always accessible in industry, farming, science and public services. The FOODMETRES project is an opportunity to allow the different parties to benefit from the project's knowledge brokerage capacities in order to commonly develop visions for a sustainable future. Taking

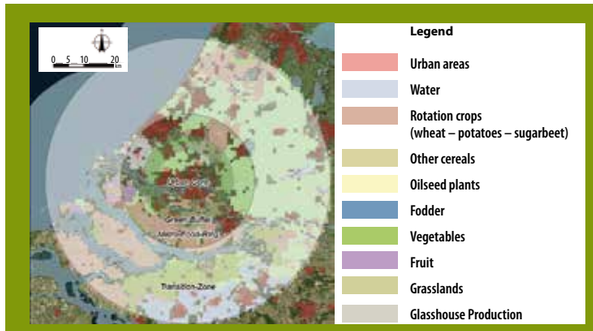
R1 Markthal Rotterdam – opened in 2014 as the first large-scale food market hall with full roof cover and more than 100 fresh-food pop-up shops and restaurants. (Source: www.markthalrotterdam.nl)

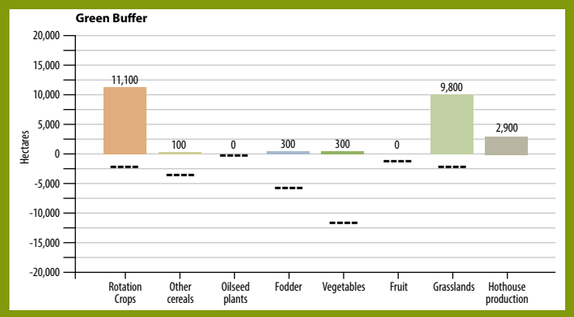
R2 Pompenburg/Couwenburg in Rotterdam: gardening programme for people suffering from substance misuse using organic manure from Midden-Delfland (Source: D. Wascher)

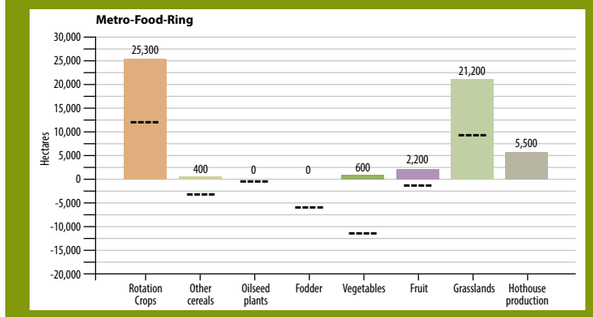
R3 Sustainability Impact Assessment of the environmental, economic and social aspects of the four dairy farm types (see legend). (Source: Wascher 2014)

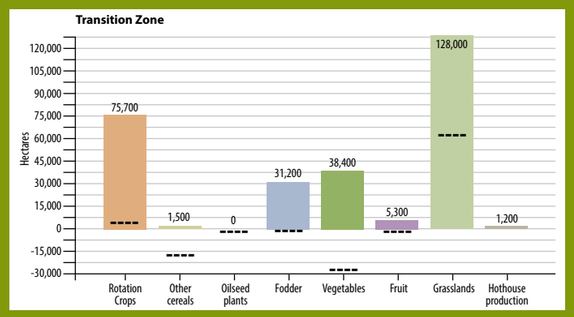
R4 MapTable configuration of the Metropolitan Foodprint Tool of Rotterdam for the Green Buffers, Metro-Food Ring and the Transition Zone. (Source: Wascher et al. 2015)

R4









R5

the city's ambitions as a starting point, FOOD-METRES focussed on three distinct types of sustainable food chain innovation:

1. Dairy food chains
2. Regional product marketing in Hoeksche Waard
3. Metropolitan Food Clusters, AgroParks and greenhouse technology

RESEARCH ACTIVITIES The research activities included regional workshops and questionnaires for impact and policy assessment. The following sections provide an overview of the Rotterdam approach.

1. MAKING DAIRY FOOD CHAINS MORE SUSTAINABLE

For shortening dairy food chains we distinguish innovations focussing on circular dairy farming, land use and spatial planning schemes, new (small-scale) local dairy chains and re-optimization of the global dairy trail. In The Netherlands we can distinguish four types of dairy farms, namely:

1. Conventional dairy farm
   A dairy farm with no special attention towards sustainability and practising farming in such a way that it is profitable and legal regarding all regulations.
2. Circular dairy farm
   A dairy farm with special attention towards mineral circulation through the farm (land, feed, cow, manure) to increase its profit and sustainability.
3. Pure graze dairy farm
   A dairy farm having a seasonal calving system where all cows calve in spring and are only fed by grazing during spring, summer and autumn with limited addition of concentrates.
4. Organic farm
   A dairy farm practising under organic (SKAL) regulations resulting in no chemical fertilizers, no pesticides, less antibiotics, etc.

These dairy farm types have been discussed with the NGO Boerenverstand representatives of the Delftland farmers and researchers during a stakeholder workshop. Figure R3 shows the (qualitative) expert assessment of the effects of the four different dairy farm types on the three dimensions of sustainability.

The project '*Kringloopboeren in Midden Delfland*' works to strengthen farmers as the main providers of the landscape. To guarantee a sustainable income for these farmers while keeping the typical landscape, other activities are necessary outside milk production. Unfortunately most of these activities do not necessarily strengthen the link between 'landscape – cow in the meadow – milk – and consumer'.

With the help of the Metropolitan Foodprint Tool workshop, participants were able to project the needs of the city against the actual availability of grasslands in the wider metropolitan region. Figure R4 shows that in the-

ory there is a substantial surplus of grassland available. The tool is supported by the digital MapTable, which allows users to propose land use changes and immediately see the spatial impacts (see Figure R5).

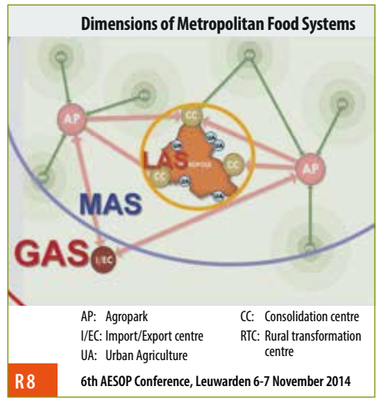
2. REGIONAL PRODUCT MARKETING IN HOEKSCHE WAARD

The Hoeksche Waard is an agricultural production area near Rotterdam that produces for an international market. An interest in more sustainable agricultural production has resulted in a platform of entrepreneurs. The farmers from the Hoeksche Waard want to redefine the relationship between producer and consumer by getting to know the urban consumers better and to find out which products to offer, where to sell them and how to organise the sale. Many farmers have individually already found their way to the city. How can we join forces to take that extra step? The farmers are proud of their Hoeksche Waard and also want to realise a reverse flow of citizens to the Hoeksche Waard to educate citizens on where and how their food is produced.

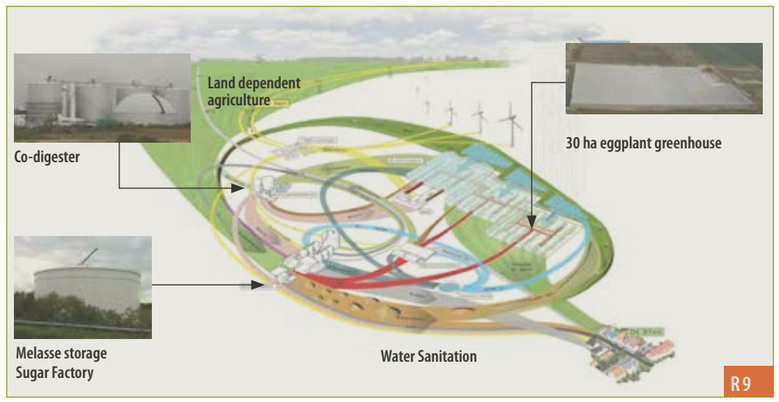
All four systems innovation dimensions (product, process, policy, social) occur in the Hoeksche Waard. There are many distinctive *products*, such as: the Hoeksche Rooie, Hoeksche Chips and potato fired Vodka. Under the banner of Hvodka precise nutrient application is made possible by highly detailed soil sampling. Using GPS-controlled tractors nutrient loss is greatly reduced. On-farm Sugar beet *process*ing to raw sugar makes recycling of the organic waste possible. Conventional agriculture in the Hoeksche Waard applies field margins management (*EU policy*), which limits the use of pesticides. Through small companies like Rechtstreex, local produce from Hoeksche Waard is sold in the city (*social*).

R6

R7



R8



R9

3. METROPOLITAN FOOD CLUSTERS AND AGROPARKS

The scale and type of challenges large and dense urban areas are confronted with have not only led to the emergence of urban farming initiatives, but also to a critical re-thinking of the way conventional farming could be made more sustainable in terms of the agricultural value chains. Central to these considerations is to substantially improve resource use efficiency of energy, water, nutrients and space. One of the proposed measures is the development of so-called Metropolitan Food Clusters (MFCs) that can provide this food system innovation at different levels, namely by horizontal integration of biomass re-cycling from non-farm origins, the better use of biomass streams off-farm (e.g. in bio-refineries as well as vertical integration of the food chain in terms of time and space). The concept of MFCs consists of three key elements:

- AgroParks (AP) – spatial clusters of high-productivity plant and animal production and processing units in an industrial set up aiming to increase productivity while reducing costs, transport, veterinary risks and environmental emissions.
- Rural Transformation Centres (RTC) – satellites in rural areas where products of the network are collected. They are also centres for training and education of farmers.
- Distribution and Consolidation Centres (DCC) – centres where products, from the rural environment or specialized APs, are combined with import flows, processed further if necessary, and then recombined and distributed.

SUMMARY AND CONCLUSIONS Though MFCs are composed of several functional units, greenhouse technology is crucial for the sustainable future of our food system. Today, the extensive greenhouse complexes in Rotterdam's Westland region are mainly used for monocultural, export-oriented mass production – e.g. tomatoes, red pepper and courgettes. Tomorrow, however, greenhouses might become regional food centres next to all major cities offering a large variety of vegetables and fruit grown in more sustainable ways, by using less water and energy, no pesticides and with high yields. Food does not need to be imported, impacting on the climate and the natural environment, but it can be harvested when it is ready to eat – fresh, healthy and of great flavour.

R10

R11

R5 Workshop with the digital MapTable using the Metropolitan Foodprint Tool. (Source: Wascher 2015)

R6 French fries produced in Hoeksche Waard and sold in Rotterdam. (Source: Kruit 2015)

R7 Hoeksche Rooie, an exclusive potato sold in the Rotterdam market Fenix Food Factory. (Source: Kruit 2015)

R8 Concept of a Metropolitan Food Cluster consisting of AgroParks (AP), Consolidation Centres (CC) and Rural Transformation Centres (RTC). (Source: Wascher after Smeets 2014)

R9 Example of a MFC combining various forms of agro-production and linking their waste-streams to optimize resource use efficiency (Source: Studio Marco Vermeulen)

R10 Portal to Venlo offers the greenhouse industry a model to develop a sustainable industry. (Source: Except 2009)

R11 A sample of exotic cress products coming from greenhouses in Westland (Source: Koppert Cress)

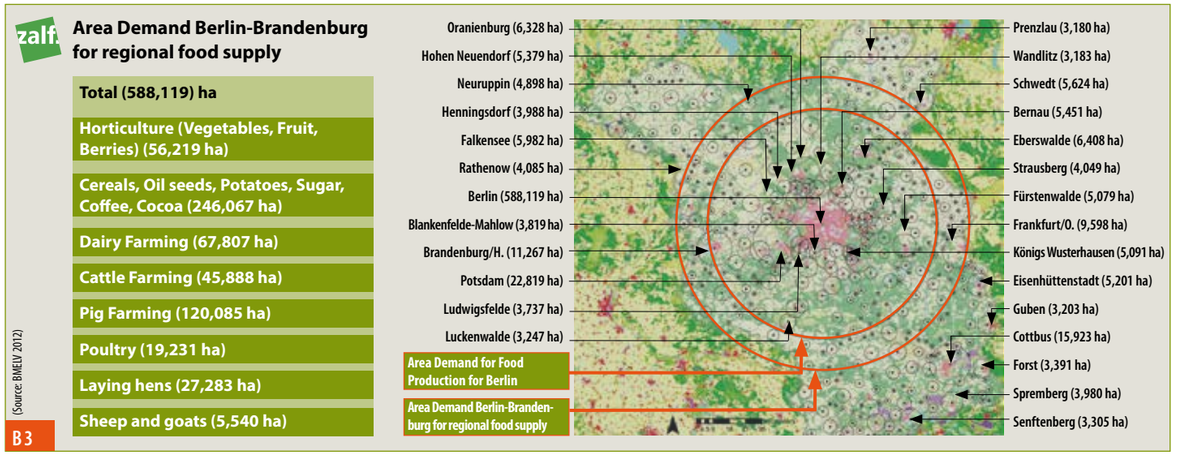
Annette Piorr
Ingo Zasada
Alexandra Doernberg

BERLIN

Innovations in organic food grown, processed, distributed and consumed within the Metropolitan area

B1

B2



B3

INTRODUCTION Berlin-Brandenburg represents a metropolitan region with rural agricultural areas in the direct vicinity of the metropolitan centre. The green and creative image of Berlin arises in a large number of innovative urban agriculture and regional food initiatives. Food is a popular issue in Berlin: "It's not just about what we eat, but how we eat it, grow it, share it and even name it. "Sustainable" isn't just a buzzword in Berlin, it's a way of life: eating organically, growing locally and getting our hands dirty" (Sarala 2015). The high public interest and engagement in the topic is rooted in a long tradition of allotment gardening in Berlin, which over the last years has been supplemented with many urban gardening innovations, e.g. community or intercultural gardens. There are also new urban and peri-urban based entrepreneurial models like self-harvesting gardens, aquaponic farm systems or community supported agriculture (CSA) emerging, featuring direct and narrow producer-consumer relationships. City authorities encounter these trends with willingness to co-operate, expressed in making spaces temporarily available for gardening initiatives, supporting exchange with Short Food Supply Chains (SFSC) stakeholders and stepwise considering new forms of agricultural land use in strategic planning.

Berlin is estimated to be one of the largest markets for organic food in Europe with suppliers from all over the world and from different German regions, whereas the surrounding Brandenburg region accounts for a high share of agricultural land under organic farming (10.6% of agricultural area and 12.6% of the farms are run organically) (Statistik Berlin Brandenburg 2013). Therefore our research focusses on organic food production and distribution and estimates potentials for regional organic food provision. In particular, we assess the environmental, social and economic impacts of SFSC.

RESEARCH ACTIVITIES In principle, related to the available area, it is possible to cover the food supply for Berlin. The calculation, on which figure B3 is based, takes the average consumption pattern of an average diet and the areas of arable and grassland and yield levels for different commodities into consideration. The area demand of the 3.5 Million people in Berlin equals 588 thousand hectares, which is roughly half of the available agricultural area. The inner circle shows the area demand for the city of Berlin. The outer circle also adds the area demand from the surrounding Federal State of Brandenburg. The results suggest that, despite the less-favoured area (LFA) conditions, the ca. 6 Million people of Berlin-Brandenburg can easily be supplied by local agricultural production. However, this calculation is only of a theoretical nature, as many commodities, such as tropical fruits, need to be imported.

Innovative concepts of SFSC are often originating from organic farming and food distribution. Research activities undertaken in Berlin applied a transdisciplinary approach: scientists from ZALF, activists, professionals and stakeholders from the organic farming sector, retailers, and public administration staff together exchanged regularly on specific in-depth themes such as:

B1 Urban community gardens with innovative management, financing and knowledge sharing concepts like Himmelbeet are spreading across Berlin. (Source: A. Piorr)

B2 Particulary organic farms from surrounding Brandenburg specialize in short chain delivery of vegetables for the Berlin market. (Source: R. Köster)

B3 Theoretical area demand (in ha) needed to cover the food consumption of Berlin-Brandenburg inhabitants through regional products. (Source: I. Zasada, ZALF, 2013)

B4 Urban gardening in post-war times in Berlin Tiergarten. (Source: Lemo, DHM)

B4


B5


B6

- the description, analysis and comparison of innovative SFSC of the Berlin Brandenburg organic food market
- the assessment of their environmental, economic and social impacts
- the potentials of a regional supply with organic food and the related marketing concepts
- the strategies, programmes and policies towards regional SFSC in different German cities.

FOOD CHAIN INNOVATIONS

SELF-HARVESTING CONCEPT BAUERNGARTEN This best practice example for a system innovation is based on social-networking and transforming traditional knowledge into new methods and practices. The central idea is a self-harvesting concept tailored towards urban lifestyles. Bauerngarten offers contracts for the care and self-harvesting of already partially seeded plots, providing a substantial share of the consumption of vegetables for individuals and groups (families) over the growing season (B5, B6). Elements of community gardening and common learning are combined with service offers through small scale agricultural entrepreneurs located within cities or at the easily accessible urban fringe. The concept covers several innovation dimensions: the technological dimension (e.g. through plot formats optimized for sectorial irrigation, leading to reduced water consumption), the process dimension through contracting machinery work or knowledge intensive practices (e.g. tillage or short term outsourcing of any management practice from the gardener to the entrepreneur), and finally the social dimension by being organised as a community garden with mutual support and exchange possibilities (exchange of know-how, seedlings, harvested produce) as well as by offering common learning in thematic courses (e.g. about plant diseases, composting). Advantages in economic viability arise for consumers who compensate costs for organic food by own labour input, and by consuming non-marketable qualities. Healthy food becomes accessible independent from the income level. Even more important social impacts are social learning, awareness building, personal skill development, community experience and health aspects. Environmental advantages lie in certified organic farming, food safety aspects due to professional management, and resource efficiency. Food miles are minimised.

ORGANIC REGIONAL FOOD DISTRIBUTION CHANNELS Distribution channels for organic food supply in Berlin are well established in specified organic stores and organic supermarkets but also in conventional retail and discounters. Usually, in order to offer a broad product range, the global agro-food system (GAS) is the provisioning source. In FOODMETRES a specific in-depth study analysed new distribution and marketing trends for regional organic food beyond classical marketing on-farm, on weekly markets or via producer groups. Face to face interviews were carried out in five companies (supermarkets and wholesalers) each holding between 1-83 branches in Berlin-Brandenburg and offering 1,000-13,000 different organic products in their portfolio. Also six heading organisations, associations and campaigns were interviewed. Central questions concerned the understanding of motivation behind the decision to take up regional organic products, their significance for the commercial enterprises, activities and strategies for further development within the organic product line. It became obvious that all experts expected a very positive future market development for regional organic products, mainly due to rising consumer demands, but also as a means for better profiling the product line. The regional organic food market is shaped through certain commodity groups like fruit, vegetables, eggs and dairy products, for which the consumer expects high quality, transparency, freshness, but also shorter transportation distances and social aspects, and for which they are willing to pay higher prices. Chain organisation showed different organisation models, structures, pathways, and rather individual strategies. However, regional structures for organic food production are not yet sufficient to cover the demand. The increased efforts of conventional supermarkets to provide regional (conventional) products, can lead to an intensification of efforts of the specialized trade to claim regional organic as a unique selling feature, which can ultimately incentivize regional organic production on farms *(Skoczowski 2014)*.

THE SUSTAINABILITY IMPACTS OF INNOVATIVE FOOD CHAIN SYSTEMS

Three workshops with stakeholders and decision-makers were carried out in Berlin to address the development potentials, the sustainability impacts and the contributions of SFSC, as well as their policy and implementation challenges. In a first workshop with the Berlin stakeholders, we discussed strengths, weaknesses, chances, risks and challenges of two new and relevant SFSC types (self-harvesting gardens and CSA) for farmers, consumers and society. As a result, development and upscaling potentials, transferability and the role in urban transformation processes differ between the SFSC forms, due to product specific, seasonal, market size, scale and target group differences. Governance structures, networks and cooperation are important but are established within individual and locally embedded concepts, which accounts for regionalised and innovation oriented development objectives and support.

In a second workshop organic farming SFSC types were selected that show a decreasing closeness between producer and consumer and an increasing spatial distance of production location to the metropolitan centre: urban gardening for self-supply, self-harvesting garden, community supported agriculture (CSA), regional organic products sold on a Berlin weekly market, retail (global organic chain, supermarket baseline). With stakeholders from the named SFSC types, we assessed the impact of the commodity vegetables. Regarding their environmental impacts most SFSC examples are estimated to perform better than the global baseline; CSA and self-harvesting garden reached the highest positive ranks. Urban Gardening for self-supply however was seen critically regarding efficient resource use and protection, because less professional gardening methods and practices are applied that perform less efficiently in e.g. use of water and nutrients. The economic sustainability profile of the SFSC differed markedly and positively from the global one, except for transportation efficiency. Regarding social sustainability, beneficial SFSC effects were assumed, except for food security. Stakeholders pointed to the still comparably low share of SFSC derived food in the overall consumption and the strong seasonal variability. The third workshop revealed that integrative approaches to urban spatial planning, food strategies and governance are required, that go beyond the existing sectorial and spatial boundaries and organisation and support innovative SFSC.


B8

SUMMARY AND CONCLUSIONS

The food sector, and in Berlin particularly the organic one, is a growing market with future potential, sensitive to individual and public perception and relevance, and integrating environmental and social values, interests and welfare. Innovative and regional food supply chains are an expression of changed societal demands and new consumer preferences and are currently notably establishing in metropolitan regions. Growing food on public and on private land is a contemporary phenomenon increasingly linked to new entrepreneurial models of professional agricultural land use, distribution and marketing but also of knowledge generation. Priority public supportive actions are justified as economic, environmental and socially inclusive impacts of these SFSC forms are verified, meeting both consumer demands and societal challenges.

B5, B6 On the urban fringe self harvesting concepts, like Bauerngarten, bring along sustainable food and land management innovation for the benefit of consumers, entrepreneurs and public land. (Source: www.bauerngarten.net)

B7 Learning by doing is a central element of many new SFSC types. (Source: www.hof-apfeltraum.de)

B8 Diversity of crops and varieties: A marketing concept connecting contemporary urban consumer demands with biodiversity. (Source: R. Köster)

B9, B10 A growing market for organic food in Berlin stepwise introduces regional product lines. (Source: Bio Company, Berlin)


B7

B9


B10

Ulrich Schmutz
Elizabeth Bos
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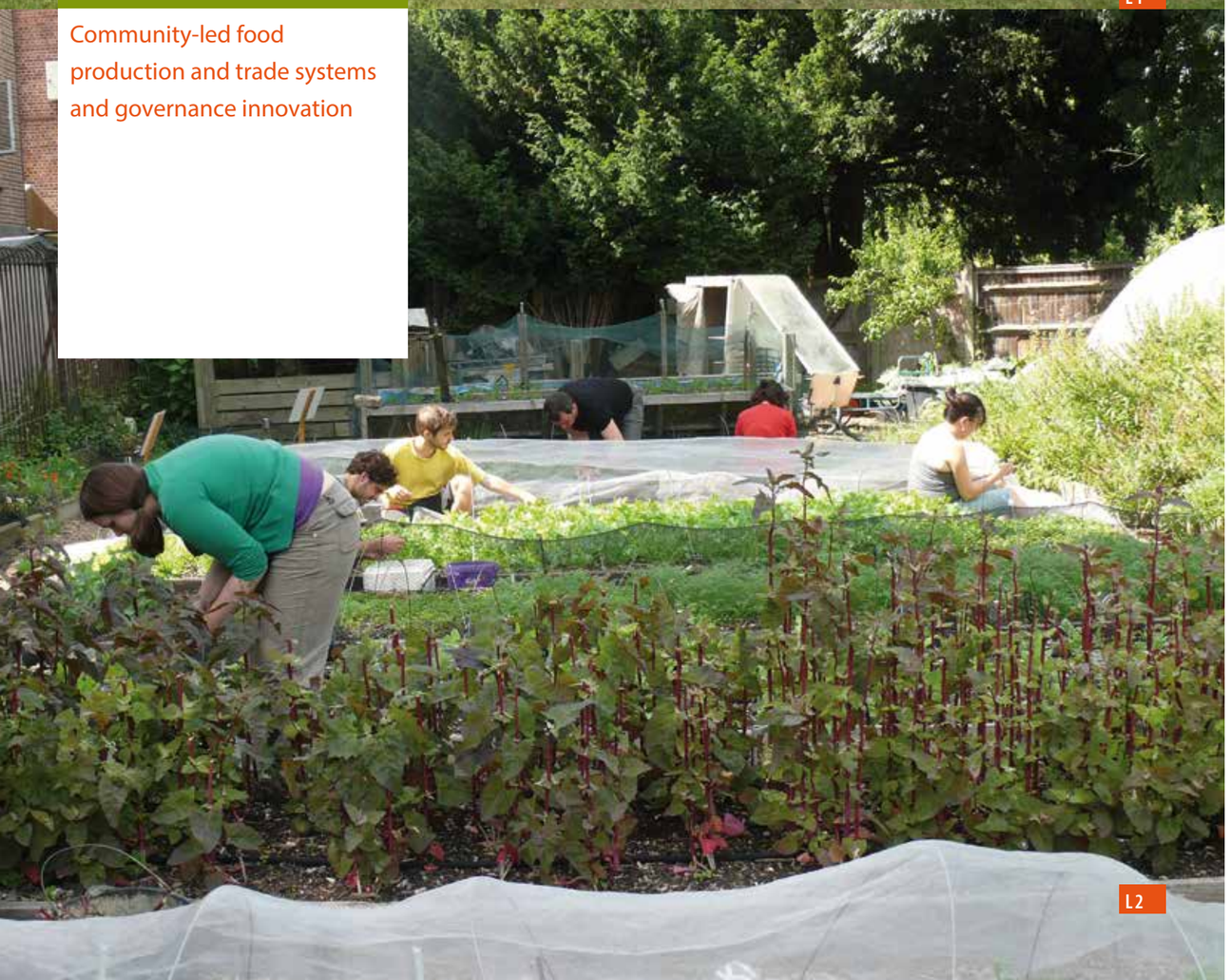
LONDON

Community-led food production and trade systems and governance innovation

L1



L2

INTRODUCTION With a population of 8.2 million people projected to grow to almost 10 million by 2030, London is one of the largest and most ethnically diverse cities in Europe. Although densely populated, a report by the London Assembly (Johnson 2010) found that the city is home to almost 500 farms and currently produces more than 8,000 tonnes of fruit and vegetables. Although agricultural land exists in the city's Green Belt, there are many barriers to increasing the amount of land which is actively farmed, including pressure on land for other purposes such as housing and activities considered more lucrative than farming.

Notwithstanding the low use of land for food production, there is a vibrant food environment in London comprising many innovative short food supply chains involving entrepreneurs, non-governmental organisations, local authorities and communities. The city-wide London Food Board (LFB) aims to co-ordinate and lead the debate on sustainable food issues in the city. Made up of an advisory group of independent food policy organisations and experts, the LFB oversees the implementation of the Mayor's London Food Strategy, inaugurated in 2006. The Food Strategy's vision is for "a sustainable world city… the food strategy sets the strategic context and outlines a plan of action to help us all make better and healthier choices".

An example of a city-wide initiative to address food system sustainability is Capital Growth, a campaign launched in 2008 to support people to grow food. Managed by Sustain (a non-governmental organisation campaigning for sustainable food and farming) Capital Growth created 2,012 growing spaces by 2012, engaging over 100,000 Londoners in this social and governance innovation at the city-wide scale, working towards sustainability through community food growing.

At a local scale, London's 33 boroughs, or administrative units, influence the food system through activities such as school meals provision, planning decisions and public health interventions. Currently, seventeen boroughs have their own food strategies or policies, fourteen have, or are developing 'food partnerships,' and several are promoting community food production in their planning frameworks. Despite this, the challenge of securing long-term access to land continues. It is also difficult for producers / growers to earn a living from the land once they secure it, particularly when faced with low wages and high rents or house prices. Incorporating these socio-economic issues into discussions around food system sustainability is therefore key, and many of the innovations in London aim to address self-sufficiency and economic fairness.

L3

L1, L4 The diversity of London food growing spaces in the urban landscape (Source: Capital Growth)

L2 Growing Communities Springfield Market Garden and Volunteers (Source: Growing Communities)

L3 Overhead of packing activities, Growing Communities (Source: Sophie Verhagen, Growing Communities)

RESEARCH ACTIVITIES By employing knowledge brokerage strategies, the UK FOODMETRES team has been working with stakeholders on three different levels of engagement.

1. We have engaged closely with local level stakeholders by exploring how the FOODMETRES project can practically contribute to their work (for example, in response to suggestions from the Greater London Authority's Food Team, we carried out a Sustainability Impact Assessment at the Crystal Palace Food Market).
2. By attending regional workshops, local stakeholders have made constructive critical contributions to the project, whilst also being kept informed of the project's progress.
3. Stakeholders with city-wide responsibilities and interests have been informed of the project's developments through a newsletter allowing for the sharing of

L4

international and local knowledge generated from the project. The knowledge brokerage techniques applied in the London case study have resulted in the building of relationships and networks and have created a dialogue between the research team and the 'users' of scientific information – innovators, and decision makers.

Throughout the project, a range of people have contributed their experience and knowledge of working to create sustainable urban food systems, including representatives from charities, business, campaign groups, food markets, and policy. Stakeholders have felt that knowledge brokerage and exchange has been valuable, not only between the UK research team but also with the international FOODMETRES consortium. Stakeholders found the opportunity to learn about other examples of short food chain innovations useful and interesting (i.e. different models such as the milk vending machines in Ljubljana or the organic food chain support network (FÖL) in Berlin, but also what is happening in other London boroughs). The promotion of cross-borough learning has highlighted that much of the work around food chain innovation is relatively localised.

SUSTAINABILITY IMPACT ASSESSMENT

We undertook a Sustainability Impact Assessment (SIA) at our first regional workshop in the inner city Borough of Lambeth. The aim was to find out how local food actors rank the impacts of different types of "short food supply chains" (SFSC) and how they compare against the current baseline scenario**,** where most vegetable supply comes from supermarkets, long food chains and large-scale producers. Seventeen participants (citizens, food entrepreneurs, growers, academic and policy makers) were asked to record what they would expect to realistically happen if we were to increase the amount of vegetables supplied through five different types of SFSC: Community Supported Agriculture (CSA), Urban Gardening (commercial), Urban Gardening (self-supply), Direct Sale (off-farm) and Direct Sale (on-farm). Results showed that CSAs were regarded as delivering the highest overall social, economic and environmental benefits, followed by Urban Gardening (commercial), Urban Gardening (self-supply) and Direct Sales (off farm). The lowest overall rating was for the supply chain Direct Sales (on farm) although this was still regarded as more sustainable than the current baseline. All five SFSC were ranked highest on the social aspects of sustainability. In addition to the SIA exercise, participants enjoyed a presentation about urban food growing in Ljubljana by Matjaž Glavan from our Slovenian FOODMETRES partner.

BALANCING FOOD DEMAND AND SUPPLY IN LONDON'S METROPOLITAN AGRO-FOOD SYSTEM

At our second regional workshop, participants discussed scenarios on how to balance food demand and supply in Metropolitan Agro-Food Systems (MAS), comparing the MAS in Berlin with London. The modelling used the latest available data on population growth for the city and the metropolitan area around it, along with recent yield data for conventional and organic production, food waste and diets. Graphical and numeric results show that for both cities it is possible to balance the city's food demand from the MAS (all food in a city's diet which can be grown in the region's temperate climate). However, for London with a predicted population growth to 26.5 million in the MAS by 2030 (10 million within Greater London) this is more challenging then in the Berlin MAS with a predicted slightly falling population. When comparing the effects of production systems, food waste, and diets it becomes clear that there are genuine win-win scenarios. This is the case, for example, when a full adoption of the 'Eatwell' plate[1] can be combined with the environmental benefits of a full adoption of organic production and consumption. This scenario model provides a 'big-picture framework' but does not give details on how a healthy diet for everyone can be achieved, or where the change in agricultural land use from e.g. grassland to vegetable, fruit and agroforestry should happen, or where fodder is replaced by legumes for human consumption in arable crop rotations. Such conflicting land use decisions can be addressed with map tools like MapTable, which was later used in the workshop.


L5

FOOD CHAIN INNOVATIONS

In London there are many interlinked innovations involving local people, particularly around 'process' and 'social' (encompassing 'governance') innovations. The following two examples in London – Crystal Palace Food Market (LAS) and Growing Communities (MAS) show how these innovations are interlinked and operate in practice. Of key importance in these two (of many) examples is the sharing of business model innovations and knowledge about how to organise markets, logistics and production for localised markets.

Crystal Palace Food Market – a small-scale community food market, was initiated by the Transition Town movement (a grassroots socio-economic movement aimed at building resilience and post-carbon living). Promoting social innovations in terms of new relationships and behavioural change, the market supports local producers, small-scale farmers and local growing projects. One of the growing projects the market works with is the 'patchwork farm', where local produce is sold, including excess produce from allotments, gardens and other small growing spaces. Part of the shared vision of the market is to create


L6

a resilient food system, not dependent on long haul travel and with a greatly reduced carbon footprint. Much of the produce is grown within walking distance of the market responding to logistical challenges as well as environmental concerns.

Another example of food chain innovation is the model developed by Growing Communities, which aims to transform food and farming through community-led trade. Whilst having a local focus, the Growing Communities model also incorporates the metropolitan area, by considering how to feed urban populations; this is expressed in their vision of 'food zones,' which demonstrates what type of food could be sourced from different geographical zones. This encompasses appropriately scaled trading relationships starting from the local and working out to the global, which enables different actors (urban producers, small farmers, producer co-ops, larger farms and food imports) to exist in harmony.

To create sustainable, resilient food systems, Growing Communities believes in restoring power back to communities and farmers. This is achieved by working towards a set of principles around ecologically produced, local and seasonal food, which is plant based, fresh and minimally processed, from 'appropriately scaled' operations. All of Growing Communities' activities are based on a set of core values including:

- Support fair trade
- Involve environmentally friendly and low-carbon resource use
- Promote knowledge
- Strive to be economically viable and independent
- Foster community
- Be transparent and promote trust throughout the food chain

Using a model based on networks of replication and proliferation, Growing Communities supports a number of box schemes to reproduce successful social enterprises (which in turn promotes 'scaling up') which include an organic fruit and vegetable box scheme, a Farmers' Market, and certified organic urban market gardens and patchwork farms which grow produce for sale through the box scheme. Their urban growing sites also provide training for apprentice growers and volunteers, thus contributing to a new generation of urban farmers.

SUMMARY AND CONCLUSIONS

FOODMETRES research is predicting that it is possible to produce enough temperate crops, meat and dairy produce in the London MAS, using organic methods, and based on a healthy diet and reduced food waste scenarios. This has opened up some important debates about how the theoretical scenario might be achieved. One particular issue is to do with the 'next steps' for short food chains and the role of communities and citizens and how to connect and 'scale up' the range of small-scale local food activities, especially in the peri-urban parts of the Metropolitan Agro-Food System. The growing network of local food initiatives and innovators that can be found in London may be one way of answering this question; however challenges still remain over how to expand, coordinate and receive better governance and political support. More broadly, London faces a number of complexities and challenges in terms of food system sustainability. For example, the interconnected issues of transport logistics and storage pose a challenge due to the scale of the city, the lack of storage space, and 'freshness' being a key aspect of local food. The dominance of supermarkets and the rise in their smaller convenience stores is another key challenge, as well as the prominence of fast-food outlets all of which compete for space and attention in the city's food environment. Our research suggests that there is a continued need for collaborative space to discuss these issues and to share learning and best practice, so that the impact of the many food chain innovations taking place in the city can be valued and improved.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L10

L5, L6 The diversity of London food growing spaces in the urban landscape (Source: Capital Growth)

L7 Forty Hall Farm, Enfield (Source: Garden Enfield Project)

L8, L9, L10 Capital Growth has created over 2,012 new growing spaces in the city and continues to expand (Source: Capital Growth)

1 The Eatwell plate is a tool provided by the UK National Health Service which aims to help consumers understand what proportions of different food types should be included in a healthy diet.

Guido Sali
Chiara Mazzocchi
Federica Monaco
Stefano Corsi

MILAN

Socio-economic innovations in the agro-food system and alternative food chains as strategies to support local agriculture and improve sustainability.

M1


M2


M3


M4

INTRODUCTION Located in a fertile plain area in Europe, Milan represents the fulcrum of the entire Lombardy region and its metropolitan area, playing a role as a transfer space between the highly urbanized contexts in the North and the more rural ones in the South.

Given the increasing interest in the sustainability of food systems, as demonstrated by important initiatives promoted by city government, such as the Urban Food Policy Pact and the Milan Food Chart as the heritage document of the EXPO 2015 "Feeding the planet, energy for life", a focus on strategies to improve sustainability is needed: the reconnection between food demand and supply can play a role in this sense. In fact, through the intensive agriculture of the Milan metropolitan area, the productive system of the whole region is more often threatened by strong urbanization, soil consumption dynamics and competition for resources. These conditions in turn affect the possibility for the local context to adequately meet food requirements, as do changes in consumers' requests and lifestyles, which require the food system to have the capacity to adapt qualitatively and quantitatively to food demand.

RESEARCH ACTIVITIES With the main purpose of providing cognitive tools that enable the generation of guidelines and useful indications to policy makers, research activities have been analysing the system features and its socio-economic and environmental value. In addition, the identification of innovative chains and networks operating in the area has been carried out, as well as the in-depth study of agricultural and food policies affecting their development.

CHARACTERISTICS OF THE AGRO-FOOD SYSTEM In order to assess the potentialities of the system in reconnecting food demand and supply, we adopted a multi-perspective approach that simultaneously indicates the compliance of food supply with dietary requirements under different profiles:

- productive capacity, *can the system provide enough food to meet demanded amounts*?
- a nutritional aspect, *does production supply an adequate nutritional content*?
- production value, *does the food system generate a positive economic balance*?

M5

M1, M3 Agrimercato meets the sensitivity of consumers promoting the commercialization of local, seasonal and quality food and supporting short food chains (Source: Agrimercato).

M2 The involvement of people in a new paradigm of sustainable agriculture is expressed by the spreading of urban gardening experiences in the metropolitan region (Source: P. De Marinis).

M4 Tasty seasonal fruit and vegetables sold in local markets (Source: C. Mazzocchi).

M5 The increasing demand for organic food highlights public interest in high quality and safe diets (Source: E. Pozzi).


M6


M7


M9


M10


M11

The chances to improve the sustainability of the system by reducing the gap between production and consumption have been assessed in different conditions, reflecting structural changes, different use of resources and changes in the dietary pattern; our research has found that a higher adaptation of the supply system to food demand is generally associated with a decrease in the generated value, but a stronger potential reconnection could play a role in a more solid permanence of peri-urban agriculture in metropolitan areas.

URBAN GARDENING In the inner city of Milan and in the outskirts, more than 190 hectares of private and public land are devoted to urban gardening experiences: municipal allotments, backyard and community gardens. Such activities, arising for social and aggregative reasons, enable the gardeners to cultivate plots for their own pleasure and to have more genuine products. They mainly produce fruit and vegetables quite exclusively for self-consumption, in amounts just sufficient to meet individual requirements.

POLICY ASPECTS To deepen understanding of the strengths and weaknesses of the regional regulatory framework for agro-food systems, a thematic workshop was held in Milan, with the involvement of local stakeholders, experts, local and regional policy makers and representatives of conventional and alternative food networks. Participants were asked to provide their perception about policies and interventions needed to develop and enhance local agro-food systems.

The most important need expressed by operators is critical information. Although local food chains are already operative, consumers have a limited knowledge of widely used terms, such as 'local food' or 'km0'. Consumers are not clearly informed about these terms and so should be informed through proper food education projects. At the same time, policy should act to simplify the regulatory context and bureaucracy. It should favour networking and encourage the formalisation of the experiences and networks of alternative supply chains, which already promote a great deal of informal co-operation, and the creation of innovative solutions in food chains with precise and targeted policies.


M8

FOOD CHAIN INNOVATIONS In the Milan area, the local population, citizens or entrepreneurs, are differently involved in system innovations that encompass interlinked social aspects, process innovation and governance initiatives. Some of them are traceable back to shortened relationships between producers and consumers, representing examples of direct sales organized in networks and supported by regulations and consumers' trust.

The SME project partner Agrimercato is a producers' association that actively operates for the organization of farmers' markets, a type of sale that is increasingly demanded by producers who benefit from guaranteed incomes, and strongly recognized by consumers, for their role in strengthening the system of short food chains and the valorisation of local, seasonal and environment-friendly products.

Solidarity Purchasing Groups (SPGs) are informal structures for the collective purchasing of food, made up of consumers who co-operate to buy food and other goods directly from producers, according to the driving principles of equity, solidarity and sustainability. Along with a closer social cohesion among actors and the strength of the local component, their number is constantly changing due to favourable conditions for both producers and consumers, and their capacity in adapting to consumers' demand for food with specific characteristics, e.g. organic products.

In addition, agricultural districts represent a new model of economic organization that aggregates different and interdependent subjects, either farms or agro-food industries, in a closer integration of production, processing and distribution phases. They refer to different agricultural sectors and production, both food and non-food. They recognize the importance of a multifunctional, locally-based agriculture, the presence of certified and protected production and favour the integration amongst actors of a regional chain. They are aimed at:

- promoting and improving agricultural competitiveness;
- integrating different actors involved in the food supply chain in a specific territory and their actions and encouraging strategies for a coordinated action;
- promoting activities and programs for local development and valorisation;
- facilitating and strengthening the local governance.

SUMMARY AND CONCLUSIONS The rise in food movements, the spread of new dietary habits, the demand for local or organic food, the increasing importance given to environmental and social contents of food, have contributed to establishing a new paradigm for the sustainability of food systems. In this sense alternative systems, short and shortened food chains and local systems arising from citizens' new awareness and interest in food, can operate towards a more strengthened reconnection between production and consumption, which goes from shorter distances to the fulfilment of consumers' needs, providing sufficient amounts of food with specific attributes.


M12


M13

M6 Direct sales can grant incomes to the producer and, at the same time, strengthen the system of short food chains, valorising local, seasonal and environment-friendly products (Source: E. Pozzi).

M7 Citizens' new awareness and interest in food is encouraging them to cultivate organic fruit and vegetables in their own gardens to meet their individual requirements (Source: P. De Marinis)

M8 The interest of people in regional and quality products is demonstrated by the large participation in local markets (Source: C. Mazzocchi).

M9 Many farms promote innovative chains and networks collecting products to be delivered to consumers through box schemes or collective purchasing groups (Source: E. Pozzi).

M10 Animal breeding in the region allows people to find processed food of animal origin – from cheese and dairy products, to cold meats, salami and sausages – in each local market (Source: C. Mazzocchi).

M11 The "Distretto del Latte Lombardo" promotes the integration of production, processing and distribution phases that involve the different actors of the supply chain (Source: E. Pozzi).

M12 Fresh herbs, which are in high demand, sold in local markets (Source: C. Mazzocchi)

M13 Rice is a very typical regional crop: its importance for the local economy and development is recognized and strengthened by its specific agricultural districts (Source: E. Pozzi).

Matjaž Glavan
Marina Pintar

LJUBLJANA

Food Hub with locally produced food and gardening as part of innovative short food supply chains

L1

L2

L3

INTRODUCTION Ljubljana is the capital of the Republic of Slovenia, administratively a part of the Municipality of Ljubljana (MOL) and, in broader terms, a part of the Ljubljana Metropolitan Region (LMR). The MOL covers an area of 275 km^2, it encompasses 1.36% of Slovenia's territory (20,273 km^2) and has 278,789 inhabitants, making up 13.5% of the population of Slovenia (2,062,874) (Statistical Office of the Republic of Slovenia 2015).

The dense core of Ljubljana is integrated with other municipalities in the Ljubljana Urban Region (LUR) encompassing 26 municipalities with a total of over 500,000 residents. The MOL has the highest population density in Slovenia, is economically the most developed and has the highest index of living standard. The MOL plays a key role in the entire area of the LUR and LMR, connecting the region into an integral whole with its administrative and economic power, traffic ways and daily labour migration.

In 2010, the MOL had 826 farms with an average size of 6.9 ha. Dairy milk production is concentrated in the flatland and beef production in the hills around the city. Fruit grown in the MOL consist of strawberries, blueberries, and apples. Vegetable production in the winter consists of lamb's lettuce, rocket, lettuce and radish and in the summer months of tomatoes, potatoes, peppers, cucumbers, cabbage and lettuce.

RESEARCH ACTIVITIES At different meetings, workshops and in field work we engaged private and public stakeholders including small and large agriculture holdings, allotment and home gardeners, cooperatives, small and medium enterprises (SME), consumer groups, the Municipality of Ljubljana, the Landscape park and the Chamber for Agriculture and Forestry of Slovenia with the purpose of acquiring information about food supply chain characteristics.

L1 Vegetable production in Ljubljana in winter time is concentrated on Lamb's lettuce, among others (Source: M. Glavan).

L2 Guerilla allotment gardens are one of the newer forms of allotment gardens in Ljubljana (Source: M. Glavan).

L3 The Municipality of Ljubljana is integrated into the Ljubljana Urban Region and in broader terms into the Ljubljana Metropolitan Region which covers all of Slovenia (Source: M. Glavan, UL, 2014).

L4 Broad supply of locally produced vegetables on the Ljubljana city fringe farm (Source: M. Glavan)

L5 The vegetable shop of the Ljubljana city fringe farm (Source: M. Glavan).

L6 The first workshop of the FOODMETRES project in the Ljubljana case study area engaged private and public stakeholders (Source: M. Lobnik).

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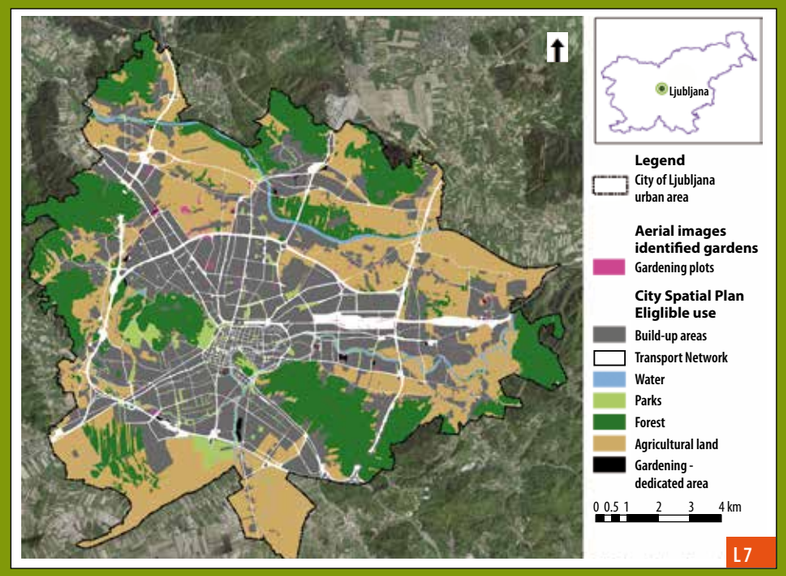
L6



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Stakeholders pointed out that local food chains are becoming longer timewise because producers must also deal with marketing and production technologies. The lack of agricultural extension officers in the field of production technologies is a serious limitation in optimizing production. Many farmers have poor or no agricultural education and new knowledge is mainly acquired through the exchange of experiences or through trial and error practice.

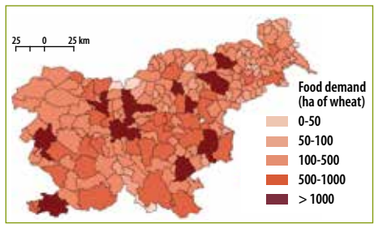
Consumers are very well informed about the advantages of locally produced food, and are therefore getting more demanding, but they are poorly informed about 'seasonal' food. Participants observed that the national generic promotion of agricultural products funded by the EU has helped to increase the sales from small growers. Growers also observe a shift in vendors' and retailers' behaviour who have started to appreciate locally produced food.

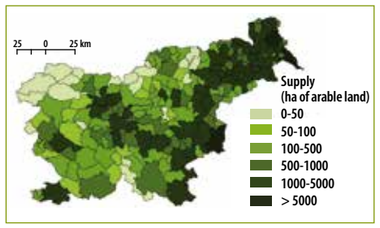
URBAN GARDENING We asked 127 gardeners in Ljubljana to estimate their yearly production costs (seeds, seedling plants, fertilisers, plant protection etc.). By multiplying the yield of vegetables and their retail price we estimated that production was valued at 3.69 EUR/m^2 and production cost at 1.27 EUR/m^2. Finally, we estimated that the average gross margin for gardening production was 2.42 EUR/m^2. The approximate expected economic impact of urban gardening on the vegetable supply chain in the city of Ljubljana expressed as the gross margin of the areas currently dedicated to allotment gardens (45.89 ha) is 1,100,000 EUR/year and of the areas identified by aerial images (158 ha) is 3,800,000 EUR/year.

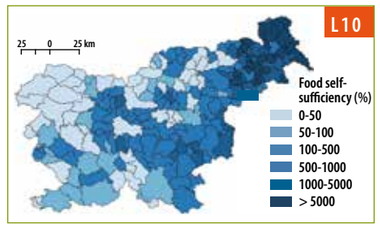
Soil samples were collected from all interviewed gardeners to analyse the content of phosphorus, potassium, organic matter and heavy metals. The results for phosphorus, potassium and organic matter show that gardeners often over-fertilise their plots. This impacts negatively on plant resistance and costs. Concentrations of cadmium, lead and zinc are below limit values mainly, although in some cases can exceed them. This means that there is possibly some risk from vegetable consumption from these locations. Although 95% of gardeners report that they cultivate their gardens in organic, integrated or permaculture ways, only 5% of them have made soil tests and less than 1% have knowledge about heavy metals in their garden soils.

Self sufficiency Our project partners from the University of Milan conducted research to analyse local self-sufficiency capacities in the LMR. Self-sufficiency is very high and equals 222%. However, cities like Ljubljana and Maribor and mountainous and mostly forested regions are faced with less than 50% food self-sufficiency. Inside the LUR, where 83% of demand is met, the MOL, despite having quite a large supply area (more than 2,700 ha of arable land), is the municipality that shows the highest productive deficit, since its capacity to satisfy population demand is about 25%.

IMPACT ASSESSMENT ANALYSIS In cooperation with project partners from Berlin we conducted a Sustainability Impact Assessment of alternative short food supply chains (SFSC). According to the results, stakeholders felt that vegetable food chains with direct consumer-producer relations (direct sale on-farm, direct sales off-farm) promote sustainable development. Stakeholders also reported that public procurement in its current form inhibits sustainable development. Social and environmental impacts were rated higher than the economic for the following types of SFSC: Direct sales on-farm, Consumer-producer partnerships (CSA), Direct sales off-farm, Urban Gardening/farming for commercial purposes and Urban Gardening/family farming for self-supply. Among the chain types 'public procurement´ scored notably lower effects. The highest positive impact was attributed to urban gardening / family farming for self-supply, because of the potential to reduce packaging (environmental impact) and direct sales on farm related to food quality (social impact).







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FOOD CHAIN INNOVATIONS In cooperation with local municipalities, producers and processors, the Landscape Park Ljubljansko Barje introduced local markets with harmonized market days around the park, allowing the producers a higher income and the consumers a wider choice. Previously, farmers were fragmented and disorganised because they did not have the necessary marketing skills.

In recent years the idea of vending machines for selling raw milk directly from the farms has been very successful. They sell only fresh milk, which is not treated with heat. Preserved at 4°C it can last for 3 days. The milk is priced at 1 EUR or less. Vending machines are placed all over Slovenia at market places, supermarkets and high-density residential areas. They were introduced due to the low market price of milk and consumer demand. Raw fresh milk can be used to make yoghurts, cream, butter, cottage cheese and cheese.

SME project partners Geaprodukt and Pro Contus found in the FOODMETRES project an opportunity to start transforming the Geaprodukt business plan towards an AgroPark Food Hub for local vegetable and fruit producers. The main goal is to increase the supply of local products via establishing direct producer-customer relationships. Geaprodukt offers local farmers a market space for free where they can sell their products directly to customers. Afterwards they can sell any remaining leftovers of proper quality to Geaprodukt. This is a win-win situation: producers sell products at the best price avoiding unnecessary waste of food due to unsold products and Geaprodukt gets local products which can be sold at a better price to the companies' customers. Their business plan also includes buying surpluses in vegetable production from small landholders like home or allotment gardeners. The new business plan is currently in a start-up phase and is time and labour demanding, however it brings satisfaction to the company through enhancing its social responsibility to Slovenian producers. Additionally, the long-term cooperation established with domestic producers is contributing to the development of the local area.

SUMMARY AND CONCLUSIONS Ljubljana has, as the main centre of Slovenia, the highest population density and food demand. Its suburban and rural neighbouring areas are known for their high production of cereals, meat, milk, dairy products, and fruit and in recent years also vegetable production. Three stakeholder meetings showed that producers have problems with understanding marketing, consumers lack knowledge about seasonality and food processing, and wholesalers and retailers are the powerful link in food chain markets. Urban gardening research showed that allotment gardeners in Ljubljana save approximately 3.8 million EUR/year with their production, which is not negligible. The Sustainability Impact Assessment showed that direct producer-consumer relationships are perceived to bring the highest social, environmental and economic value and promote sustainable development. Food chain innovations are in their starting phase initiated by producers, however they often need support by the public sector in regard to health regulations or marketing skills.

L13

L7 Almost 46 ha of land in the city of Ljubljana are currently dedicated to allotment gardens (Source: M. Glavan, UL, 2013).

L8 The average yield of the five most commonly grown vegetables on the gardening areas in Ljubljana is almost 1.9 kg / m^2 (Source: M. Glavan).

L9 New functions of the field of the former farm, now changed to an allotment garden area on the setlement's fringe (Source: I. Šuklje Erjavec).

L10 Although food self-sufficiency in the entire Ljubljana Metropolitan Region equals 222 %, the city of Ljubljana is faced with less than 50 % food self-sufficiency (Source: S. Corsi et al., UMIL, 2014).

L11 In recent years the idea of vending machines for selling raw milk directly from the farms was very successful. Vending machines are placed all over the Ljubljana Metropolitan Region in high density residential areas (apartment blocks) among others (Source: J. Krol, www.flickr.com).

L12 The central market place in Ljubljana connects producers and consumers directly (Source: M. Deutsch, www.flickr.com).

L13 SME project partners found in the Foodmetres project an opportunity to start transformation of Geaprodukt's business plan towards an AgroPark Food Hub for local vegetable and fruit producers (Source: M. Glavan).

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NAIROBI

Innovations in Urban Agriculture in Nairobi

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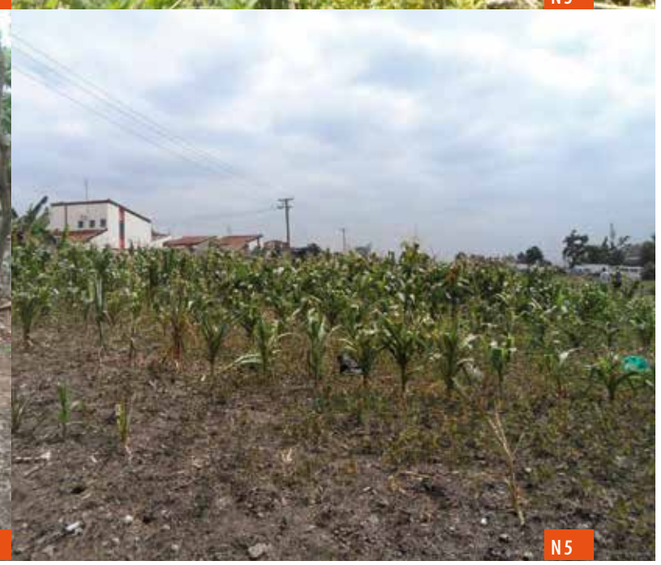

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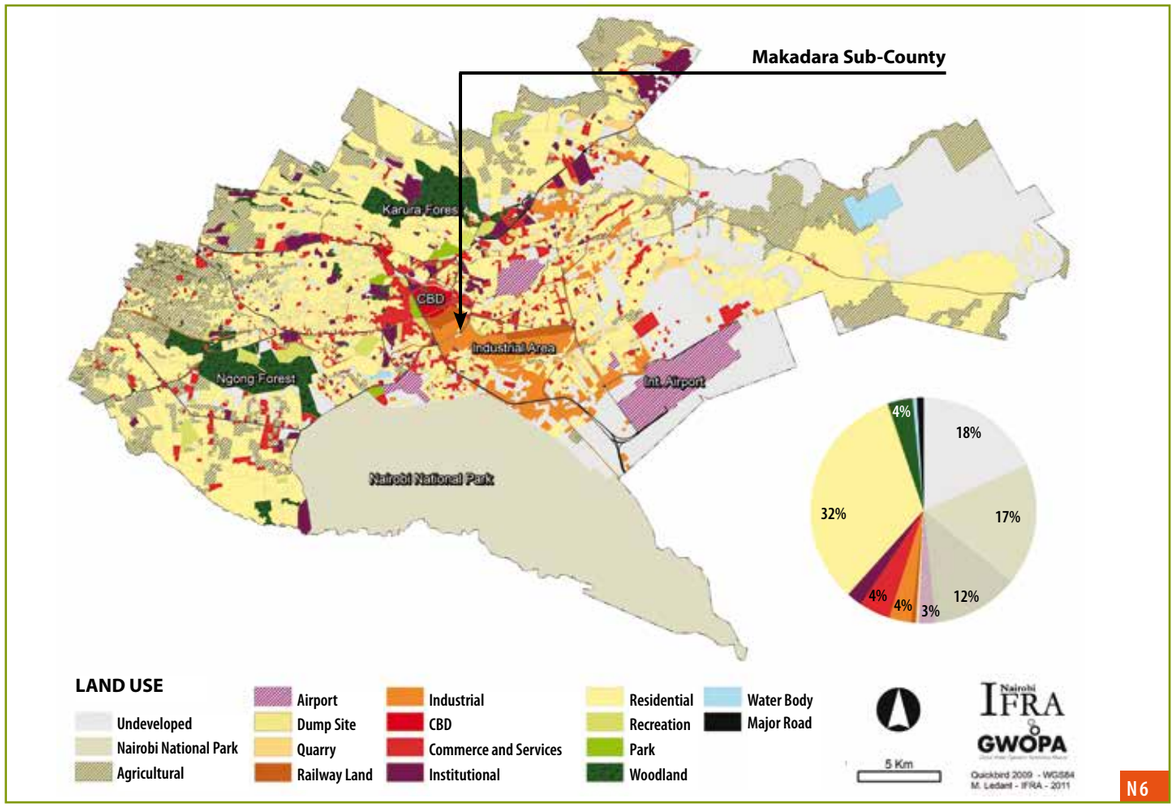

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INTRODUCTION Nairobi is the capital city of Kenya and the main regional hub in East and Central Africa. It is the second largest city in the African great lake regions after Dar es Salaam in Tanzania. The administrative area of Nairobi is 696 km^2. The city has a population of 3.1 million inhabitants according to the last census done in 2009, while estimates done in 2011, referred to 3.36 million people. 60% of the residents of Nairobi are low-income earners with a large proportion of them living below the poverty line, in slums and informal settlements in the city.

Accessibility and affordability of food especially for the urban poor is a major issue. Due to their low income or poverty status, some urban poor residents have found ways of cutting down their food expenses and subsisting in the city, by practicing various forms of urban agriculture. By growing their own food in various parts of the city, these poor urban residents are able to meet their food demand, and in some cases, sell. In the process, in several of the cases, they are able to earn some extra income from the sale of surplus grown.

Despite the fact that urban farming is widely practiced in Nairobi and evidence that it enhances food security and livelihoods among urban poor households, the practice continues to be shunned and discouraged by many, receiving little support from city authorities and policy makers.

The general belief is that urban farming takes place on a scale which is too small to have any significant impact. Therefore, not much attention is given to the practice. Secondly, even where there is sale of produce from small or large-scale commercial urban farming, the public is usually very wary of buying.

CASE STUDY OBJECTIVES In order to investigate these perceptions and beliefs, the Nairobi FOODMETRES case study set out to understand the nature and sustainability impacts of urban farming in Nairobi. The main objective of the Nairobi case study was to analyse innovations in short food supply chains by studying urban agriculture in Nairobi.

N1 Nairobi, "Green City in the Sun". (Source: Monicah Mwangi, https://monicahnjeri.wordpress.com)

N2 Multi-storey garden used to grow several food crops at the same time. Essential in areas that have limited space. (Source: Bancy Kinuthia)

N3 Farmer Asha Nyatoro displays some of her crops grown in tins. She has adopted this innovation due to limited space in her backyard. (Source: Bancy Kinuthia)

N4 Farmer Rabani Maimba displays some of the various tree seedlings he grows in his farm located on a road reserve. He sells them to various institutions. He also grows vegetables for sale and home consumption. (Source: Bancy Kinuthia)

N5 Commercial Maize Farming on an Urban Road or Railway Reserve. (Source: Bancy Kinuthia)

N6 Land use zoning map of Nairobi City (Source: Martin Ledant, 2011)

The sub-objectives of the study were to analyse the nature of urban agriculture in Nairobi, identify innovative practices in urban gardening and assess the social, economic and environmental sustainability impacts of the various forms of urban farming.

Facts & Figures on Makadara, Nairobi

Population	218,641 according to 2009 census
Size	23.1 Square Km
Number of farms	16 institutions (schools, rehabilitation centres and churches)
Number of farmers	1480
Horticultural crops	Kale, Spinach, Cabbage, Tomatoes, Onions, Capsicum, Bananas, Coriander, Aubergine, etc.
Food crops	Maize, Beans, Irish potatoes, Sweet potatoes, Cassava, Arrow roots, Cowpeas, Green grams


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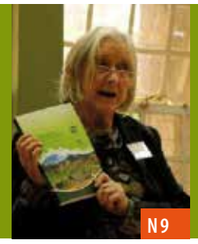
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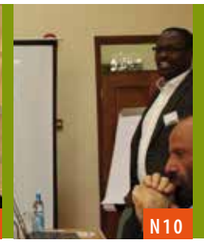
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RESEARCH ACTIVITIES

A number of research activities were conducted. These included two stakeholder workshops and fieldwork where interviews and questionnaires were distributed to urban farmers and a range of key informants working with and/or supporting the urban farmer's activities. The Nairobi case study concentrated on one sub-region of the city known as Makadara sub-county as shown in the map.

Located in Eastland's, the marginalised part of the city, Makadara Sub-County contains some of the oldest planned public housing residences. These housing areas have numerous pockets of open spaces that are used for urban farming by some of the residents. However, due to the high population density, there is limited space. As a result, some of the residents in the area have come up with innovative urban farming methods.

The study established that urban farming in Nairobi is varied, and depends on the space where the gardening takes place. The main spaces where farming takes place include: 1) in people's backyards or home gardens and 2) in garden plots away from home in public open spaces. Most of this type of farming is very small scale, for subsistence or household use. Any surplus is sold nearby.

Where the backyard spaces and garden plots away from home are limited the innovative gardening practices are adopted like the use of sacks and tins or multi storey gardens. The former (sacks and tins) are in use by the majority of the residents in the study area. The latter (multi-storey gardens) are rather complicated to set up and require training, thus they have been adopted by fewer households. Both these types of farming are used in the household while the surplus is sold in the neighbourhood.

Some forms of limited small to large-scale commercial farming takes place in Nairobi, practiced mainly in institutional land belonging to public institutions like schools, churches or hospitals and on public open spaces (usually unutilized plots, road or railway reserves).

SUSTAINABLE IMPACT ASSESSMENT

A Sustainable Impact Assessment (SIA) exercise was carried out with urban farmers and county agricultural extension officers in the study area, in order to understand the impacts of the urban farming activities in Nairobi. The study established that urban gardening for self-supply had the highest expected impact on the environment, particularly on 'ecoefficiency for abiotic resource use', followed by 'provision of ecological habitats and biodiversity' and 'reduction on transportation costs'. Urban gardening for commercial purposes had considerably lower positive environmental impacts, with medium level impacts on the same items and ranking as urban gardening for self-supply. Direct on-farm and off-farm sales had the lowest positive environmental impacts overall.

Urban gardening for commercial purposes, community supported agriculture and direct on-farm sales and direct off-farm sales had the highest positive economic impacts compared to urban gardening for self-supply. The highest economic impact was felt on generating employment along the food chain, enhancing regional viability and competitiveness, generating long-term profitability. The lowest economic impact was felt on enhancing transportation efficiency.

It was evident that urban gardening for self-supply had lower economic impacts overall than all the other forms of urban gardening for small or large-scale commercial purposes.

The highest positive impacts for all the urban gardening types were felt socially. Thus, all the five types of urban gardening had high positive social impacts, particularly on food quality, food safety and human health, food security and sovereignty. Overall, urban gardening for self-supply had the highest social impact, particularly on food quality, security and sovereignty, viability on traditions and cultures, in that order. Urban gardening for direct on-farm sales had some impacts on food safety and human health, while urban gardening for commercial purposes and community supported agriculture had medium level impacts on food safety, security and sovereignty.

Summary of Sustainability Impact Assessment results

Sustainability impact Item	Environmental	Economic	Social
Type of urban gardening	Level of Positive Sustainability Impact		
Urban gardening for self-supply	High	Medium	High
Urban gardening for commercial purposes	Medium	High	High
Community supported agriculture	Medium	High	High
Direct on farm sale	Low	High	High
Direct off farm sale	Low	High	High

NAIROBI STAKEHOLDERS WORKSHOP

On July 3rd, 2013 the Nairobi stakeholders workshop took place at the University of Nairobi, Kenya. More than 20 people attended the event, with a broad range of interests, including academics, urban farmers, urban planners, Food and Agricultural Organization (FAO), Nairobi and Environs Food Security, Agriculture and Livestock Forum (NEFSALF) – a forum for urban farmers and Nairobi City County.

The morning session began with several presentations from key stakeholders. Dr. Paul Omanga from FAO gave an overview of the nexus between urban food security and urban and peri-urban agriculture. He showed the benefits of urban farming, but also the challenges and problems faced by both policymakers and urban farmers, including use of polluted waters, waste from farming and land pressure. Dr. Omanga's presentation set out a useful context for the remainder of the day.

Prof. Diana Lee-Smith of Mazingira Institute (an urban farming research institute and an advocacy platform for urban farmers) presented on "Planning for Urban Farming". She noted that the debate around urban and peri-urban forms of agriculture (short chains), was at a crucial juncture in that Nairobi County was, for the first time in over 30 years, moving towards embracing the benefits of urban and peri-urban agriculture – a radical shift away from rejecting the practice.

According to Prof. Lee-Smith, the crucial questions are related to planning and zoning policies, and less – at this stage – to the practice of urban farming. She noted that "planners and policymakers have been left behind by urban farmers" and civil society organizations. Dr. Lawrence Esho from the Centre for Urban and Regional Planning delivered a presentation on, "Agriculture as an Urban Form", which explored the possibilities of incorporating urban agriculture as a land use in Nairobi.

GROUP DISCUSSIONS & FEEDBACK

A session on group discussions was held in the afternoon session. Urban farmers were split up and assigned a group of participants representing different interests. Each group was given a hypothesis to discuss. Some of the conclusions drawn from the discussion included:

"With rapid urbanisation, you need proper planning for food for these growing cities. Otherwise, people will be underfed, and strategic reserves are important, because you don't know what will happen tomorrow."

"Less actors in the chain, makes food cheaper and so the shorter the food chain, the better for the poor and middle class, making short chains more desirable. Furthermore, the shorter the food chain the safer the food will be. Supermarkets buy the best produce, which is also the most expensive, and only the rich can buy from the supermarkets. The quality gets less as you move down the ladder, to kiosks and dukas (small neighbourhood groceries)"

"...food security agenda should be guided by environmental considerations".

CONCLUSIONS

The most innovative type of urban farming identified was the use of sacks and tins (practiced by the majority of the households) and multi storey gardens, used by those who had no access to land. In terms of impacts, urban gardening for self-supply had the highest expected environmental impacts overall. Both the small-scale and large-scale urban commercial farming activities had high positive economic impacts, particularly in generating employment along the food supply and production chain, long term profitability and reduction of food waste. Socially, all the types of urban farming had high positive social impacts, on food safety, quality, health, sovereignty, security and traditions and food culture. Based on the above results, it is evident that there is need to give more attention to urban gardening as a positive social, economic activity in the city, and find ways of incorporating it into mainstream urban land use planning and policy making.


N12


N13

N7 County Executive Minister for Water, Energy, Forestry, Environment and Natural Resources, Mr. John Gakuo, representing the City Governor. (Source: Sebastiaan Soeters)

N8 Dr Paul Omanga, FAO Representative Giving an Overview of, "The Nexus between Urban Food Security and Urban and Peri-Urban Agriculture". (Source: Sebastiaan Soeters)

N9 Prof. Diana Lee-Smith, an Architect-Planner and Researcher from Mazingira Institute giving a presentation on "Planning for Urban Farming". (Source: Sebastiaan Soeters)

N10 Dr Lawrence Esho from Technical University of Kenya giving a presentation on, "Agriculture as an Urban Form". (Source: Sebastiaan Soeters)

N11 Nairobi FOODMETRES Stakeholders Workshop at Chiromo Conference Centre, University Of Nairobi. (Source: Sebastiaan Soeters)

N12 Mr. Francis Wachira, a successful Urban Farmer in Nairobi being interviewed about his farming practices. He grows over 50 different types of food crops. (Source: Bancy Kinuthia)

N13 A large scale vegetable farm in a school and church farm (Source: Bancy Kinuthia)

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Synthesis Report

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FOOD METRES

Food Planning and Innovation for Sustainable Metropolitan Regions

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