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Table of Contents

Editorial

Research Articles

News

ISSN-Internet 2197-411x OLCL 862804632

Reports and Analyses

Reviews

Photo credits

Front cover photos

- Background picture, by Rob Roggema

Back cover photos

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Editorial

Planning for Sustainable Food Production: A New Challenge for City Developers

Dr. Rob Roggema is the Professor of Design for Urban Agriculture & Slow Urbanism, VHL University of Applied Sciences, the Netherlands. He is the Chair of the 6th AESOP conference on Sustainable Food Planning, 5-6 November 2014 in Leeuwarden, the Netherlands.

The production of food has long been a topic we called agriculture. It was an activity that took place somewhere in the countryside or even outside of the country, and the harvest we found back in the supermarket, in neatly organised packages and shelves. Up to 2010 this was the dominant way, maybe even the only way food came to us. With these kind of production systems, landscape architects did not have much to do, as the land was organised according to the most effective production system and planning was fully based on farm efficiency.

The 2014 AESOP conference on Sustainable Food Planning marked a transition. So far, the discussion about sustainability had been an issue of implementation in existing large-scale farming. Now, the Urban Agriculture movement starts getting traction. Sustainability and the growth of food in urban environments came slowly, but certainly, together. The tentative highpoint of this merger was reached during this conference. People with abundant expertise in food systems, sustainability, resource management and entrepreneurship used their knowledge to plan and design a substantial amount of food production in urban precincts. Why is this urgent?

The urgency is directed from one side by the 'twins' food security and food safety. These global issues and concerns are well documented, though not solved by any means yet, but they drive communities and individuals to think about the origin and availability of their food. Besides this, a recent report by WHO came up with new prognosis about obese people in Europe. As an example, between 51% (the Netherlands) and 89% (Belgium) of the women in Europe are expected to be overweight by 2050. For men the score is even higher. The interesting work of Prof Jaap Seidell from the Free University in Amsterdam finds that the direct environment people live in (education standards, job participation, direct contact with healthy food) determines to a large extent the diets of the inhabitants, hence the sensitiv-

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ity of people to become overly obese. In addition, the spatial conditions of the urban environment could provide the circumstances for increased well-being of the residents, a new learning environment and could create the places where food is grown. This could help to develop an environment influencing the diets of the residents in a healthy way.

A second driver of the urgency to produce in urban environments comes from these areas themselves. Local residents increasingly put pressure on their local urban environment to become more productive. At this level people can literally see what and how the crops are produced, how the availability of food can be guaranteed, and how the quality of the food production can be easily controlled. Local production minimises distances in transportation and people feel pride about their 'own' local products. Here, people start to work together in neighbourhoods and precincts and new social constructs are built. But the pressure on the local food system also implies that demand for these local products is on the rise, and when more produce is required, more space is needed to grow it. The attention on vertical agriculture is a symbol of this increasing search for spaces to grow food. I personally hold the opinion that vertical agriculture is mainly a provisional new hobby of architects, but as long as these projects deliver local products in a sustainable way, it needs to be valued as a welcome contribution to the local food supply.

So if the environment people live in determines their diets and if people are keen to start producing their food locally, it is time to bring these developments together in an integrated vision for the city. The main problem to achieve these newly developed visions is the current thinking in urban planning and design, which determines its building in high densities. Many European cities have embraced the compact city model for various good reasons, such as less car travel, energy saving and carrying capacity for public transport. However, this has also led to relatively dense urban conglomerates with limited space for green and environmental uses. At the moment there is hardly any space used for food production within the urban boundaries. For the Netherlands I have roughly calculated the amount of food produced in cities as percentage of the entire consumption. Approximately 0.002% of the total consumption is produced inside cities. This number, even if in reality it is ten times more, is so close to nothing that we might speak of foodless cities at the moment, despite what many enthusiasts want us to believe. The minimal contribution of urban food production to our entire diet leads to one important observation: the city must reinvent itself if it would like to raise its productivity. This reinvention needs to include more than only creating spaces for growing food, it would also need to transform the other circumstances determining healthy feeding, as discussed by Seidell. Creating spaces for food needs to go hand in hand with increasing green public spaces, create learning spaces, improve job participation, education and social connectedness.

Photo credit: Rob Roggema

In a wider context we see movements of shared responsibility for goods, resources and products, citizen initiatives to jointly become productive, take care and reuse waste products as well as processes of co-creation of a sustainable urban future. In the upcoming era traditional roles of (big)

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companies, governments and citizens will change and create a place for more integrated and shared responsibility for public goods, resources, nature, products, means and facilities. These new co-operatives gain traction and could be a valuable way of maintaining urban precincts. The production of food is an easy to imagine and important part of these initiatives if not to say an inseparable part.

The urge for more space is a historic question that goes back to the Romans, which were the first to urbanise society. After a long period of high densities, due to the need to build defendable cities, the Twentieth Century showed a long period in which densities decreased, especially in North America and Oceania, where the car dominated urban design. In recent decades densities went up again, with the Chinese, African and South American mega-cities as result. The enormously fast population growth couldn't otherwise be accommodated except within extensive and dense urban megalopolises. The Twenty-First Century will teach us modesty in growth, even shrinkage in substantial parts of Europe and North America. This development, paired with the sense of sustainability that large groups in society, especially younger generations, feel as their responsibility, opens up an avenue of lower densities, in which mental and physical spaces become available to think about redesigning the urban environment.

If we take our current cities as a starting point of thinking, the dense urban form allows several ways to search for undiscovered or 're-plannable' space. Besides the already mentioned vertical ways of growing food, the first option to increase spaces available is through decreasing densities, for instance by widening streets and transforming them into green boulevards, or to transform urban buildings into green productive spaces. However, before we even think about decreasing densities and replacing urban land-uses, there is quite alot area in urban environments suitable for food production in green spaces that can be qualified as replaceable (Mulder & Oude Aarninkhof 2014). The findings of Mulder and Oude Aarninkhof state that in Amsterdam 12.3% of its total area resorts under this category. This space is capable of feeding 25% of the Amsterdam population. Quite a number! The final option for finding spaces in dense urban areas for food production is on top of buildings or in the underground. The thinking about rooftop gardens could be extended into creating multiple storeys of productive floors and high-tech forms of food production could also be thought of in several floors in the underground of cities. Taking the 25% in current spaces as a starting point and the remainder of Amsterdam's food demand comes from newly created spaces resulting from lower density and re-use of space below or above built-up areas, the city could supply its own food.

For this quantitative exercise to be realistic, the design task is evident. New urban concepts are required in transforming and connecting all these spaces. This design task was the key topic discussed at the AESOP conference Sustainable Food Planning. The conference can be seen as the first example of thinking about and designing these new concepts. The major outcomes of the design sessions held during the conference can be summarised with one word: connectedness. Individual

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projects will not survive in the long term, but if they interact at the urban level with other solo-projects they can benefit from the advantages at that level. For instance, they can exchange resources and products for the market, share the distribution to minimise chain lengths, or link with buyer/entrepreneurs in an efficient collaborative way. The examples developed during the conference (see the article by Roggema in this issue) show the integration of these issues as well as the connections outside the study areas. Resulting from these discussions thinking emerges about the development of the Meervaart/Tuinen van West, for which new research will be conducted, which explores the connectivity between producers and buyers of food produce at the precinct or urban borough level. Several thought-provoking papers supporting this integrative, connectivity and spatial way of transforming the urban environment into a productive city which could feed larger metropolises or urban agglomerations have been presented at the conference and selected for publication in this special issue. The conference itself was a feast for the many delegates. From the start of the conference every component aimed to be interactive, design-oriented to provoke debate and new insights amongst the delegates. In Roggema's article we dig deeper in the way the conference succeeded in achieving this goal.

Let the 2014 AESOP conference be the start for future thinking about reinventing the city, in a similar way as the CIAM movement changed our way of thinking about urbanity since the beginning of the Twentieth Century. Could we build on the cautious first steps put forward in Leeuwarden to further shape our cities of tomorrow to become sustainable, inclusive and (food) producing? I call for a platform of thinking about city design for (food) production and close the cycles of the circular economy. This might be the following AESOP conferences, but if not, let a small group of likeminded city designers and developers, urban planners, future thinkers and other creatives come together to kick-start the Twenty-First Century. We are on the brink of fundamental new urban life, join this thinking and contact us.

The papers in this special issue of Future of Food Journal have been selected by the scientific committee of the 6th AESOP Conference on Sustainable Food Planning, held 5-6 November 2014 in Leeuwarden in the Netherlands. Anna Maria Orru's paper, winner of the best paper award, investigates whether the engagement of citizens as design agents can bridge the gap between urban design and citizens through transfer of spatial agency and new modes of critical cartography (via digital and bodily interfaces). The data gathered from these approaches gave way to a mode of artistic research for exploring urban agriculture. The paper by Giusseppe Cinà and Francesco di Iacovo discusses some relevant aspects of urban and peri-urban agriculture in Italy, such as the lack of suitable solutions coming from regional and local planning, and the rich set of initiatives generated by local stakeholders, illustrating a variegated cross-section of Italian policies and practices. Andy Jenkins' paper analyses cities as light capturing devices capable of growing vast amounts of crops directly upon their massive surface area. In the article empirical data is collected from a constructed urban farm in Manchester, England and combines it with a shadow study of the same city to determine its productive capacity. The research calculates the bio-productive capability of cities as they stand today, without the need for newly built structures or indoor, artificially lit, agriculture.

The article by Michael Roth et al. uses the case of an economically declined neighborhood in the post-industrial German Ruhr Area. The paper analyses, describes and concludes how urban agriculture can be used as a catalyst to stimulate and support urban renewal and regeneration, especially from a socio-cultural perspective. The methodology used in this research initiated community projects with an intended transgression of the boundaries between research, planning, design, and implementation.

Benoit Grard et al. focus in their article on the design of sustainable rooftop gardening based only on urban organic waste. The paper examines the use of different types of organic waste, shows the feasibility and the great potential of rooftop gardening.

I hope you enjoy reading Vol. 3 Nr. 1 of Future of Food Journal titled, 'Finding Spaces for productive Cities'.

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Integrating top down policies and bottom up practices in Urban and Periurban Agriculture: an Italian dilemma

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Abstract

The paper deals with some relevant and contradictory aspects of urban and peri-urban agriculture in Italy: the traditional exclusion of agricultural areas from the goals of territorial planning; the separation between top-down policies and bottom-up practices; the lack of agricultural policies at local scale. In the first part the paper summarises the weak relation between urban planning and agriculture, showing how in Italy this gap has been only partially overcome by new laws and plans. Moreover the paper focuses on how, due to the lack of suitable solutions coming from regional and local planning, a large number of vibrant initiatives were started by local stakeholders. In order to show the limitations and the potentialities of these various approaches, three peculiar experiences based on Milan, Turin and Pisa are presented. They give a cross-section of the variegated Italian situation, demonstrating that a major challenge in Italian context affects the fields of governance and inclusiveness.

Introduction

Today it is becoming more and more evident that the future challenges for sustainable development will involve cities as most of the world's population is and will be living in urban areas. The capability of understanding and providing suitable solutions for an uncertain future is essential for reducing the impact of cities on the planet's natural resources. In this regard, research on smart cities is focused on city renaissance mainly by means of ITC technologies, innovative transportation and clean energy, which although providing important solutions are still widely criticised (Hollands, 2008). Therefore, in respect to a less ITC-based smart city, growing attention is being paid to the relationship between cities, food provision and agriculture due to its possible impact on social stability (Wiskerke, 2009; Morgan and Sonnino, 2008) and its possible follow up on urban planning.

Before modernisation in Europe, cities used to consider food management as a strategic policy for ensuring rights and stability for their inhabitants (Steel, 2008). After the Common Agricultural Policy (CAP) intervention and market liberalisation, cities started to ensure mass consumption and food provision through long chains of large intermediates, retailers and caterers (Pothukuchi and Kaufman, 1999). As a result the interest for local production decreased and the management of agricultural land close to the city lost its relevance (Gereffi et al., 2005),

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In the last decades, the new trends of the growing population, energy distribution and reduction of natural resources, are generating new tensions on food prices/provisions and are increasing urban food instability, starting from the lower classes (Brunori and Guarino, 2012).

In this new critical framework, Urban and Peri-Urban agriculture (UPA), in its diverse forms (ordinary food production, alternative food networks, community supported agriculture, short food chains, civic agriculture and community gardens), is receiving more and more attention. A number of diverse projects are providing innovative solutions in many cities so that UPA is now a cross-cutting topic, with contradictory definitions due to its multiple aspects and increasing interest.

The UPA concept incorporates issues related to urban rehabilitation, sustainable development, health, access to safe food, water and waste management, social stability, better integration among generations and cultures, city resilience and also new forms of economic engagement. UPA gathers together people with diverse aims, capabilities, aspirations and initiatives for creating a new urban daily life. It also allows for the organisation of social coalitions that are able to redefine food policies - today led by large hegemonic retailers - and provides a more democratic environment for sharing choices concerning food (Brunori and Di Iacovo, 2014a).

The way actors interact with UPA is normally the result of a negotiation process among the various public and private stakeholders such as municipalities, city planners, civil society, consumers, third sector associations, new enterprises linked to UPA (farmers and their associations, processors, caterers, trainers, traders) and also schools and families. Due to such a large number of variable factors, UPA does not always receive coherent attention from public bodies as well as from various related sectoral policies (planning, agriculture, education, commerce). How can we deal with such a multi-layered target?

Starting from this question the aim of this paper is to deal with UPA issues in Italy, by highlighting some relevant aspects connected to its contradictory process from a planning perspective. Namely, (i) the traditional exclusion of UPA valorisation, usually performed in terms of urban growth, from the goals of territorial planning, (ii) the too sharp-cut distinction between top-down policies and bottom-up practices in urban and rural areas, and (iii) the lack of governance of the agricultural sector at municipal and provincial scale, quite completely left to Common Agricultural Policy (CAP). As such, by considering the dynamics in the Italian context, the aim of this study is to find coherent pathways for the food-UPA discourse in urban planning. To this end three case studies, in Milan, Turin and Pisa will be discussed, mainly focusing on the particular way in which the relation among top-down policies and bottom-up practices are performed. By their comparison it will be possible to understand how today food is becoming both a major target of planning and a tool for a better integration of different sectoral policies (social, health, environmental, economic, cultural).

Planning in Italy: an adverse separation between agricultural and territorial policies

The Italian planning system is affected by a traditional separation between urban and agricultural policies that impacts at various levels of government, from the Region to the Municipality. Until today in the municipal planning documents UPA land has remained a white area on the map, out of planning jurisdiction. This contradictory relationship can be understood by shortly recalling its evolution. In Italy the main tool of the planning system consists in the municipal plan (MP) or "Piano regolatore generale". The Law 1150/1942 assigned to this plan, inter alia, the function of defining building rights (firstly to residential areas), thus shifting the emphasis from those that may be used for different functions. The aim was to refer the planning regulation to the farming "zones" (Art. 7), which was then confirmed by the Law 765/67 and DM.1444/68 on urban standards. In the latter the agricultural areas were simply classified in terms of maximum "building density". This approach created a gap between agricultural policies - focused on farming "activities" according to CAP intervention - and urban planning, focused on farming "zones" with three possible results: to become urban, to remain farming zones, and to become potentially buildable land in accordance with some conditions (Urbani, 2006). At the end of the 1970s, the Regions became re-

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sponsible for territorial planning (Presidential Decrees 11/77 and 616/77) and introduced innovative changes in planning regulations. At that time agricultural policies and CAP intervention started to be increasingly managed at regional level thus devoting more direct consideration to farming activities.

In the 1980s and 1990s, these developments encouraged the evolution of policies that overcame the limited field of municipal planning through the involvement of regional and provincial levels. In those years, the Regions issued many organic laws concerning urban and territorial planning (Cinà, 2000), and delivered special regulations for agricultural activities within the planning system at different scales. At provincial level, with the Territorial Coordination Plans, the agricultural areas were identified according to their different conditions and vocations. Consequently, a discipline to be transposed into municipal plan was implemented. Many municipalities defined more complex analysis and proposals for agricultural sector also at the local level. Among these, we can cite the MP of Giussano for the protection of cultural aspects (Paolillo, 2009), the MP of Luzzi for the proposed "minimum units of production" (Caligiuri et al., 2008) and the MP of Verona for his updated methodology of analysis (Montresor, 2012). However, it still remains difficult to implement these approaches due to the weak relationship between the aims of public interest established by the plan and the farmers' goals.

More recently the new regional planning laws (e.g. in Tuscany, Lombardy, Liguria), having acknowledged the important role of the agricultural areas in environmental and landscape protection, have started to regulate the building rights concession only in strict connection with farming activities. For example, in Tuscany the L.R. 1/2005 no longer establishes the old buildings ratios and the rationale for any volume addition is founded on the definition of a "minimum farm area" supported by a "business plan for agricultural and environmental improvement" (art.41).

This excursus on the half-hearted attempts to plan agricultural areas within the territorial planning instruments, and without an integrated vision of agricultural economy, would not be complete if one does not consider the contradictory support of landscape protection policies for planning agricultural areas. In this context, the new conceptualisation of landscape planning related to the European Landscape Convention and the Italian Landscape Act (D.L. 42/2004) have provided new potential for enhancing landscapes and agricultural areas. The Landscape Convention introduced a significant opening to landscape as a product of human intervention (art. 1) connected with agricultural policies (art. 5d). The Landscape Act broadened the range of landscape planning actions which were once limited to some categories of environmental relevance (L. 431/1985). In short, the latter established that each regional landscape plan can also consider agricultural landscapes as elements to be protected, both as a natural-environmental value and as an artificial man-made landscape (art. 131). Therefore, rural areas become part of a purely conservative strategy for enhancing landscape, nature and cultural heritage, that still remain un-related to the complexity of the economic system within which they are included (Urbani, 2006).

The new landscape plans are defined according to a structured set of principles and devices normally accompanied by wide cognitive frameworks, fervent directives, strict requirements, confident predictions and a large set of local institutions and associations that are supposedly ready to intervene. Yet these over-equipped plans are scarcely linked to the regional 'Rural Development program' originating from CAP which also includes landscape policies, and are not supported by operational conditions able to achieve their objectives. Therefore they remain weak, simply based on the reduced operational field of top-down governance. They claim to be cross-sectoral but remain based on only protection rules.

Meaningful examples of this new generation of landscape regional plans are those approved in Piedmont (Regional executive committee of Piedmont, 2009), Liguria (Regional council of Liguria, 2011) and Apulia (Regional executive committee of Apulia, 2015) where the potential of landscape policies in preserving the agricultural Italian landscape appears to be overestimated (Cinà, 2009, 2012). As a matter of fact, it appears to have been a big misunderstanding to imagine that the conservative system of landscape protection could affect the dynamics of agricultural landscape transformation, mostly depending on purely economic interests.

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In short, ever since the start municipal planning has been limited to the classificatory function (zoning) of new developments. Meanwhile, regional legislation and its related plans have attempted to regulate agricultural areas, combining urban issues to those of agricultural land and its relationship with the environment. Finally, two levels of regulations have been established: one related to the aspects of production activities and the other to protection. Unfortunately, their effectiveness is still limited as they are not adequately specified on the basis of the real agricultural market and on the changing dynamics of the stakeholders involved. UPA planning has been directly affected by these ineffective approaches.

Urban and peri-urban agriculture: asymmetric approaches in three urban contexts

As reported in the previous chapter, there is still a large gap between planning and agricultural policies in Italy. In a framework of this kind, a project for rooting UPA in urban transition still requires an appropriate response in terms of knowledge, brokerage among stakeholders, rules and governance. Due to the lack of suitable solutions coming from spatial planning, various stakeholders implemented a large number of initiatives in autonomous but not always convergent ways. According to the transition management theory (Loorbach and Rotmans, 2006; Geels, 2004), in this situation, UPA enhancement should be based at least on the following factors: a strong interaction among public and private stakeholders open to participatory approaches, a political environment that is capable of managing multiple connections between groups of interests, a greater technical competence in public and private stakeholders, easier access to physical (land) and immaterial (cultural) resources, and the stakeholders' ability to focus on a wider social perspective rather than on their own individual interest.

Starting from this evidence we will discuss the three above mentioned peculiar experiences of Milan, Turin and Pisa. From a methodological point of view, the Milan case study is mainly analysed toward a literature review; on the other hand, information related to the Turin and Pisa cases are the outcome of a long-term action research activity started in the 2010 in both territories. The case of Milan is characterized by a top down approach, which was modified over time by the manifest weakness of public governance and the relevant role of local stakeholders and the third sector (NGOs and other non-profit organizations). By contrast, the case of Pisa is characterized by an extra institutional evolution and the gradual involvement of public stakeholders. Finally, the Turin case is characterized by the presence of a deep-rooted food culture linked to the Slow Food experience (Schneider, 2008) that is at present developing on the basis of a mixture of bottom-up and top-down initiatives. As eloquent cross-sections of the variegated Italian situation, these cases are now facing changes aiming at integrating food policies and UPA in an overall strategy of urban transition.

The case of the south agricultural park in Milan: a disconnected network of weak top-down policies and vibrant bottom-up practices

The innovation of UPA projects, at the level of formal planning and bottom-up initiatives has found a particular area of interest also in the planning and design of agricultural parks (AP). AP addresses the issues of UPA areas both by regulating their uses through a multifunctional strategy and by protecting the environmental and landscape assets.

In a first phase, the potential of an agricultural green belt at municipal scale was experienced in a few cases. One example is the AP of Ferrara (1970s) that designed the recovery of the agricultural areas along the city walls and their connection to the Po river (Amati, 2012).

Later, the South Milan Agricultural Park (SMAP) made a quantum leap compared to previous experiences. Established in 1990 as a regional park, and planned as a green belt extending to the neighbouring municipalities, it introduced a metropolitan strategy. The SMAP (47,000 hectares, 61 municipalities) spreads east south west in the Province of Milan and covers most of its UPA areas. It has two main key uses: the "urban belt park" devoted to the enjoyment of leisure time within important natural assets and the AP (also including urban functions). Unlike other regional parks in Lombardia, it has so far been managed by the Province of Milan and now under the government of the new – and still uncertainly defined - Metropolitan City. Looking at 25 years of the SMAP management,

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the overall appraisal is disappointing at most levels (Aquilani, 2014). Both the operational plans, (identified by the Territorial Coordination Plan, 2000), namely the Plans of Urban Belt (PUBs) and the Fruition Plan, have not been processed; the Management Plans (2003) and the Agricultural Sector Plan (2007) have not been updated (Vescovi, 2012); finally, also the opportunity to relaunch the SMAP into EXPO 2015 has been lost.

The PUBs are textbook examples of both the grandiloquent objectives of planning and the inconsistent ability to effect a top-down governance, mainly based on the expropriation mechanism and the equalization of development rights (the so-called "perequazione"). Actually the PUBs were planned by the provincial government (centre-left parties) and their implementation was based on the expropriation/compensation of private areas to be used for the park project (Targetti et al. 2010). Private land-owners expected to concede their properties would be compensated with building rights in some selected buildable areas. Therefore, the newly acquired public areas would be leased out to farmers or other parties, provided that the respect of the landscape, the reclaiming of the natural elements, a short food chain and the possibility for all citizens to benefit from the large metropolitan green areas would be guaranteed. The main objective of the SMAP was to create five large metropolitan parks characterized by the coexistence of agriculture, nature and public facilities.

Unfortunately, due to the conflict between the social partners, these plans failed to achieve the final approval and, following a political change in the government of the City and the Province of Milan (from left to right parties), they were submitted to strong real estate pressures and were declassified (Vescovi, 2012). Moreover, the Park Authority did nothing to prevent large urbanization projects (areas of Cerba/Rosate/Vignate 770,000 sqm), or the collapse of the agricultural system caused by the construction of the eastern ring road (Teem). Consequently in 1999-2009 the municipalities of SMAP increased the urbanized areas by 4% at the expense of agricultural areas.

Nevertheless, it is worth noting that the SMAP has imposed fruitful limitations on the use of the land thus ensuring an institutional coverage for the containment of urbanization. Moreover, it has also facilitated the development of positive trends which all originate from the bottom. Therefore, institutional action has been combined with, and sometimes replaced by, various practices carried out by committees and associations, who have raised the banner of the park in order to defend their territories. In several cases a partial bottom-up planning initiative took place, which was implemented by various stakeholders and public bodies. This approach gave rise to some relevant components of the SMAP, such as the Ticinello Park, "Wood in the city" Park, Quarries Park, Vettabbia Park, thus highlighting the possibility of network farming and urban functions in a more transversal framework.

More recently a complex set of stakeholders have spontaneously begun to share common principles and tools in order to improve the agricultural activities and protect the environment and landscape. In fact, a process of self-empowering occurred in which farmers switched from a holding position to a planning approach and a gradual restructuring of the agricultural sector. The original planning approach of the Territorial Coordination Plan, remained too limited to the zoning regulation, was then overtaken by events (Branduini and Scazzosi, 2011). As a result new consortia and rural districts based on sustainable and multifunctional agriculture were born, such as the Milan-Agricultural District, the Rice and Frogs, Three Waters, the Olona Valley, as well as the establishment of the Rural District for ethic economy.

All these initiatives advanced in combining environmental protection with economic aspects, and public commitment with private interests, but the farming sustainability is far from being settled (Migliorini and Scaltriti, 2012). Therefore, it is evident that the park's salvation mainly depends on the reinforcement of the farming economic role as the main factor, among the others related to multifunctional agriculture that is able to contrast the real estate development.

The Pisa experience: a growing interconnection on food initiatives in a fertile and competitive environment

In the area surrounding Pisa there has been much debate concerning food, food planning and UPA in the last few years due to an increasing active

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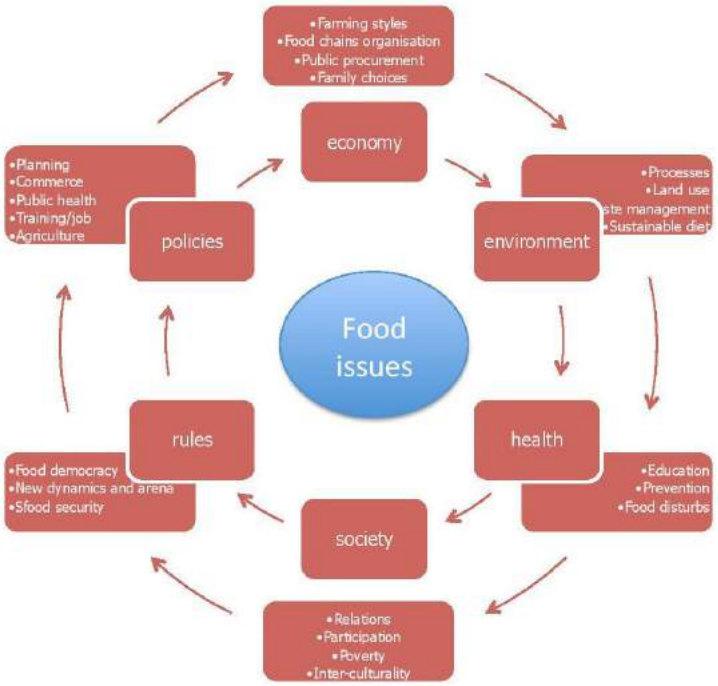

Figure 1: Pisa, Food issues (source: authors)

interest of local communities, institutions and farmers. The university has played an active role in this process by organising public meetings and implementing research projects on alternative food networks, civic agriculture, organic agriculture, ecosystem services and food planning in agreement with institutions, association and local food movements. In the area private and public institutions implemented a number of initiatives with the aim of defining a kind of food deal regarding new urban policies (Brunori et all 2014b).

Since 2005 short food chains have grown spontaneously in Pisa thanks to farmers' markets and since 2010 a community of private stakeholders supporting UPA has been established. In this area there are numerous ethical purchasing groups and a district for ethical economy. Resourceful farmers are reshaping their agricultural activities bearing in mind environmental and social sustainability (e.g. *www.ilmulinodipietra.it*, *www.ortietici.it*).

As for public stakeholders, many municipalities in the Province of Pisa have set up community gardens (in Pisa specific Guidelines have been approved) and this Province implements the largest number of social farming initiatives in Tuscany. Since 2007 the Valdera Health Society has formally included social farming into its public health plans. Public procurement in school meals was also started by local municipalities in order to promote a diet based on local and organic products (Galli et al., 2014). The Valdera Health Society has introduced educational activities on food as well as supporting people who are less able to access food.

In the Valdera area some participatory initiatives for planning and programming were launched (Valdera 2020), which competed successfully with the policies implemented in Pisa. In 2011, following a research-action on "carrying capacity" and a methodological proposal to include ecosystem services in local planning, both coordinated by Pisa University, the "Valdera Union" (a voluntary association of 15 municipalities established to organise public services in the territory of the Arno and Era river basins) launched a participatory planning project (*www.valdera2020.it*). The aim of this initiative, which lasted one year and involved approximately one thousand stakeholders and citizens, was finalized to design future strategies for the area based on four main thematic areas (territorial planning, institutions, economic development and environment, welfare). 17 strategies and 100 actions were defined following a European Awareness Scenario Workshop. By means of a poll organised on a web platform local residents were classified on the basis of the territorial distribution of population, by age and sex. Actions regarding food, agriculture, environment and planning were introduced in

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Figure 2: Pisa, Urban food strategy (source: authors)

the group discussions and ranked according to an open poll. The best ranked strategies and actions were taken into consideration in the "Valdera strategic plan" approved by the Valdera Union.

In 2011, thanks to this fertile environment and the formal agreement with the Province of Pisa, Pisa University launched a "Food planning" project with the aim of coordinating and integrating all the aspects and activities related to food issues (Brunorand Di Iacovo 2014a). Various meetings supported by a web 2.0 platform involved municipalities and other public institutions, scholars and professionals, citizens and associations, so that they could exchange ideas and co-produce new knowledge on these issues. As a result a map of the stakeholders and goals involved in the Food plan (Figure 1) was defined. This exercise increased the collective understanding of the existing links among policies, local economy, environment, health, society and the possibility to design innovative rules affecting food choices. There then emerged an increasing awareness of the role played both by civil society and local public institutions in innovating the approach to food management. The organisation of food governance was considered the way to facilitate the involvement of all actors in the frame of a sustainable food management (Figure 2). To this end the urban food strategy was based on few elements like (i) a food chart, (ii) a food strategy, (iii) a food plan, (iv) the organisation of a food alliance among private actors and (v) a formal agreement between public actors.

The main principles introduced by the Food chart focus on sustainability, social justice and the organisation of a fair relationship between urban and rural areas also regarding planning activities. The Food chart was transformed into proposed practices and a Food strategy which describes the goals (health knowledge, equity, sustainability, innovation, and organisation), the actions and stakeholders to be involved. The Food strategy establishes that the municipal plans must safeguard the land dedicated to agro-environmental activities as green infrastructures for daily life. In 2012 the Food chart and the Food strategy were both approved by the Pisa Province and by 19 municipalities including those belonging to the Valdera Union. In 2013, in accordance with the Food strategy two main tools were developed:

- a Program-agreement among public stakeholders in which each subscribing actor commit itself, according to its field of activity, in the direction designed by the Food strategy with specific goals and indicators.
- a Food-alliance grouping private stakeholders (associations and citizens of Pisa) engaged in co-planning new initiatives in agreement with public actors and monitoring the Program-agreement activities.

ISSN-Internet 2197-411x OLCL 862804632

At present this initiative has been stopped due to the administrative reorganisation of the Italian Provinces. Pisa University is leaving the project leadership to the local stakeholders, and the Valdera Union is willing to take on the project by promoting a dialogue with the main stakeholders in the area of Pisa and the Food-alliance to re-launch the Food strategy.

Finally in the Pisa Case a large amount of actors is contributing to the definition of a new approach to food planning issues. Normally actions start separately but gradually converge in more organised forms. The related process of social empowerment is facing a strong complexity and it risks failure in front of institutional changes and the difficulty of achieving immediate results. Consequently the conflict between the different ways of thinking urban planning and food planning is still being negotiated according to the forces and the views of different actors on the field.

The Turin experience: attempts of mutual learning among public and private stakeholders

Following the progressive dismantling of the car sector (FIAT) and the subsequent innovative development policies, Turin is reshaping its social and economic identity as a city for tertiary services and tourism. In this scenario, the food sector is a field of innovation towards a new identity. In this sense the Slow food movement, that holds its bi-annual exhibition "Salone del Gusto" in the most famous FIAT plant in Turin, is a paradigmatic example. The "Salone del gusto" has given Turin an international reputation as being a centre of quality food, which experiments with innovative food production and distribution patterns. In addition, it deserves to be known for the Porta Palazzo market, one of the largest traditional food markets in Europe and an important tourist attraction, where one can find a large variety of local products. Turin also houses the headquarters of Eataly the first and largest Italian retail outlet for typical food. In this particular environment, various initiatives on food and UPA have been implemented by public and private stakeholders although not always coherently.

The local public bodies started to explore food issues and their connection to city planning. Since 2000, the Turin Province and local municipalities have been supporting local collective purchasing groups, together with several other projects related to multifunctional agriculture in UPA areas. The authors were involved in some of these processes by organising specific action research activities or being involved as research observers.

In 2011 the municipality of Turin launched the "TOCC" (Turin-city-to-growth) project in the framework of "Torino-smart-city". Its goal was to upgrade and develop UPA in order to increase urban sustainability. To this end a quite large amount of peri-urban and under-used land was surveyed. Moreover, maps and ideas for illustrating the project were prepared by technical staff and presented to citizens in order to explore the possible use of public land around and within Turin's boundaries. A second initiative was also established by trying to implement the Villaretto Agricultural Park in the Municipal plan. However, although they received strong communicational support, the outcome of these initiatives is still quite limited for two reasons: Lack of support from the planning department of the Turin Municipality, which is politically more oriented to the implementation of built-up areas, and lack of interaction with private stakeholders.

Besides their direct effect, the value of these initiatives lies in the possibility of attracting more attention to the UPA theme and legitimating new active stakeholders in the field (Dansero and Puttilli 2013). In fact, at operational level a large number of small but effective initiatives were carried out on various scales by private stakeholders – farmers and farmers' associations - and by third sector companies. These initiatives have some features in common such as: giving new value to abandoned land (private or public); being economically sustainable although providing public goods (social and relational); involving adolescents and often women in innovative hybrid forms of enterprises; being strongly connected to local communities and groups of citizen. In this perspective, two initiatives deserve to be cited among others: the "Venaria Orti" project, which divided a property into small, organised gardens and rented them to local citizens who wanted to dedicate themselves to small agricultural activities; and the case of "Cavoli Nostri", a farming cooperative established on the land of some properties owned by Cottolengo (a distinguished religious institution),where or-

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ganic vegetables are cultivated and people with disabilities take part in the agricultural work thus producing positive economic and social results.

Other projects are also being developed in the small municipalities around Turin that are trying to generate new opportunities of socialisation, integration and training for the young or less empowered people. Some of them are supported by local municipalities that do normally offer land and initial support for projects, as in the case of the "MiraOrti project" in Turin, a community garden that also organizes educational activities for primary schools (Baldo, 2012) and "Orto che cura" in Collegno which involves disabled people. Actually, there was much public interest in all of these projects although they are still organized on a small scale.

However, the vitality of the food discourse in Torino also motivated relevant stakeholders in the agricultural sector to modify their strategies from corporate attitudes to wider goals. This is the case of Coldiretti, the most important farmers' union in Italy, which has given birth to "Campagna Amica", a farmers' association that combines educational and economic activities. In the last few years in Turin, Coldiretti established many "Campagna Amica" markets in order to meet the demand for local/quality food and create new opportunities of income for small farmers. The initial aim of the association was to represent the economic interest of its associated farmers by creating new networks and visibility in the urban context. Slowly but surely, a different idea of the city and the local system emerged. In this context UPA areas may support the city's resilience by achieving better quality food and providing innovative services.

To this end Coldiretti implemented a series of initiatives on social farming and a network of approximately 35 farmers, 15 social cooperatives, local health consortia and municipalities in order to provide services for citizens and less empowered people (disabled, addicts, prisoners, refugees, the elderly) (Di Iacovo et al., 2014). All these initiatives, promoted by economic associations and by civil society, gradually managed to involve the local authorities in a more comprehensive project thus creating jobs for about 40 less empowered people (over the last three years), new services for hundreds of citizens, better economic positions for the farms and social cooperatives involved, and a more effective public intervention on health policies.

The increase in initiatives and debates has helped to create a turning point in the food and UPA discourse, generating new interest in public institutions as well as in the food-farming economy. More recently, in the third strategic plan called 'Turin metropolis 2025, the city has launched the "Turin food capital" program. The food issue is expected to become one of the preeminent development issue axes of this on-going program. Moreover, some other initiatives, such as the Food start Lab "Towards a food local agenda in Turin" and the project "Turin smile", are working toward an overall food policy (Dansero and Toldo, 2014). The latter allows for a progressive mutual understanding of the public-private stakeholders involved in broader top-down policies and vibrant bottom-up initiatives, considering food planning and land use as the tools of a more sensitive strategy of urban qualification and resilience. This seems to be a promising path for connecting the UPA issues to urban transition, but this path is still far from overcoming traditional interests and the limits of a too self-reported city planning.

Conclusions

There is still a gap in the Italian context between the increasing interest in UPA and food issues, fostered by new stakeholders and the deficient planning tool-box, which provides strategies, regulations and technical tools. This divergence cannot be solved just by laws and plans at institutional level. Therefore it is essential to review the planning approach by reframing a brokerage among policies and practices, public and private stakeholders, competences and interests from an integrated perspective. This review should affect not only the vertical integration in spatial planning practices (top-down vs. bottom-up) but also the horizontal integration between the sectoral planning practices related to agriculture.

In support of this argument, the three above mentioned experiences prove that a reframing approach is already in progress, but in scarcely synergic forms, which encompass the remarkable auto organizational resources of local stakeholders and also the strong limitations of

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planning and governance at institutional level. These cases offer more than a hint for reflection. In the South Milan Agricultural Park, faced with a never consolidated public governance, there have been innovative experiences that were developed even though the stakeholders sometimes ignore or distrust one another. Therefore, by observing the problem from the viewpoint of the local farmers and the third sector, we can ascertain that although there has been some evolution in terms of consolidation of productive activities and new initiatives, it is still difficult for the farmers to overcome the new challenges of the market without a strong organizational support from the Park Authority, providing a strong and inclusive governance.

In the case of Pisa on one hand the relevant role of civic engagement of the University emerges through a research-action approach; on the other, it emerges as a third stakeholder working to overcome the distance - and mediate win-win solutions - between the institutions and stakeholders. As a result, the current pending situation requires a more coherent commitment from the local institutions in terms of rules, policies, knowledge and practices in order to offer stronger pillars to a sustainable food planning.

In the case of Turin the progressive merging of different approaches among public and private stakeholders is now leading to a new phase. In this case the rich constellation of practices and the first steps of a public food policy (firstly by the Turin food plan) provide the planners and the community with the opportunity of building a far more efficient public space to trigger a proper governance for food-UPA issues.

Yet governance is not a quiet long river. According to Voß and Bornemann (2011), it is part of a process of change during which transition cannot be seen as the rational activity of an external driver of social change. On the contrary, it is the outcome of a laborious process of benchmark, negotiation and understanding among diverse positions and stakeholders in situ impacting at local as well as at higher level. As such the assessment of diverse options is demanding in terms of mediation and it implies the presence of an influential public stakeholder that is able to guarantee an effective space for discussion and support a subsidiarity among different actors. That said, the first challenge in the Italian context in the field of governance and inclusiveness is to overcome the limitations concerning the tradition of the top down planning system. However, one should not rely on the idea that inclusiveness is the panacea of all evils. In fact the challenges crossing the question of UPA and food are also focused on many other goals such as:

- to effect an urban and territorial policy able to impact on UPA reconciling the demands of productivity and organic farming;
- to implement urban projects - in UPA areas - able to enrich the city without reducing agriculture to urban scenery useful for cheap urban utopias (as unlikely vertical gardens);
- to strengthen the revolutionary impact of new food cultures, both at local and global level.

To this end, a full inclusion of UPA in urban planning is part of a process that is known to be necessary but is still moving its first steps.

To foster its implementation two kinds of expertise come into play: on one hand, that of the planners committed to updating their disciplinary approach in agricultural area planning; on the other hand, that of the experts and scholars from other fields (agronomists, sociologists, geographers, economists, etc.) who are helping to raise the issues of UPA in all its importance, giving significant contributions in terms of food planning. At this point it is essential that the distinction between these two planning approaches, which echoes that of the historical opposition between town and countryside, is overcome through appropriate forms of disciplinary interaction and social participation. In this frame planning the territory will include the organization and economy of UPA and all the benefits UPA may produce according to various policy goals.

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Conflict of Interests

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Recycling urban waste as possible use for rooftop vegetable garden

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urban farming, urban agriculture, organic waste, green roof, vegetables.

Abstract

Urban authorities in Europe are confronted with increasing demands by urban dwellers for allotment gardens, but vacant urban soil tends to be scarce and/or polluted by past industrial activities. A possible solution for local authorities could therefore be to promote rooftop gardening. However little technical information exists on certain forms of rooftop urban agriculture, called Z-Farming. In 2012, a pilot experiment was run in Paris (France). Simple and cheap systems of rooftop gardening were tested on a rooftop using as crop substrates only local urban organic waste so as to contribute to the urban metabolism. Production levels and heavy metal contents in cropping substrates and edible vegetables were measured. Available results show (i) high levels of crop production with limited inputs compared to land professional gardening, (ii) low levels of heavy metal pollutants in the edible parts of the crops, especially for Cd and Pb with respect to EU norms for vegetables and (iii) positive influence on yields on organizing the substrate in layers and enhancing the biological activity through earthworm inoculation. These encouraging results allow us to consider that rooftop gardening is feasible and seem to have a great potential to improve urban resiliency. It will nevertheless be necessary to identify more precisely the types of roof that can be used and to assess more fully the generic result of the low level of pollution, as well as the global sustainability of these cropping systems.

Introduction

Urban sprawl increase and development across the globe are producing many challenges including atmospheric, soil (Säumel et al., 2012; Alloway, 2004; Wong, Li, & Thornton, 2006) and water pollution due to the concentration of people in urban areas (Girardet, 2008), needing transport for food production and supply. Among these challenges urban authorities and inhabitants are increasingly concerned about the food security of cities, for example like Toronto, Cleveland and Detroit.

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Figure 1 : The rooftop of AgroParisTech in 2012. On the right side the first crop sequence (S1) and on the left side the second crop sequence (S2) (Photo credit: Xavier Remongin)

(MacRae, Gallant, & Patel, 2010)(Grewal & Grewal, 2012)(Aubry, Dabat, & Mawois, 2010)(Aubry, 2013).

Partially in response to this growing concern, the phenomenon of urban agriculture has been spread worldwide, especially in the northern hemisphere, for more than a decade. Urban agriculture can be defined as an agriculture located inside or near the city, producing mainly for the city and using resources shared and/or in competition with urban uses (Smith, Moustier, & Mougeot, 2004; Veenhuizen, 2006). Urban agriculture is characterized by its multi-functionality and diversity of forms (Aubry, 2013)(Smit, Ratta, & Nasr, 1996; Pourias, 2013). Amid these forms, urban allotment gardens have been developed rapidly worldwide in the last few decades. For instance, a city like Paris has seen the number of urban allotment gardens rise from 5 in 2002 to more than 100 in 2014 (Pourias, 2013 op.cit). This strong development coupled with the need for space in megacities led to many unsatisfied demands and waiting lists for urban dwellers applying for an urban allotment garden. The exploitation of unused spaces such as rooftops can be a solution to this scarcity of space for urban allotment gardens. This solution is already used by urban agriculture, mainly for commercial purposes in cities like Montreal, Toronto or New York (Specht et al., 2013)(Thomaier et al., 2014). In Paris, the newly elected mayor Anne Hidalgo promised during the 2014 election campaign to turn 100 ha of Parisian walls and rooftops into green roofs and walls, 30% of this area will be dedicated to gardens or food production (Hidalgo, 2014). A study by the Urban Parisian Planning Study (APUR, 2013) investigated the current area of rooftops that could be turned into productive rooftops inside the city. These eligible rooftops were identified by the way of aerial photography cross-compared with building licenses and specific criteria (minimum area of 200m2, slope below 2% and a supposed concrete structure). The results showed 460ha of flat roofs, among which 80ha were classified as having a "high potential for vegetalization". Further case by case investigations are needed to assess such classification. Anyway, this study provides a first survey of the actual potential of Paris' rooftop gardening. Note that (i) Paris is well known for its old centre that presents a very low rate of eligible rooftops, as shown in the APUR study. (ii) The potential of the suburbs of Paris (which represent the majority of the region's urban surface area) has not yet been investigated, although these areas are likely to have a higher potential, owing to their more recent, flat rooftops. This emergence of new forms of urban agriculture in or on buildings is called "Z-farming" for Zero-Acreage Farming – a term coined by Specht and Thomaier (Specht et al., 2013; Thomaier et al., 2014). Z-farming is raising research questions especially on the technical aspects of setting up rooftop gardening. Concerning the choice of a growing media, many researchers worked for more than a decade in horticulture and soil science on the use of waste as a growing substrate or peat/soil substitute (Ostos, López-Garrido, Murillo, & López, 2008; Abad, Noguera, & Burés, 2001; Hernández-Apaolaza, Gascó, Gascó, & Guerrero, 2005; Rokia, Séré, Schwartz, & Deeb, 2014; Morel, Poncet, & Rivière, 2000). In the

ISSN-Internet 2197-411x OLCL 862804632
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research reported here, we sought to open a new pathway as we consider the urban environment as a source of possible organic and mineral growing substrate using only local urban waste for a productive rooftop. This led us to design an experiment with rooftop gardening in Paris that take into account the specific constraints of this environment. We adopted three main principles for the pilot experiment:

1. To be transposable to people without specific agricultural skills and with limited economic resources. This implied to look for cheap and easy ways to cultivate. These conditions, as well as the minimization of the workload and our environmental friendly approach (see below) excluded the use of high-tech production techniques (such as hydroponic systems or rooftop greenhouses).
2. To be based on the use of local urban organic waste as a part of the urban metabolism (Barles, 2009). This could have many direct advantages such as, avoiding the costs and harmful greenhouse gases generated through waste transportation and treatment and recycling the nutrients at a local scale thus partly turning the city into a closed loop system (Smit & Nasr, 1992). Furthermore, using organic waste as a cultivation substrate is an advantage in these cultivation conditions, as it is a lightweight substrate.
3. Not to use any chemical fertilizer nor any pesticide or insecticide, in order to limit contamination of food products and ecosystem as well as to limit the use of energy costly fertilizer. In any case local regulations in a city like Paris and a future law has or will prohibit the use of chemical products for green spaces. Exogenous substrates like peat or coco fibre are used for some rooftop production in Montreal or New York. However due to their environmental impacts (Cleary, Roulet, & Moore, 2005) we chose not to use them in our experiment. Our environmentally friendly approach also imply that a key aspect of our cropping system would be the substrate's sustainability (i.e. its capacity to ensure a significant amount of production before needing to be replaced).

The overall purpose of this paper is to assess the potential of such cropping systems, based on the first results of a pilot experiment in which we manipulated the nature of the substrate components, their organization in production beds and the presence of soil organisms. We focus here on the production level of our cropping systems and on a key aspect of UA: the content of pollutants in edible production.

Materials & Methods

Rooftop experiment

The experiment T4P (Pilot Project of Parisian Productive Rooftops) was started in 2012 on the rooftop of AgroParisTech (French Technical University of Agronomy; 16 rue Claude Bernard, 75 005; coordinates: 48°50'24.4"N, 2°20'54.5"E). We chose to use wooden containers classically used as a backyard composter. This choice was made not only to facilitate the experimental observations and measurements but also with the idea that small spatial units could be easier to manage than plots on a roof. These containers are very easy to build and are sold cheaply in garden centres (around 20€ for a wooden container 40 cm height). They also allow an urban allotment gardens to be more flexible by adapting the total numbers and spatial localization of cropping containers on the roof to its specific characteristics (global weight carrying capacity and variability on the roof, useable area, number of families each year, etc.). A picture of the experiment is shown in Figure 1.

Growing media

Initial substrates:

We used three types of urban organic waste as a component of the growing substrate:

- Green waste compost from urban public parks and green spaces, which is commonly made in Paris as well as in the suburbs. This compost is used by the public parks services of the city in their green space as the compost maturity turn it into a good fertilizer. The surpluses are frequently given to individuals or local non-profit organizations. Our supplier is a company located in Versailles near Paris, BioYvelinesServices (see annex 1 for the description of our experiment partner);
- Crushed Wood, also from public spaces, of which the surpluses are given or sold cheaply

ISSN-Internet 2197-411x OLCL 862804632

to the public. An ample supply was provided by BioYvelinesServices;
- Coffee grounds with Pleurotus Ostreatus mycelium was a more original substrate: it came from a new urban farm (The U-Farm, part of the Up-Cycle company ; see annex 1) producing mushrooms in ship containers on a coffee grounds mixed with wood chips. U-Farm, in partnership with a leading coffee supplier, collect used coffee through a specific supply chain from coffee machines in Paris.

We used a potting soil (see annex 2 for the detailed composition) as a control. This horticultural substrate, commonly used in urban allotment gardens, was supplied by a garden centre. Woodchips were also used as mulch in each box, in order to minimize substrate evaporation and weeds. The main agronomic characteristics of our substrates are presented in Table 1.

Mixes tested:

Our cultivation system was inspired by an original gardening practice born in the United States of America and which started to be known and used in France a few years ago: lasagne beds (Collaert, 2010). The idea is to mimic a soil by putting down layers of "brown" and "green" organic matter. The "colour" relates to the decomposability and mineralization rate. For instance, a brown layer could be crushed wood that is supposed to have a low rate of mineralization and provides an input of carbon, with a high C/N ratio. The green layer could be a green waste compost with a high mineralization rate and a consequent input of nutrients due to a low C/N ratio. Every year, at the beginning of the cropping season, an additional layer of "green" matter is added. This ensures an input of organic matter to provide nutrients by mineralization to compensate for that used by the previous crop. Inputs of chemical or organic fertilizer during the cropping season can thus be avoided.

We tested the nature of the initial substrate used and its distribution in the container, either as a lasagne or homogenously mixed, and the inoculation with earthworms. The latter were introduced with the hypothesis that earthworms would create and maintain a soil structure favourable to plant growth. Two functional groups were used (epigeic and anecic) given their contrasted roles in soil (Blouin et al., 2013)(van Groenigen et al., 2014). Five mixtures of the three organic wastes and a potting soil were randomly distributed in 2*15 wooden boxes of 0.64m2 each, with 0.5 m between them. The five treatments are presented in Figure 2 and composed as follows:

- Treatment n°1 (T1): two layers of 15 cm of green waste compost and crushed wood.
- Treatment n°2 (T2): two layers of 15 cm of green waste compost and crushed wood in which we inoculated three species of earthworms corresponding to two functional groups (epigeic and anecic): 15 Dendrobaena Veneta (epigeic earthworm) adults, 35 Eisenia Fetida (epigeic earthworm) adults and 10 Lumbricus Terrestris (anecic earthworm) adults.
- Treatment n°3 (T3) : three layers : two of 12.5 cm composed of crushed wood and green waste compost and 5 cm of coffee ground with Pleurotus Ostreatus mycelium.
- Treatment n°4 (T4): 30 cm of a green waste compost and crushed wood mixture (50/50 v/v).
- Control (C): 30 cm of potting soil.

Each box was filled at the bottom by 5cm of clay balls used as a water reserve and surrounded by an EPDM (Ethylene-Propylene-Diene Monomer) membrane. On the top of this we placed 30cm of growing substrate surrounded by a "geotextile" through which the roots can grow.

Cropping species:

Each row of 15 boxes corresponded to a crop sequence: either lettuce (Lactuca sativa) then cherry tomatoes (Lycopersicum esculentum var. chery) then green manures (Trifolium incarnatum and Secale cereale) called S1; or cherry tomatoes then lettuce then green manures called S2. These two sequences were designed to represent the most common crops grown in UAG in Paris As well as to vary by their nutrients needs over the cropping season. Indeed, the tomatoes plants export more nutrients to grow than the lettuce (Argouarc'h, 2005). In this paper we focus on the first sequence, (S1), as shown in Figure 3.

Technical processes of the experiment:

The only input allowed was organic, applied at the beginning of the cropping season (end of

ISSN-Internet 2197-411x OLCL 862804632
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Table 1: Average physico-chemical characteristics of the source materials for growing substrate used in 2014. SD = Standard Deviation and DM = Dry matter, n=3. The analyses were performed by the soil laboratory of INRA ARRAS that is accredited by COFRAC. http://www6.lille.inra.fr/las

	pH water (mean ± SD)	$CaCO_3$ total (mean ± SD) g/kg of DM	Organic carbon (mean ± SD) g/kg of DM	Total nitrogen (mean ± SD) g/kg of DM	$C_{organic}/N_{total}$ (mean ± SD)	Potassium (mean ± SD) g/kg of DM
Green waste compost	7.7 ± 0.03	53.2 ± 1.6	233.0 ± 31.1	11.8 ± 0.2	19.6 ± 2.6	1.2 ± 0.04
Coffee ground with mycelium	6.0 ± 0.8	11.1 ± 9.4	436.3 ± 5.1	26.7 ± 1.3	16.4 ± 0.6	0.4 ± 0.09
Crushed wood	7.3 ± 0.07	3.2 ± 1.08	454.3 ± 5.7	4.7 ± 0.3	96.9 ± 6.8	0.6 ± 0.01
Woodchips	6.9 ± 0.04	<1 ± <0.01	484.7 ± 4.7	1.5 ± 0.2	325.8 ± 28.6	0.2 ± 0.04
Potting soil	6.7 ± 0.06	18.6 ± 7.9	264.0 ± 2.7	6.8 ± 0.1	39.1 ± 0.2	1.3 ± 0.02

March or April) when the containers were refilled with organic material (to 30 cm height) to compensate for substrate compaction and biodegradation. In March 2013 the following proportion of the initial volume of the substrate was filled with (in % of initial volume of the substrate):

- C: 25% of potting soil
- T1: 34% of green waste compost
- T2: 40% of green waste compost
- T3: 27% of coffee ground with mycelium (16% of the 27% as the bottom layer) and green waste compost (the other percent as the top layer)
- T4: 37% of green waste compost mixed with crushed wood (50/50 v/v)

As for diseases protection, we applied copper sulphate only on the tomato plants, in three treatments in 2012 (June, July and August) and two in 2013 (June and July). In parallel we did two preventive horsetail treatments in 2013 on tomatoes and in 2013 we put one Indian carnation plant in each box to avoid aphids. The box was irrigated by way of two kinds of drip irrigation system in the cropping season 2012 and 2013.

Sampling and analyses:

During the harvest of lettuce (June 2012 and June 2013) and tomatoes (between July and October 2012-2013) 100g of fresh matter were collected from each box washed and dried at 40°C for at least a week. The fresh and dry matter was weighed in order to determine the precise biomass production. Five trace metals (Cd, Pb, Cu, Zn and Hg) currently found in polluted urban garden soils were analysed (Alloway, 2004)(Wong et al., 2006). A Polarized Zeeman Atomic Absorption spectrophotometer model Z5000 (HITACHI) was used by means of ETAAS (Electrothermal Atomic Absorption Spectrometry) to determine Cd, Pb and Cu and by means of FAAS (Flame Atomic Absorption Spectrometry) to determine Zn. Hg was analysed by means of CVAAS (Cold Vapor Atomic Absorption Spectrometry).

Three times a year the growing substrates were sampled layer by layer (12 or 16% of the box volume) and 500g of each layer were used for agronomic and pollutant analyses. Each substrate was dried at 40°C and sieved at 2mm by a crusher. The agronomic analysis (pH, OM, CaCO3 etc.) was performed by a certified soil laboratory. Climatic data were registered through an automatic station giving daily temperatures, rain and evapo-transpiration. Due to a technical problem at the meteorological station, the data for the two growing seasons are not yet complete (see Annex 3).

Statistical analysis:

Statistical analyses were performed on fresh biomass production (3 replicate boxes per treatment) using R software (R-3.1.1). The five treatments were compared through an analysis of variance (ANOVA) after ensuring normality of the data. A multiple comparison of means was determined by the'post-hoc'Tukey test. A significance level of $P<0.05$ was used. All the p-values from the analysis are presented in Annex 4.

Results

Production levels

Figure 4 (i), (ii), (iii), (iv), (v) & (vi): Biomass production (edible: tomatoes and lettuce; above ground for green manures) per box during the two-year ex-

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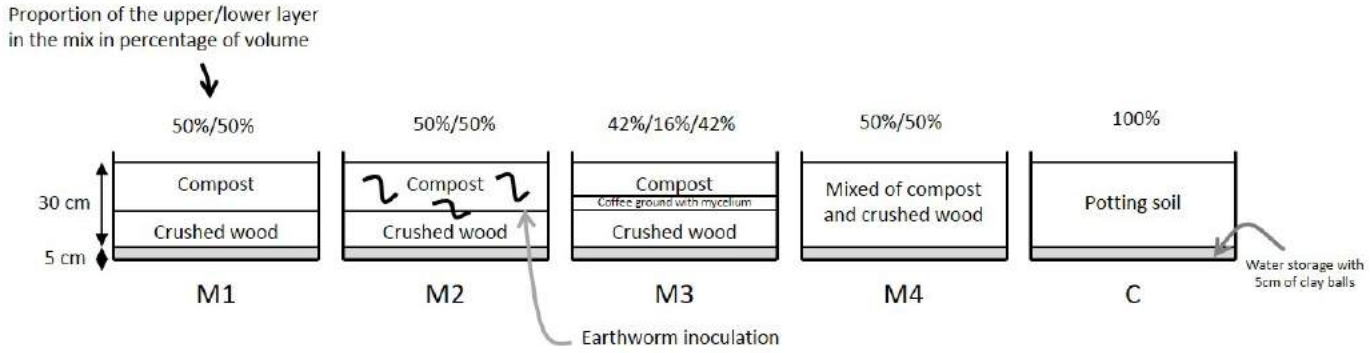

Figure 2 : Description of the five treatments used in the T4P experiment

periment T4P. On the graph different letters means significant differences; p-value<0.05. The red dot symbolize the mean value and the red line show the standard deviation.

As Figure 4 shows, higher yields were obtained every year for treatment T2 and T3, which are the most diversified ones in terms of substrates and biological diversity. For green manure and tomatoes higher yields were observed in 2013 than in 2012, reaching 3.24 kg.box-1 of tomatoes for the T3 in average and 1.10 kg.box-1 of green manure in average for the T2. The opposite situation was noted for lettuce, with higher yields in 2012 than in 2013. The lettuces weighted more than 540g per piece for the T3 treatment.

By comparison with T2 and T3, the control did not

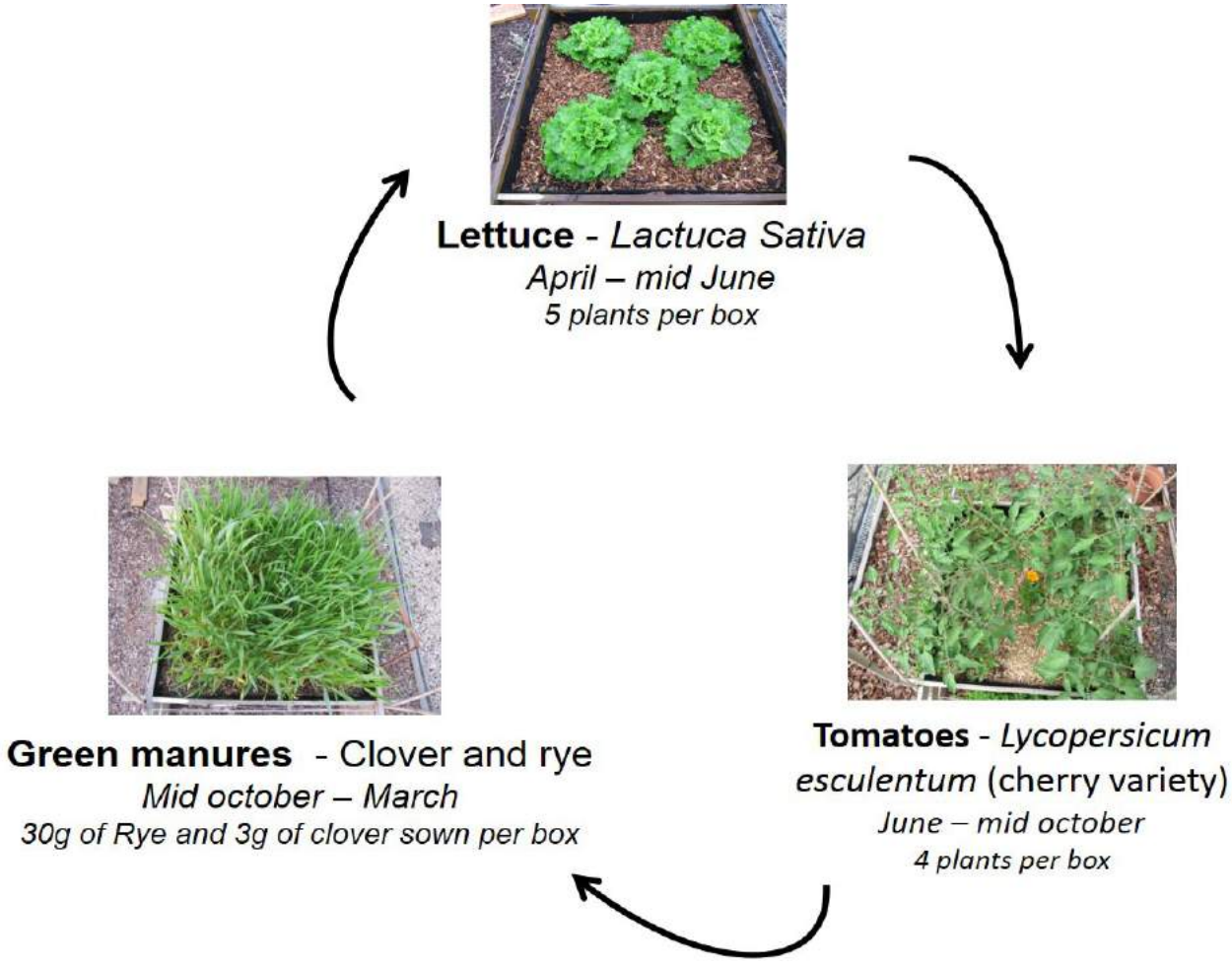

Figure 3 : Representation of the first crop sequence (S1) in the T4P experiment

ISSN-Internet 2197-411x OLCL 862804632
™ UniKassel & VDW, Germany- May 2015

lead to good yields. Respectively four and six out of six harvest were significantly lower for the control than for T2 and T3. This shows the interest of growing food on urban organic waste rather than potting soil. Putting the different substrates in layers instead of directly mixing them seems to have a positive effect on yield. In fact, the yields were significantly higher for the T1, T2 and T3 (in comparison with T4) respectively for 3, 4 and 5 harvest out of six.

The inoculation of earthworm seems to have either a positive or no effect on yield. For T2, the harvest was higher for only one harvest (and equal for 5th others). Remaining mycelium inoculation has as well either a positive or no effect on yields. Indeed, T3 showed higher yields than T1, for three harvest.

Pollutant levels

During the two seasons of the experiment we measured the concentration of five trace metals in the edible crops. Of these five elements, only Cadmium (Cd) and Lead (Pb) are regulated by a European standard that we take as a reference here. The content of Pb and Cd in lettuce (Table 2 a & b) and tomatoes was four to ten times lower than the European norms. Similar results were obtained for Cd and Pb levels in tomatoes: 0.001 to 0.003mg of Cd per kg and 0.005 to 0.02 mg of Pb per kg (fresh weight) to be compared with the EU limits 0.5 mg of Cd per kg and 0.1mg of Pb per kg (fresh weight). With the exception of treatment T1 in 2013 where the lead content was 0.11 mg.kg-1, for which we have no satisfactory explanation at the moment.

The trace metal content in our parental substrate was under the applied standard in all cases (French standard NF U 44 551 (AFNOR, 2002)). Lead and cadmium concentrations were respectively 40mg. kg-1 and 0.47mg.kg-1 in compost and 0.17mg.kg-1 in potting soil. Over the two-year experiment there was no significant change in the trace metal content in any of the substrates.

Discussion

The difference of yields between 2012 and 2013 might be due to meteorological conditions (see Annex 3) or to differences in substrate evolution although we have no available data yet. Note that our cropping period for tomatoes was shortened in mid-October because of green manure seedling periods. It is also noteworthy that our experimental device presents a low density of lettuce compared to professional producer's practices (five lettuces for 0.64m2 against 7 to 11 for a professional producer (personal communication).

Few studies focus on an evaluation of the potential for rooftop edible food production (Whittinghill, Rowe, & Cregg, 2013; Kortright, 2001; Orsini et al., 2014) and none focus on food production using only urban organic waste. We provide a first insight of this potential. During the two growing seasons we found three major patterns:

- Food production using urban waste (T1, T2, T3 and T4 in comparison of C) is significant. Indeed, in almost all harvests the potting soil was one of the less productive as well as the T4. The fact that this potting soil offers the lowest yield may however be explained at least partially by the non-use of mineral fertilizer. A classical input in horticultural cropping systems ;
- The layout in lasagne beds has a positive effect (T4 in comparison with T1, T2 and T3) on the production, especially for T2 and T3. One hypothesis could be made to explain this lasagne effect: the high C/N ratio of the crushed wood may immobilize all the nitrogen from the compost due to the microbial activity. It should be note that the effect was stronger on yield of lettuce and green manures compared to tomatoes so the rooting system could have an impact.
- Earthworms or coffee grounds with remaining mycelium inoculation have a mixed direct effect (positive or null) on the production level (T2 and T3 in comparison with T1) and an impact on substrate evolution (i.e increase in water retention).

Our production results show the feasibility of growing food on a rooftop garden based only on local urban organic waste. Regarding the first experimental results, during the whole cropping season (April to October) and despite the limits explained above, we demonstrated good or even high levels of food, production. Thus, for T2 or T3 we produced around 4.8 to 7.5kg/m2, equivalent to 48 to 75t/ha (see Annex 6) without any fertilization other than that brought by the organic waste itself. The yields of T2

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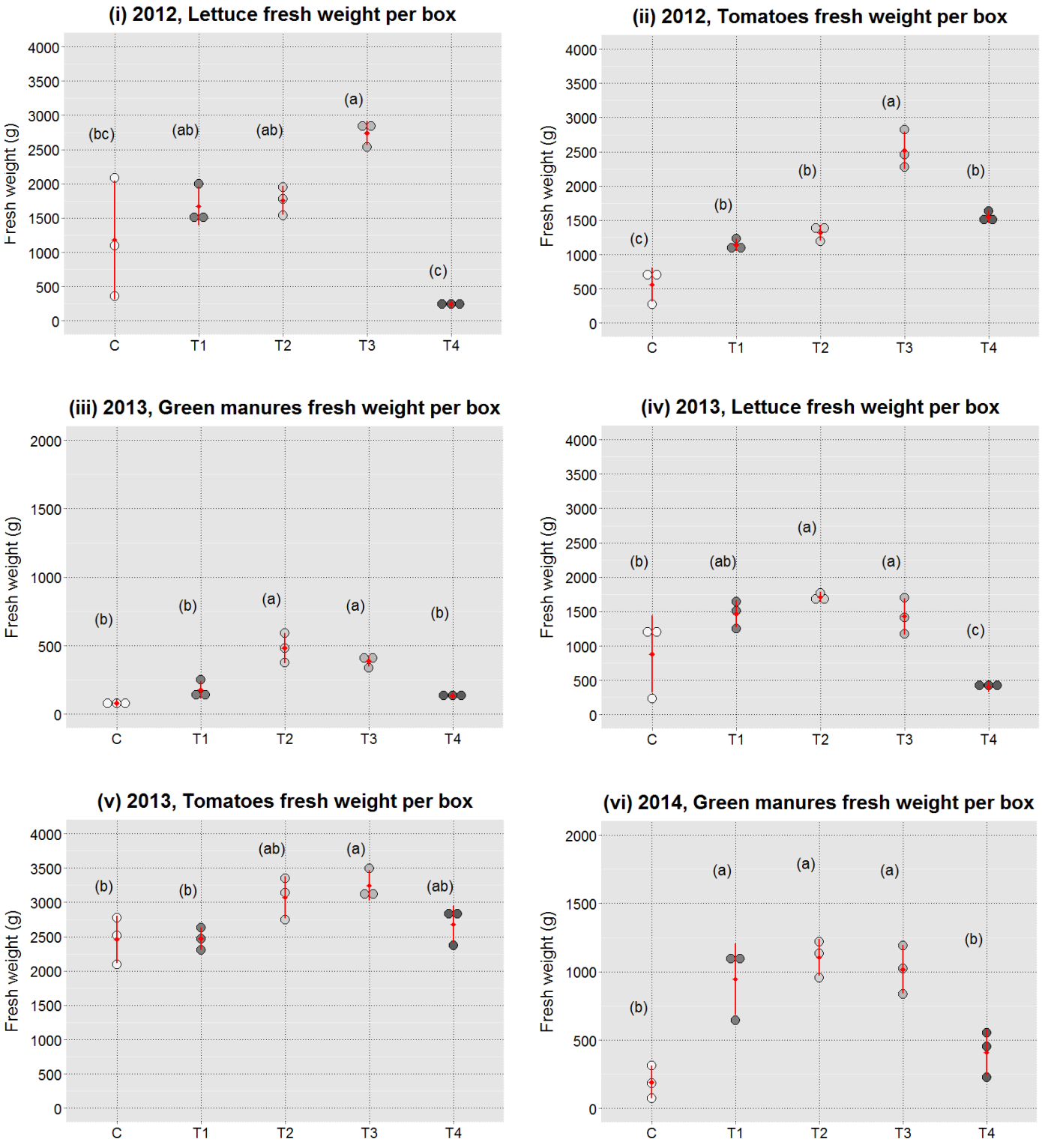

Figure 4 (i), (ii), (iii), (iv), (v) & (vi): Biomass production (edible: tomatoes and lettuce; above ground for green manures) per box during the two-year experiment T4P. On the graph different letters means significant differences; p-value<0.05. The red dot symbolize the mean value and the red line show the standard deviation.

ISSN-Internet 2197-411x OLCL 862804632
™ UniKassel & VDW, Germany- May 2015

and T3 were higher than those obtained currently in "on the ground" urban allotment garden where gardeners are cultivating mainly to produce food (Pourias, 2013). This is also the case if we compare with professional open-air organic market gardens in the Parisian region: in 2012, 14 000 tons of lettuce were produced in the Parisian Region from May to October on 740 ha (i.e. with a mean yield about 20 t/ha). For tomatoes, regional data is not available but at the national level the mean yield of open air tomatoes is around 52 t.ha-1 – while tomatoes cultivated in green houses reach a mean yield of about 236 t.ha-1 (DRIAFF, 2013; Agreste, 2013)

As presented above, we observed a strong decrease of the volume of substrate (- 10 to 15 cm after the first cropping season). This could result from a physical dynamics (compaction) or a biological one (biodegradation). This evolution contrasts with the classic behaviour of a peat-based substrate supposed to be physically stable over time. And highlights the question of the sustainability of growing substrate based on local urban waste. Especially the question of the possible (physical and/or chemical and/or biological) impediment to vegetable growth.

We designed our agro-ecological cropping system as a living ecosystem in which the resilience should increase with time. In doing so we observed the importance and benefits of greater diversity of soil fauna including higher yields. During experimental tests we measured the strong development of the epigeic species of worms (data not shown here). The focus on the specific influence and importance of biological diversity will be examined in another study. But even now, these results suggest the need to study the potential of these rooftop gardens to be an habitat for urban fauna such as arthro-

Table 2 a and b: Cadmium and lead contents in cherry tomatoes (a) and lettuce (b) during the two-year experiment. European standard refers to the standard CE n°188-2006. FM = Fresh Matter and SD = Standard Deviation.

a- Cherry tomatoes

Treatment	2012		2013		European Standard
	[Cd] ± SD mg.kg^{-1} of FM	**[Pb]** ± SD mg.kg^{-1} of FM	**[Cd]** ± SD mg.kg^{-1} of FM	**[Pb]** ± SD mg.kg^{-1} of FM	
C	0.009 ± 2.6E-04	0.005 ± 1.5E-03	0.002 ± 6.0E-05	0.03 ± 3.0E-03	
T1	0.002 ± 5.6E-05	0.008 ± 1.3E-03	0.003 ± 4.0E-05	0.1 ± 8.2E-03	
T2	0.002 ± 7.9E-05	0.02 ± 8.2E-03	0.004 ± 2.3E-04	0.03 ± 2.1E-03	**0.2**
T3	0.003 ± 1.2E-04	0.01 ± 1.3E-03	0.003 ± 9.0E-05	0.03 ± 4.0E-04	
T4	0.001 ± 1.02E-04	0.005 ± 8.4E-04	0.002 ± 6.4E-05	0.02 ± 2.2E-03	

b- Lettuce

Treatment	2012		2013		European Standard
	[Cd] ± SD mg.kg^{-1} of FM	**[Pb]** ± SD mg.kg^{-1} of FM	**[Cd]** ± SD mg.kg^{-1} of FM	**[Pb]** ± SD mg.kg^{-1} of FM	
C	0.008	0.05	0.009	0.08	
T1	0.006	0.04	0.009	0.04	
T2	0.008	0.05	0.007	0.04	**0.3**
T3	0.02	0.06	0.008	0.05	
T4	0.007	0.06	0.006	0.08	

ISSN-Internet 2197-411x OLCL 862804632

pods (Madre, Vergnes, Machon, & Clergeau, 2013).

Looking at a larger scale, many studies investigate ways to improve cities' resiliency and sustainability through food supply, energy, and nutrient cycles (MacRae et al., 2010; Grewal & Grewal, 2012; Billen, Barles, Garnier, Rouillard, & Benoit, 2008; Orsini et al., 2014). By using urban organic waste we insert our cropping system into the urban metabolism, ensure cheap access to substrate for gardeners, and reduce the city's waste treatment costs. For instance, coffee grounds with mycelium are a residue of an urban farm producing mushrooms from a previously unprocessed waste which is very common but still largely unknown today as a potential fertilizer. As an illustration, the annual production of coffee grounds by an average Parisian café is estimated at around 4 tons (Urban Farm personal communication). But this data has to consolidated. Other urban waste (organic and mineral) need to be tested, as it has been, to some extent, for other purposes (i.e. soil for urban trees, parks etc.) (Rokia et al., 2014Ostos et al., 2008). Possible optimal layout for production needs to be investigated. Apart from the advantages to use previously un-valorised urban waste, the ecosystem services potentially provided by this rooftop gardening (i.e provisioning services such as food production or food quality or regulation services such as flood regulation, climate regulation, carbon storage etc.) and their potential optimisation need to be studied.

Cropping sequences with too short a return time of a given crop in the same location are known to be unsustainable, especially from a sanitary point of view regarding parasitic species or plant diseases. In order to avoid these problems, since March 2014 our research team choose to work on pertinent diversified cropping sequences and crops associations. Furthermore, as Boudreau (2013) emphasizes, the majority of our knowledge on intercropping species is empirical and there is a need of scientific work on this question.

The remaining pollutants in edible production of urban agriculture are a key aspect of its development. In their study Saümel et al. demonstrated the possible effect of urban pollution (mainly from urban soil) on urban allotment gardens crops that are likely to be contaminated by trace metals (Säumel et al., 2012). As our results indicate, it is possible to produce edible crops in a dense city like Paris, with regards to levels of trace metals. In addition we have to point out the site-specific limits of our experiment: not close to a busy road, on one of the highest roofs in the area, and no known source of pollutants close by. Further investigations are however needed including the measurement of other pollutants (especially organic pollutants). As well as the understanding of the potential correlation between the roof's altitude or proximity to a highway and pollution levels.

Conclusion

Green roofs have been studied extensively for their multiple benefits and generally consist of a thick layer of substrate with plants. There are currently 1.3 million m2 of green roofs in France mostly made up of exogenous substrate generally with a sedum plant covering. In this article we propose a new kind of green roof: a productive garden which is a form of Zero-Acreage farming designed to participate in the urban metabolism, primarily through the use of local urban organic waste. This could be an opportunity for cities, urban planners and even private building owners to solve the problem of the scarcity of land in dense cities like Paris. It may also be a solution to urban soil pollution risks facilitating the creation of new urban allotment garden and satisfying urban dwellers' demand for arable land. We have stressed the food producing potential of this new cropping system as well as the possibility of using rooftops even in cities like Paris.

Throughout the first two years of the experiment we witnessed a growing interest in our research by the media as by, inter alia, architects, restaurants, and public stakeholders. Thanks to the experiment a firm called Topager has emerged in the Parisian region and is now a partner in the experiment. Further investigations are needed to determine the real potential of Paris and of its suburbs for such productive rooftops. Using local organic waste and considering our cropping system as a living ecosystem that should be as functional as possible, shows interesting patterns that encourage us to pursue the research on different aspects, including the possible hurdles of such cropping systems (physical and/or chemical and/or biological); the influence and other possible biological inoculations; other

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urban substrates (mineral or organic) adapted to the local context; and the potential of rooftop gardening to be an habitat for urban plant and animal species. More generally, this underlines the necessity for research and quantification of the ecosystem services linked to this new type of green roof.

Climbing onto rooftops to create urban gardens is an opportunity to meet many needs of urban dwellers, and it offers new possibilities for urban planners.

Acknowledgements

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Conflict of Interests

The authors hereby declare that there is no conflict of interests.

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Annexes

Annex 1: Description of the partner of the experiment T4P

BioYvelinesServices (*http://www.bioyvelines.fr/*) is a social-integration firm working for the valorization of green waste from the municipality of Versailles.
UpCycle (*http://www.laboiteachampignons.com/upcycle/*) is a new and innovative urban farm that produces mushrooms (*Pleurotus Ostreatus* mainly) on coffee grounds for selling to gourmet restaurants. The firm operates in a social and solidarity economy involving disabled persons in the production cycle.

Annex 2: Potting soil composition

Potting soil "Terre à planter" Or brun brand.
Composition: Topsoil, blond sphagnum peat moss, composted bark, brown peat, horse manure and composted seaweed.

Annex 3: Meteorological condition for almost the entire two growing seasons

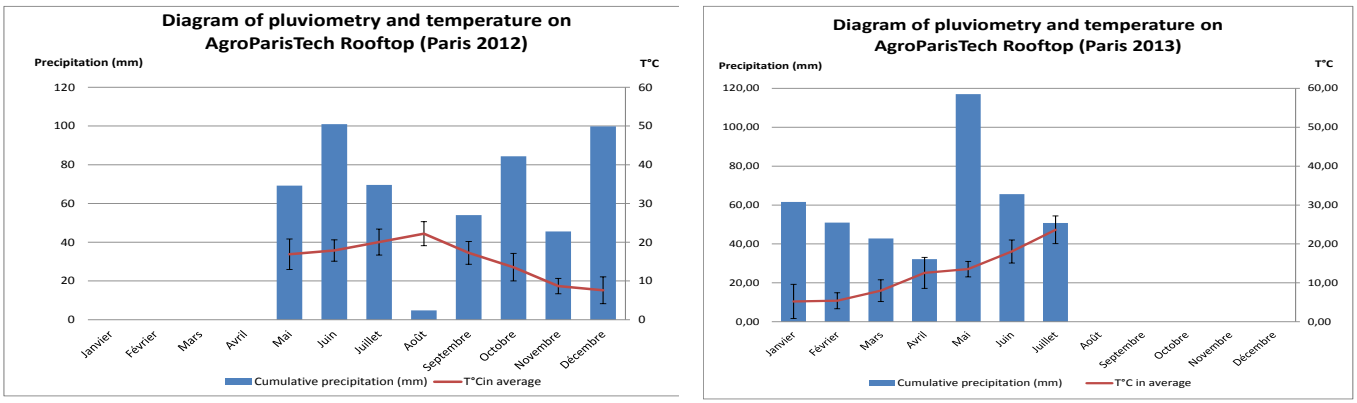

Figure 5: Rain and temperature for almost the entire two growing seasons.
Unfortunately, the data are not complete due to a problem with the meteorological stations on the roof.

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Annex 4: P-value from the ANOVA comparing the biomass production of each treatment

Table 3: p-values from the statistical analysis of the biomass production during the two growing seasons

	T1	T2	T3	T4
C	0,378883	**0,0000971**	**0,0009214**	0,8395126
T1	p-value	**0,0009294**	**0,0134274**	0,9011971
T2		p-value	0,3819518	**0,0003128**
T3			p-value	**0,003718**

Comparaison of yield per box of green manures per treatment in 2013

	T1	T2	T3	T4
C	**0,003094**	**0,000723**	**0,001574**	0,5897235
T1	p-value	0,8121444	0,9866147	**0,0285028**
T2		p-value	0,9732582	**0,0055696**
T3			p-value	**0,0134479**

Comparaison of yield per box of green manures per treatment in 2014

	T1	T2	T3	T4
C	0,634594	0,5002128	**0,0081974**	0,1247338
T1	p-value	0,9991145	0,0714591	**0,0142077**
T2		p-value	0,1033842	**0,0098706**
T3			p-value	**0,0002285**

Comparaison of yield per box of lettuce per treatment in 2012

	T1	T2	T3	T4
C	0,188174	**0,0403131**	0,2296012	0,3487934
T1	p-value	0,8431644	0,9998951	**0,0094673**
T2		p-value	0,7751587	**0,0021949**
T3			p-value	**0,0116955**

Comparaison of yield per box of lettuce per treatment in 2013

	T1	T2	T3	T4
C	**0,020434**	**0,0035443**	**0,000001**	**0,0004499**
T1	p-value	0,7626363	**0,0000262**	0,1176208
T2		p-value	0,000088	0,5539708
T3			p-value	**0,0005368**

Comparaison of yield per box of tomatoes per treatment in 2012

	T1	T2	T3	T4
C	0,999999	0,1055834	**0,0317052**	0,8488883
T1	p-value	0,1134095	**0,0341171**	0,8690501
T2		p-value	0,9310184	0,4220423
T3			p-value	0,147379

Comparaison of yield per box of tomatoes per treatment in 2013

Annex 5: Fresh extrapolate weight for the first crop sequence during the two growing seasons

	Green manure ± SD (kg/m^2)		Lettuce ± SD (kg/m^2)		Tomatoes ± SD (kg/m^2)	
	2013	2014	2012	2013	2012	2013
C	0,13 ± 0,04	0,30 ± 0,19	1,85 ± 0,39	1,38 ± 0,91	0,87 ± 0,08	3,80 ± 0,11
T1	0,28 ± 0,1	1,48 ± 0,41	2,61 ± 0,33	2,29 ± 0,51	1,78 ± 0,09	3,86 ± 0,12
T2	0,75 ± 0,17	1,72 ± 0,21	2,74 ± 0,25	2,67 ± 0,4	2,06 ± 0,12	4,80 ± 0,12
T3	0,60 ± 0,07	1,59 ± 0,28	4,28 ± 0,33	2,23± 0,5	3,94 ± 0,33	5,07 ± 0,16
T4	0,21 ± 0,04	0,41 ± 0,26	0,38 ± 0,32	0,63 ± 0,26	2,42 ± 0,18	4,19 ± 0,12

Table 4: Projected production for the cropping season 2012-2013 and 2013-2014. S-D: standard deviation

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Planning Urban Food Production into Today's Cities

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Abstract

If cities are to become more sustainable and resilient to change it is likely that they will have to engage with food at increasingly localised levels, in order to reduce their dependency on global systems. With 87 percent of people in developed regions estimated to be living in cities by 2050 it can be assumed that the majority of this localised production will occur in and around cities. As part of a 12 month engagement, Queen's University Belfast designed and implemented an elevated aquaponic food system spanning the top internal floor and exterior roof space of a disused mill in Manchester, England. The experimental aquaponic system was developed to explore the possibilities and difficulties associated with integrating food production with existing buildings. This paper utilises empirical research regarding crop growth from the elevated aquaponic system and extrapolates the findings across a whole city. The resulting research enables the agricultural productive capacity of today's cities to be estimated and a framework of implementation to be proposed.

Introduction

The future possible impacts of technological food systems within todays cities are at present difficult to assess. The aim of this paper is to devise a method of analysis in order to determine the agricultural productive capacity of a Northern European city ratified through the use of real-world data on technical food systems. This data was collected from an operational elevated aquaponic system in Manchester, England designed and constructed by Queens University Belfast. The paper discusses the benefits of integrating agriculture within buildings and cities and analyses its impact on total domestic food production; the environmental benefits associated with this; and the resulting economic impact such activities could have on buildings, neighbourhoods and cities.

The ecological context of food in the UK

Self-sufficiency and food

The UK, like many other developed regions, is dependent upon food imports to sustain its population. In 2006 the UK spent £6 billion on importing fruit and vegetables alone and is reported to be 'about 60 percent food sufficient' (The Cabinet Office, 2008), leaving a 40% food deficit which has to be import from other countries. Over the past six years, the debt of the UK as a percentage of GDP has doubled from 42.8 percent in 2007/2008 to 84.3 percent in 2013, which equates to a gross debt of £1.387 trillion (Office for National Statistics (ONS), 2013). As a result, the food supply chain upon which the UK depends on is economically fragile, susceptible to change without warning, and ill

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equipped to deal with shock. These figures, however, only take into account the economic strain of supplying the UK with food. The feeding of the UK population also has an environmental impact.

Taking into account nourishment, shelter, mobility, goods and services the ecological footprint of the UK is estimated to be three times its size, requiring 321,621,000 global hectares to sustain its population (Stockholm Environment Institute (SEI), 2003). This impact corresponds to 5.45 global hectares per capita, which is in striking contrast to the fair land share per capita of 1.8 global hectares (World Wide Fund for Nature, 2012). This dictates that the UK's ecological footprint needs to decrease by at least 65 percent in order to live in equilibrium with the replenishment of natural resources. Nourishment, as a proportion of the overall ecological footprint, accounts for 28 percent of the total impact of the UK, requiring nearly 92 million global hectares (SEI, 2003). In 2008, the food industry accounted for 18 percent of the total CO2 equivalent production in the UK, estimated at a total of 147 million tonnes per annum (The Cabinet Office, 2008). The transport of food within the UK produces 19 million tonnes of CO2 and burns 20.9 million tonnes of oil per year (The Cabinet Office, 2008). If every person on the earth lived as one did in the UK, three earths would be needed in order to supply the demand indefinitely.

Food waste and land use

In 2011, the world's population surpassed 7 billion people for the first time in human history (Economic and Social Affairs division of the United Nations (ESA), 2013). As a result, the availability of agricultural land per capita is decreasing. In 1970, 0.38 hectares of global agricultural land was available per person. This value decreased to 0.23 hectares in 2000, and is projected to decline to 0.15 hectares per capita by 2050 (Food and Agriculture Organisation of the United Nations (FAO), 2012). A single hectare of agricultural land will, by 2050, have to supply enough food for 6.7 people annually, whereas the same area of land in 1970 only had to produce enough food for 2.6 people. It is a possibility, that by 2050, this agricultural land may become exhausted and be incapable of supporting the intensive agricultural activities needed to feed the 10 billion world.

The availability of food, however, is only part of the problem facing future populations; waste is also a concern. The Food and Agricultural Organisation of the United Nations reports that 28 percent of global arable land is used annually for the production of food that is either lost or wasted (FAO, 2013). Within the UK this food waste equates to approximately 16 million tonnes per year at a cost of £22 billion per annum (Waste & Resources Action Programme, 2011). The UK is, in essence, paying to waste food, waste energy, and damage the environment unnecessarily through the intensive industrial activities which are needed to feed its populations.

The wasting of food also has social and humanitarian impacts. It is estimated that 12 percent of the world's population is undernourished at a figure of approximately 842.3 million people (FAO, 2013). Taking into account that 28 percent of all food produced is either lost or wasted, world hunger could be solved twice over if a solution could be brokered.

The actions needed to prevent any further ecological deterioration as a result of the intense industrial activities needed to feed the UK, as well as address the issues surround food security, lay in the ability to produce more food domestically, in addition to wasting less. However, these actions are in no way simple. The Office for National Statistics notes that 69 percent of UK land is already utilised for agriculture, with 11 percent of land developed, 11 percent as forest/woodland and the last 9 percent left to other natural habitats (i.e. grassland, mountains, moors, coastlines and marine environments) (Office for National Statistics and East Anglia University, 2010). The need to produce more food when there is little to no additional land available makes the goal of producing more food difficult.

By 2050 the urbanised population of the planet is expected to reach 67.2 percent; accounting for 1.1 billion people in developed regions and 5.1 billion people in less developed regions (ESA, 2013). If cities are to become more sustainable and resilient to change it is likely that they will have to engage with food at increasingly localised levels. With 87 percent of developed regions estimated to be living in cities by 2050 it can be assumed that the majority of this localised production will occur in and around cities, and more specifically, within or upon buildings.

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Soil-less growing technologies

Background to the technologies

Nearly all food today is grown in soil but within urban areas, and more importantly within or upon buildings, soil-based agriculture may not be the best method. This is due to the large proportion of contaminated land in many urban areas - a byproduct of the industrial revolution - as well as its additional weight, which adversely affects its ability to be retrospectively added to buildings. Thus, localised food production within cities depends upon alternatives to soil based practices. One such alternative is to use technical food systems. These hybridised systems, utilising technical products such as glass, plastic, and mechanical pumps, allow food to be grown directly in nutrient rich water at a fraction of the weight.

There are two recognised methods in which food can be grown within technical food systems. These include hydroponics and aquaponics. These techniques utilise similar equipment in order to grow food, but the way in which they make nutrients available to crops is very different. Hydroponic systems utilise nutrients that are added manually to a recirculated water system, whereas aquaponics aims to develop an ecosystem between fish and crops. Aquaponic systems are dependent upon the naturally occurring nitrogen cycle to make nutrients available to crops. The system utilises waste ammonia (NH_3) - produced by the fish as a byproduct of respiration - and through the natural colonisation of nitrosomonas and nitrobacter bacterias within the system, converts the waste ammonia primarily into nitrite (NO_3) and later into nitrate (NO_2). This conversion serves two functions. Ammonia is toxic to fish it would poison them if allowed to accumulate within the water supply. The second function of this process is that nitrate is an available form of nitrogen - a plant's largest nutrient requirement - which crops can easily take up across the surface of their roots. The fish, bacteria and crops live symbiotically, much as they would within a natural ecosystem.

In both hydroponics, and aquaponics, crop roots are in direct contact with the nutrient rich water. As such, the crops use little effort in acquiring nutrients and can instead, utilise a larger proportion of their energy to grow. As a result, yields are substantially increased (in some cases up to four times) and water use is reduced by a factor of up to ten when compared to traditional agriculture (Bernstein, 2011). Through the growing of crops indoors or under glass, a protective environment is created which increases resilience to shock events such as storms, prolonged rainy periods, temperature drops or dry spells. Their reduced weight, through the use of Nutrient Film Technique (NFT) - a growing channel utilising only a few centimetres of water - allows such systems to be successfully retrofitted into or onto existing buildings without compromising the building's structural integrity.

The design of a novel roof-based aquaponic system

As part of the Manchester International Festival 2013, Queen's University Belfast was approached to design and implement an elevated aquaponic food system within a disused mill in

Figure 1: Aerial view of the elevated urban farm in Manchester, England (left) with rooftop NFT system (right)

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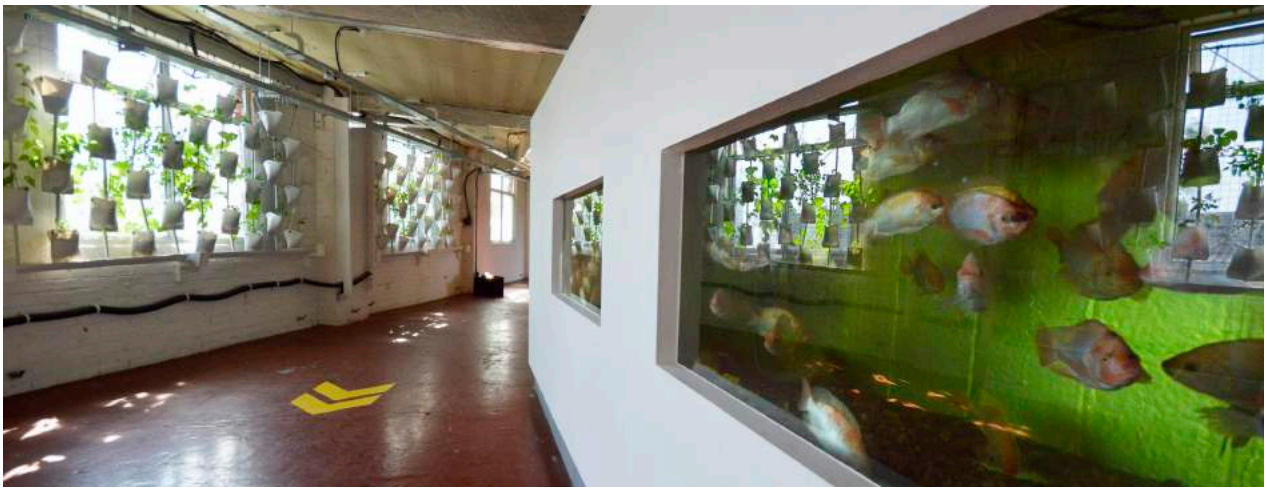

Figure 2: Internal view of the urban farm in Manchester, England.

Manchester, England (Fig. 1). The project itself was a 12 month engagement and included the design, construction and commissioning of one of the very first elevated farms within the UK.

The system was partially contained within the building and partially upon the roof, where light levels were highest. The more visually engaging components of the system were contained on the top internal floor of the building. This included fish tanks, a filtration/mineralisation system, and deep rooted crop bags placed in the south-facing windows (Fig. 2). The roof space housed the NFT system - located within a large polytunnel - capable of growing 4,000 leaf crops at any one time. The design team worked closely with structural engineers throughout the course of the design and construction of the systems to ensure it would not compromise the existing structure of the mill. As a result, the heaviest elements of the system (i.e. fish tanks and polytunnel) sit upon primary beams in order to safely distribute the load to the ground.

In total there are 12 fish tanks, which are fed with filtered, clean, fresh water returning from the roof as a result of bacterial and crop filtering actions. The overflow from the fish tanks collects in a sump, and the water is pumped to the filtration/mineralisation bank where it drains consecutively through a series of siphonic containers comprising of expanded clay balls and worms. The expanded clay balls provide the large surface area needed upon which nitrifying bacteria can colonise, with the worms helping with the breakdown of solid waste. When the water is nitrogen rich and free of solid waste it is pumped toward the silicon bags hanging in the south facing windows. These deeper grow bags cultivate plants such as tomatoes and peppers, which require sig-

Figure 3: Facade Farm prototype

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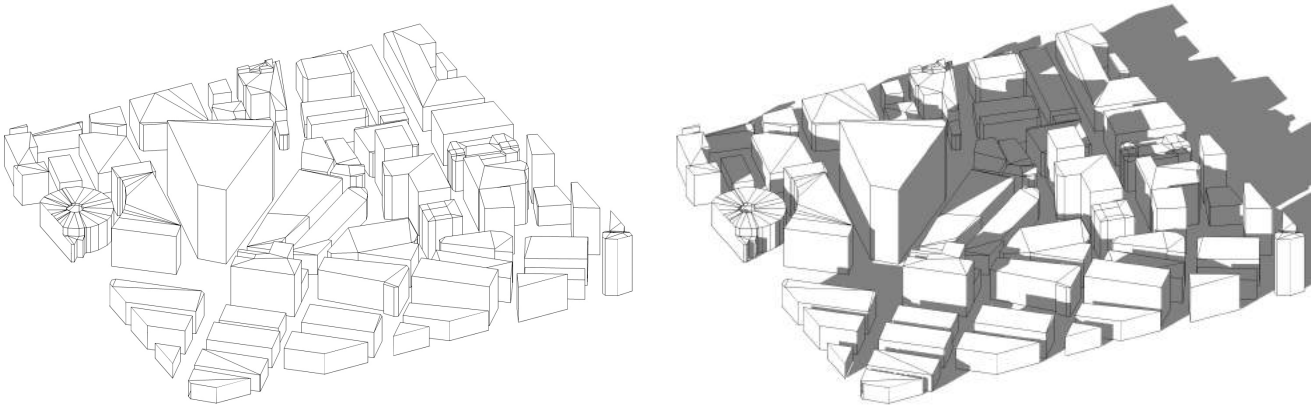

Figure 4: A section of the three-dimensional model (left) with sample image of shadow information (right)

nificantly larger root systems in order to grow. The water is lastly pumped up to the roof and into the polytunnel where it flows down through 34 NFT channels, each 14m in length, in order to grow leaf crops (Fig 1). The clean filtered water flows back down to the fish tanks, where the process can start again.

The NFT system was capable of growing 26.66 crops/m2, including the additional space taken up by filtration, fish tanks and walk ways between crops. Based on a growing season of eight months, consisting of four harvests, the system is capable of producing up to 16,500 crops per annum. The sale of the crops in the local shop as part of the project sold for between £2 and £4 per crop dependant on size and species of crop. Hence, the system could generate between £33,000 and £66,000 per year. The material cost of the system itself was approximately £30,000 with an additional £30,000 spent on labour. The system was designed to need only one person to operate it on a day to day basis and a full operational manual was produced by Queen's University Belfast upon the hand over of the system to the building tenants.

Although the aquaponic system and urban farm was successful, it was clear upon completing the project that it may not necessarily be good practice or cost effective in future to locate these systems within buildings. They not only take up space within structures that could otherwise be utilised for office or residential purposes, generating income, but they also create issues related to flooding and water ingress from open water systems - i.e. a mixture of pressurised and unpressurised plumbing. Containing technical food systems within buildings also greatly reduces the amount of light available for crop growth. Deploying these systems on the external skin of buildings - i.e. rooftops and facades - in the future would eradicate both of these issues in addition to freeing up the floor plan of buildings for commercial or residential activities.

Facade Farm Prototype

The benefits associated with exterior systems led to the development of the 'facade farm' prototype: a twin walled glass facade, capable of growing crops within its cavity. The vertical surfaces of architecture, which generally experience too much glare or too much heat gain, would be the perfect sites for the growing of plants, which in turn would reduce both glare through foliage and heat gain through transpiration, decreasing building energy consumption and creating economic return through the sale of crops.

The first constructed facade prototype took all the available research from the larger aquaponic system, which occupied a whole building, and miniaturised it into a space 3m high, 2.5m wide and 35cm deep (Fig. 3). This space housed all the components seen within the larger system, including fish tanks, filtration/mineralisation unit, and growing channels. The prototype of the facade farm was capable of delivering 15 crops per metre squared of vertical surface, taking into account the space required for fish tanks and filtration. The prototype cost approximately £7,500 minus labour and using the sale value of the crops sold in the adjacent shop, is cable of producing approximately 450 crops per year (60 crops/m2/annum).

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The Agricultural Capacity of Cities

Cities can reduce their ecological footprint and positively affect their impact on the earth through the integration of urban agriculture upon their abundant surface area. However, not all surfaces within a city are capable of supporting the growth of crops due to orientation and/or overshadowing. A virtual modelling methodology - one that views cities as illuminated surfaces - is necessary so that the productive capacity of a city can be quantified, and the impact on domestic food production be calculated. The following analysis describes a methodology where direct light falling upon a surface is captured through the use of a three-dimensional model, and the aggregated annual lighting data used to help predict the total annual crop production of a city.

For the purposes of this paper, the city centre of Manchester, England was used as a case study to help derive and test the method of analysis. The main reason for this choice is the close proximity of the centre of the city to the elevated aquaponic system used for productive assessment. The centre of the city lies upon an area of land approximately 369 hectares in size, although its total surface area is closer to 720 hectares. This implies that through the building of structures the surface area of the city has doubled in size. The following analysis strives to determine to what extent this additional surface area is capable of supporting crop growth and hence, help inform a future framework of integration for urban agriculture within the city itself.

It should be noted that the research understands that availability of light is only one aspect effecting the integration of urban agriculture within existing cities. Other issues include the access to the right skills, ownership of urban surface, as well as the inclination of inhabitants to grow food. However, the point is taken that this method of analysis would be used at a city level, to discuss such possibilities with local authorities and to identify which areas might be suitable for pilot studies. Upon which, more detailed site analysis regarding applicability can be taken forward.

Three-Dimensional Modelling

To make it possible to determine upon which surfaces of the city crops can be grown, the overshadowing of each horizontal and vertical surface must first be visualised and understood. This is achieved by creating an accurate three-dimensional model of a particular city within virtual space onto which virtual light rays can be cast.

To create the virtual model of Manchester more than 2800 building plots were created in three-dimensional space, with each plot containing information on building form and building height (Fig. 4). Both of these characteristics are crucial in determining the overshadowing, and therefore reduction in light capture, as a result of adjacent buildings. All building plots were modelled simply and therefore were all represented as having flat roofs. In later analysis, all pitched roofs are identified and omitted from the analysis due to the lack of data regarding the growing of crops on an inclined plane. However, these surfaces may be utilised for solar energy capture in the form of photovoltaics or solar hot water which could help operate the technical food systems upon adjacent roofs and facades. The data used to create the virtual model of Manchester was taken from Land Map (*www.landmap.ac.uk*), which identified the height of each building plot above ground level. This data is referenced by Land Map as originating from Cities Revealed which is now part of the Geo-information Group.

Modelling Light Intensity and Assessing Shadow Data

Once the model of the city in question has been created in three-dimensional space it is then capable of accepting light rays in order to generate accurate shadow maps.

To collect the shadow information, a physical sun object was added to the scene, which is dependent upon latitude, longitude, time of day and month of year to calculate the sun's position. The latitude and longitude used for Manchester was 53°29'N 02°12'W. Using this object, images were taken at half hourly intervals from sunrise to sunset to represent a typical day within each month. The 21st day of each month was used to represent a 'typical day' within the study, due to the winter and summer solstices occurring on the 21st of December and 21st of June respectively.

To better represent the three-dimensional data as two dimensional images, the analysis splits the in-

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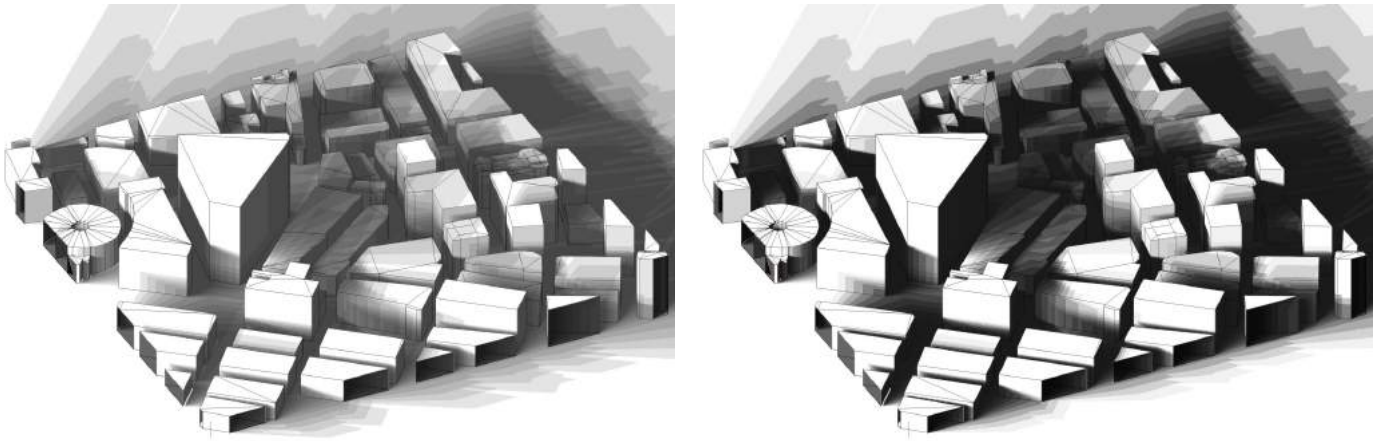

Figure 5: Multiple shadows with the same transparencies (left) and with accurate transparencies applied (right)

formation into vertical and horizontal data sets. To collect these two data sets three views are utilised in order to better represent the findings. The light capture of the horizontal surfaces - i.e. roof spaces - is viewed from above in plan so as to clearly view each individual roof. In contrast, the vertical data - i.e. building facades - is difficult to represent as a single image. Therefore, two views with different vantage points were utilised in order to fully understand the light capture of the vertical surfaces. These views were taken from the south-east and the south-west at an elevation of 60 degrees and in parallel projection. For the facade study, no data was captured from north facing surfaces as it could be assumed that these surfaces would be over-shadowed for the majority of the day and would only receive diffused radiation.

In total, over 250 images were taken to represent each half hourly shadow across a single day within each month of the year (Fig. 4)

Creating Shadow Maps

To create the shadow maps, the individual shadows for each respective month were overlaid on top of one another and a transparency applied to them in order to create a gradient map. Where multiple shadows coincided, darker patches would be seen, and areas mostly out of shadow would be represented as lighter patches (Fig. 5). However, this approach does not accurately represent the impact of a single shadow upon the daily solar capture of a surface throughout the day. That is to say that an area in shadow at midday would see a greater decrease in its overall daily light capture, than an area only in shadow during sun rise or sunset.

In order to account for this the impact of each shadow was individually calculated. This was achieved by calculating the proportion of total daylight that

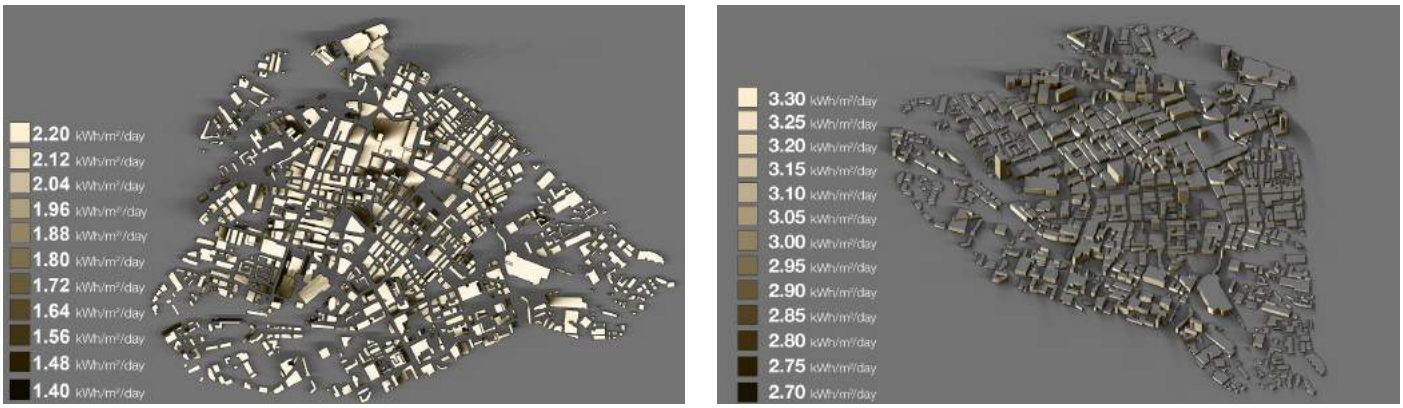

Figure 6: Completed roof top shadow map for March (left) and completed south-east facade map for June (right)

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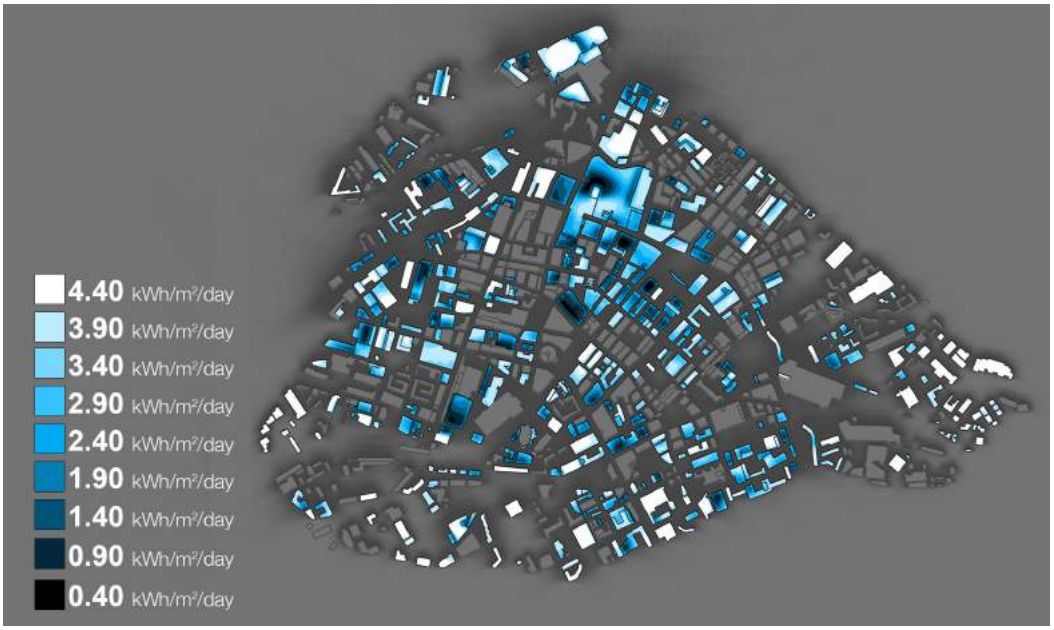

Figure 7: Annual roof top shadow map

landed upon a surface within each half hourly period against the total light capture of a known day. Taking April as an example, the light falling upon a surface between 13:00 and 13:29 accounts for 6.2 percent of its total daily light capture, whereas the light falling upon a surface between 07:00 and 07:29 accounts for only 0.4 percent of its total light capture. Therefore, a surface in shadow between 13:00 and 13:29 would see a reduction in it total daily light capture of 6.2 percent and a surface in shadow between 07:00 and 07:29 would only see a 0.4 percent reduction in its daily solar capture. Hence, shadows towards the middle of a day have a larger impact on the overall light capture of a surface and should be represented as darker than shadows towards the extremities of the day. Once calculated, the transparencies were amended to reflect this, representing the data more accurately than before (Fig. 5). The final stage of producing the shadow maps was to combine the shadow information with accurate lighting data. The data, kindly provided by SolarGIS, captured information on both direct irradiation (i.e. direct sunlight) and diffused irradiation (i.e. diffused light from the sky). An area in continual shadow would only ever receive diffused irradiation from the sky, whereas an area in constant sunlight would always be exposed to the total direct irradiation value. Taking the lighting data for March as an example, it can be seen that the total direct irradiation is 2.18 kW/m2/day and the total indirect illumination is 1.40kW/m2/day. Therefore, it can be assumed that all areas that are a solid black within the shadow map (i.e. always in shadow) would have a light capture of 1.40kW/m2/day whereas the areas without any shading would achieve a light capture of 2.18 kW/m2/day. The resulting images clearly represent which roofs and facades are susceptible to overshadowing, and how much energy each surface receives throughout the day within each month (Fig. 6).

Upon the completion of the shadow maps it was important to identify pitched roofs and eliminate them from the research. If Manchester was to be comprised entirely of flat roofs, it would have a total roof area of 136.3 hectares. However, 44.2 percent of the buildings have pitched roofs leaving the remaining flat roof area at 76 hectares.

Average Annual Light Capture

To determine the overall capacity of the horizontal and vertical surfaces to produce food, the average annual light capture would also be required. In order to combine all the overshadowing data into an annual shadow analysis, the yearly impact on light capture for each shadow had to be calculated. This was achieved by calculating the proportion of total daylight that landed upon a surface within each half hourly period of a specific day, against the total light capture of a total year. Thus, providing a percentage contribution of each half-hourly

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section to the total yearly light capture of the city.

For example; the light capture of a surface in shadow between 10:00 and 10:29 of a typical December day is reduced across the year by 0.1 percent. If a surface is in shadow between 12:00 and 12:29 in June, its light capture is decreased by 0.9 percent across the year. When all 258 shadows are laid upon one another, and the yearly transparencies of each shadow applied, an annual lighting map emerges. A stepped gradient was added in order to reduce the number of colour shades within the image and to allow a clearer differentiation to be drawn between well lit and poorly lit areas (Fig. 7). The annual shadow map covers a much larger range of values than previous monthly lighting information and, as such, is divided into nine 0.5kWh/m2/day energy levels. The annual results were processed in blue to help differentiate the data from the monthly data.

In order to determine what relevance this data has on annual crop growth, the energy needed by a plant for photosynthesis to occur must be included in the research. As a working average some plant species require a minimum of 1MJ/m2/day (0.28 kWh/m2/day) of light energy to survive. To obtain maximum growth rates, however, they require 3MJ/m2/day (0.83kWh/m2/day) (Badgery-Parker, 1999). In order to maximise the integration of technological food systems, the saturation point of photosynthesis (i.e. 0.83kWh/m2/day) will be taken as the baseline from which crops can be grown in a city to achieve the highest yields.

Predicted productivity

If every flat roof of the total 76 Hectares was capable of growing crops, Manchester could grow approximately 20.2 million crops at any one time based on 26.66 crops/m2 as found in the elevated aquaponic system. Extrapolating this throughout the year, based on a two month growing cycle for eight months of the year, Manchester would be capable of growing close to 81 million crops per annum. Based on a sale price of between £2 and £4 (as per the sale values achieved from the food shop adjacent to the elevated aquaponic system), the resulting crop could be worth between £162 million and £324 million per annum. Using the annual lighting data above, all areas indicating a yearly average light capture of 0.9kWh/m2/day or above would be considered perfect sites on which to grow food. However, once these sites are identified further research would be needed to conclude the viability of urban agriculture dependant on access, structural integrity and the inclination of the building owner to partake in such activities to name a few.

In the case of Manchester, 99.4 percent of available flat roof surface is capable of supporting crop growth and therefore, the total growing capacity of city centre roofs in Manchester is 80.4 million crops (based on four harvests per annum) indicating a total worth of between £160.8 million and £321.6 million per annum based on a sale value of between £2 and £4 per unit.

In total, the area of vertical facade accounts for 310.6 hectares of the total surface area of the city. Based on the information collected from the facade prototype - that facades can produce up 15 crops per metre squared of vertical surface - the vertical surfaces of Manchester are capable of growing 46.5 million crops at any one time. However, approximately 20 percent of the entire facade area is incapable of supporting crop growth due to close proximity of other buildings (i.e down tight streets or alley ways) with a further 35 percent of the facade area facing between North-East and North-West, never receiving any direct sunlight as a consequence. Although capable of supporting plant life during the brighter and warmer months, for the purposes of this research, the north facing facades would be collectively titled 'additional growing space' due to their orientation. The east, south and west facades would be more effective at growing crops. Therefore the overall productive area of vertical surfaces is 167.7 hectares, not including the 86.9 hectares of north facing facades. Using this area to grow crops in double skinned facade farms would enable a total of 25 million crops to be grown at anyone time. Based on four harvests per year, 100 million crops could be grown on the vertical surfaces of Manchester worth between £200 million and £400 million per year based on a sale value between £2 and £4.

In total, between both vertical and horizontal surfaces, the city centre of Manchester is capable of growing an estimated 180.4 million

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crops per year, achieving a maximum sale value of approximately £721.6 million per annum.

Framework of Integration

Light capture

Light capture is one of the key requirements for the successful integration of urban agriculture alongside access, demand and structural integrity. Manchester performs well in this respect with 99.4 percent of roof space and 45 percent of vertical surface providing suitable to excellent light capture. An aspect of the annual light study which has not been alluded to until this point, is the information it provides for the integration of urban agriculture. It would make little sense to roll out urban agriculture across all productive surfaces before first exploring and testing what systems are best suited to this scale of agriculture within the context of Manchester. Additional parameters to consider will also be how well a system performs against expected production, how the systems within the the city are run, who operates them, and where the produce is sold. The areas which receive the highest light levels would be the best sites for further analysis when testing the above. Beyond this, areas which receive less light can also be sought, in order to test a systems ability to perform in less than perfect conditions.

Prioritisation of implementation

The research collected to date on the operational elevated aquaponic system in Manchester, along side the facade farm prototype, shows that horizontal systems are easier to implement and to maintain. Although the ability of double skinned facades to grow crops is apparent, their integration is more disruptive and far more complex. At the outset of integrating urban agricultural systems, the route of least resistance should first be taken in order to reduce expenditure, gain support and increase revenue streams. Therefore, roof space should be considered primarily as sites on which food can be grown with facade integration occurring at a later date. Initially, this might manifest itself as a succession of simple greenhouses or polytunnels upon roof tops (as per the polytunnel used in the elevated urban farm) to kick start urban food production, which future urban systems can build from and improve upon; most importantly flowing into newly created supply chains. The majority of north facing facades should only be considered for vertical systems in the event that all other growing opportunities have been explored.

Interface with food networks

The final factor considered within this study is the ability to sell food once it has been harvested from urban agricultural systems. Demand for the food grown is a key requirement for the successful integration of urban agriculture. Without demand for food there would be no sale of crops, and therefore no economic model. Growing food where it is needed - i.e. where it can be easily sold - will increase the ability of these technical food systems to sell crops closer to the rate of production, removing the possibility of surplus produce and ensuring a resilient economic model. The ability to sell food locally will also have the biggest impact on food transport, as changing from food miles to food steps will drastically reduce the distance food travels. The adjacency of food production and

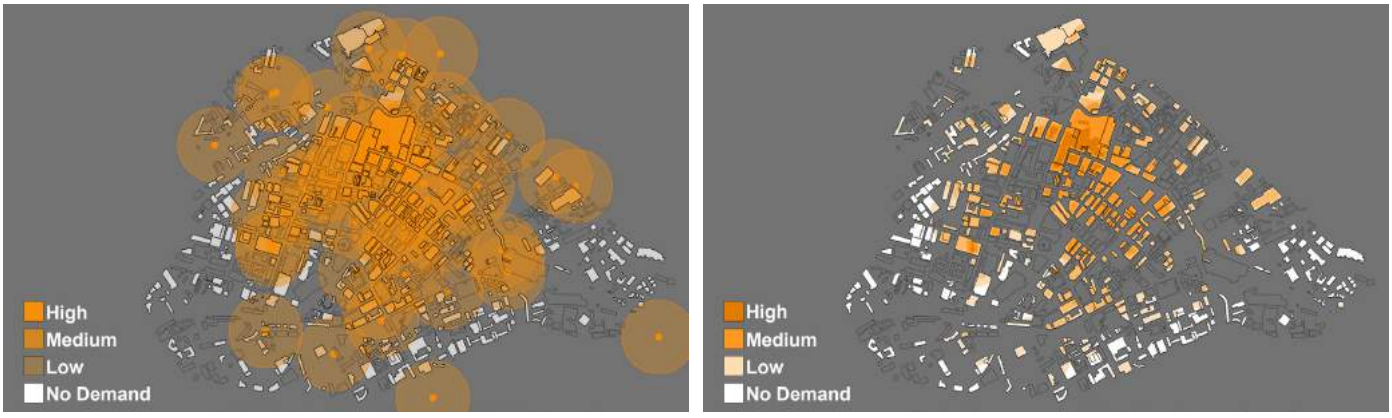

Figure 8: Location of 54 supermarkets including a 250m catchment area (left) and gradient map of demand (right)

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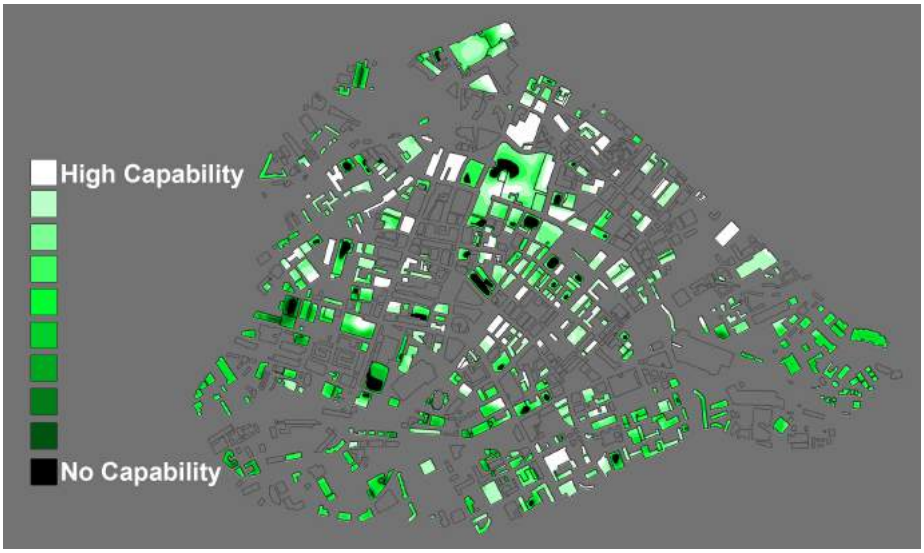

Figure 9: Roof top framework of integration based on light capture and demand.

food sale will allow the continuous trade of freshly harvested organic fruit and veg, with higher nutrient content, and little need for packaging or refrigeration. As a consequence, CO2 production would decrease and urban diets would improve.

In total, there are 54 supermarkets in Manchester and, based on a 250m catchment area, the demand for available roof space would initially be 74 percent (Fig. 8). As a result of this, food would never travel further than 250m to its point of sale. The resulting gradient map based on these locations identifies the places that are in highest demand and where food might be initially grown (Fig. 8).

Framework of integration into the city

The framework of integration proposed within this research focuses on the availability of light and the findings discussed within the paper integrated with existing food networks and points of sale. (Fig. 9). This map is the culmination of the research as it identifies areas from most to least desirable for urban agricultural activities. This information shows both the areas of high light capture and high food demand in white, and the areas of low light capture and low food demand in dark green. The black areas are the areas identified previously as not being able to support plant life (i.e. having an average daily light capture throughout the year of less than 0.90 kW/m2/day) . The resulting information represents simply that the white areas be developed first, working through to the dark green areas as the role of food production within the city takes on a larger and more integrated role. This map is the resulting framework of integration and will hopefully lead to a city no longer comprised solely of manmade surfaces, but a city integrated with a natural metabolism, intrinsic to its future prosperity.

Conclusions and Future Considerations

The findings of this paper show that cities are capable of producing large quantities of food and wealth but currently only includes for such crops as iceberg lettuce, rocket lettuce, Thai basil and cabbages - as per the crops grown in the elevated aquaponic system - but it is the future ambition of the research to develop the light study to include energy data of other crops and propose a city wide production map as to which crops are best suited to which light energy levels.

Taking the total surface area of Manchester into account - including roads, paths etc. - 33 percent is capable of growing food. Within the UK, 11 percent of the country has been developed. Applying the findings of Manchester, where the growing area was 1.5 times that of its footprint, it can be assumed for the purposes of this research, that 16.5 percent of the total land area of the UK could grow additional food.

As a model, urban agriculture is capable of producing vast amounts of food and wealth, but cannot solve the issues of globalised food production and transport alone. Instead, it sits amongst a range of options that need to be implemented in order to reduce the impact humans have on the natural landscape, and is a part of a series

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Figure 10: The use of three-dimensional shadow data to inform real-world urban food production

of interventions that include a reduction in meat consumption, the adoption of clean renewable energy, the reduction of waste streams and the integration of closed loop urbanism, to name a few.

One thing is clear however, urban agriculture can be integrated within today's cities and produce vast quantities of food without the need for purpose built food producing sky scrapers that are dependent on artificial lighting to grow crops. Instead, the retrofitting of simplified food producing facades and roof-based systems based on virtual lighting data can make a real difference (Fig. 10). Urban agriculture is the start of a city revolution that connects the urban with the natural, improving the physical environments of cities forever and improving the wellbeing of its inhabitants for years to come.

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Conflict of Interests

The authors hereby declare that there is no conflict of interests.

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Extracting Urban Food Potential: design-based methods for digital and bodily cartography

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critical cartography, spatial agency, bodily engagement, design-based methods, artistic research, urban agriculture

Abstract

Sweden's recent report on Urban Sustainable Development calls out a missing link between the urban design process and citizens. This paper investigates if engaging citizens as design agents by providing a platform for alternate participation can bridge this gap, through the transfer of spatial agency and new modes of critical cartography. To assess whether this is the case, the approaches are applied to Stockholm's urban agriculture movement in a staged intervention. The aim of the intervention was to engage citizens in locating existing and potential places for growing food and in gathering information from these sites to inform design in urban agriculture. The design-based methodologies incorporated digital and bodily interfaces for this cartography to take place. The Urban CoMapper, a smartphone digital app, captured real-time perspectives through crowd-sourced mapping. In the bodily cartography, participant's used their bodies to trace the site and reveal their sensorial perceptions. The data gathered from these approaches gave way to a mode of artistic research for exploring urban agriculture, along with inviting artists to be engaged in the dialogues. In sum, results showed that a combination of digital and bodily approaches was necessary for a critical cartography if we want to engage citizens holistically into the urban design process as spatial agents informing urban policy. Such methodologies formed a reflective interrogation and encouraged a new intimacy with nature, in this instance, one that can transform our urban conduct by questioning our eating habits: where we get our food from and how we eat it seasonally.

Introduction

Gröna linjen is a vibrant transdisciplinary urban platform formed to investigate alternate participation for citizens in the urban design process. This paper responds to several knowledge gaps highlighted in Sweden's report on urban sustainable development, and furthermore, on urban food discussions in the Netherlands. One gap in the report calls for more research into the urban design process where the citizen is viewed as a 'co-creator' in designing the city merely through their participation. Another gap links urban agriculture to well-being, and a third beckons for new participatory and dialogue strategies. Furthermore, the discussion on food in the 2012 exhibition Foodprint in the Netherlands calls for a paradigm shift for individuals' conduct when it comes to food, and creative and artistic practices can play a vital role for this change (Stroom den Haag, 2012). The investigations take place in Stockholm, Sweden, where a growing desire to grow food has emerged and a number of productive foodscapes are appearing. A foodscape refers to an urban food environment devoted to food produc-

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tion, distribution and/or consumption, but in the context of this research it refers to urban food production. Urban Agriculture, a term more commonly used, seems too vast as some of these productive foodscapes are small in size, but nevertheless, immense in their community impact. Therefore, in response to the highlighted gaps, can the role of the citizen be strengthened and enacted through new practices in the urban design process? The research investigated methods to transfer spatial agency to the citizen as 'co-creator' and tested new modes for critical cartography. Gröna Linjen staged a safari intervention, an overland green expedition, for locating existing and potential places for growing food by orchestrating encounters with five foodscapes and the community surrounding them. Meanwhile, testing the methodologies for gathering data from these sites, that could be used to inform policy on urban agriculture was also done. The approaches gave way to a mode of artistic research in the study using design-based practices with digital and bodily interfaces for cartography, along with inviting artists to be engaged in the dialogues. The digital interface, the Urban CoMapper app, was a tool for hand-held devices that captured perspectives through crowdsourced mapping in real-time.[1] The bodily interface used the participant's body to gather data from these green spaces, as an individual and in a group, via their sensorial perceptions of tracing the sites with their bodies. The methods encouraged an intimacy with nature and formed a reflective interrogation of our eating habits: where we get our food from and how we eat it seasonally. The challenge remains whether assigning spatial agency, via innovative methods for critical cartography, can develop an urban design approach that integrates citizens as agents and informs policy for urban agriculture.

Swedish Research in Sustainable Urban Development

To begin with, the motivation for these projects has been the 2011 Formas Report on Urban Sustainable Development, which identified several knowledge gaps in the relationship between citizen and city. The report maintains that 'there is an unquestionable link between built environment and living conditions. Therefore the urban space tends to be understood as something external by which people are affected, while it is forgotten that man, by acting in and appropriating the built environment, is also its co-creator'. In essence, 'the place is created by the people using it in a reciprocal interplay with the place itself' (Swedish Research Council Formas, 2011: 36). This changes our view of experts as being the only ones creating the urban environment, and includes citizens as design agents in the urban design process. More research is needed into this 'co-creating' role and how citizens' effect could shape the urban environment towards sustainable means. This paper responds by examining methods for spatial agency and critical cartography as templates for further enforcing this role.

The Formas report (2011) goes further to highlight a gap in urban agriculture: 'another neglected research field concerns the link between people's wellbeing and urban growing, which is a big topic internationally but not in Sweden.' The aim of the research also accentuates this food-related lifestyle of urban farming and its influence on strengthening citizens' relationship to nature in the city through the act of growing food. The gaps mentioned above are interlinked and it can be assumed that citizens, as creators of productive foodscapes, become designers of the urban landscape. In sum: a transfer and democratization of spatial agency. But how do we incorporate these design concepts? The report identifies a need for 'new forms of user participation and civic dialogue at early stages' of the urban design process using alternate methodologies (Swedish Research Council Formas, 2011, 61). Further dialogue into urban agriculture is needed, and how to include it in the city. The approaches outlined in the paper specifically answer this call with the Gröna Linjen intervention which explores unique methodologies in critical cartography: the digital and bodily to allow both citizen and expert to seek alternative ways to record their contexts, perceptions, and how they engage with green spaces. Therefore, allocating a bridge for the exchange of ideas, information and dialogue towards a practice of 'co-creation' is important.

Spatial Agency in Foodscapes

Actively engaging citizens as design agents in the urban design process by providing a platform for alternate participation provided the base for a transmission of spatial agency. The citizen as 'co-creator'

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becomes a spatial agent, which necessitates an alternative way of looking at how buildings and cities might be produced, through citizen rather than only expert involvement. The Gröna Linjen platform, created in January 2014 by 6 enthusiasts including the author of this paper, intended to identify Stockholm's gardening community and offer new forms of participation.[2] The network's title also has a recognizable geographic configuration as it is named after Stockholm's green subway line #17, coincidently also the route where most urban farming initiatives are currently taking place in the city (Figure 1). The group is a vibrant transdisciplinary alliance between artists, architects, gardeners, performers, researchers, geographers, cooks and more, who highlight the barriers and opportunities of urban agriculture provided by linking art, science, practice and research. The network gave opportunity to explore spatial agency as a citywide concept, tied together by the concept of growing food.

'Spatial agency is about a different understanding of the production and dissemination of knowledge. This entails opening it up to the architecture's outside, through acknowledging the contribution of non-experts and through disseminating it in an accessible manner' (Awan, Schneider, & Till, 2011, 63). The task of designing an urban space is handed over to citizens who wish to participate in the design development, cultivation and implementation of these foodscape sites. They are now agents for the space, which gives way to an alternate and

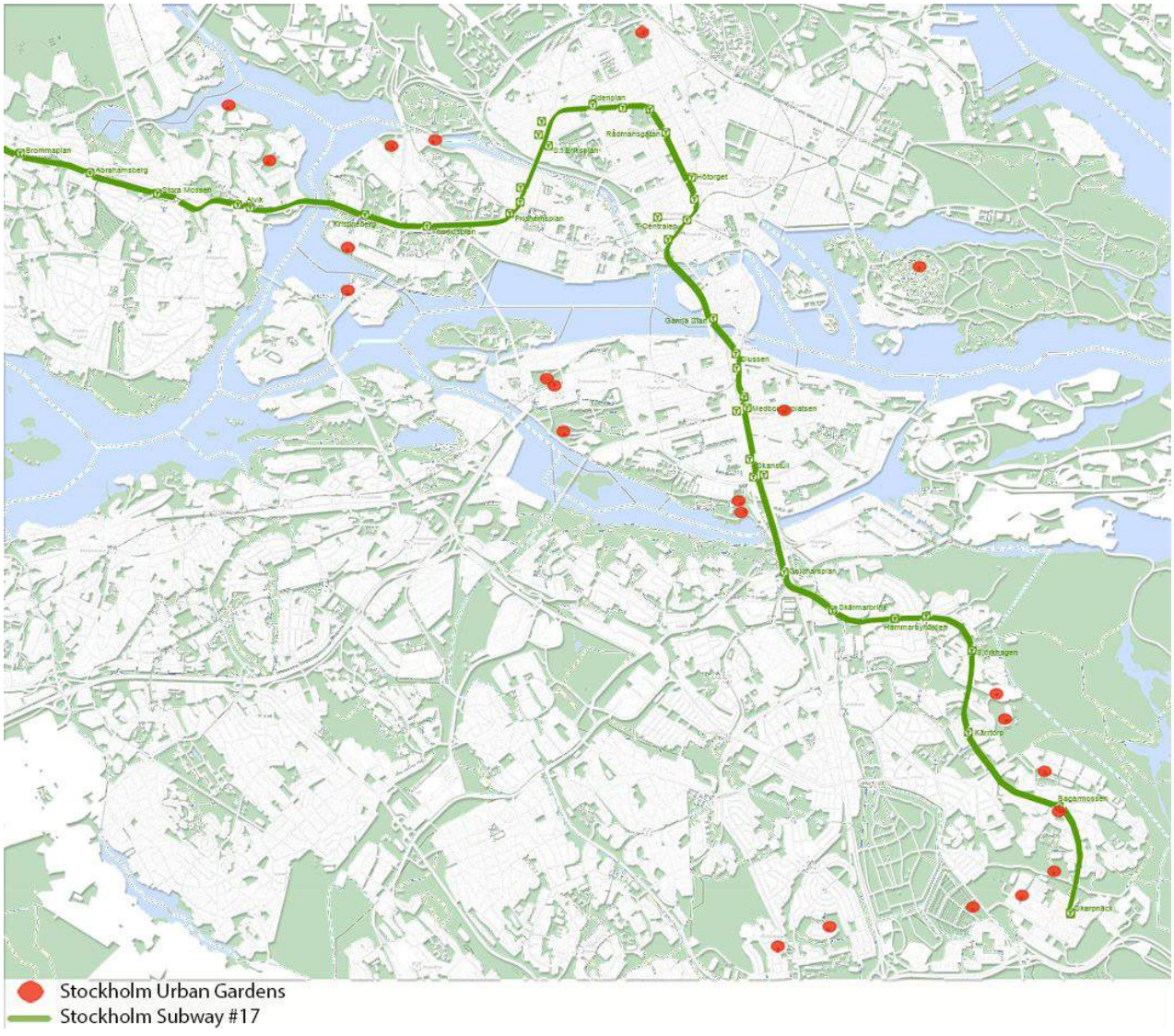

Figure 1: Map of existing gardens in Stockholm.
Data Credit: Initial data courtesy of Stadsodling Stockholm 2014
Graphics credit: Anna Maria Orru 2014

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more activated mode of participation and creation. tion.

"In spatial agency, their agency is effected both through actions and visions, but also through the resulting spatial solutions; and spatial agents have to be responsible for all aspects of their actions, from their initial relationship with others to enabling the production of physical relations and social structures. Spatial agency is here as much about modes of behaviour as it is about modes of making" (Awan et al., 2011, 32). Simultaneously, such modes of collective visioning can increase green areas in the city and promote biodiversity especially in underutilized urban spaces, for example, unused grass patches between housing complexes. In such areas, local involvement is a vital ingredient in the maintenance and setup of a productive foodscape as it requires vigilant care to keep them running, thus strengthening the bond between caretaker and their garden. The vulnerable nature of such food-productive spaces requires this spatial connection to have agency, as the ongoing-costs are usually not included in urban landscaping budgets. In conversation with a Stockholm planner, she mentioned that the main opposition towards community food gardens is maintenance, who takes care of them or their associated costs, is fundamental to their existence. Therefore, having citizens seize agency and accountability of their foodscape spaces gives them responsibility to maintain them, especially if they are in close proximity of their homes. It also gives them the opportunity to be more engaged in urban discussion, as they become keepers and voices for their foodscape by way of their experiences. The eco-urban network called Ecobox, is an example of establishing opportunity for spatial agency to occur in a neighbourhood, set up by Atelier d'Architecture Autogeérée (aaa) in 2001 (Atelier d'Architecture Autogeérée, 2009). The network started a series of food-productive gardens in the La Chapelle area of northern Paris, and is a successful example of setting up spatial agency that created a platform for social participation, collaboration, engagement and action. The project included mobile raised beds, constructed from recycled materials, giving the possibility for food cultivation, production and consumption. However, it also gave the potential for urban dialogues to form around local activities and discussions. The project, though started and curated by Atelier d'Architecture Autogeérée, was fully operated by local residents who also took the primary role in advocating a new site when the garden was evicted from its original location. Likewise, the Gröna Linjen network is aimed to explore spatial agency within urban agriculture movement on a city-wide urban level, rather than only a neighbourhood. Its' intentions were manifold and responded to what was needed for the Stockholm context: to start up urban discussions on the challenges of growing food in the Nordic city, to weave together the different urban farming initiatives along the #17 route, and to provide them with 'a place on the map' and within the urban fabric. Furthermore, the platform also allotted artists the opportunity to be engaged in the gardening movement, and in discussions about sustainability within the context of food. All intentions gave the possibility to inform policy where experts and citizens gathered for discussion in demonstration sites.

Hence, there is particular weight given to production of a community around this activity, and how individuals come together around gardening that is directly linked to their agency. The question remains, where should these productive foodscapes be located in order to craft this close tie and psychophysical relationship to the farmed site? Both site and interested groups need to be clearly identified for a relationship to be nurtured and to ascertain their potential impact – politically, socially and ecologically.

Critical Cartography through Community Mapping

This paper investigates new modes of critical cartography for locating and allocating foodscapes and their agents. Critical cartography is a contemporary approach incorporating both theoretical and practical underpinnings for the mapping of 'new societies'. Here, the theoretical parameter questions the social relevance of mapping: its knowledge, ethics and power relations. The practical aspect is associated with new mapping capabilities, including development of open-sourced and pervasive tools (Crampton, 2006).

Within this research context, this relevance is further extended to include an inquiry into the anatomy of urban agriculture. Urban food production is not a

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new phenomenon in Swedish urban contexts with its long-standing tradition of private allotment gardens called koloniområden. There are however not enough allotments to meet the current demand in Stockholm, coupled with long waiting lists, up to 15 years in some cases, for citizens wishing to have a space in the centre for growing food. Hence, the design challenge will be to find and create communal spaces that meet the desires of people who want to grow in them. Opportunities surface in underutilized urban plots, at the same time, producing potential for different forms of integration and participation.

Community mapping is a method within the practice of critical cartography, which could identify suitable sites, simultaneously reinforcing the project's ambition for a transfer of spatial agency. Between 1978-1986, the Calcutta organization Unnayan prepared maps to detail and locate informal settlements that did not exist in official and commercial city maps. The maps rendered the communities visible, whereas official maps labelled them as 'vacant land', illustrating how cartography can be used to gain basic rights for dwellers to 'have a place on the map' (Mogel & Bhogat, 2007). Similar to revealing communities, maps can also render invisible practices, such as urban agriculture, visible within the urban fabric. Chris Perkins defines community mapping as local mapping, produced collaboratively, by local people and often incorporating alternative local knowledge. Such democratized mapping offers new possibilities for articulating social, economic, political or aesthetic claims. He further states that 'expertise in participatory techniques is shared at the grassroots level, and that wider social influences are fundamental for all community mappers' (Perkins, 2007: 136). Critical geographer Brenda Parker (2006) states that community mapping is often centred on the allocation of local resources, or at least the judicious reallocation of resources (Parker, 2006: 470). She argues that these mapping processes serve as an empowering process, where local capacity is built-upon with the emergence of a particular 'community' around a mapping activity. Parker (2006) considers community mapping to employ three themes: inclusion, transparency, and empowerment. For inclusion, she suggests two dimensions: the involvement of populations formerly excluded from mapping, and diverse involvement within local communities (Parker, 2006: 472). She affirms Denis Wood's reference for transparency which 'considers the lucidity of the goals, context and authorship of community maps.' She turns to Christina Drew who sees transparency as being 'associated with many concepts - including clarity, accessibility, accountability, and openness' (as cited in Parker, 2006: 472). Parker refers to Maeve Frances Lydon who states that 'Community Mapping is not mapping for or of a community, it is mapping by the community of their values, assets, and visions for the future' (as cited in Parker, 2006: 477). Furthermore, in terms of empowerment, Parker offers one viewpoint from varying sources, Freidmann, Elwood and Kyem, on the topic that describes empowerment as 'building capacities or human capital for collective action, in which communities acquire skills, politicised consciousness, or knowledge that informs or inspires collective action' (as cited in Parker, 2006: 477). All three mechanisms allow community maps to provide a medium for interaction, consciousness-raising, and conceivable action. By mapping their land, communities reclaim the territory for themselves, figuratively and literally (Parker, 2006: 479). As a result, they are better equipped to make decisions about allocation of resources, such as redefining green areas in cities to be allotted for growing food. She concludes her study on critical cartography and community mapping by stating that: 'what seems most crucial then is that scholars and practitioners draw on multiple methodological and theoretical approaches to critically evaluate community-mapping projects in a sustained manner. This effort can help sort hyperbole from politically and socially embedded "realities" of mapping agendas, and can contribute to the production of a more robust and reflexive cartographic counterculture' (Parker, 2006, 482). This statement serves as a springboard for the cartographical modes used in the Gröna Linjen intervention, where diverse methodologies endeavour to engage the community around growing food and to provide space for these green encounters. These alternative cartography practices enable new forms of urban green space to emerge, and a transfer in spatial agency to occur for a co-creative urban planning. The digital cartography tool Urban CoMapper, with the thematic of urban green potential, was designed to reveal places of and for urban food production. The tool provided participants the opportunity to map a green Stockholm through the lens that he/she would

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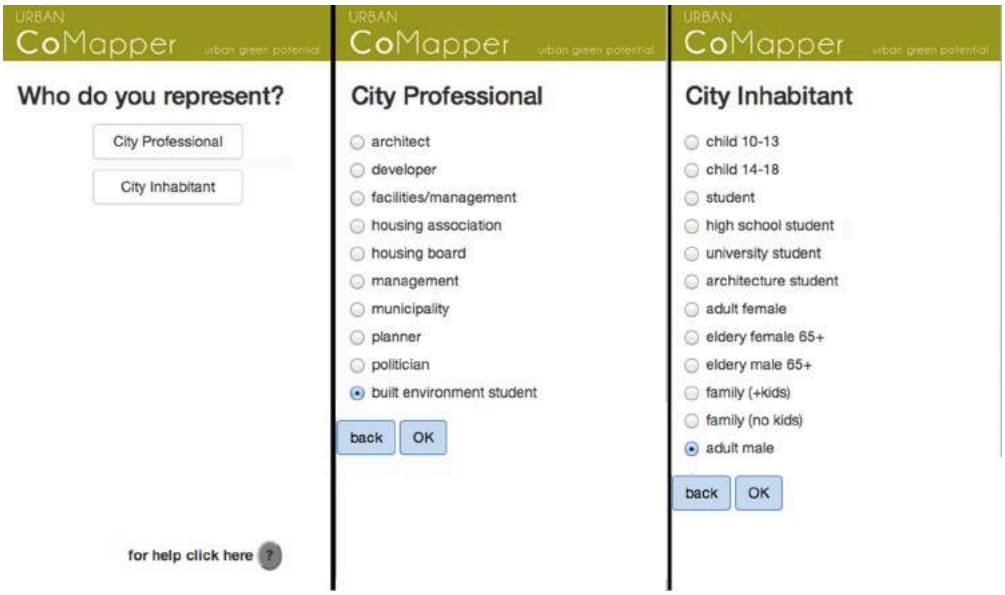

Figure 2: Urban CoMapper Interface (3 screen shots) - The survey offers city inhabitant and professional registration.
Source: Urban CoMapper 2014

like urban agriculture to be understood (Figure 2).

Citizens involved in the allocation of these green spaces take pride in being included in the dialogue concerning the allocation of green spaces in the urban fabric. In critical cartography, 'social movements employ spatial and cartographic knowledge in order to analyse and transform existing spaces and prefigure alternative ones' (Herb, Häkli, Corson, Mellow, Cobarrubias, & Casas-Cortes, 2009: 339). Their daily experiences and contact with the sites generate knowledge that could be used in the planning of urban agriculture.

Digital and Bodily Cartography – An Introduction:

The proposed strategies explore new methods for locating and allocating foodscapes. Both cartographical approaches provided for data collection, however it is the methodology and not the data that is the focal point in these investigations. Each method was diverse in its approach and documentation. The digital cartography, a smartphone app called Urban CoMapper, was used for a tacit reflection and tracing of the sites to input data in real-time from the site (Figure 3). In the bodily cartography, the participant's body was used as an interface and became an active tool for reflection. This bodily experience provided a tracing of the

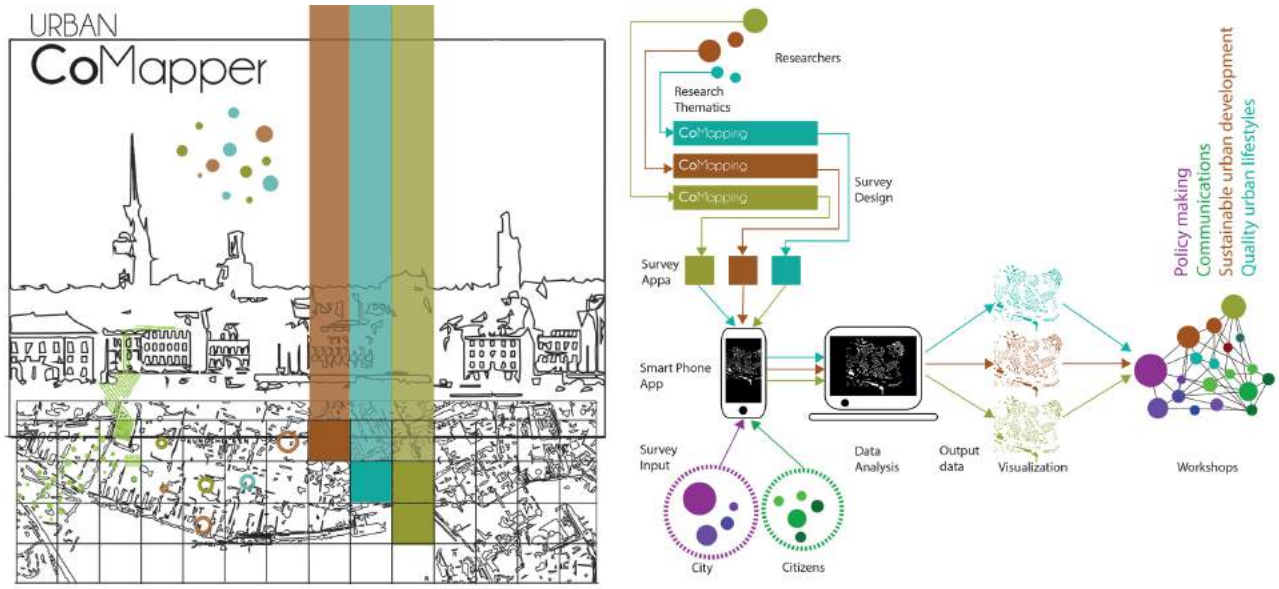

Figure 3: Urban CoMapper diagram showcasing the framework for data gathering and communication
Graphics Credit: Hye Kyung Lim & Anna Maria Orru 2014

ISSN-Internet 2197-411x OLCL 862804632

foodscape sites on the ground, via a bike and foot tour, with the stomach and mouth for further sensorial examination of the grown data – the produce. The intervention was a bike-riding tour safari through the city along a set agenda of garden visits (Figure 4). In the tradition of a safari, participants were invited to an overland green expedition through five Stockholm's sites and met the various communities involved in the growing (Figure 5a). The intention was to have them meet gardeners, but in the process of organizing the event, it also became apparent that the gardeners did not know each other. In preparation for the safari, participants were given a small 'survival guide' booklet for their journey which outlined the timetable, route and involved persons (Figure 5b).

Digital Research Cartography - Urban CoMapper:

The digital interface, Urban CoMapper (UCM), created a web-based setting for allocating and mapping urban agriculture which could be used in the urban design process. In report for the World Future Council, authors stated, 'In order to set up an urban agriculture programme, we need a framework of policies' (Girardet & Bree, 2009: 14). Today, many cities worldwide have instigated food councils to contemplate urban agriculture, but it is still unclear how to implement food as a seamless building block for the making of green spaces in cities. For instance, the city of Stockholm has indicated a vision for urban agriculture as part of their Green Walkable City report from observing engaged and involved citizens who currently, through their own initiative, have started gardening in Stockholm responding to a lack of available private allotments and long waiting lists for such spaces (Stockholm Stad Stadsbyggnads Kontoret, 2013). But Stockholm has yet to draw up policy for the effective inclusion of urban agriculture, or a technique for collecting data on existing and potential sites. Currently, a citizen-initiated map-blog called Stadsodling Stockholm/ City-farming Stockholm, provides a map of existing farming initiatives with data collected spontaneously through word of mouth or yearly harvesting/

Figure 4: Gröna Linjen Safari, 15 June 2014
Photo credit: for © images Ulrika Flodin Furås, other: Anna Maria Orru 2014

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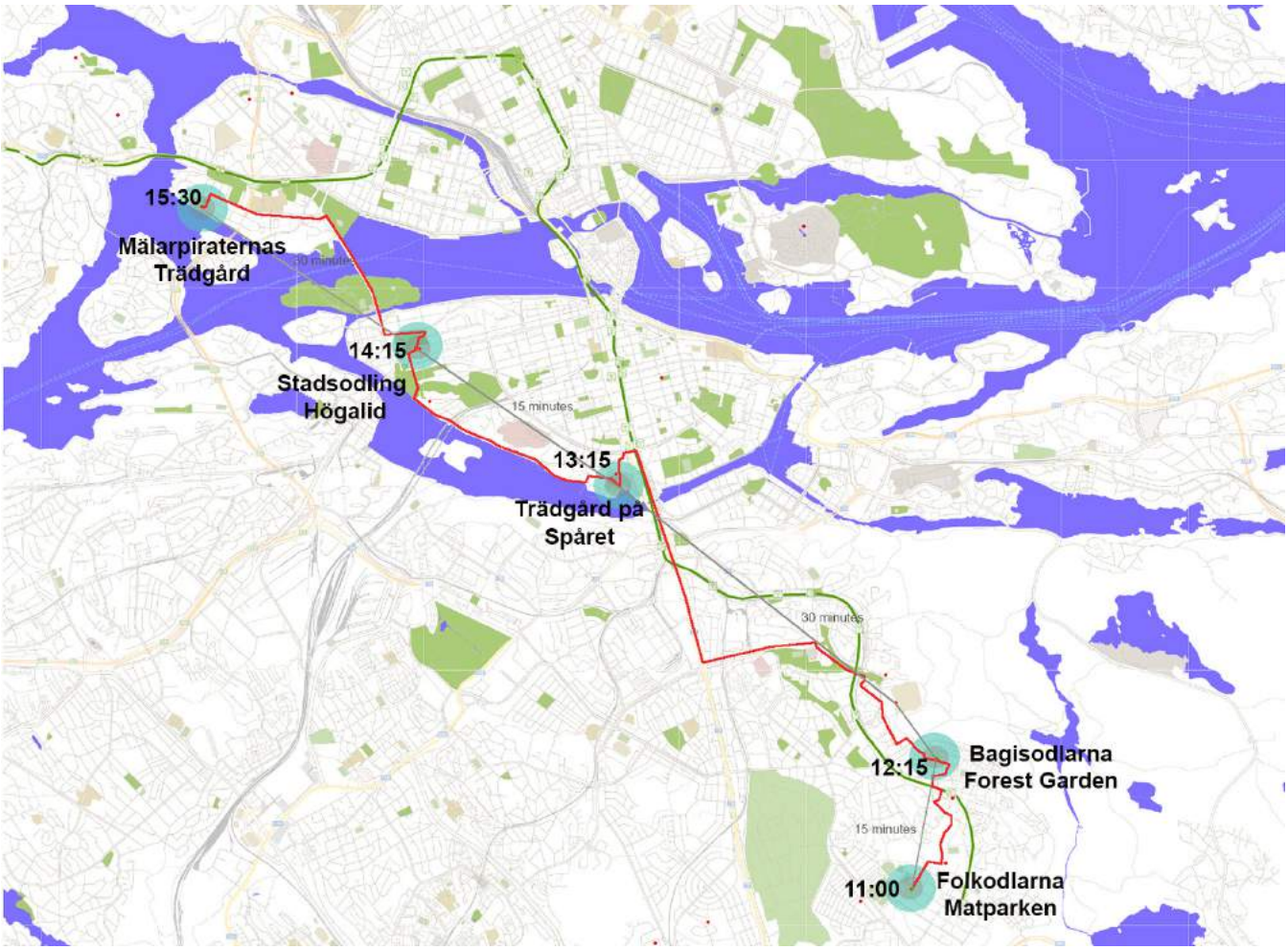

Figure 5a: Gröna Linjen Safari map: A day agenda for 5 sites
Graphics Credit: Anna Maria Orru, David Relan 2014

Figure 5b: Gröna Linjen Safari survival guide booklet
Photo Credit: (first left image) Ulrika Flodin Furås, other: Anna Maria Orru 2014

gardening events (Stadsodling Stockholm, 2013). However, there is a need for gathering this information in real-time on site by citizens themselves, keeping it regularly updated, and linking it to urban planning by feeding data directly into the design process.

The majority of these gardens are grassroots initiated and spring up where interest is assembled and implemented, which is difficult to keep track of. Therefore, how can the support be implemented and available land be allotted? The intention of the UCM tool is to connect communities to a site that is being farmed or could be cultivated, based on collected crowd-sourced data. The aim is also to connect the gardening communities to each oth-

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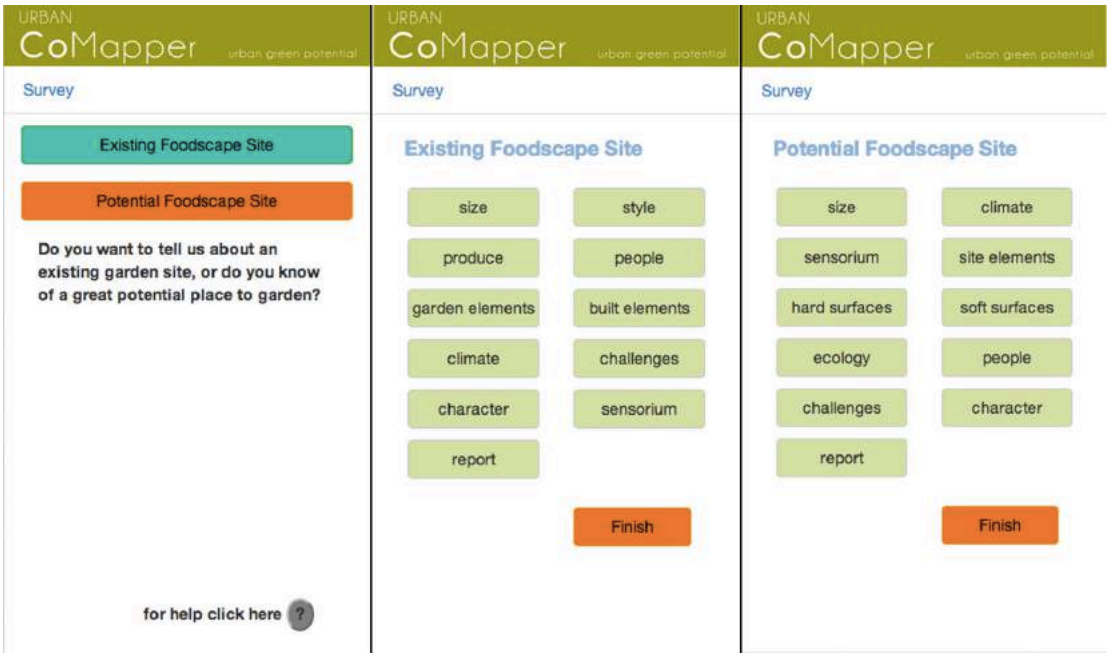

Figure 6: Urban CoMapper Interface (3 screen shots) - Survey categories for locating existing and potential sites for urban agriculture
Source: Urban CoMapper 2014

er, through the emergence of a real-time database identifying these areas and creating dialogue between citizens and planners. The tool explores the collection of data for locating both existing and potential sites. It locates the user and asks them to report their perceptions according to several interlinking factors (Figure 6). These factors include:

- Size – site size (existing sites) and location options (potential garden)
- Style – existing design, site and built elements, its sensorial description
- Site conditions - hard and soft landscaping, surface and site elements such as zoning areas and traffic conditions (potential garden)
- Produce/ecology – existing green infrastructure
- Climatic conditions pertaining to sun, wind, and seasonal perception

The aim with this range of data is to create a holistic mapping of urban agriculture that can provide adequate input into the urban design process. The collection of data via smartphone momentarily pulled participants away from the 'safari group' into their digital task, creating a reflective space to enquire the site intricately. The UCM tool becomes an interface between the users experience and their perception, along with setting up a link to urban design experts. Martijn de Waal (2014) sees urban media devices as an interface to the city, especially into the making of new urban public spheres and specialized communities. It's the stage or platform where city dwellers show who they are (make their way of life public) and, as a result, become acquainted with other people's ways of life and compare themselves with them. City dwellers can recognize like-minded people and, together with others, be absorbed into new collectives (new publics) or distinguish themselves from other city dwellers (De Waal 2014: 14). Furthermore, the UCM tool becomes a 'territory device', explained by de Waal as 'an appliance or system that can influence the experience of an urban area' (De Waal, 2014: 19). This is a vital association into agriculture that establishes alternative forms and scales of the green landscape that are not mainstream urban lifestyles. This research explores whether this alternative and effective approach to identifying, greening and engaging with the city, can perhaps transform our urban behaviour around food. The challenge is whether this short exposure to gardening sites is transmissible and can arouse non-gardening individuals living close to a site, to become interested in 'growing communally'. UCM tracks such occurrences of contact, locates them, and hopes to increase the possibility for more to emerge.

In sum, the UCM tool by no means claims to have worked out themes highlighted by geographer Brenda Parker because of project limitations, such as finance, time and media design. There was also a problem of the smartphone app to reach a wide

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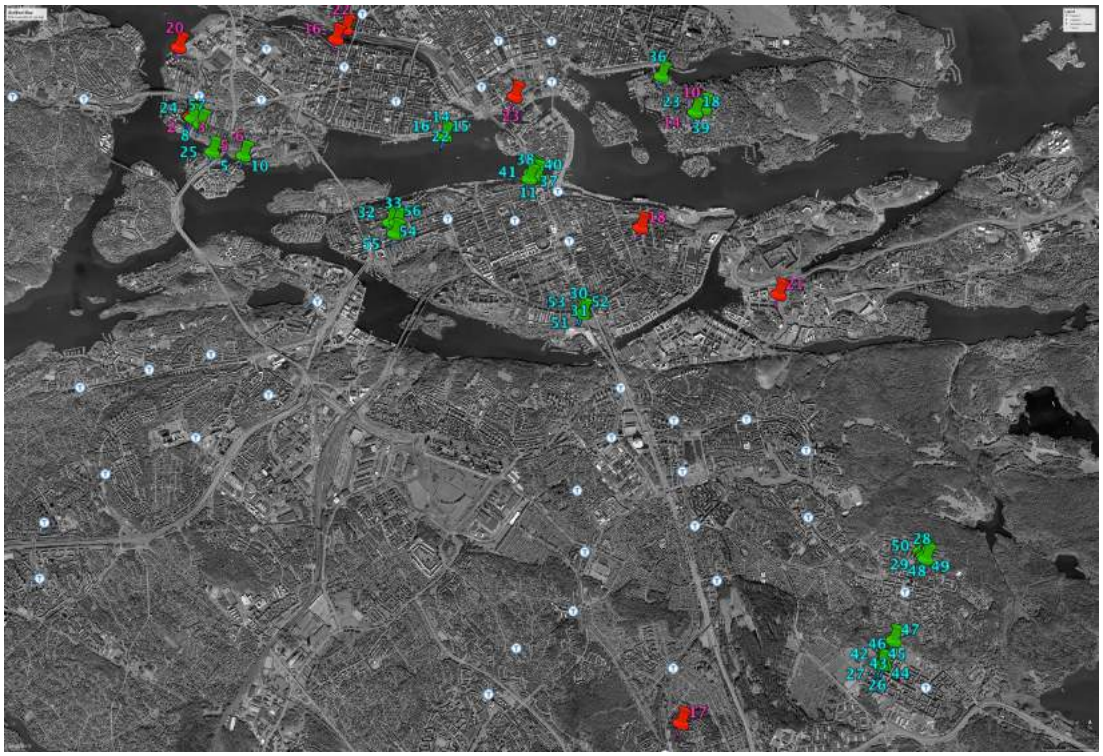

Figure 7: Urban CoMapper - Preliminary visualized map after Safari. (Red pins = Potential gardens. Green pins = Existing gardens)
Image Credit: courtesy of Google Earth Maps 2014

enough audience. However, the app managed to instigate a platform of research that highlighted sites, engaged citizens and experts in dialogue, and connected existing gardening communities (Figure 7). Continued design efforts are needed for such urban agriculture digital platforms, as are staged events like the safari, in order to promote and remedy issues associated with such tools. Here a prototype has been executed which could be used to go further into discourse with municipalities, who could develop such tools further, making them seamless and more useful to urban planning.

Bodily Research Cartography:

The bodily cartography experience allowed participants further reflection based on their bodily contact with the sites, something that could not be achieved only through the digital device. The UCM provided an opportunity to capture the perceived experience of the site but could not provide for tracking the sensorial aspects that are integral to fostering a deeper relationship with urban gardening - a bodily act in itself. The bodily tracing of the site gave opportunity to activate the bodily senses, and provided a 'lived experience' rather than only a perceived one. Its aim was to become a sensuous immersion and encounter, but how was the bodily cartography staged? The safari activated the body in a number of ways: the cycle ride from garden to garden, the tour on foot in each garden, the act of planting a seed and seeing others that have grown, and the simple act of tasting something from the garden and eating food amongst growing produce. All these experiences viewed the body as a catalyst for a food-related awareness because of its direct connection to an embodied experience. Notwithstanding that, creating an awareness of sustainable urban eating through growing, touching and eating becomes a playful act, one in which citizens are more likely to participate.

Traversing a landscape using your body, such as walking or biking is a known and used concept in the artistic world. Artist Hamish Fulton utilizes walking as a medium to explore many different areas around the world documenting it in various formats. He describes his work as 'What I build is an experience, not a sculpture' (McKibben, Tufnell, Scott, & Wilson, 2002, 16), and believes that walking, unlike objects, has a spiritual dimension to it that cannot compete with an experience (Vettese, Hapkemeyer, & Messner, 2005). Fulton's art is connected to the environment in some manner, encouraging us to gently revisit our personal relationships with it. He may

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place his walk at a juxtaposition of seasons in order to experience them, observing the interconnectedness between the wilderness and at times the urban environment (Fulton, 1999). Another example, where walking is used as a device and research, is by architect Francesco Careri. He refers to this as 'an instrument of phenomenological knowledge and symbolic interpretation of the territory, as a form of a psychogeographical reading of it' (Careri, 2009: 11). Using bodily experiences to understand a site is synonymous to how performance studies looks into different ways that a body can be sourced for comprehending an emotion. The term psychophysical blurs the border between mind and space, where the body in a particular physical space can be used for creating awareness, in this instance, a body in a space that grows food can create an awareness of our food-related behaviour. This extends to a lived understanding of food in different seasons. Nordic winters pause food gardening, and thus an experienced physical understanding transpires of what is available to eat through the lack of it, or non-act of it. The body in essence becomes a political body with knowledge to give. This does not assume a Cartesian approach to the subject, where the body is transformed only into an object of knowledge, because the body is also a lived experience or entity. Here, the research is underpinned by phenomenology, developed by Maurice Merleau-Ponty, who described this sensorial based experience of the world. He stated that 'sense experience is that vital communication with the world, which makes it present as a familiar setting in our life. It is to it that the perceived object and the perceiving subject owe their thickness. It is the intentional tissue which the effort to know will try to take part' (Merleau-Ponty, 1962: 61). Likewise, Constance Classen (2010) argues that, 'A full bodied experience of the world requires all the senses. If we are to counter the domination of sight in contemporary culture, Classen suggests paying attention to touch. By cultivating tactile values of intimacy, interaction, and integration - values that promote engagement with our physical and social worlds - we can more effectively sustain both our cities and ourselves'(Classen, 2010: 69). Both Classen and Merleau-Ponty support the association between the sensorial bodily experience and psychophysical awareness. Performer Ladron de Guevara clarifies this 'lived body' to senses connection further. He states, 'we experience and make sense of the world through the interplay of a wide range of senses, systems, internal and external stimuli. Merleau-Ponty refers to this dynamic grouping as one's being-in-the-world. Our perception not only filters (and therefore articulates) reality but also, it necessarily implies as active engagement with the world surrounding us' (Ramírez Ladrón de Guevara, 2011: 25). One can argue that it does not only imply, but rather mandates this bodily engagement to take place, 'because our conceptual systems grow out of our bodies, meaning is grounded in and through our bodies' (Lakoff & Johnson, 1999: 6). For it is in this activated role that we develop a relationship with the outside world, and with our ecological values, gesturing us to engage or not and perhaps change our behaviour.

Another difference between the bodily cartography from the digital is that it was an activity done in a group rather than by oneself. Whereas the digital interface made participants input data into a smartphone in an isolated practice of concentration, the bodily experience was conducted with other participants together in a group. 'Sensuous encounters between individuals and environments are produced and structured, not just by their material features, but also by the particular social and cultural contexts in which encounters take place' (Cowan & Steward, 2007: 2). The experience of these spaces was changed when it was done within a group tracing the route. Activating a body by oneself is a reflective and intimate encounter, however activating it within a group dynamic allows for the 'act' to become a peer interaction and critical conversation to take place. What becomes interesting is that through the bodily group experience, versions of spatial agency occur. As Martijn de Waal referred to digital tools as territory devices, where like-minded people recognize and create collectives with each other around an activity, could this collective bodily experience also be seen as form of collective and territory making? In essence, both the bodily and digital exercises could not be conducted by themselves if they are to commit larger questions of sustainable behaviour.

The Role of Artistic Practice in Urban Agriculture

Though both methods of cartography differ in their approach, it could be said that their compli-

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mented combination, along with the Gröna Linjen and safari experience, makes way for new forms of artistic research into cartography. The bodily tracing and experience of urban agriculture lends to strengthening its impact and longevity into mainstream lifestyles. The way to get participants is to guide them on an experience of this kind, introduce them to a growing community, and wrap the experience in a creative playful envelope. In essence, the aim of the Gröna Linjen safari was to overlap sustainable living with garden play, composing sustainability into a pleasurable encounter. To this extent, the research interventions not only intended to take participants on a nomadic excursion but also to 'intersect' food artistically. The safari invited several artists to investigate food through artistic performance and discussion. One artist, Malin Lobell, discussed the politics behind urban growing. Her art piece entitled 'kan växter bli politiska?' (can plants be political?) was exhibited in the Hogalidsparken garden in the Hornstull neighbourhood (Figure 8). In addition, at the Mälarpiraternas Garden, Lobell together with artist Ulrika Jansson moderated a discussion on the role of art in urban gardening (Figure 9) .

Finally, artist Andrea Hvistendahl conducted a glimpse into the bodily interface with her performance 'No Waste Cooking.' Her artistic practice engaged participants to trace their neighbourhoods using their stomachs by bringing up the discussion of wasted food in society. Participants were welcomed to ingest the delicacies from the Mälarpiraternas garden in the neighbourhood Fredhäll and from local supermarkets' that had volunteered their expired produce (Figure 10A and 10B). The body once again took on a reflected internal journey of what nature provides in the city, and how we con-

Figure 8: Artist Malin Lobell's exhibition on the politics of plants
Photo Credits: Ulrika Flodin Furås 2014

Figure 9: Artists Malin Lobell and Ulrika Jansson in discussion
Photo Credits: Anna Maria Orru 2014

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sider this prospect.

All these performances gave yet another dimension of an artistic approach to food-related behaviour in the city. They assembled dialogues into what role artists and creative urban practices play in urban agriculture and its dissemination. In the book following the Foodprint exhibition, Louise Fresco, a Dutch scientist was quoted from her 2005 Cleveringa Lecture, 'food stands at the beginning of all moral awareness. Food implies many dangers: not only health risks, but also challenges to values and ways of life. We need a new paradigm, a coherent set of rules of conduct for individuals, government bodies, businesses, and civil society, so that food can once again become central to a fair and sustainable global society' (Van Roosmalen, 2012: 10). Arno van Roosmalen (2012), director from the art centre stated: 'art can play a role in this process through its capacity to create unprecedented situations, present parallel worlds, and make the invisible visible. In these ways, art can spark individual awareness of ethical, social and political issues and speak to the motivations, convictions, or emotions underlying rules or laws' (2012: 10). It can be said that sustainability needs a more creative approach, combining art with science, in order to make citizens participate and take agency for their cities.

Concluding statements

In summary, this paper responded to several research gaps as highlighted in the Swedish Formas report on urban sustainable development. The proposed strategies offered a platform for alternate participation for engaging citizens into the urban design process with underpinnings from critical cartography and spatial agency. An urban platform called Gröna Linjen was formed to stage an intervention safari through Stockholm's urban foodscapes. Methodologies for digital and bodily cartography were used to locate existing and potential sites for urban agriculture. The digital approach designed a smartphone app for locating and allocating space for urban agriculture through a perceived experience of the site. The bodily approach used the body as a device for recording the sensuous encounter through the lived experience of the site. At the start of the research, it was assumed that the two cartographic modes were in opposition to each other. What came through after the intervention was that both modes complimented one another, and if we are to include citizens in the urban design process, both are needed for a holistic approach. The purposes behind these experiments are clear and motivated: the first was to create new engagement processes into the urban design process, forming new practices for citizens' contribution into urban poli-

Figure 10A: Andrea Hvistendahl performance with ingredients from local supermarkets set to be thrown away.
Photo Credits: Anna Maria Orru 2014

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Figure 10B: Andrea Hvistendahl - 'No Waste Cooking'
Photo credits: Ulrika Flodin Furås 2014

cy and to build a bridge for dialogue with experts. Another was to give alternative opportunities and platforms for citizens to have spatial agency for their green spaces. Finally, it challenged our rapport with the natural urban environment and our food-related behaviour in the city. All these notions bring urban agriculture into the forefront as necessary alternative ways of making urban green spaces because of its ecological, social and political impact. Future research will broaden the use of artistic research into studying food in urban sustainable design. The intervention strengthened the author's intuition to use the body as an interface and cartographical instrument because of the sensuous information it can gather which the digital interface could not. The next set of research experiments will use a form of Japanese dance called Butoh to further intervene with urban agriculture, as its choreography is taught through the act of farming itself. The question remains: what paradigm shifts in urban sustainable design and behaviour could concur from positioning the body in recreating urban space?

[1] Urban CoMapper app was developed during 2014 by PhD candidates, Hye Kyung Lim and Anna Maria Orrù, with two varying research thematics: Urban Green Potential-Foodscapes and Compact Mixed City.

[2] The Gröna Linjen platform was initiated by Christina Schaffer, Ulrika Flodin Furås, Mattias Gustafsson, Ulrika Jansson, Malin Lobell and Anna Maria Orrù.

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Conflict of Interests

The author hereby declares that there is no conflict of interests.

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Reinventing the academic conference: how delegates design productive cities

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Abstract

During the 6th International Sustainable Food Planning Conference, the so-called Design LABs partly replaced the regular parallel sessions. The reason for this change was twofold. On the one hand it aims to break through an endless series of parallel presentations, and on the other hand the LAB's aim was to produce innovative design solutions for increasing the amount of food production in the city. This article describes this experiment to enhance the delivery of urban design concepts, which could substantially produce more food than current models. During the conference each of the parallel sessions half of the time consisted of a design-LAB, in which participants were brought together around a map with the task to design a substantial amount of food productive spaces in the case study site. The results of this experiment were dual: 1. a very committed attitude of delegates to this part of the conference and 2. the design tasks resulted in innovative design results. These results not only emphasise the potential design measures onsite but also pledged for a strong and more intensive connectivity with the city and the landscape around it. This makes it possible to link the supply and use of resources with the typology of the region, hence determining an effective and productive urban agriculture system.

Introduction

Have you ever found yourself yawning in the back of the room during the sixth academic presentation in the fourth parallel session on the third day of the conference, which, when you initially registered, seemed so exciting? Or, have you seen a yawning audience in front of you when you were up for presentation of your paper on day three, session VII-c in a badly lit room with second tier projector? Even if you enjoyed this, it must have occurred to you that half of the room was empty, delegates had left for more interesting sights in the conference city, and no new knowledge has been developed during the conference. This leaves the coffee breaks as the most exciting moments of the conference, when you have time to catch with colleagues and discuss future collaboration and new ideas. Despite organisers doing their best to develop a lively programs it proves to be difficult to go beyond great keynote speakers, good food and an occasional surprise lecture during dinner. In many cases this inevitably implies that the knowledge and expertise of the delegates is underused, if at all, it is hardly made productive nor made available for others. This is especially relevant when the topic of the conference is still 'young', lacks well-defined academic concepts or still searches for additional ideas and explorations to existing paradigms. Urban Agriculture, or sustainable food planning is such a research area. Therefore, the 6th AESOP conference on Sustainable Food Planning (www.findingspaces.nl/aesop6)

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chose an approach, which aimed to generate new knowledge, to give delegates an active role during all parts of the conference and to make use of tactile and creative collaboration-methods. The poster session was linked with the plenary session at the beginning of the program and held in the plenary room, and each of the parallel sessions consisted of a presentation and a design/workshop LAB. The purpose was to exchange expertise and combine this into new knowledge in the field of Urban Agriculture. The ambition was to design new urban concepts for the production of food. The first three sections of this article deal with the problem, the background and the methodology. In section four the design results of the study are presented. In section five the findings about the conference process are presented. In the last two sections the conclusions are drawn and discussed.

Problem

The problems discussed in this article are twofold. First, many academic conferences do often not deliver new outcomes. Sometimes, this wasn't the purpose in the first place, but others explicitly look for new knowledge and interaction. The problem arises in the latter category when these ambitions are not represented in the conference program and methods. The second problem concerns Urban Agriculture itself. Assuming that Urban Agriculture implies the production of agricultural products which takes place within urban boundaries, the question is whether there is enough space to grow food. At the moment, cities cannot accommodate the space to produce substantial amounts of food within its boundaries. Looking at the total consumption of food in the Netherlands, this is approximately 14.6 billion kilos (based on analysis of CBS, 2009; Geurts et al, 2014; Nederlandse Vegetariërs Bond, 2014; Productschap Vee en Vlees and Productschap Pluimvee en Eieren, 2011; Van der Bie et al., 2012; Van Rossum et al., 2011; Van Rossum en Geurts, 2013; Westhoek et al., 2013; *www.goeievraag.nl; http://statline.cbs.nl; www.voedingscentrum.nl*). In order to determine how much is produced inside the city, a range of investigated literature (De Graaf, 2011a; 2011b; De Muynck, 2011; Dijksma, 2013; 2014; Ecovrede, 2012; Expertisegroep Stadslandbouw, 2009; Gemeente Rotterdam, 2012; Gorgelewski, Komisar and Nasr, 2011; Jansma et al., 2011; Kuypers, 2012; Ladner, 2011; Marsden and Morley, 2014; Miazzo and Minkjan, 2012; Philips, 2013; Point to Point Communicatie, 2013; Stedennetwerk Stadslandbouw, 2010; Stutterheim, 2013; Van der Sande, 2012; Van Straten en Koning, 2013; Veen, Breman en Jansma, 2012; Viljoen, 2005; www.groeneruimte.nl) leads to the conclusion that there is very limited knowledge available. Assuming that every municipality in the Netherlands contains an average of one hectare of urban agriculture space within its urban boundaries, combined with numbers about the average productivity of these areas (Madigan, 2009; Viljoen, 2005) 0.002% of the total consumption is produced within the boundaries of the city. Based on this figures, it can be concluded that cities are not well prepared to accommodate the space for food production. There is simply not enough space available, spaces are confined and in many cities the compact city mantra has increased densities over the last decades. Therefore, in order to increase the amount of urban food production more space must be reserved and developed to grow food. This space can be 'new' space, created by realising lower densities with more green spaces in between buildings (which implicitly means the death of the compact city), space created as result of a transformation of existing land use into food growing space, or unsuspected space in the air or underground (Roggema, 2014). Arranging more space for food production in the city also requires an increase of mental space to intensify exploration of productive spaces beyond current accepted uses. This search for additional 'foodspace' defines the design problem: how to design a city concept in which additional spaces are found to accommodate the growth of substantial amounts of food. The city must be reinvented. In the good tradition of the CIAM conferences (such as the fourth CIAM Congress, on the Functional City, Mumford, 2000), the AESOP conference cycle could become the platform to discuss, exchange ideas and develop ideas of a future food-producing city.

Background

a. Conference approach

There are several ways to create more lively and engaging conferences. For instance, Harrison Owen developed the Open Space Technology, when he realised that the coffee breaks at academic conferences allowed for deeper engagement than the monotonous presenting of papers (Owen 1997b).

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Open Space (or 'Open Space Technology') is an interactive method of managing major meetings in business or conferences in science. It is nothing more than a gathering of people of diverse perspectives talking on self-selected topics in self-selecting groups, participants being free to move from group to group as they wish. Open space (Owen 1997a, 1997b), and similar methods, such as the World Café, Work Out, Preferred Future, Search Conferencing, Future Search, or Simu-real (Bunker and Alban 1996; Holman & Devane 1999; Brown and Isaacs 2005) all provide a way to get people/attendees talking. The ethos of Open Space is: 'Open Space begins, and in some ways ends, with the invitation to follow that which has heart and meaning for you' (Owen, 1997b). From this the four basic principles were derived:

- Whoever comes are the right people
- Whatever happens is the only thing that could have
- Whenever it starts is the right time
- When it's over, it's over

Taking this open way of encouraging discussion and interaction a step further, and adding the process of mainly conversational tools with tactile, iterative and creative methods, the design charrette (Condon, 2008; Lennertz and Lutzeniser, 2006; Roggema, 2013; Roggema, Martin, Vos, 2014; Roggema, Vos, Martin, 2014; Roggema and Martin, 2014), defined as a: 'two- or more -day intensive design workshops in which a mixed group of participants work collaboratively towards designing climate adaptation future scenarios' (Clune et al., 2013), offers a way of working in which creativity is encouraged, boundaries between organisations drop and new knowledge and ideas are conceived. The main difference with Open Space methods is that in design charrettes active, constructive and tactile exercises, such as the 30-30 exercise (Roggema, Vos, Martin, 2015), sketching or draw-doodle-draw (Condon, 2006), and 3D-plasticine modelling (Roggema, 2013) play an important role. The combination of free moving and choosing the LAB session by yourself, in combination with the usage of tactile methods, was chosen as the main method during the AESOP-conference to provide the basis for an interactive, creative process, in which new knowledge and ideas can emerge.

b. Urban Agriculture

Urban Agriculture is defined by the International Development Research Centre as: "an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city, or a metropolis, which grows or raises, processes, and distributes a diversity of food and non-food products. It (re)uses on a daily basis human and natural resources, products, and services largely to that urban area" (Mougeot, 2000) and is in practice often represented by rather small, single projects of open, sometimes public, green space, where food is produced (see Gorgelewski, Komisar and Nasr, 2011; Miazzo and Minkjan, 2013; Philips, 2013). However, food can also be seen as a major factor that shapes our cities, determines the functionality of the city and the way the city looks (Steel, 2008). This implies a larger impact of the growth of food on the city than only small, isolated single Urban Agriculture projects, which function without any connectivity with other projects or the rest of the city. A connected, continuous food landscape can shape the urban lay-out (Viljoen, 2005; Viljoen and Bohn, 2014) and food becomes part of an integrated spatial approach of which it is a major element, such as the Detroit example shows (City of Detroit, 2012), or operates as a strategic policy framework for food, such as the Toronto Food Strategy (Knechtel, 2007; Palassio and Wilcox, 2009). If the growth of food in the city is subsequently connected to a healthier diet, in which fish, vegetables and fruit replace meat, potatoes and bread, the required spaces for food-growing in the city can be shaped according the requirements of fish-based systems. The first experiences with building aquaponic systems in Western cities, such as in the Biospheric project in Manchester (Keeffe, 2014; Jenkins, Keeffe and Hall, 2014) and in Brazilian slum areas where 'Foodroofs' have been developed (Roggema, et al., 2014; Adjacent Government, 2014; International Innovation, 2014), teach us that these systems have the qualities to provide food in many different contexts and are capable of closing the cycles of materials, energy, water and nutrients. These techniques are ready to be used at higher scales, even the implementation of large-scale algae production, which are capable of restructuring the large-scale harbour area of Liverpool (Keeffe, 2009; Keeffe, 2014). When the potential of large-scale environmentally friendly fish-based food production and the integration of food in the urban environment are com-

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bined with the desire to produce more food within the urban boundaries than the current estimate of 0,002%, the search for space and the need to reinvent the city is apparent. If we would like to raise the percentage to 2% or even 50%, each municipality in the Netherlands should allocate 1000 hectares, or 25,000 hectares respectively. This enormous task is not realistic without thinking fundamentally different about the city. The question is how urban land use should conceptually look like in order to make a substantial amount of food production possible? What are the densities, can we use space vertically, at which scale can we close cycles? The existing city is the place where these additional spaces need to be developed and where highly productive food can be grown. A city that has reinvented itself implies that existing spatial standards, shapes and regulations no longer work: built-up areas, infrastructure and concrete will lose space to productive spaces.

Figure 1-4 show how, in abstract images, the current city can be transformed into a productive city. In figure 1 the city is represented by building blocks in a certain density. The first step to increase productivity is to lower the density in order to create space to grow food in the spaces that become available, for instance as green boulevards (figure 2, left). Once the density is decreased, some of the existing build-up land-use can be transformed into productive green land-use (figure 2, right). The third option is to find spaces that are defined as 'impossible places' for food production so far: in the air (including multiple layers of rooftops) and in multiple layers underground (figure 3). When all these options are brought together at the urban level, a novel model for a productive city emerges, in which substantial more spaces are available to becoming productive.

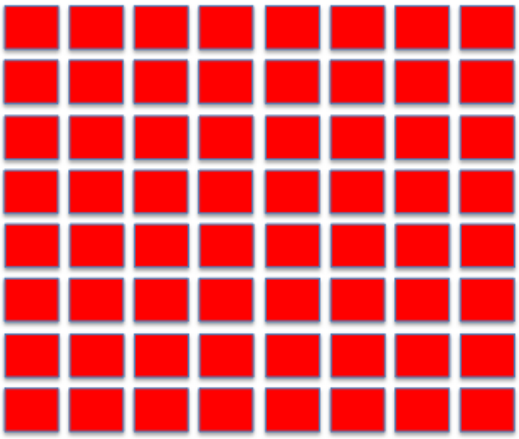

Figure 1: Basic urban grid with build-up spaces in red, and infrastructure as space in between

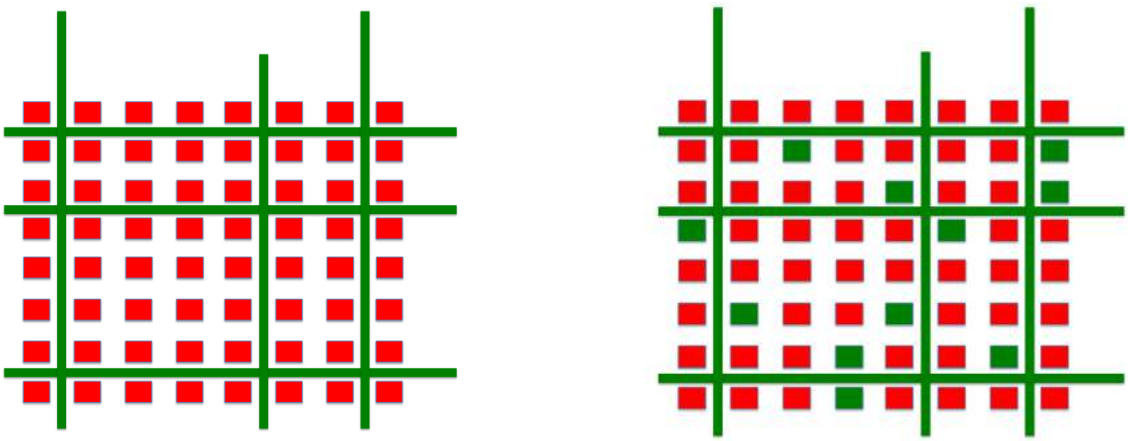

Figure 2: Transforming roads into green laneways (left) and transforming buildings into green public spaces (right)

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Figure 3: Using spaces underneath buildings for green production (left) and using multiple layers of rooftop gardens for green production (right)

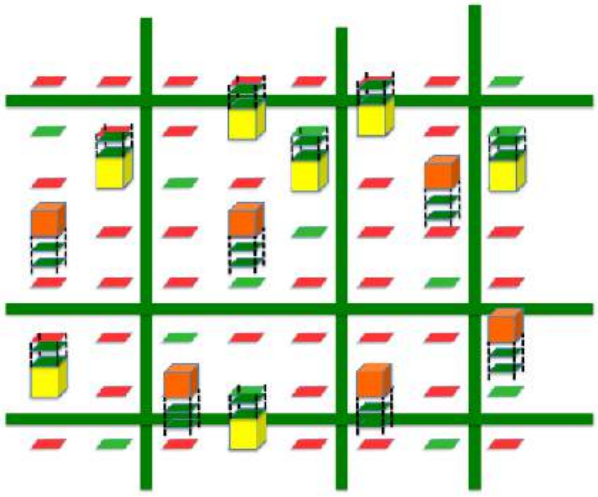

Figure 4: Integrated model of a city in which streets, building sites, sand spaces underneath and on top of buildings are transformed into productive Urban Agriculture spaces

The transition to new city concepts is not only made from a food-perspective, but also from a geo-political one. Europe, opposed and distinctive from China and other new economies, should, according to Holslag (2014a, b, c), re-create its urban form and strengthen its traditional core values. Such a revisited new city concept consists of less than 100.000 inhabitants (which is arbitrary), the city should be compact with lots of green space and low traffic, contains mixed residential and commercial use, will develop organically, with building blocks of an average of five floors high and comfortable living, it will be connected with other cities for exchange of special goods and culture, built with local building materials, and is part of the circular economy, and if there are bigger conglomerates of cities, these consist of a series of small cities with shared uses. This was the task given to the conference delegates in the design LABs: design such a liveable city in which a substantial amount of space is available to grow food.

Methodology

The method used in this experiment consisted of six distinctive steps:

1. On the day before the conference expert visits were planned to a total of five case studies. A delegation of the conference participants travelled to a case study location, where the case study owner, usually the owner of the property or site, hosted them. The case study owner was responsible for the program, the questions to be discussed and the problem statement. The aim of the visit was twofold: to learn what's going on at the case study site, and respond to the case study owner with advice how to solve his problem. The case study visits were facil-

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itated by a group of students who were well informed about the content of the case study and practical issues.
2. The results of the case study visits, the experience of the visits and the understanding of the cases were then brought to the conference venue, where they functioned as the basis for the LAB-sessions. These sessions of two hours include a maximum of four paper presentations (one hour in total) and a design session about a particular case. The aim was to use the expertise and insights presented in the papers to develop an urban food-growing concept in smaller design groups.
3. During the two days of the conference each case study is the subject of a LAB in at least four sessions. With an average of three groups in each session, a maximum of 12 design results were delivered. The output for each case study is a set of designs, drawn on big maps and an expert advice derived from the visits.
4. After the conference the results are harvested. The group of students collect all the materials and ordered it based on the content of the output. Out of all the findings one integrated spatial map is constructed on which a coherent spatial future for the case study area emerges.
5. The results of four case studies are brought together and the common elements are grouped according to the scale they belong.
6. After the conference a questionnaire was send out to all delegates. In this questionnaire people could give their opinion about the general quality of the conference and also specifically rate the elements meant to stimulate exchange and discussion.

The experiment finishes with a concluding statement about the potential for a follow-up and general conclusions about the findings.

Results

The following case studies have been part of the conference experiment: Meervaart in Amsterdam, CHV-Noordkade in Veghel, Graansilo in Groningen and Potmarge-zone in Leeuwarden. For each of these case studies four LAB-sessions have been held and the outcomes of these sessions are summarized.

a. CHV-Noordkade, Veghel

The site in Veghel is an old industrial site for storage of wheat and corn, which is in transition to become a lively, multifunctional arts, food-, and cultural hub in the town of Veghel.The accessibility and large scale of public spaces and building is seen as the most important negative aspect of the site. The

Figure 5: The core of proposals in the heart of CHV-Noordkade

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LAB-sessions came up with design proposals to establish a zero-food-miles zone and improve connectivity with surrounding areas. Connections by water are proposed, green corridors between the site and the countryside to provide exchange of green products and veining of productivity and economic activity into rest of the town. For the site itself a 'borough'-concept is proposed creating an urban environment where art and culture, and the growing of food go hand in hand. Rooftops, old silos and existing buildings are transformed into productive spaces. New, smaller buildings are added for residential and student housing, and to break the large scale into pieces. Productive spaces are located on and aside the canals (i.e. aquaponics, shrimp and catfish runs, and fish barges) and green rooftops, with markets operating on the water. The food cluster is extended with an arts precinct, a community orchard and café, tearoom, restaurant and brewery, with a craft brewery bar, and a skate-park. Visits are organised to the old storage spaces, the industrial heritage, and in, on and near the buildings industrial farming of fish, plants, worms, insects, bees, and small animals (chicken, rabbits) is foreseen.

b. Graansilo, Groningen

This building, centrally located in the city of Groningen is a creative centre and hatchery for innovative businesses, such as the 'enervarium'. It is well connected with infrastructure to the countryside, but the site itself is somewhat isolated. The LAB's suggested to strengthen the industrial-archaeological character of the area where historic ways of food processing are connected with new techniques and processes. The site should be connected with the surrounding urban environment and the countryside, using food ships transporting people and food, create food ways and edible boulevards and streets, as continuous green connections. The wider area around the Graansilo is used for food production, on land, on roofs and on water, such as FoodRoofs, aquaponics, water gardening, greenhouses and more. Waste from surrounding food factories is used to support roof-salad growing. The Graansilo is also seen as suitable to develop a cultural agenda, including different groups of artists, artists in residence, where multicultural food festivals and events about the future of food from local to European scale can be organised. In this agenda the Graansilo itself becomes a gastronomic centre point and water-based meeting point to learn about and experience food.

Inside the Graansilo seedlings are produced and spread out on food barges, an Aquaponic system is implemented in the old silos and an eco-

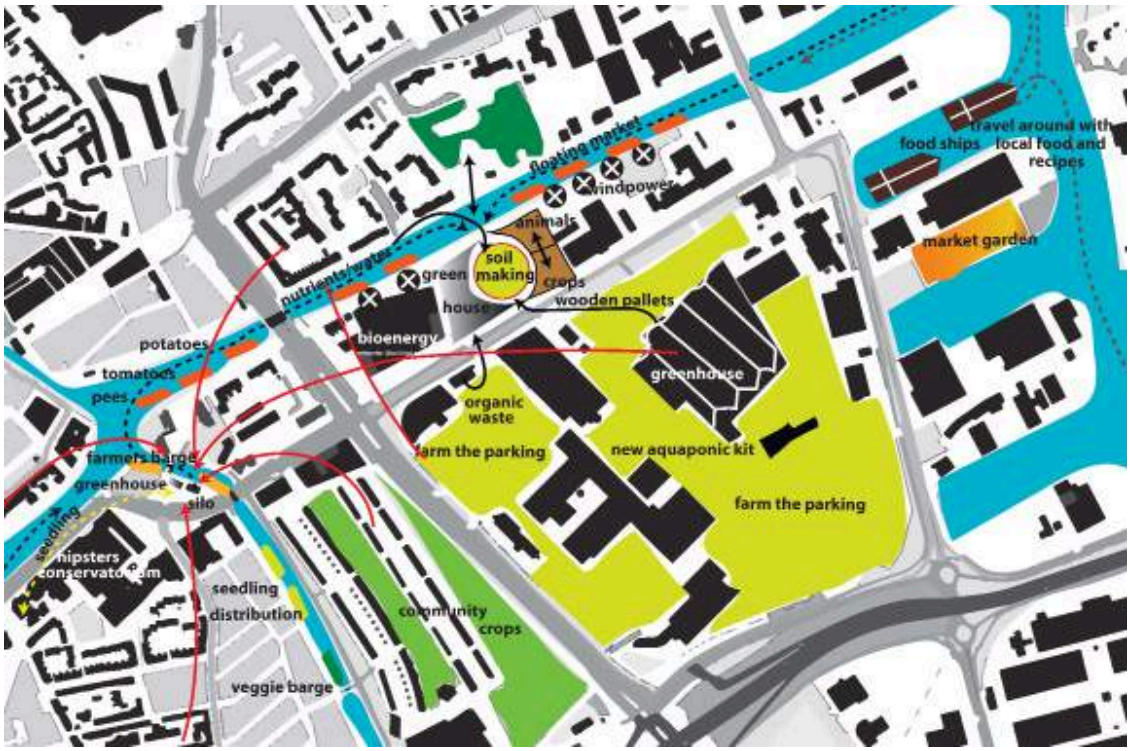

Figure 6: Graansilo as the initial point for expanding food initiatives towards its direct environment and beyond

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logical market is located on a barge next door, on which veggies are grown. On the square around the Graansilo pigs and chicken are kept and a small hop plantation is located, with an explanation of beer components and a small brewery.

c. Meervaart, Amsterdam

De Meervaart is a theatre in the western suburbs of Amsterdam. The LABs propose to position the Meervaart as the heart of an Urban Agriculture zone in the neighbourhood and beyond. On the rooftops of the Meervaart and the buildings in the neighbourhood green gardening and aquaponic systems are foreseen. The products can be directly sold to the Meervaart café and restaurant and other small restaurants in and nearby in the shopping centre. Locals who learn from local farmers, which bring their farm knowledge to intercultural rooftop gardens, may exploit these gardens, and the local producers can sell their produce at a local food market, shops and restaurants. Food establishes connectivity with people living in the vicinity of the theatre. The

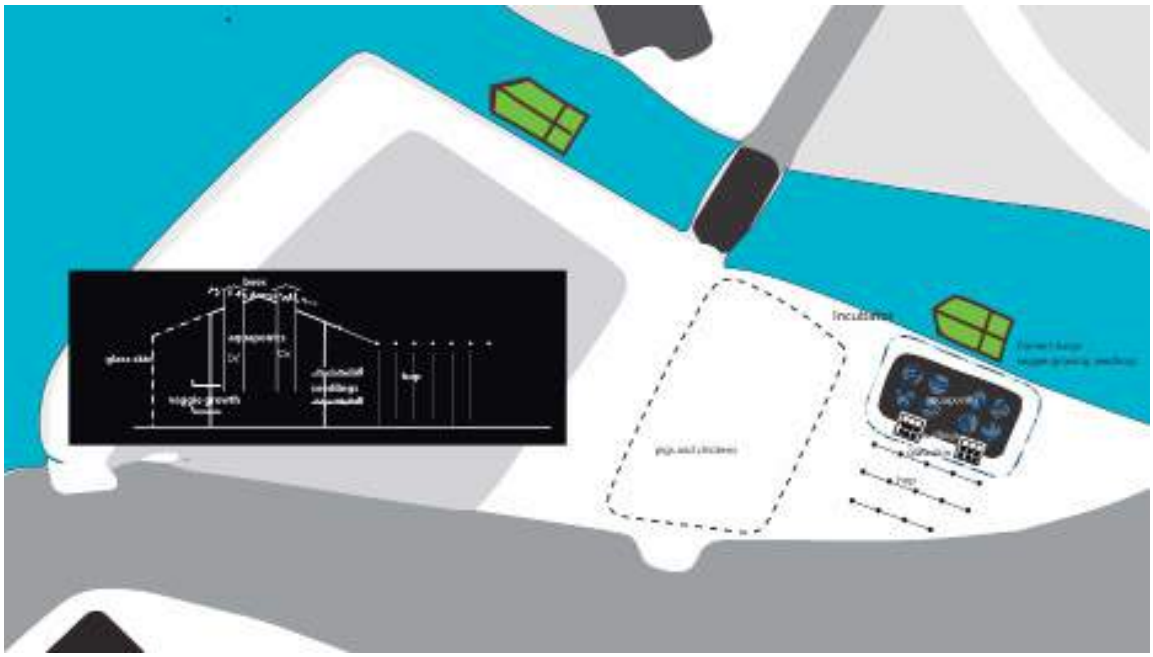

Figure 7: Concrete proposals for the direct environment of the Graansilo

Figure 8: Urban Agriculture components in the Meervaart area

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shores of the Sloterplas can be used as a productive space together with the lake itself where fish basins are proposed and an Urban Agriculture barge. The products can be used during the yearly food festival in front of theatre and at different street feasts taking place by surprise in the neighbourhood streets. The (rain-)water coming off public spaces and roofs is collected and reused on the rooftops and balconies. Organic waste from these flats and public green is composted and re-used in greenhouses located in public green spaces. There are several green linkages proposed to connect the Meervaart with the rest of the city and the countryside, such as the Gardens of West, using a river or canal-taxi, which transports agricultural products and resources to and from the urban heart, but can also serve people.

d. Potmarge-zone, Leeuwarden

The Potmarge is an old river near the city centre of Leeuwarden along which a broad spectrum of land-uses appears. This has led to a messy area, urging for a certain restructuring and clarified spatial system. The accessibility of the area with schools acting as barriers, and the water quality are seen as the main issues.

The main suggestion of the LAB's is to reshape the area as a Green Urban Boulevard of Leeuwarden, where additional spaces can be created to grow food. This Boulevard is seen as a long connecting urban space, which consists of the river itself, its shores, the productive zones around it and the continuous bike paths, footpaths and ecological corridors. It primarily connects the city centre with suburban Leeuwarden, but can also be seen as a loop when completed as a circle along the Nieuwe Kanaal in the North. It is a connection of experience, experiment and learning for fun, relaxation, innovation, creativity and eating local produced food.

The ambition is to increase the value of the Potmarge-zone through a transformation of the area into an aesthetic 'foodscape' (a productive food-landscape), and consume only organic food produced within 50 km from the area. A range of thematic gardens fit in the Boulevard concept: sensorial gardens for rehabilitation purposes, edible schoolyards, a University farm for research, rooftop farms and greenhouses atop institutional buildings, aquaponic systems, and rainwater harvesting systems. In the surrounding neighbourhoods the rooftops are used to harvest PV/solar energy or aquaponics, edible streets are realised, coffee grinds are harvested for mushroom farms. The Potmarge is corked with a series of floating gardens and green markets, under which floating farmers markets, and floating fish- and veggie-barges are located.

In every case study there is attention for the larger scale and connectivity with the rest of the city or town and the countryside. Further common topics are water (floating markets, productive barges, aquaponics), the use of green rooftops, closing cycles of water, energy, nutrients and materials, and the accessibility of the site. In table 1 the most important subjects in each of the case studies are summarized.

When these outcomes are categorized according spatial scale an interesting insight in a possible future city concept emerges. The first category suggestions relate to the connection of the site with the rest of the urban environment and the countryside. Each of the case study-designs does not function satisfactory by themselves, and they all reach out to the countryside to establish connections with other cities and landscapes. Therefore, this regional scale is important to connect all pieces of local Urban Agriculture projects with urban flows and connect it to a regional food productive system based on a water-landscape-typology. These typological landscapes determine the potential to design a 'fish-water-based' food system allowing inhabitants of these regions to produce their own healthy diets, a task for future research. The second category contains those design ideas and activities related to the direct surroundings of the case study areas. These surrounding neighbourhoods also contribute to the case study areas when they become productive In these areas edible streets are proposed, the re-use and recycling of rainwater, composting of organic waste in the neighbourhood is suggested and direct connections with routes on water and land, for boats, bicycles and social connections could be developed. These interventions support the use and exchange of resources and improve the food-productivity of site and surroundings. Special attention is paid in this category for barges, on land and water as a means of transport for products and people, but also on floating markets and farms. Finally, at this scale social connections are important.

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Education, intercultural food festivals, art and culture shape these social networks.

In the third category the measures are taken at the building level. Foodroofs, where food on rooftops is grown, aquaponic systems, in or on buildings, vertical farming, nursing seedlings and places for keeping small animals, such as bees or chicken belong to this category. Most of the produce can be consumed by the people living inside the building, but the overshoot requires accessible transportation means to sell crops in neighbouring

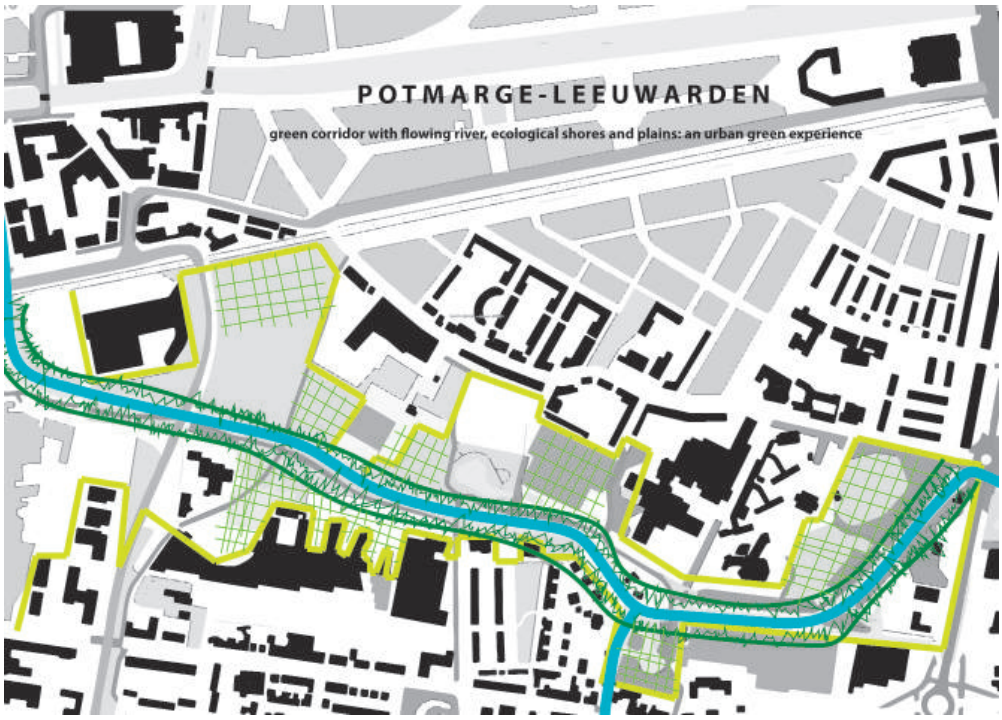

Figure 9: The green boulevard, connecting the Potmarge zone with the city and forms linkage between all of the land-uses

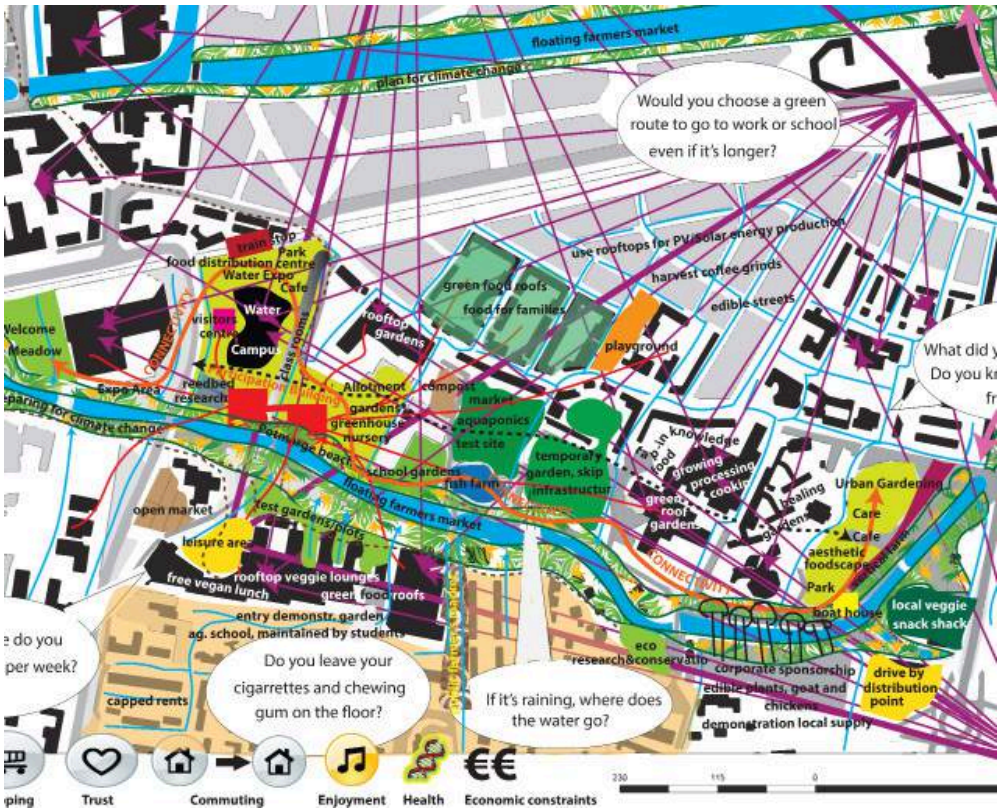

Figure 10: Urban Agriculture in the Potmarge-zone

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places. To be able to grow crops in and on buildings resources, such as water and nutrients, need to be available and provided from the other two scales, another reason for effective transportation. The combination of these three scales of design requires further elaboration, especially on how the connections between the scales are shaped. Approaching the design of the city as an integration of these three scales, instead of looking at the design of the food system from a global food market point of view, opens the way to innovative spatial patterns, structures and systems, which provide the opportunity to grow a substantial amount of food in the urban environment.

The conference process

A second result is the impact of the conference-program and methods on the delegates. Were they active and committed, did they learn and enjoy? This result can be formulated in a soft and hard way. The soft way is an impression, built up by conversations with delegates, looking at their faces, receiving their comments, the attendance, even at the end of a conference day or the last day, the 'atmosphere', noise and buzz in the conference rooms and the level of questions from the audience during plenary and parallel sessions. This impression is a very positive one. People stayed until the end in large numbers, were focused even

Leeuwarden	Veghel
Comprehensive food-landscape	Linkages with other areas through greening
River Potmarge	Aquaculture canal
Connectivity	Foodhub', integrating culture and art
Rooftops	Aquaponics
Aquaponics	Rooftops
Stakeholders	Stakeholders
Education	Productive barges
Accessibility	Industrial heritage
Biodiversity, ecology	Broad spectrum program
Organic food	Zero-foodmiles area
Floating markets	Food landscape
Tactile landscape, sensuality	Bees
Amsterdam	**Groningen**
Rooftops & Balconies	Industrial archaeology
Aquaponics	Accessibility
Experimentation and learning	Floating, farmers market
Stakeholders	On water food growing
Food feasts, street market	Aquaponics
Connectivity	UA-Barge
Fish basin, UA-barge	Recycling
Local products for local restaurants	Continuous green connections
Reuse wastewater	Arts and culture, hipster and creativity
Recycling water, organic waste, composting	Food festivals
Accessibility and links with areas outside urban	Hop plantation and beer brewing
	Seedlings
	Bees

Table 1: The most important subjects in each of the case studies

ISSN-Internet 2197-411x OLCL 862804632

when they must have been tired, stayed interested and atuned. They kept the conversation going and the rooms kept buzzing until the very end. Is this impression underpinned by the hard way of quantifying the satisfaction of participants about the core program elements? To investigate this a questionnaire is sent out to all delegates (138). 32% returned the questionnaire. The opinion of the respondents about the conference as a whole, the keynotes and the poster session were consistently high. The satisfaction about the design LAB's was not uniform. 17% scored these low (2-4), 54% scored these an average score (5-7) and 29% scored the LAB's very high (8-10). The average score of 6.4 falls apart in distinctive groups showing appreciation or dissatisfaction. The main comment on the LAB's was a lack of understanding and information about the specific case study, which made it difficult to deliver valuable contributions.

It can be concluded that in general terms the questionnaire supports the impression, as written above. However, part of the participants have let seep they have critical notes about the LAB-sessions.

Conclusion and discussion

On the basis of this study and experiment, conclusions can be drawn about the conference process and about Urban Agriculture as driver for urban development.

a. The conference approach

Overall, the conference program and set-up was successful. The participants stayed focused, even if session were long or later in the afternoon. The received feedback was also positive. The results of the questionnaire underpinned this. The positioning and timing in the program and the location of the poster session were successfully chosen. The LAB sessions have been qualified as fuzzy sessions, though supporting the inspirational and creative process. In these Design-LABs tactile methods and workshop tools, were used to 'softisize' the brainstorming process and challenge the participants. A critical note on the Design-LABs however was the lack of information and background of the case studies. It would have been helpful if the case study owners were involved in the LAB sessions during the conference to improve the connection between site visits and sessions.

Discussion

Setting up the conference in a way it could deliver new insights, innovations and ideas about future urban design based on an ambitious amount of food production is a relatively small experiment. It is recommended to elaborate the program set-up and content and methods of each of the sessions for application in other, food- or design related conferences. The LAB sessions have been highly valued, but to fully make use of the expertise of participants, it is recommended to increase the amount and quality of information, knowledge base and understanding of the case study areas beforehand.

b. Urban Agriculture

Approximately 0,002 % of our total consumption of food is produced within the boundaries of the urban environment. This is relatively close to zero. This fact should impact the way we think about the design of our cities, assuming we would like to increase the production amounts. In each of the case studies the results illustrated possible avenues to respond to this question. The designs show a way forward, because whilst focusing on the individual sites, the solutions brought to the table went far beyond individual sites only. Onsite new productive techniques are foreseen, such as aquaponics and roof gardens, there is much attention for establishing connections with the surrounding city and every case study included the improvement of accessibility by adding routes for transportation over land and water. These routes are also important to transport resources, such as water, compost or seeds and products. Moreover, the case studies emphasised the need to be embedded in the wider spatial context, at the regional level. In order to understand and benefit from a specific environment, landscape typologies can determine the available resources hence the most productive options to grow food. Local projects can then be informed by the type of landscape they are part of, the available resources and the ease of transportation to the site and deliver products.

Discussion

Thinking along the lines of the three integrated scales, the role of Urban Agriculture might be to provide healthy food products. The current diet of many people is unhealthy, leading to high percentages of obesity. When Urban Agriculture makes use of the spaces at each of the three scales, there

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Table 2: Summarized results of the questionnaire

Subject	Average score	% Low (2-4)	% Average (5-7)	% High (8-10)
Conference as a whole	7-Jul	0	39	61
Plenary sessions	7-Aug	0	40	60
Poster sessions	7-Feb	0	60	40
LAB-sessions	6-Apr	17	54	29

is enough space to produce food for healthy diets. If this ambition is combined with the outcomes of the case studies, as described above, the key question is if we can create a diversity of spaces for the production of a healthy diet. These spaces connect all three scales within urban boundaries. In recent decennia the built-up area and the percentage of people living in the city has increased in the Netherlands. 83% of the population occupies around 8% of the area. This percentage is expected to rise to 87% in 2025 and, in 2050, to 90% (PBL, 2010; 2011; De Groot et al., 2010). The Netherlands is a truly urban. Connecting these ideas, a new role of Urban Agriculture and design task emerges: how to shape the production of healthy food for the entire country? Designing for Urban Agriculture then implies the design of a national plan for healthy food production, differentiated per region, based on fish, fruit and vegetables. This national design task requires not only an exploration in design, but also into economics (the impact on food prices, possible decrease in export revenues and simultaneously a decrease in healthcare costs, and potential growth of jobs) and logistics.

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The author would like to acknowledge the contributions and attendance of the participants of the 6th AESOP international conference on Sustainable Food Planning in Leeuwarden, 5-7 November 2014. Especially their contributions during the LAB-sessions and the site visits have been highly appreciated. Secondly, the students of the minor Sustainable Area Development at VHL University of Applied Sciences are truly thanked for their efforts and support before, during and after the conference in helping to organise the case study visits and design sessions, and harvesting the outcomes and design propositions derived from the design LAB's.

Conflict of Interests

The author hereby declares that there is no conflict of interests.

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Finding Spaces for Urban Food Production – Matching Spatial and Stakeholder Analysis with Urban Agriculture Approaches in the Urban Renewal Area of Dortmund-Hörde, Germany

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urban renewal, urban agriculture, model project, participatory planning, network approach

Abstract

Using the case of an economically declined neighbourhood in the post-industrial German Ruhr Area (sometimes characterized as Germany's "Rust Belt"), we analyse, describe and conclude how urban agriculture can be used as a catalyst to stimulate and support urban renewal and regeneration, especially from a socio-cultural perspective. Using the methodological framework of participatory action research, and linking bottom-up and top-down planning approaches, a project path was developed to include the population affected and foster individual responsibility for their district, as well as to strengthen inhabitants and stakeholder groups in a permanent collective stewardship for the individual forms of urban agriculture developed and implemented. On a more abstract level, the research carried out can be characterized as a form of action research with an intended transgression of the boundaries between research, planning, design, and implementation. We conclude that by synchronously combining those four domains with intense feedback loops, synergies for the academic knowledge on the potential performance of urban agriculture in terms of sustainable development, as well as the benefits for the case-study area and the interests of individual urban gardeners can be achieved.

Introduction : From Steel and Coal to Lake and Bean Pole

The Ruhr Area (today Germany's "Rust Belt"), was characterized by mining and steel industry in the 19th and first half of the 20th century. It is a continuous urban agglomeration from Düsseldorf in the West to Dortmund in the East and with 5.1 million inhabitants and around 4,500 km² it is Germany's largest and Europe's fifth largest agglomeration. From an urban and regional planning perspective this polycentric metropolitan agglomeration can be seen as an example of the so-called "Zwischenstadt" (Sieverts 2000). In the late 1950s, the decline of the mining and steel industry began, leading to a massive structural transformation process. The district of Dortmund Hörde is a model for this structural change. Lighthouse projects such as the conversion of the Phoenix-East steel mill to an artificial lake and residential area, and the conversion of the Phoenix-West steel mill to a technology centre have attracted national and international attention, but also face the criticism of contributing

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to gentrification of the area. In between those two successful transformation projects is the centre of Dortmund Hörde, an economically declined area, strongly affected by demographic change, which is funded in the urban renewal program by the EU, the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, the North-Rhine Westphalian Ministry for Building, Housing, Urban Development and Traffic, and the City of Dortmund to generate new economic, cultural and social development perspectives.

Urban agriculture has proven to contribute to economic (e.g. job generation), socio-cultural (e.g. intergenerational knowledge exchange) and ecological (e.g urban biodiversity) benefits, especially in old industrial regions (Reid et al. 2012, Pierce-Quinonz 2012, Ackerman 2012, Hamwaye 2013, La Rosa 2014). Despite this potential, sustainable food systems have been a topic neglected in planning in Europe for decades (Morgan 2009, Hardman & Larkham 2014), and still today, the use of urban agriculture as a means of urban development (including urban renewal) is not yet a mainstream topic for the planning discipline (practice and administration) in Germany, with some laudable exceptions such as Stierand (2008 and 2012), Lohrberg (2001), LWK NRW (n.y), and BGALK & ABDO (2006). On a European scale, especially in academia, the topic of sustainable food planning has been well-established, e.g. by the Association of European Schools of Planning (AESOP) through a thematic interest group that gained considerable attention for its annual conference.

Within the urban renewal program Dortmund Hörde, the model project "Querbeet Hörde [Growing across Hörde] – Harvest your City!" was funded as a model project to explore and realize the potential of urban agriculture as a catalyst for urban renewal and to realize the intended economic, social, cultural and ecological benefits.

The Project Approach: Querbeet Hörde [Growing across Hörde]

Looking at approaches to implement urban agriculture throughout the world, three main types of project paths can be observed, according to a working typology developed by the authors: First, there are a lot of successful projects with strong community involvement that were realized without expert planning or concepts, mainly following bottom-up strategies, sometimes in a legal grey zone on other parties' land or as interim usages. Once these projects are successful in terms of reviving the neighbourhood, increasing the open space quality and other positive effects, they often face the threat of other economically more profitable uses on the land they have been implemented on. Prominent examples for this threat are South Central Farm in Los Angeles in 2006 (cf. Broad 2013) or Prinzessinnengarten in Berlin in 2012.

Second, there are numerous examples of top-down planning and design approaches to master-plans or general frameworks for urban agriculture in specific cities. These approaches often lack the full political support and financial aid for specific implementation, yet serve an important purpose in raising public awareness and keeping the topic on the (policy) table.

Third, there is a series of publications providing guidance to planning, designing, constructing, maintaining and managing urban agriculture projects, based on successful projects described in colourful illustrations (such as Philips 2013, Plantinga & de Sera-de Jong 2013, Gorgolewski et al. 2011 or Nomadisch Grün 2012). These publications can be very motivational, but they cannot provide specific directions and assistance for potential urban farmers in terms of the local environmental, social and legal conditions.

The second (more planning-oriented) and third (more design-oriented) project path can be considered top-down strategies, where artistic design quality or intended benefits influence the project design sometimes more than the needs, wishes and potential contributions of the local population affected.

Taking the advantages of the three approaches described above and trying to avoid the disadvantages, we developed a mixed top-down and bottom-up approach for the model project in Dortmund Hörde.

Based on a profound expert analysis of relevant spaces (e.g. brownfields, neglected open spaces, semi-private green spaces), and an analysis of stakeholders and network structures, a modular toolkit and concept for urban food production were

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Figure 1: Dialogue with local inhabitants while distributing seed mixtures during spring market festival. Photo Credit: Michael Roth, 2014

developed. A strong participatory approach was followed, linking bottom-up and top-down planning approaches to include the population affected and foster individual responsibility for their district, as well as to strengthen inhabitants and stakeholder groups in a permanent collective stewardship for the individual forms of urban agriculture to be developed and implemented within the model project.

Designed as a model project which can be transferred to similar regions affected by structural transformation, demographic change and economic decline, "Querbeet Hörde – Harvest your City!" is characterized by focussing on experimenting with different conditions. Various approaches of participation and implementation are tested. Despite the specific focus on the local situation, general recommendations can be derived due to the accompanying (action) research, monitoring and evaluation. Although several approaches to use urban agriculture as a catalyst for urban renewal can be found, especially in North America for example by looking at the cases of Detroit or San Diego (Monardo, 2013), they cannot be easily transferred to the German context (with its specific planning system, geographical and legal conditions).

We want to explicitly state that urban agriculture (in terms of food production) was used as a means to achieve mainly social goals within the project, but the amount of food produced was always second priority as compared to the following main goals:

- Creation of identification of the inhabitants with their neighbourhood/district, by actively farming open and green spaces.
- Creation of intercultural, inter-generational and social-class-overarching dialogues through collective farming activities.
- Establishing sustainable actor networks to maintain the farming activities started even after the end of the funded model project.

Methodological Concept: Urban Agriculture as a Catalyst for Urban Renewal

In order to achieve the above mentioned goals, a methodological concept following the approach of participatory action research (PAR) was used. PAR can be characterized as an attempt "to merge theory with practice and to collaboratively generate solutions to practical problems" (Fahy, 2015). It included working closely with local communities "to produce knowledge in the interest of social change (Torre, 2015). A strong visibility of the project and potentials of urban agriculture in Dortmund-Hörde was a central

ISSN-Internet 2197-411x OLCL 862804632

part of our approach, already in the first phase of the project, which mainly dealt with expert analysis (spaces, stakeholders and network structures) and concept development. To realize this, low-threshold activities were offered during local festivals. During a very popular local festival, cost-free mobile juice-pack mini-gardens were planted together with visitors, which they then could take home. Thus, several hundred people carried juice packs with lettuce, herbs or kohlrabi over the festivals, stimulating public discussion about urban agriculture. A second example of such activity was Dortmund's longest salad bar, a line of 100 large plastic boxes, planted with different types of lettuce, which was placed at a very central area in the district and later on that day collectively harvested and consumed in a school building nearby. Also, seed mixtures (herbs, lettuce, and radish), in a bag hand-printed by a local youth initiative was given away during the local spring market, together with a project flyer and a cultivation manual. The visibility of the project in the area and beyond was also ensured by constant public relations work in print newspaper (free and paid ones), on local/regional web platforms, and via posters and leaflets.

In order to maximise the network effect in web communication, we decided to use existing local and thematic online platforms for project communication. Separate sub-sections within the website of the local district agency (Hörder Stadtteilagentur, *http://hoerder-stadtteilagentur.de/*) and the website of a region-wide urban agriculture platform (Urbane Oasen, *http://urbaneoasen.de/*) were established, to use existing platforms for dissemination and to link our project to other local initiatives in Hörde, and other urban agriculture projects in the Ruhr area.

The analysis of potential spaces for urban agriculture gives a quick overview of suitable spots for different activities by providing information on the location, size, exposure to sunlight, distances to public transit and local infrastructure such as schools, stakeholder groups in the surroundings, land owner, and an assessment of the potential uses. An orientation map, photos and a verbal description are also included for each location. Around 60 stakeholder groups, initiatives and institutions were researched in the area (commercial institutions, schools/preschools, restaurants, social institutions, and housing associations). For several of them, in-depth-interviews were conducted to identify potential links to urban agriculture, their motivation and wishes, potential areas of collaboration and project ideas.

A network of co-operation partners was established, reaching from local and regional administrative bodies, commercial enterprises and job initiatives to schools, church and social institutions and non-governmental organisations.

To support future urban agriculture bottom-up initiatives, projects and individuals, a toolkit was elaborated, illustrating various cultivation methods (e.g. sack gardens, raised beds, bottle gardens, box gardens) and potential crops suitable for the area in a simple language and with easily readable illustrations. By making expert knowledge available to the general public in a layperson-compatible format, the risk of failure and mistakes which is an inevitable part of community gardening (Nomadisch Grün 2012, p. 129) could be reduced.

Based on the spatial analysis, potential actor analysis, network and toolkit, several project ideas were developed, that were discussed with the stakeholders. One central feature of the concept was to explore the potential of using the numerous brownfields in the area for establishing community gardens. On a theoretical and empirical level, this potential has been proven by Tobisch (2013). The spatial analysis described above exposed a derelict former open air pool area that was fed by hot sulphuric slag water to help mining and steel workers with respiratory and rheumatic diseases. The network analysis revealed a gardening initiative that was looking for a space to garden, due to the eviction from their formerly used land. In an intensive co-ordination process with the owner of the area (Thyssen Krupp Steel Factory), the tenant of the land (a local soccer club), the gardening initiative, the city administration and the local district agency, an initial three-year leasing contract was prepared and signed. Although the main focus of the gardening initiative was not growing food, but the integrative aspects of gardening before, they were very open for the idea of urban agriculture and took up the concept and toolkit elaborated in the model project Querbeet Hörde.

To support the gardening initiative in developing

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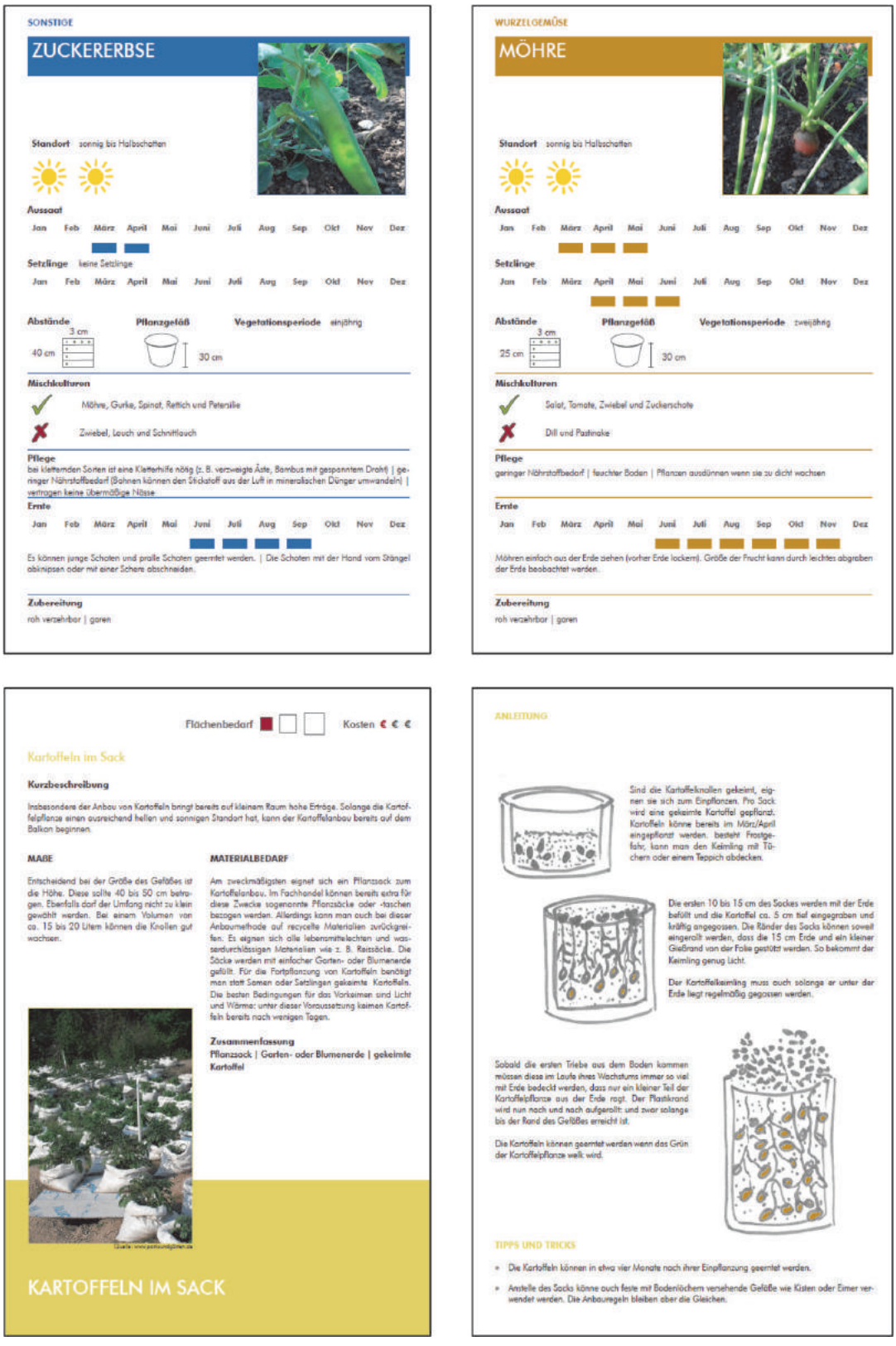

Figure 2: Examples of the toolkit for crops and cultivation methods.
Source: Project Team Querbeet Hörde, 2013

the new community garden and link them with other local initiatives and interested individuals, a half-day planning and design workshop was conducted in the club house of the neighbouring soccer club (fig. 3). Again, this combination of bottom-up initiatives with feeding in expert knowledge in a very subtle way proved to be very helpful in avoiding potential pitfall for the starting phase of the community garden. Another positive aspect of the elaborate network established in the concept phase of

ISSN-Internet 2197-411x OLCL 862804632

Figure 3: Community garden planning and design workshop with local gardeners.
Photo Credit: Miryam Frixen, 2014

Figure 4: Building a vertical strawberry garden at a local preschool fence.
Photo Credit: Michael Roth, 2014

ISSN-Internet 2197-411x OLCL 862804632

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Querbeet Hörde was the possibility to re-use local building materials, for example a fence that was dismantled during the reconstruction of a schoolyard, and thus can be used by the community garden without additional cost.

Children are considered very effective agents and/or multipliers in achieving social change (Linares Pónton & Vélez Andrade, 2007), environmental change (Uzzell et al., 1994, Ballantyne et al. 2006), sustainability (Stuhmcke, 2012), and healthy food purchasing (Wingert et al., 2014). Urban agriculture workshops in preschools (fig. 4), with local teenager initiatives and in schools helped to spread the idea of urban agriculture in the district of Dortmund-Hörde and to realize the intended social, ecological and economic benefits.

Results and Conclusions: Planting and Harvesting, Growing and Learning

Towards the end of the initial one-and-a-half-year funding period of the model project "Querbeet Hörde – Harvest your City!" we can draw a first balance of how the collaborative production of food has generated economic, ecological and socio-cultural "harvest" and contributed to give a new impetus to urban renewal and transformation processes without jeopardizing local identity and increasing the risk of gentrification. In terms of the social sphere, a stimulus for social cohesion across generations, nationalities, income groups has been given. From an ecological perspective, the conservation of urban biodiversity e.g. by growing old cultivars within the city has been promoted. Last but not least, economic achievements e.g. the provision of cheap and healthy food for low income groups have been realized.

The partnership of city administration, using EU, national, federal state and municipal funds, together with academia, planning consultancies, regional associations, NGOs, and local stakeholders and individuals proved to be capable of generating network structures and implementing forms of urban agriculture that already have proven to last beyond the duration of our model project. Without the combination of expert knowledge, a profound networking approach and many enthusiastic individuals in administration, agencies, and initiatives this would not have been possible. The relatively small contribution of urban agriculture to vegetable consumption in a densely populated urban area justifies the focus on socio-cultural goals of our project. McClintock et al. (2013) have used aerial imagery to quantify the potential of urban vegetable production on vacant lots (public and private land) in Oakland, California. They conclude that only 0.6 to 1.5 % of the recommended vegetable consumption could be grown on those plots. Although their focus was mainly on the site inventory and production potential assessment, they conclude that additional site assessments and a negotiation of (potentially conflicting) stakeholder interests are necessary to determine how much vacant land should be committed to urban agriculture. With Querbeet Hörde, the site analysis was combined with exactly these two aspects, plus the establishment of a network of stakeholders and a communication structure to actually realize the ecological, socio-cultural and economic potentials identified.

With the amount of green spaces decreasing in many urban areas and the "promising multifunctionality" of new forms of urban agriculture (La Rosa et al. 2014), the use of brownfields and vacant land for urban agriculture can contribute to improve the sustainability of cities. Similar to the approach described by La Rosa et al. (2014), but without the extensive use of GIS due to the relatively small area of interest (84 ha, 7,500 inhabitants), the physical, ecological and social features of potential urban agriculture sites were analysed. The combination of the site and the actor network analysis, linking bottom-up and top-down approaches, combining expert knowledge and layperson commitment, with strong support by the city administration proved to be a driving factor for successful implementation of urban agriculture. Positive feedback from all parties involved provides an encouraging picture of the potential of urban agriculture to contribute to identification of the inhabitants with their district, to create multiple dialogues between people involved and to generate a new impetus for transformation processes in the neighbourhood of Dortmund-Hörde and beyond.

On a more abstract level, the research carried out can be characterized as a form of action research with an intended transgression of the boundaries between research, planning, design, and implementation. We conclude that by synchronously

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combining those four domains with intense feedback loops, synergies for the academic knowledge on the potential performance of urban agriculture in terms of sustainable development, as well as the benefits for the case-study area and the individual urban gardeners can be achieved.

Future Urban Farming Seasons – An Outlook

Based on the very positive experiences made during the initial one and a half years of our project, we are very confident, that should the funding be extended, we can achieve an expansion of our approach in several ways:

- After a strong focus on the social impacts, we aim at including the economic perspective by stimulating the local economy through small-scale low-threshold initiatives like "crowd growing" for local restaurants and adjacent neighbourhoods. The potential for more technology-oriented forms of urban agriculture such as aquaponics could also create local economic benefits. For Chicago, Taylor & Taylor Lovell (2012) have identified the majority of urban food growing sites in private home gardens and not on public land, using a GIS-based approach with high-resolution aerial images. While up to now, our inventory is based on site visits and mainly public or semi-public land, the inclusion of private home gardens is also one possibility of extension.
- The ecological benefits shall also be more central by linking urban agriculture with the municipal climate protection concept and rain water management concept.
- In terms of a more holistic approach to sustainable food planning, the whole food cycle from production over transport, processing, consumption and waste recycling would be included.
- One social goal that would be more central is to establish links between the new inhabitants of the rich neighbourhood around the new and the (poorer) inhabitants in the old part of Dortmund Hörde.

If the model project continues to be successful, perhaps even an up-scaling to a municipal master plan for urban agriculture would be possible. The city of Dortmund has a very proactive position towards agriculture within the city, as can be seen in their master plan "Agriculture and Nature Conservation" (Stadt Dortmund 2005). Let's hope that sustainable food planning will finally find its way into the well-developed formal urban planning system in Germany. The ground has been set and is ready to grow!

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Conflict of Interests

The authors hereby declare that there is no conflict of interests.

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By FOFJ Editorial Staff

New Master Programme "Sustainable Food Systems" from fall 2015

Starting in fall 2015, the new Master Programme "Sustainable Food Systems" will be introduced by a consortium of six European-Universities. The programme focuses on sustainability along the entire food chain, with specific regard to learning in an international context. Students participating in the programme are able to study at several of the following universities:

- Ghent University, Belgium
- Aarhus University, Denmark
- ISARA-Lyon, France
- Fulda University of Applied Sciences, Germany
- University of Kassel, Germany
- USAMV Cluj, Romania

The combined expertise of these six higher education institutions offers a broad range for specialization in various fields. A flexible schedule allows for student mobility:

1. In the first semester, a "home university" can be chosen out of the following countries: Belgium, Germany and Romania
2. For the second semester, a specialization is selected at either Belgium, Denmark, Germany or Romania.
3. The third semester is characterised by a practical approach for all students in France
4. A Master's thesis can be done in the fourth semester at either of the universities with the exception of Aarhus, Denmark.

For more detailed information, please visit the programme website: *http://www.susfoods.eu/*

Hidden hunger as an alarming public health problem

Hidden hunger is becoming an alarming public health problem in both developed and developing countries. Difficult to detect from the first sight as it is not felt as a real hunger, hidden hunger requires careful health examination. In addition to this, lack of certain micronutrients might cause long-term health and developmental problems, unless proper treatment has been applied. Resolution of this issue requires enhanced research and deep analysis in order to understand causes and consequences of micronutrient deficiency. Moreover, active involvement of different actors on all levels of the decision-making process is crucial for tackle the problem of hidden hunger on a large scale. To tackle this complex issue, University of Hohenheim organized the 2nd International Congress on Hidden Hunger, Childhood Development and Long-term Prospects for Society and Economy on March 3-6, 2015 in Stuttgart, Germany. Taking place every two years, the Congress gathered a number of stakeholders working on the issue of child malnutrition around the world, including scholars from different fields, representatives of NGOs, private firms and field workers. Divided into six parts, the program had a logical sequence, including state of the art of malnutrition, importance of proper nutrition during the first 1000 days, nutrition transition in low-income countries, reasons and consequences of hidden hunger and ways to improve nutrition security. Thus, during the presentations and poster session, the topic has been considered from different angles where representatives of such fields as paediatricians, agricultural sciences, pediatrics, neonatology, gynecology, social sciences including economics and political science. The

Picture 1: Poster by A. Otunchieva during the Hidden Hunger Conference

poster (Picture 1) named "Child malnutrition as a challenge for ensuring food security under the water shortage conditions in Batken Province of the Kyrgyz republic" was prepared by Ms. Aiperi Otunchieva, Mr. Sisira Withanachchi and Prof. Dr. Angelika Ploeger (University of Kassel, Department of the Organic Food Quality and Food Culture).

AESOP-sustainable food planning conference

The 7th Annual Association of European Schools of Planning (AESOP) sustainable food planning conference which will be help in Turin from the 7th to the 9th October 2015. See *http://www.aesoptorino2015.it/*

These conferences provide a wonderful opportunity for cross disciplinary dialogue, networking and identifying important and emerging research related to sustainable food planning. Over the past 7 years a community of practice has formed around the conferences and last year a PhD student / new researchers group was formally established as a valuable network for building the research area and the work of early career researchers. The organising committee welcome as wide a spectrum of delegates as possible! **The deadline for application is 31st of May 2015.**

More information: *info@aesoptorino2015.it*

Manageable drain system into crowd cities in developing countries

Urban flood management is is emerging as a future global challenge connected to rising urbanization and increasing complexity in city systems. Under poor management, fragile and lack of urban flood control system and drainage systems could bring about gigantic social problems, health issues and economic losses. The imbalance between urban runoff volume and effective drainage capacity could create flash flood (Chandrasena et al., 2014). Nadeeha Chandrasena from Sri Lanka has been selected for a special graduate training course in Singularity University in NASA Research Park, United States of America. Chandrasena is selected based on her young innovative phenomenon of study and engineering creativity to tackle the urban flash flood in crowded cities in Asia and Africa. With the supervision of her doctoral research committee, Associate Professor Dr Khamaruzaman B Wan Yusof, Dr Muhammad Raza Ul Mustafa, Dr Zahiranisa B Mustafa at the Department of Civil Engineering, University of Technology PETRONAS, Malaysia, Chandrasena is developing a two-phase drainage pipe to collect the residual and smoothly rain water floating. Her new invention is feasible and amicable to the limited budget available in developing countries.

Picture 1: Nadeeha Chandrasena (Source: BBC)

Calling for papers Vol 3 Nr 2 FOFJ

Innovative Green Technologies in Agriculture and Food (Food processing/ production)

Challenges such as population growth, economic globalisation, urbanisation and changing food cultures lead to a rising demand for food production. Water shortages, soil erosion, overreliance on fossil fuels, overconsumption and loss of biodiversity are among the most urgent problems caused by business-as-usual agriculture. There clearly is a need for greener and smarter technologies to address these challenges that have emerged in the 21st century world food system, working towards sustainable agriculture, food production and processing.

Future of Food Journal, the collaborative work of the Department of Organic Food Quality and Food Culture at the University of Kassel, Germany and the

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Federation of German Scientists (VDW), is calling research paper for the Vol.3 Nr. 2 (autumn 2015). The titled is "Innovative Green Technologies in Agriculture and Food (Food processing/production)".

The submission deadline will be 20th of July 2015.

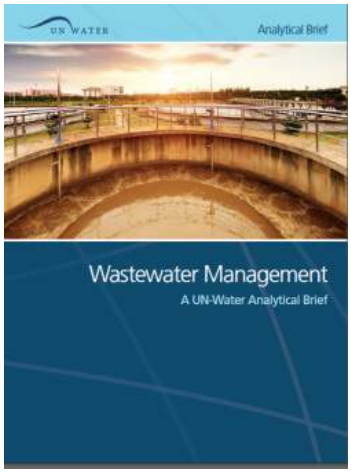
You can find more information on the submission at *http://issuu.com/fofjournal/docs/calling_for_paper_2*

Picture 1: Farm Direct Hydroponic Vegetable Retail Concept Store in Hong Kong (Source: Farm Direct Hong Kong)

NEWS from UNWater

Wastewater Management- A UN-Water Analytical Brief

As the timeframe for the Millennium Development Goals (MDG) nears completion, minds are turning to the Post-2015 Development Agenda. This is accompanied by the realization that the focus on drinking-water and sanitation without due attention being paid to the end products of water and sanitation provision (i.e. wastewater) may have exacerbated some of the water quality problems seen globally.



It is increasingly being recognized that the issues of wastewater management and water quality have cross-linkages with a range of other water- and non-water issues, not least in respect of the water, energy and food nexus. It has also been acknowledged that wastewater management clearly plays a role in achieving future water security in a world where water stress will increase (OECD, 2012).

Against this backdrop, there is an emerging consensus on the need for a dedicated water goal in the Post-2015 Development Agenda, one which includes explicit recognition of the importance of good wastewater management and its contribution to protecting water quality.

The full report can be downloaded at

http://goo.gl/W7uOMP

(This news is taken directly from UNWater, for more information please visit *http://www.unwater.org/*)

TTIP and Food Systms

Photo credit: Christoph Liebentritt - *www.liebentritt.at* via flickr

The Trans-Atlantic free trade treaty between the EU and the US, TTIP (Transatlantic Trade and Investment Partnership), continues to be under negotiation. As Jürgen Mayer elaborated upon in Vol.1, No. 2 of Future of Food: Journal on Food, Agriculture & Society, parts of civil society are critical or downright negative towards the free trade agreement. Trade Unions, environmentalists and also farmers and critical consumers are afraid of a watering-down of the relatively high environmental, food safety and labor standards in the EU. Proponents of the free trade package claim positive effects for both economies, as standards would be harmonized

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and regulatory barriers abolished. The debate also relates to mechanisms of investor-state dispute settlement; the lack of transparency in the negociations; and the precautionary principle, which touches on matters of genetically modified organisms (GMO) and additives.

At the time, the transatlantic food market is rather small, as explained by Prof. Gabriel Felbermayr, Ludwig-Maximilian-University (LMU), Munich. Food products that are traded between the US and EU include rather marginal products such as raisins and nuts, and spirits. With the down-scaling of regulations, which are often seen as barriers to free trade rather than as protection of consumer's right, Felbermayr projects a remarkable growth in the trans-atlantic food market. However, he also expects a number of exceptions to be written into the treaty. German consumers, for example, are horrified by the thoughts of American "Chlorhuhn", chlorinated chicken, in their supermarket aisles. The US poultry industry defends the practice, used to battle samonellas, which it insists does not pose any health threat.

The Anti-TTIP-Movement called for a global day of action on April 18, 2015 and managed to move tens of thousands to the streets in peaceful protest. Meanwhile, negotiators on both sides intend to find solutions to conflictual parts of the agreement soon. The Obama Administration wants to sign and ratify the treaty before the end of term in late 2016, and European politicians, such as the Sigmar Gabriel, German Federal Minister of Economic Affairs and Energy, also seek to end the debate. It remains in the open wether civil society organizations can manage to bring about the suspension of the treaty any longer.

Sources: *http://dw.de; http://www.ttip-unfairhandelbar.de; own reporting*

Ulrike Wunderle new director of VDW

Ulrike Wunderle is the new managing director (*Geschäftsführerin*) of VDW e.V., Vereinigung Deutscher Wissenschaftler (Association of German Scientists), one of the two co-publishers of Future of Food: Journal on Food, Agriculture & Society. She has taken over office from Reiner Braun on March 15, 2015. Ms Wunderle has been a member of VDW from 2006 and member of the advisory board (*Beirat*) from 2009. She also has a background in the Young Pugwash Movement, an international movement of students and young scientists working towards world peace. The FOFJ Editorial Staff congratulates Ms Ulrike Wunderle to her new appointment, we are looking forward to a long and fruiful co-operation.

Sources: *http://vdw-ev.de*

Monsanto: Even more Power to the Agri-Science Corporation?

Monsanto, the US corporation that holds great chunks of the international market on both commercial seeds (of the conventional and GMO variety) and agro-chemicals, may gain access to even more economic power.

In the beginning of May 2015, rumours about a merger with the Swiss agritech giant Syngenta solidified. For the time being, Syngenta's board has rejected a 45 $ Billion takeover bid. But as environmentalist magazine Mother Jones explains, this is not the end of it. Syngenta holds large shares in the pesticide industry, while Monsanto seems to strife towards a dominant position in the seed market, already controlling a market share of about 26%. Monsanto is number one in biotechnology and number five in agrochemicals, while Syngenta is number one in agrochemicals and third-largest player in the biotech market. The merger, should it ever come through, could create a veritable monster that would be extremely hard to challenge by competitors such as Bayer CropScience, Dow, BASF, DuPont etc.

In related news, environmentalists, organic farmers, and health advocacy groups are putting more pressure on European legislators to ban *glyphosate*, a best-selling herbicide invented and sold by Monsant under the brand name *Roundup*. The widely used chemical is found to be likely to be carcinogetic, among other health risk associated with the spraying of the herbicide. The appropriate committee of German federal states, currently chaired by the Lower Saxon Minister of Agriculture and Consumers' Rights, Christian Meyer (Green Party), are discussing a ban on selling glyphosate. The Netherlands have decided upon a ban for glyphosate that will become effective by the end of the year.

The high-input, large-scale agribusiness model relies on *glyphosate* and similar chemicals in order to make profits, and a turn to an alternative model is not in sight, despite the growing protest against Monsanto and its competing agrochemical

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companies.

Sources: Mother Jones; *http://naturalsociety.com*

Opening of Food-Themed EXPO 2015 Milan

Picture credit:Lorenzo Click via flickr

May 1, 2015 saw the opening of Milan's food-themed World Exposition. "Feeding the Planet, Energy for Life" is the motto of the EXPO 2015 held in the Lombardian city in Northern Italy. World Expositions tend to be great shows celebrating technological progress and national pride. The decision to emphasize food and agriculture mirrors part of the Italian national identity, which prides itself with a rich and tasty food culture

Picture credit: Fedra Studios, via flickr

which is highly appreciated in many countries of the world. For the next five months, the World Expo aims to be a festival of cultural diversity.

However, all's not fair in the City of Milan: The preparation for Milan's Expo were accompanied by accusations of corruption and other criminal practices in the construction of the Exposition's pavillions. Also, the grand opening on May 1, called a "glitzy ceremony" by The Guardian, was overshadowed by riots and confrontation between militant protesters and police. Protesters, presumably from an anti-capitalist background, used black bloc tactics and torched cars. However, these riots may say more about the fragile social fabric of Italian society than about the Expo itself.

Sources: *http://guardian.com, http://www.expo2015.org*

New section in FOFJ for Knowledge/ Science Transfer

Beginning in Vol. 3 No. 2 of the Future of Food Journal - to be published September/October 2015 -, there will be a new section for exchange and introduction of innovative ideas and new business plans in the field of food, agriculture and social development. Especially young researchers, activists and inventors all over the world are searching, pondering and producing new strategies to address current and future problems that will effect ecosystems and human beings. Young people today are pursuing diverse and new experiences with different forms of cultural exchange and knowledge production. With the new section, Future of Food Journal will provide a platform in order to distribute these experiences in an online forum.

You are welcomed to share your idea and inventions to the global public.

Please send your idea to us not later than **10th of September 2015** to *managingeditors@fofj.org*

Picture credit:Sean MacEntee via flickr

A Report from Expo 2015

The FOFJ Editorial Staff will explore the diversity of the EXPO 2015, gather impressions, find out about best practice and research innovative approaches. In summer 2015, we will conduct a field trip to the EXPO 2015 in Milan and bring back many images and ideas. Learn more in the next issue of Future of Food: Journal on Food, Agriculture & Society!

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Reports and analyses

Caimanes and the Water – Infinite Legal Struggles about a Finite Good

Comments on the Chilean Supreme Court Judgement of 21 October 2014, rol 12.983-2013

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Abstract
This report is intended to shed more light on the ongoing water struggle in Caimanes, a small urban area in the central northern area of Chile, neighbouring Latin America's biggest tailings dam. Undoubtedly, the water in Caimanes is running out and the conflict between the opponents of the dam and its owner, a multinational copper enterprise, is getting more and more attention by the national and also international media. In the discussion a judgment of the Chilean Supreme Court from last October plays a central role, because it is said to have granted the people from Caimanes their right to water. After a short introduction with some details about Camaines and the tailings from the dam El Mauro, the key points of this judgment shall be outlined. The final part of the report is dedicated to various institutional problems of the Chilean resources law and policy that can become virulent for the water supply and the environmental well-being of many other urban areas in the industrialized north of Chile.

"Art 19 The Constitution guarantees to all persons […] N°8 The right to live in an environment free from contamination. It is the duty of the State to watch over the protection of this right and the preservation of nature.[…]"
(Political Constitution of the Republic of Chile)

Introduction

Agriculture, mining, urbanization and water

The production of food and mining are related through water. Water is obviously crucial to produce all kinds of food, water - potable water - itself is indispensable to food and water is also needed for the extraction of all sorts of minerals. Therefore, especially when water is scarce, there are problems of allocation between mining, agriculture, and the (potable) water supply in adjacent villages and cities. This hydrological relationship is, however, more complex, since there is not only water consumption via condensation (Withanachchi ,2012). The extraction of minerals leads to considerable chemical contamination of ground and surface water (Withanachchi et al. 2014). This creates a series of problems for agriculture and causes potable water stress in neighbouring settlements. The problematic entanglement of mining, agriculture, urbanization and (scarce) water is the issue of the following report.

Media and social media: #Caimanes

When searching social media for Caimanes, a small urban area with approximately 2000 inhabitants, in the region of Coquimbo (IV Región), the north of

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Chile, there are reports and images of street blockades, hunger strikes and tough police intervention. Numerous tweets, posts and small articles inform about a water fight between a multinational mining enterprise and the inhabitants of Caimanes. It is thereby furthermore conveyed that the people from Caimanes are deprived from their right to water, although a judgment of the Chilean Supreme Court last October has granted it to them. Apparently, Caimanes has for some people become a new symbol for the desperate resistance of a small community against a multinational company that does not respect the environment and the rule of law. Established newspapers and broadcasting corporations in Chile, on the other hand, have not covered the on-going events for a long time and now seem to take a quite neutral position. Other media are more in favour of the mining enterprise Los Pelambres S.A., which argues that it has the law on its side. The following paragraphs shall briefly provide information on what the discussion is about.

Figure 1: A mega mining plant in Chile, Photo credit: James Byrum via Flickr

Latin America's biggest tailings dam and legal procedures

At the end of the Pupío valley, lies Caimanes, where Latin America's biggest tailings dam is situated. The dam receives its name from the huge natural basin at the high end of the valley, where it was built: El Mauro. The El Mauro basin gathers major parts of the water that runs through the Pupío Valley to Caimanes where it is being used for private consumption and for agriculture. Traditionally, the community of Caimanes has had usage rights related to this water. The El Mauro dam was established by the owner of Chile's 5th biggest copper mine, Minera Las Pelambres, situated around 60km from Caimanes, as a deposit for the mine's tailing waste to be produced until the planned shut down in 2043. The tailings are transported through a watered tube system from Los Pelambres to the basin and retained by a 1.400 meters long and around 250 m high wall. Undoubtedly, the construction entails economic benefits for Caimanes, including long-term employment of locals in Los Pelambres. Nevertheless, several inhabitants of Caimanes, among them farmers, have been contesting the dam since its first projection in 2003. They have been arguing that the dam has negative effects on the water in Caimanes, both in quantity and in quality. They formed civil society groups and issued numerous environmental and technical objections against the project. Los Pelambres S.A. counter that there is no negative influence on the water situation in Caimanes, since the water run-off from El Mauro to Caimanes is filtered and clean (*aguas claras*). Also the competent administrative authorities, the National Water Agency (DGA) and the Regional Environmental Commission in Coquimbo (COREMA) did not find that there was any substantive infringement of respective regulation and approved the project which encloses the El Mauro basin by a 1.400 meter long and 237 meter high wall. By the end of 2008 the tailings dam El Mauro started to operate. Legal remedies of the opponents were brought before the District Court Los

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Vilos and the Appellate Courts of La Serena and Santiago but were only partly successful. However, last October the Chilean Supreme Court has rendered a judgement which was celebrated as a victory for the activists. Hereafter the said judgement of the Chilean Supreme Court shall be presented and discussed.

The Supreme Court's Judgement

Facts of the Case

On 3 October 2008 three individuals from Caimanes issued a so-called claim of new building (*denuncia de obra nueva*) against Minera Los Pelambres S.A. before the regional court in Los Vilos. As argued in older claims and objections, the applicants alleged that the denounced construction had harmful effects for the local community of Caimanes. They stated that it would infringe water rights of all entitled persons situated downstream of the area where the construction of the tailings dam has been permitted, including the intervention in natural riverbeds which run at the El Mauro basin. The alleged violations of water rights included the change of the water supply sources for all users and environmental problems not only for the water but also for the whole environment throughout the Pupío Valley. Additionally, the applicants argued that the denounced construction was hampering the community by creating a considerable risk for the maintaining of natural resources, mainly the human consumption of drinking water and the use of water as means of production, thereby perturbing natural riverbeds and affecting collective social goods (*bienes sociales colectivos*), as is living in an environment free from contamination guaranteed by Article 19 N° 8 Chilean Constitution. Finally, the applicants postulated that the functioning of the tailing dam El Mauro should be entirely prohibited and that those parts of the construction altering the course, the flow, or the bed of water rivers should be demolished.

The respondent denied that the tailings dam was to be considered as a new building, since it had been finished by November 2008 and that furthermore no right or servitude existed that could be affected by the tailings dam. Additionally it claimed that there was no environmental perturbation and even if there was, it was not caused by a new building. According to the respondent, the construction was fully in compliance with the respective regulation and the applicants had not contested Resolution N° 1.791, 30 November 2005, by which COREMA arguably approved the construction and the functioning of the tailings dam.

With judgement of 12 November 2012 (rol C-7.957-2008) the District Court of Los Vilos entirely rejected that the construction was a new building, without granting costs. The Appellate Court of La Serena, then, took up the applicants' appellative claim and by the decision of 28 August 2013 essentially maintained the District Court's decision, solely repealing the costs decision. Against this final decision

Figure 2: The demonstration against the Pascua-Lama gold mine in Chile and the Conga gold mine in Peru (Codi Yeager-Kozacek , http://www.circleofblue.org/)
Photo credit: *The future is unwritten* via Flickr

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the applicants lodged an appeal of merits (*recurso de casación en el fondo*) claiming that there had been infringements of law of substantial effect. The applicants asked the Supreme Court to render a new judgment (*sentencia de reemplazo*) this time entertaining the initial claim of new building.

Decision

By judgment of 21 October 2014 the Supreme Court's third chamber (Chamber of Constitutional and Contentious-Administrative Procedures) entertained the claim with three against two votes. The High Court stated that the respondent Los Pelambres S.A. was obliged to restore the natural course of the water in El Mauro due to violation of water rights held by the Community of Caimanes. He ordered that Los Pelambres S.A. should present an execution plan before the local court of Los Vilos within a month consisting in entire or partial demolition of the dam wall or other suitable construction works.

Ruling of the Court

When assessing the applicants' legal capacity to sue the respondent party (locus standi) the court firstly had to examine whether the tailing dam el Mauro was to be considered as a new building (*obra nueva*), this being a necessary prerequisite for claim of new building provided for in Articles 930 and 931 of the Chilean Civil Code.

The court added that the public interest claim according to Art 948 Chilean Civil Code widens the personal scope of the locus standi, thereby allowing all inhabitants of Caimanes to raise the claim of new building, when buildings are planned to be built in streets, squares or other areas of public usage. The court found that the construction of the tailings dam consisted on the one hand in the construction of pavement distress as a foundation, but that the rest of the dam wall was and is made additionally of rough tailing material proceeded from the mine Los Pelambres through the mentioned channel system. Through the permanent deposition of tailing materials onto the dam wall, the court came to the conclusion that construction of the tailings dam is not concluded during its functioning and that therefore it is to be seen as a new building within the meaning of Articles 330 and 931 Chilean Civil Code.

Secondly, the court had to deal with the question as to whether the functioning of the El Mauro dam injured the applicants' water rights. The court repeated that in 2008 administrative authorities had taken four different samples from the clear water run-off at the El Mauro basin and that the samples did not exceed the maximum limits prescribed by the respective regulation in force. However, the court found that this was not sufficient evidence to exclude future incidents and that water would be free of contamination throughout the functioning of the dam. Hence, the court continued by citing hydrological and medical expert opinions and derived that there was evidence of aluminium, boron, iron, manganese and mercury in the Pupío river and the main drinking water fountain in Caimanes, exceeding the levels for drinking water laid down in the regulation. Besides, the court stated that according to another expert opinion there had been an incident in 2008, in which contaminated water infiltrated into

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the tubes carrying the clear water run-off. Additionally, the court held that the National Water Agency had missed to control the subterranean water flows.

In view of the court, this affected fundamental freedoms and rights under the Chilean Constitution. Given the facts, the court held, there has been an interference with the right to live in an environment free from contamination (Article 19 Section 8 CPCH) and the duty of the state to protect every person's physical and mental health (Article 19 Section 1 CPCH). To assess the constitutional framework the court deemed necessary to take into account the "global problem" (*problemática global*) the dispute entails, even when dwelling on topics that could in limine be seen as a digression of the subject matter.

The court started its "global" deliberations evoking the contribution of the mining industry to increment the GDP and to improve living conditions in Chile. It continued by stating that it is the duty of the state to strive for a development of an avant-garde mining industry in which "in complete harmony with the natural environment and its interaction with human beings living in this place and by means of the security of production processes and works can be carried out in a framework of good relations with contiguous communities". Moreover the Supreme Court deduced from the constitutional framework that there is an obligation of the state to actively prevent contamination (*principio de prevención*) even when scientific certainty about the contamination cannot be reached (*principio de precaución*).

Referring to a former reasoning by the Appellate Court of Santiago, the High Court evoked that the position of the tailings dam 45 km away from the mine Los Pelambres was exclusively owed to economic considerations, such as lower costs for the mining enterprise, whereas the impact on the biological habitat and the people living in the area even further than 45 km away from the mine is – in view of the court – more serious and contravenes constitutionally granted rights. Furthermore, the court added that in its judiciary experience once the tailings deposits are filled with mining waste, the constructions are often abandoned making environmental prevention "very complex". The court specified that due to its constitutional rank, environmental protection and the principles it entails have to be observed by all mining activities as well as the respective statutory environmental law which implements the said constitutional mandate. Taking all these considerations together the court came to the conclusion that the applicants' claim had to be entertained.

Assessment

The north of Chile (I-IV Región), one of the most arid regions in the world, has seen both its natural and social landscape shaped by mining. Mainly large deposits of copper have placed Chile as number one producer of this metal. Urban areas in this region are intensely connected with mining. Veritable business cities like Calama or Copiapó, once quiet villages, have been witness to the economic boom (Penaglia Vásquez, Francesco Emmanuel & Van Treek, Esteban Valenzuela, 2014). However, the environmental sacrifice of this wealth is not yet foreseeable and available water sources are diminished continuously, thereby dramatically increasing resource competition among the mining industry, agriculture and the urban areas themselves. The court also alludes to another aggravating phenomen: that due to the depletion of mineral resources in more remote areas the production industry is more and more approaching towards urban areas and zones of agricultural use (Pokhrel & Dubey, 2013) and that last but not least the leaking of tailings dams represents an especially high risk (Hansen, Rojo, & Ottosen, 2005).

In view of these circumstances it may be surprising that Chile arguably has the most liberal water law in the world. With the implementation of the free market-oriented Water Code in 1981, but also as a consequence of Article 19 Section 24 of the Chilean Constitution, water has been legally turned into nearly untouchable private property (Bauer, 1997). Technically speaking, in Chile water law has to be seen nearly exclusively as private law, possibly subject to all forms of treaties and private agreements. The Water Code of 1981 is just the opposite of European water codes containing numerous state regulations on water protection, special procedures for different kinds of water, which in case of infringement are all enforceable by the competent administrative authorities. The institutional configuration of the Chilean model is therefore also different, leaving only restricted power to the National Water Agency DGA and putting the resolution of water conflicts

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mainly in the hands of the judiciary (Bauer, 2013).

This explains why the Supreme Court had to deal with a civil law claim deriving from the Roman interdictum operis novis nuntiatione (enabling to sue the constructor of the allegedly harming building before the Pretor). In legal systems with a mainly state-dominated environmental law this claim may occasionally still exist (e.g. Section 340 Austrian Civil Code), but in cases of a dimension comparable to the El Mauro tailings dam an application is just not imaginable. Admittedly, it is creative that the applicants argued that the huge tailings dam was a new building because its construction continues by means of the mining waste deposit. Admittedly, it is positive from an environmental perspective that the court adopted this viewpoint. However, it points at the weakness of the competent administrative authorities both in their legal capacity and in their risk prevention management. Without being able to study all the decisions and approvals made by the COREMA and the DGA, it is at least surprising that the project was repeatedly approved, seemingly for a period of 40 years. The apparent lack of administrative state control of the El Mauro dam becomes even more worrying when bearing in mind the elevated seismic activity in the north of Chile.

The second part of the judgment is less technical and mainly tries to enforce Art 19 N° 8 of the Chilean Constitution. Environmental lawyers may find it positive that the High Court connects the provision not only with the principle of prevention but with another principle originally deriving from international environmental law: the principle of precaution. Some of the court's "global" considerations partly read – at least from an Austrian Public Lawyer's position – rather like a political program than the merits of a High Court interpreting the law. Again, this hints at the feebleness of the administrative (and possibly legislative) power related to integrative resource management, especially water management.

Conclusion

From a legal perspective this case shows the challenges a free market based resource law means for urban areas, above all because it shifts the main responsibility to the judiciary; (Chilean) judges are not sufficiently empowered to definitively solve complex resource conflicts, among other things they will be always dependent on the administrative authorities to execute their orders. Additionally, the concrete judgement at issue has got two other problems. On the one hand, it leaves the respondent party the choice to take other measures than the demolition of the dam wall, although practically there is no other way to re-establish the natural flow of the waters in the El Mauro basin. On the other hand, decisions of the Chilean Supreme Court only rule on a restricted object and do not yet represent binding precedents (Bravo-Hurtado, 2013). At this point it has to be mentioned that shortly before finishing this report, the Appellate Court of La Serena repealed a decision by the District Court of los Vilos that had ordered the demolition of the dam wall. One can only hope that the Chilean administrative and the judiciary collaborate to take the necessary measures to prevent a major contamination. For the future institutional change seems to be vital.

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Conflict of Interests

The author hereby declares that there is no conflict of interests.

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Reports and analyses

Cultivating the City: Infrastructures of abundance in urban Brazil

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Brazil, landscape architecture, urban agriculture, green infrastructure, agroforestry, landscape democracy

Abstract

Urban agriculture, if it is to become integrated into the city, needs landscape architectural thinking in order to be woven into the larger urban fabric. Thinking at the scale of ecosystems running through a city creates a framework for spatial change; thinking in assemblages of stakeholders and actors creates a framework for social investment and development. These overlapping frameworks are informed and perhaps even defined by the emergent field of landscape democracy. Cultivating the City is a prospective design project seeking to embody landscape democratic principles. The intention is to reclaim the meaning of landscape as the relationship between people and place, both shaping each other. The design in question is a proposed network of urban agriculture typologies in Porto Alegre, Brazil. These hypothetical designs, emphasizing agroforestry with native species, serve as a basis for dialogue between potential stakeholders and as catalysts for future projects. This landscape architecture project sets out to be a mediator in processes of spatial evolution in order to envision just and sustainable urban landscapes.

"Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody. - Jane Jacobs

The potential of green infrastructures in the context of rapid growth

The economic boom in recent years in Brazil has brought with it a complex array of social and environmental challenges. Continued growth has added to the pressure on informal housing areas or favela neighbourhoods in urban areas. Although the general rate of favela formation has decreased in the last several years ("6% da população...", 2011), cities are increasingly stratified according to wealth. Currently over 50 million people still live in urban slums (Blanco, 2008). Together these urban inhabitants would form the fifth largest state in Brazil (Carta Capital, 2013). Public space is a contested zone where the urban poor compete for resources and economic opportunity.

On the level of health and prosperity, growing obesity in the general population has greatly increased while malnutrition continues among the poorest. In 1974, the obesity level was 2.8% in men and 8% in women over twenty, compared

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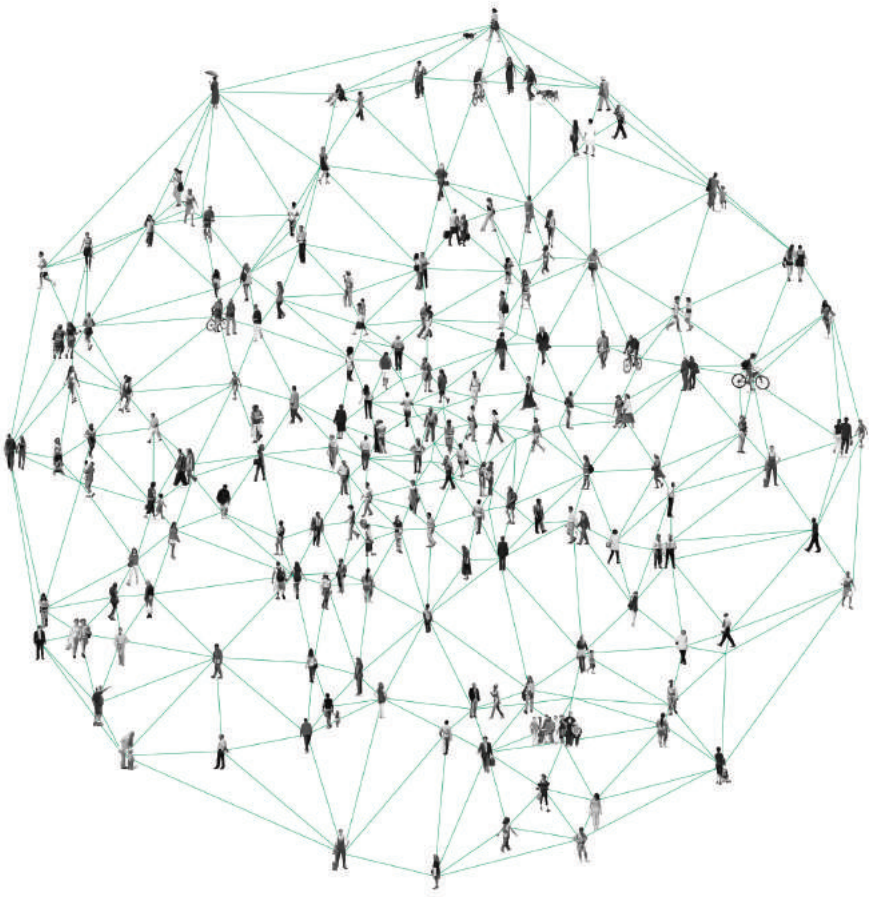

Figure 1: Green Infrastructure is made by people (Illustration credit: Jacques Abelman)

with 12.4% and 16.9% respectively in 2009. Obesity rates have grown far more quickly amongst people of lower incomes, although since 2003 this trend has stabilized, with the difference in obesity rates between the wealthy and lower income currently quite narrow (Monteiro, Conde and Popkin, 2007). The Brazilian Department of Health Analysis has projected that Brazil will match the United States' obesity levels by 2022 (The Telegraph, 2010).

As urban populations continue to expand, cities in Brazil must adapt to the spatial as well as the social needs of all their inhabitants in order to move towards just and sustainable urban models. New spatial practices must therefore be articulated in order to offer successful strategies for attaining these goals. Urban agriculture (UA) is a practice which can potentially address urban spatial quality and access to food simultaneously. UA can create a secondary food network in the city, simultaneously creating opportunities for livelihoods and new economic activities (FAO, 2008). The FAO cites UA as an important factor in helping cities reach the Millennium Development Goals (FAO, 2010). At the same time, networks of food producing spaces can potentially increase the spatial quality of the city.

Urban agriculture, if it is to become integrated into the city, needs landscape architectural thinking in order to be woven into the larger ur-

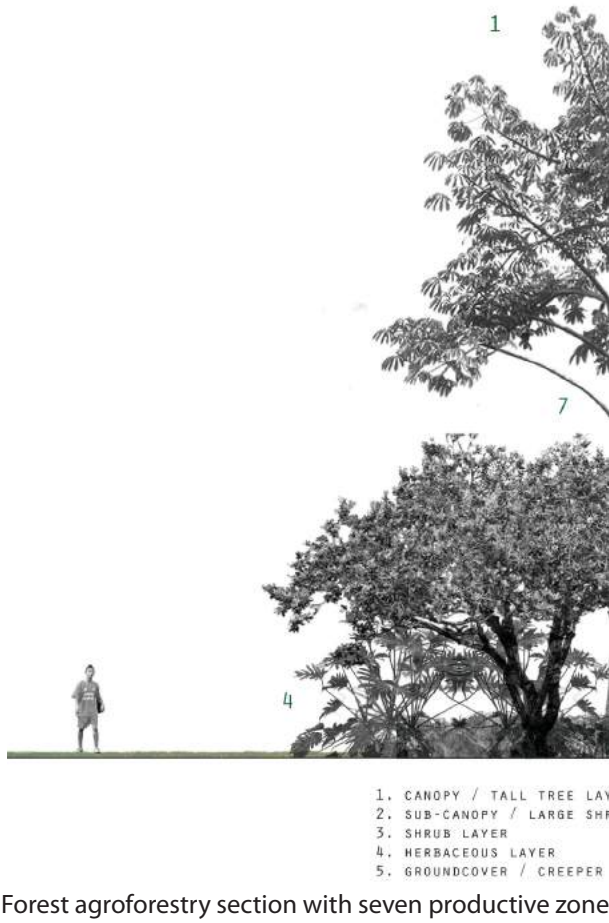

Figure 2: Food Forest agroforestry section with seven productive zone

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ban fabric. Thinking at the scale of ecosystems running through a city creates a framework for spatial change; thinking in assemblages of stakeholders and actors creates a framework for social investment and development. These overlapping frameworks are informed and perhaps even defined by the emergent field of landscape democracy. Landscape democracy understands landscape as an embodiment of differing forms of energy, labour, and organization. Landscape is also understood as a basic infrastructure of society.

Cultivating the City explores and reclaims the meaning of landscape as the relationship between people and place, both shaping each other. Through a series of hypothetical designs for new productive spaces in the city based on interviews and site analysis, the potential of landscape architecture to create new green infrastructure is illustrated. The project is based on a network of productive urban green spaces in the southern Brazilian capital of Porto Alegre in the state of Rio Grande do Sul. The plant species are selected from the hundreds of food-bearing and medicinal tree, shrub, and plant varieties present in southern Brazil's Atlantic Forest ecosystem. Different typologies of plantings, based on orchard or forest patterns, compose a lace-like network of productive and aesthetic green infrastructure in the urban fabric. Each typology is a scenario of different actors in a specific short food production chain. These narratives, as explorations of potential stakeholders working together on specific sites, illustrate the larger strategy of a adding a productive and multifunctional green infrastructure to the city.

s of indigenous species (Illustration credit: Jacques Abelman)

Observing places and practices

In order to propose a project built on people and place it is essential to study the city first-hand. In March and April of 2013 I lived in and conducted site research in Porto Alegre. My research methodology in this context was to explore the city on foot, by public transport, by bike and by car, and to observe and engage in dialogue wherever and whenever possible. I immersed myself in the processes of the city and discovered relationships and tensions present in a variety of different sites. Over the course of my city explorations and while attending classes at the Universidade Federal do Rio Grande do Sul (URFGS) in the Rural Sociology, Agronomy, and Urbanism departments, I met many engaging people who introduced me to their city. Through them, as well as people I encountered on the street, I discovered sites and observed practices that became the foundation of Cultivating the City.

Fieldwork: exploring three urban sites

Praça Bernardo Dreher

My hosts, the Endres family, are *gaúchos*[1] with German and Portuguese origins. Oscar Endres ran a large market stall in the Mercado Central of Porto Alegre for over fifty years. He prides himself on knowing the origins and culture surrounding Brazilian food and its multitude of regional

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products, processes and recipes. Now retired, Oscar is an avid gardener. He and his family have lived in the Ipanema suburb of Porto Alegre since the late sixties, a middle class neighborhood far away from the bustle of downtown. Ipanema's tree-lined streets frame well-maintained homes with fences and gardens. Security is an issue here, as the slums are not far away and break-ins, sometimes at gunpoint or carjacking are not uncommon. Neighborhood security guards watch from the shelter of small sheds on street corners, surveilling passers-by day and night through tidy lace curtains. At the end of the street, there is a small park, Praça Bernardo Dreher. The park has lawns, some swing sets, large trees, and a football terrain. I walked there with Oscar, who showed me with pride a leafy shoot protected by broom handles and pieces of wood. It is a *goiaba*[2] tree that he has raised from seed in his own backyard and transplanted into the park. He treats it with care, and visits it regularly. Other residents have begun to do the same. A seed of *pitanga*[3] or *araça*[4] for example, will quickly grow into a shrub, then a tree in the favorable sub-tropical conditions. The trees yield abundant fruit and in this neighbourhood the harvest is free for all who care to pick it. The municipal workers who come to mow the park lawns steer clear of the protected seedlings, and once they are established they seem to be absorbed into the design of the park. A dozen new fruit trees planted here over the years augment this neighborhood landscape. Small acts of guerilla gardening have become a shared neighborhood practice, bringing residents out to meet each other. Eyes and ears in the vicinity are on the trees, also creating a safe area for children to play. An atmosphere of unease sometimes reigns in the suburbs, as though danger or violence could erupt if the wrong conditions arise. My hosts' accounts of incidents of crime confirmed this. However, small children playing in the park with no parents to watch over them attest to the network of awareness around the Praça.

Vila São José

"Spontaneous occupation" is the term used to qualify urban slums in Brazil. Cities are their own ecosystem; whatever niche that can support life is soon filled by an individual or family whose concern is food, shelter, and the business of survival. The pressure on empty urban land is great; spaces are quickly claimed by those arriving to the city who cannot afford conventional housing. However, over time favela areas can come to be thriving neighbourhoods of ingenious architectures as residents climb the economic ladder out of poverty. Temporary shelters solidify into lower middle or middle class housing made of brick and masonry. I toured an area of spontaneous occupation with Pedro, a man responsible for the nearest posto de saude, or neighborhood health clinic. The favela niches in an empty band of land behind a row of wealthy villas with impenetrable razor wire and glass shard topped walls. Together we met many of the inhabitants, Pedro's clients, whom he knows closely after years of attending to their health needs. Tiny manicured gardens are attached to many houses, often with similar plantings of medicinal, culinary, and religious plants. For example, Espada de São Jorge, Sanseveria, is thought to protect houses from evil spirits.[5] Mature fruit trees planted intentionally or as remnants of natural areas peppered the housing areas, and were carefully maintained as sources of extra food. In other favelas in peri-urban areas, housing transitions into farmland, natural areas or aggregates along infrastructures such as highways. Although there were no new trees planted in common areas in this favela, the residents rely on free sources of food such as fruit trees. Across the city the locations of mature fruit trees are known, for instance many of the trees of the university campus in the downtown area.

Praça dos Açorianos

Praça dos Açorianos is the heart of the central administrative district in downtown Porto Alegre. Most public transportation networks take passengers by this plaza, whose center features a monument to the first Azorean settlers of the city. The wide spaces of the pristine plaza are kept constantly clean by municipal workers. Their job is to remove any litter that accumulates there, on the lawns or beaten earth tracks and pavement. Public space is kept free of debris to the point of sterility. These spaces are free of bushes or clumps of weeds or anything that might possibly create shelter for humans or other creatures. Some people take to sleeping in relatively unpoliced areas. At night these spaces become dangerous. The noteworthy practice here, from a spatial

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point of view, is the manpower required in such a central, public space to keep not only humans but all extra vegetation out. In Portuguese, the word *mata* means forest. *Mato* is a closely related word meaning an uncultivated area covered in wild plants, but implies overgrowth and potential vermin. Thus spontaneous vegetative growth, even of useful plants which happens without human help in the sub-tropical climate, is something to be kept under tight control rather than to be encouraged. People as well as plants are carefully kept out of public space.

Figure 3: Site visit and interview reveal incipient urban agriculture practices at the Praça Bernardo Dreher, Porto Alegre (Photo credit: Jacques Abelman)

Top down meets bottom up: potential scenarios for networking urban agriculture

What the sites above share in common is intensive human use shaping urban space. The obvious problems in these sites belie their potential; the potential of nature as well as the human potential. If the relationship between people and place could be augmented, challenged, and reimagined, Cultivating the City could take shape. If we think of landscape democracy as an exploration of the relationship between people, place, and power, then we can begin to trace outlines for landscape democratic practices in the contexts described above. It is beyond the scope of the project to provide an accurate critique of Brazil's politics and socio-economic complexities in terms of urbanism. However, some landscape democratic practices can be traced in this context which lay the ground for further work. One key issue is how the economic disparity increasingly present in Brazilian society is creating more economically stratified spaces in the city.

Who has access to public space? In the capitalist market system, those without the capacity to buy or sell, and those who are not owners, are quickly and literally pushed to the margins. Landscape democracy in this context means an emphasis on inclusivity and connection. Opportunities for the disadvantaged must be created in addition to designing new leisure and recreational spaces. Human power can be coupled with ecological power (rich biodiversity, rapid growth) to create a motor for new projects. The four examples that follow, based on the sites described above, illustrate new configurations that become elements in a city-wide network.

Praça Bernardo Dreher: suburban food forest park

The *Praça Bernardo Dreher* is a good example of bottom-up and top-down meeting halfway. As the act of neighborhood guerilla fruit tree planting is integrated into the life of the park, social cohesion is increased. The results are accepted and even maintained by municipal workers. Augmenting this practice could mean providing seedlings for free to those who want to plant them. Almost all native fruit trees and medicinal plants are available at the botanical garden or the municipal plant nursery. A landscape architect or planner's role could be to co-ordinate these plantings into better designs than haphazard planting. It would take a small number of interventions to achieve this. Information could even be posted on site. The resulting food production could be distributed between neighbours, or simply left to those who need or want it. Harvest moments create occasions for people to meet each other around meals or celebrations. Fruit can also be gathered for sale in other areas, from a cart or a small stand, or even brought to the farmer's market. Processed fruits become fresh juices, preserves, and a variety of other products with potential small-scale market value.

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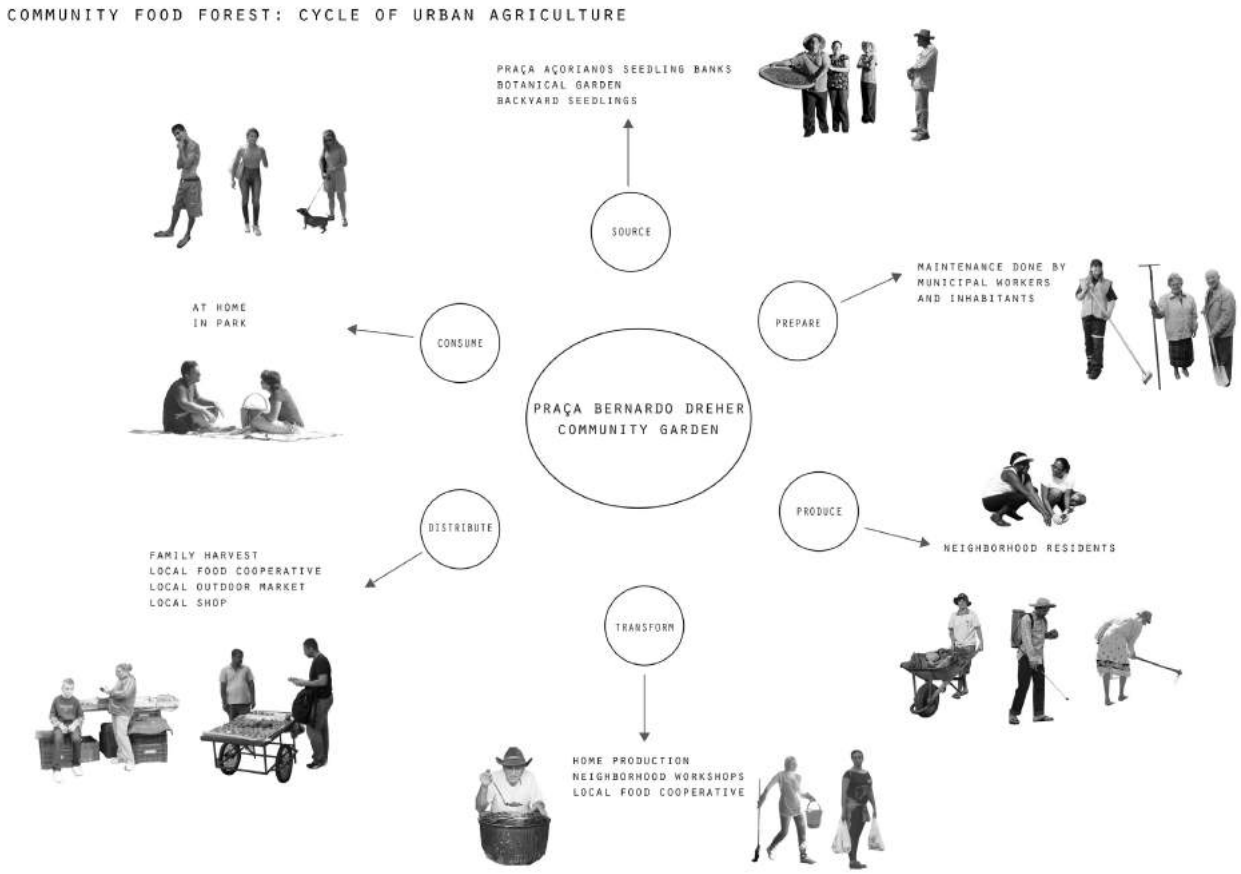

Figure 4: The potential UA cycle of the community food forest at the Praça Bernardo Dreher (Illustration credit: Jacques Abelman)

Vila São José: new partnerships for intensive production

Many residents in favelas have come to the city from rural areas to look for employment. Many are from families who left agricultural production to benefit from the economic and social possibilities offered by the city. Favelas are reservoirs of human labour and knowledge. The location of peri-urban favelas next to agricultural or public land makes agricultural projects potentially possible. Public projects could be created with land belonging to the University in collaboration with experts from agronomy and horticulture. The city could encourage entrepreneurs to start peri-urban agricultural projects by donating land, offering tax breaks, and offering social support for worker training. Here high intensity fruit production could create jobs as well as large quantities of fresh food to be brought to market in the normal distribution chains. Many of the native fruit varieties are not commercialized because they are either too labor intensive to pick, or too fragile to travel long distances. In a short food supply chain this problem is avoided. Fruits and berries could also be processed into a variety of products, from juices to cosmetics, to be sold locally.

Praça dos Açorianos: a flagship project for the heart of the city

Cidades sem fome, or Cities without Hunger, as well as the Zero Hunger Project (FAO, 2011) relate to a governmental program called the National Food and Nutritional Security Policy (Chmielewska and Souza, 2011) concerning projects to combat hunger in cities across Brazil. In Belo Horizonte, the capital of the state of Minas Gerais, several farmers' markets allowing direct sales were established, as well as public kitchens serving extremely low cost nutritional meals. Nutritious and affordable food is deemed a right for all. These policies changed the identity of the city. In Porto Alegre, large and empty urban plazas could serve as the sites for urban orchards whose beauty and productivity, seen by all, would become a new badge of identity. Rows of native fruit trees would increase the beauty and lei-

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Figure 5: Imagining a bottom-up initiative creating a community garden and tree nursery in the Vila São José (Illustration credit: Jacques Abelman)

sure value of areas that were previously lawn or concrete, creating a new form of urban park. Because the maintenance of the trees and the harvesting of the fruit is labour intensive, many new jobs could be created not requiring intensive training or education but instead relying on basic agricultural skills.

Downtown destination: an ephemeral market at the heart of the network

Every Saturday a farmers' market takes place in the Parque de Redenção, the major urban park of Porto Alegre. The masses of people coming to attend the market every weekend suggest that the city could support another market. There is a strong interest in health and food in Brazil; organic food is a strongly growing market. The central urban plaza of the Praça dos Açorianos could support an ephemeral urban agriculture market- a farmer's market for all the food and herbs grown around the city. The new market would be a vital link in the organization of the various food production projects across the city. As a platform bringing together many of the actors in the larger project, the market would become an anchor point and destination in a network that emphasizes economic opportunity and inclusivity across the city, as well as improving the overall urban spatial quality.

First conclusions

The practice of landscape architecture in this context moves from fieldwork and analysis to normative illustration of spatial change. The images and scenarios created through the design process are boundary objects, what Susan Star defines as "entities that enhance the capacity of an idea, theory or practice to translate across culturally defined boundaries, for example, between communities of knowledge or practice" (Star and Griesemer, 1989).

The intention of Cultivating the City is to frame the landscape architecture project as creative research endeavor that understands an urban context and makes a projection– through design– about best-practice scenarios. Large-scale urban and landscape analysis create a framework for establishing the structure and linkages of the network. The network relies and reacts to the ecological as well as human capacity found within it. The project works on not only one site's potential but on many sites' potential, and how these differing assemblages of site and actors could be linked together in one system.

The principles of the emergent field of landscape democracy allow us to see urban space as a field of negotiation between people, places, and pow-

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er. Within this field, finding the every day practices that link people and place make it possible to augment and connect these practices into a larger strategy. In this way the project has the potential to catalyze processes of urban evolution, with the landscape architect acting as a mediator. Based on dialogue, design, and the democratic ideal of inclusion, Cultivating the City works toward this vision for change as one piece of a complex process.

1. In Brazil, gaúcho is also the main gentilic of the people from the state of Rio Grande do Sul.
2. *Acca sellowiana*
3. *Eugenia uniflra*
4. *Psidium cattleianum*
5. *Espada de São Jorge* (sword of Saint George) is also associ ated with the god Ogoun in Brazilian syncretic religions.

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Conflct of Interests

The author hereby declares that there is no conflct of interests.

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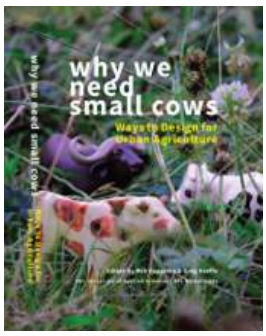

Why we need small cows. Ways to Design for Urban Agriculture

A book review by HANS BROESS

Editors: Rob Roggema & Greg Keeffe
VHL University of Applied Sciences/ The Netherlands & Queens University Belfast/ UK
Pages: 329
Hardcover 25,00€
Published October 2014
ISBN: 978-90-822451-1-0

An unusual academic pledge in which 27 authors explore in 16 articles the potential to grow food in the city. The history of the food map is drawn in the first two chapters. New food maps are subsequently developed in six chapters, spread over the book, for Amsterdam and Rotterdam in the Netherlands, Middlesbrough in the UK, Cantagalo in Brazil and Bendigo Creek in Australia. One chapter investigates the suitability of suburbs for the new food map and one chapter takes the systems and typologies as an object of research. One chapter performs architectural research resulting in architectonic designs. In three chapters the search for sustainable upscaling is conducted, such as Pig City. The final two chapters deal with a financial exploration and in a concluding chapter five chances for Urban Agriculture are presented.

While published as a book, the registration of articles in a non-causal manner makes it more like a documentary. A documentary about the transition of the food map of the countryside towards the city, viewed from different disciplines in different countries. Together with an unusual large number of images ,drawings and schemes it is quite an experience to wander through this book and seduced by images or words have a detailed look, read and search further.

During my journey of discovery through this documentary I came across interesting inspirational moments as I passed by elementary questions. A crucial question such as 'Can we produce similar amounts of food in the city as we are capable of in the countryside?' – is remarkable in the buoyancy of the answer. One needs to start small, in empty buildings in the city, on roofs in parks or empty sleeping rooms, where lamps fed by solar power on the roof bring light without costs wherever you want.

But what can be found under this buoyancy? Is there knowledge of large-scale food production, which only becomes bigger without a reverse to get smaller in scale? Is knowledge available about capitalistic amoral food production, becoming even more amoral? Is food being turned by on the auction instead of giving it to the hungry? Or are the excesses of thinking in yields preventing us from discussing alternative food maps? Or is on-going individualism making us afraid?

Whatever it may be, the fact is that the enormous enthusiasm felt in the documentary to search in a very intelligent way for new places and new ways of sale. Small-scale hatcheries give innovation an undercover presence and the absence of answers to old-fashioned questions prevent the proposed transition poses a threat.

It is impressive to see what the results are of the different search paths, whereby the photos and schemes really convince the birth of food production in the city is plausible and in some places already a reality.

The documentary starts with Darwin and his adaptation to changing circumstances, such as the changes in climate, implying changes in the food map of animals. These changes also started small, which places the entire book in another perspective. Every change

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starts with a small adjustment. They seem improbable but not impossible. They may achieve an adjustment of the food map. Darwin takes care of the rest.

The contribution of Evert Kolpa really captured my imagination. The urban food map was apparent in the city for centuries, within the fortifications! Kolpa designs this concept all over again. He introduces schemes in which spatial areas are distinguished to which he adds new cultural dimensions. For example, restaurants where one first harvests his green tea, a community centre that combines a greenhouse where new contacts can be made. He introduces supermarket parks where food is produced in old parks. Or the photos from Japan, in the article by Arjanvan Timmeren and Ulf Hackauf in which urban farms look like large blocks of green and harvest rice inside buildings.

I am doing a disservice to many authors by not mentioning them, but I hope I made you curious. Really, you shouldn't miss this book. An academic work that touches you, that makes you think and makes you aware in such an easy way. Well done, Rob Roggema and Greg Keeffe and a big compliment to both Universities in Velp and Belfast.

Author information:

Hans Broess works at the Atelier Inspirator 'Shrinkage'- studio Academy of Architecture. The shrinkage studio is in the most recent three years the core theme of graduation for young architects to receive their final diploma. The design task was to develop new impulses, which could tackle problems such as housing vacancy, poverty and joblessness, in the shrinking region of Delfzijl. The most recognisable results are a concrete design in which empties 30% of the built-up area and 30% within the buildings themselves to create space for climate change and is temporary used as landscape of to grow food. Another recent architectural design includes a vertical mussel nursery in an empty high-rise building in which sea water is pumped up and flows down in a cascade-type of system, feeding the mussels at every floor.

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