# Challenges for Sustainable Food Systems in Metropolitan Landscapes

Carsjens G J[1]

[1]*Wageningen University, Land Use Planning Group P.O. Box 47, 6700 AA Wageningen, The Netherlands.*
*E-mail:* gerrit-jan.carsjens@wur.nl

## Abstract

Metropolitan landscapes are facing the challenge to find a balance between urban development on the one hand and the preservation of farmland and natural resources on the other. Conventional land use planning approaches are often not up to this complex challenge and many regions are in need for innovative knowledge and approaches. This paper discusses the role of scenario methodology in the search for innovative solutions, with special emphasis on the challenges related to the sustainability of the food system. An example of application of scenario tools is presented for the Metropolitan Region Amsterdam, the Netherlands.

**Keywords:** sustainable food systems, future studies, land use planning, scenarios

## Introduction

Landscapes are being shaped by societal activities, as human kind strives to make a living in the biophysical environment. These activities include, for example, the cultivation of land for food production, the construction of buildings, the extraction of raw materials and the consumption of services such as leisure activities. Some consequences of these activities are the translocation of nutrients, altered hydrological systems and the loss of biodiversity (Baldwin 2009; Lang *et al.*, 2009). The consequences are especially prominent in densely populated metropolitan areas, such as delta regions. Delta regions are worldwide among the areas with the most fertile soils and often accommodating important wetland areas. Many of these delta regions, such as in the coastal areas of South America and Asia, are subject to urbanization, resulting in an increasing pressure on the rural area for economical and urban development, but also an increasing need to preserve farmland and natural resources (Chen *et al.,* 2015). A key challenge is to find a balance between urban development on the one hand and the preservation of farmland and natural resources on the other. In practice this balance often turns in favor of urban development. Conventional land use planning approaches are often not up to this complex challenge and many regions are in need for innovative knowledge and approaches (Carsjens 2009, Carsjens *et al.*, 2013). This paper discusses the role of future studies in the search for innovative solutions, with special emphasis on the challenges related to the sustainability of the food system.
First, the challenges related to the sustainability of current food systems will be described. Afterward, some methodology of future studies and scenario tools will be introduced and an example of application of these tools in the Metropolitan Region Amsterdam, the Netherlands. The paper concludes with a discussion.

## Toward Sustainable Food Systems

"When you consider that every day for a city the size of London, enough food for thirty million meals must be produced, imported, sold, cooked, eaten and disposed of again, and that something similar must happen every day for every city on earth, it is remarkable that those of us living in them get to eat at all" (Steel 2013, p. ix)
A food system includes all processes and its related inputs and outputs involved in feeding a population, from the production of food to the disposal of waste after consumption. The conventional, industrial-based food system has been especially successful from an economical perspective. It does not only offer cheap food but delivers a wide array of choice as well. The main characteristics of the conventional food system are standardization, centralized distribution, just-in-time principle and a-seasonality (Lang *et al.,* 2009, Pirog *et al.,* 2009, Steel 2013). Standardization is a way to increase cost-efficiency. If all the products are the same, the same

treatment and distribution can be used, which cuts the costs. Standardization also gives more control on the product. This control is needed with increasing concerns about food safety and quality. When supermarkets grow larger, they centralize their distribution channels. By centralizing, less coordination is needed, which reduces the transaction costs. Although transport costs and energy usage increase when the product travels longer, the overall costs still decrease. Next to the shift towards centralized distribution, a shift towards self-distribution emerges. Supermarket chains are starting to buy their products directly from manufacturers instead of wholesalers. This centralized distribution system relies on the 'just-in-time' principle. Products should go as fast as possible to the consumer, especially when perishable. To save on the relative high costs of storage, the motorway has turned into a warehouse, in a complex logistic exercise. Moreover, customers nowadays do not know anymore when fruits and vegetables are in season and expect to find the products in the shelves all year round.

The price of food is relatively cheap because in many cases impacts are un- or underprized, making the conventional food system unsustainable (Morgan *et al.,* 2006, Baldwin 2009). The environmental impacts of intensive agriculture are well known. Too intensified farming systems in areas with limited resources lead to problems such as eutrophication, acidification, overgrazing, deforestation, loss of soil fertility, air pollution, water shortages and loss of biodiversity. We often do not realize the hidden costs of food (Pretty *et al.,* 2005). When looking at water usage, significant differences exist between products. One gram of lettuce takes 130 milliliter of water to produce, one gram of rice 3,4 liter, and one gram of lamb nearly 15 liter of water. From environmental perspective, the production and processing of meat is an inefficient way of feeding ourselves. Large areas of farmland are needed to produce fodder for animals. It takes 23 kilogram of grain to produce one kilogram of lamb, 15 kilogram to produce one kilogram of beef, 6 kilogram to produce a kilo of pork, and 2.3 kilogram to produce a kilogram of chicken. Moreover, the production of meat contributes to nearly a fifth of greenhouse gas emissions.

The pursuance of sustainable agriculture is justified considering the high environmental impacts of intensive agriculture. But defining the sustainability of the food system is even more complicated when realizing that environmental impacts are only one dimension of sustainability, as shown in Table 1. It is also important to consider the social, economic and health dimensions of food products. To avoid complexity, current product labels are often partial, they only focus on one topic like fair trade, animal welfare or local food.

Two competing paradigms can be distinguished in the transition towards a more sustainable food system: the agri-industrial paradigm and the alternative food paradigm (Morgan *et al.*, 2006). The agri-industrial paradigm aims at improving efficiency and productivity by specialized, high-yield farming systems, focusing on technical solutions for environmental problems, quality and safety assurance schemes, and nutritionally engineered functional food. The alternative food paradigm involves various types of alternative, local and ecologically produced food This paradigm focuses on closing cycles at regional scale, trust in the quality of food based on personal relations between producer and consumer, and selling fresh, whole foods (Carsjens 2015).

Although more and more sustainable initiatives and technologies are available, improvements in food systems happen slowly. An explanation can be found in the complexity of conventional food systems with an overwhelming number of actors involved, ranging from the government, the private sector to civil society (Lang *et al.,* 2009). This complexity makes it hard to find a consensus which is supported by all involved parties. Transitions cannot be pressed by governments only nowadays, as they have to share their power with the private sector and civil society. Policy and decision making takes place in a multi-level framework of governance, which also requires more time. In these processes, the involved actors use their power to influence and shape policies on food. In metropolitan landscapes the complexity is further raised, as the development of food systems has to compete with many other types of urban related land uses.

**Table 1.** Examples of sustainability indicators (Pirog *et al.,* 2009).

| Environmental | Economic | Social |
|---|---|---|
| Food miles/LCA | Profitability | Distance grower - consumer |
| Energy consumption | Import vs. domestic products | Nutritional value of food |
| $CO_2$ emission | Waste produced per unit food | Food safety |
| Land use | Transport efficiency | Number of farmers' markets |

These complex situations asks for planning and decision making approaches that can deal with the many uncertainties involved, including uncertainties related to value and power issues of involved actors and uncertainties related to future developments and trends, such as economic development, climate change and the energy market. Some authors argue that this asks for the ability to link strategic visions and scenarios for the future development of a region with short-term decision-making processes (e.g. Albrechts 2004, Carsjens 2009, Ratcliffe and Krawczyk 2011). The next section will introduce scenario methodology as a potential tool to support this complex challenge.

## Scenario Methodology

Börjeson *et al.* (2006) distinguish three types of future scenarios: predictive, explorative and normative scenarios. Predictive scenarios aim to predict what will happen in future, based on probability analysis. Explorative scenarios analyze developments that might happen, usually resulting in sets of scenarios showing a variety of possibilities. Normative scenarios or visions have explicit normative starting points, and focus on how the future should look like. Some authors (e.g. Dreborg 2004) propose a combination of explorative and normative scenarios, also called a two-scenario approach. Such an approach has been developed at the Wageningen University, the Netherlands (Carsjens *et al.,* 2013), shown in Figure 1.

The approach combines the development of external scenarios, a type of explorative scenarios, with normative scenarios or visions. External scenarios focus on external trends that are outside the control of the actors in a region, such as sea level rise due to climate change. An important step in the development of external scenarios is the classification of trends according to their potential impact on the region and their uncertainty. The most uncertain and important trends are then used to explore opposing future conditions and to construct diverging scenarios that represent a range of future conditions that the region may have to meet. Visions are usually made using the diversity of perspectives of actors about their ideal future for the region. A SWOT analysis is then used to confront a vision with the current conditions in the area, which results in identifying strengths and weaknesses of the current situation. A confrontation between the vision and the external scenarios results in opportunities and threats, resulting from how certain trends may evolve in the future. The results of the SWOT analysis allow to arrive at policy strategies that can support the debate about current and future decision making in the region.

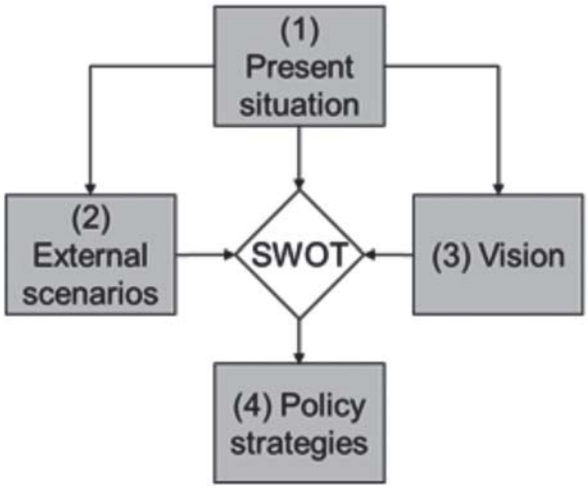


**Figure 1.** Scenario approach.

However, scenario studies have to deal with an important dilemma. On the one hand scenarios aim to describe possible future trends that can help policy makers to anticipate on possible future conditions. On the other hand, the future has still to unfold, so consequently there is no empirical basis to do research. Therefore, scenarios try to jump from factual developments in the past and present to possible or desirable developments in the future (Dammers, 2010). It is important to keep in mind that the results of scenario studies are not end-states of the future, but rather narratives about how future events could or should unfold. These narratives especially help to raise the debate among actors in a region, which may allow to develop a shared vision for the future, and to reflect on the potential consequences of current and future decision-making.

The next section describes the application of this scenario approach in a project for the Metropolitan Region Amsterdam (MRA), the Netherlands. The project took place in the context of a so-called regional innovation network that aims to link educational institutes with practitioners, politicians and stakeholders in a region. The aim of a regional innovation network is to stimulate the sharing of knowledge and approaches among the participants, which should support regional innovation through personal and professional development (Foorthuis and Lutz 2012, Carsjens *et al.,* 2013). In the project a group of 12 bachelor students from the Landscape Architecture and Spatial Planning program at the Wageningen University worked for four weeks on a project assignment of the MRA. The assignment aimed at

developing a vision for the long term (2045) for the region, taking into consideration trends and developments that may have an impact on the structure and the interplay between different functions in the region. The students were also asked to develop strategies for the longer term and an action-oriented program for the shorter term (4-10 years). They worked in two project teams, focusing on two themes and corresponding detailed areas within the MRA. In both themes the role of the food system in the MRA played an important role.

## Project Metropolitan Region Amsterdam

The Metropolitan Region Amsterdam (MRA) is an informal cooperation between 36 municipalities and two provinces in the Netherlands (Figure 2). The region is one of the main economic and urban regions in the Netherlands and Europe. Outstanding qualities of the metropolitan landscape of the MRA are its diversity, the interweaving of city and countryside and the cultural, historical and ecological values. These qualities are important assets for the international competitiveness of the MRA as an attractive living, working, living and business climate for both (current and future) residents and visitors.

Agriculture and food are assigned as a top sector by the Dutch government, and horticulture is on top of the political and social agenda of the MRA. MRA has a highly developed agriculture, water sector, distribution and trade sector, knowledge infrastructure and a population that wants something with food. The region is exploring the building blocks for a common vision on agriculture and food, in which all parties can agree and know their role. These building blocks include, for instance, a food strategy, sustainable agriculture and alternative agriculture.

The project focused in particular on two areas that are important in the context of the food system, the Zaanse Schakel and Waterland (Figure 2). The Zaanse Schakel is a declining harbor area, in-between the cities of Amsterdam and Haarlem, with several food related companies located in and around the area. Waterland is a mainly agricultural wetland area with dairy farms and areas of special importance for wetland birds, bordering the city of Amsterdam in the northeast. The economic activities in certain parts of the metropolitan landscape, such as Waterland, are unilateral, partly caused by current policies. A new vision for this area can make a world of difference, but can also meet severe opposition due to colliding value systems of different stakeholders in the area. Therefore, the students were asked to provide new, innovative input for a renewed discussion about the future of the metropolitan landscape and the role of agriculture in it.

The results of the scenario approach of the two project teams included two sets of A0 size posters, which were presented orally during a meeting with the client and stakeholders from the region, and two 14-pages management summaries, one for each detailed area. The management summaries are intended as stand-alone products that can be used in future discussion sessions with stakeholders in the region. A collage of graphical examples from these products is shown in Figure 3.

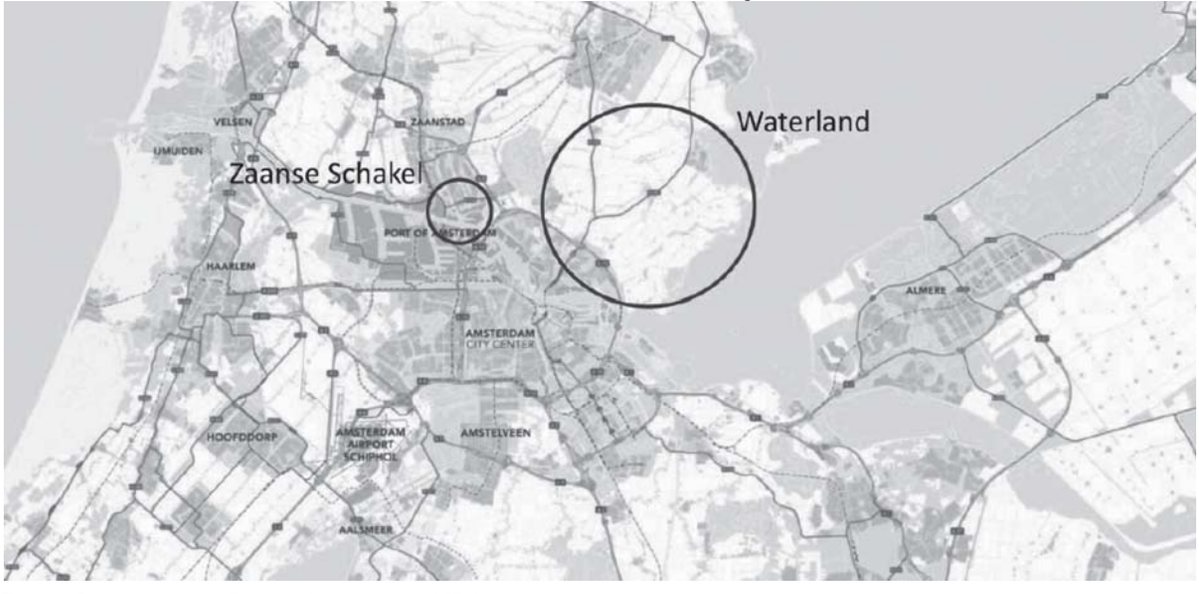


**Figure 2.** Metropolitan Region Amsterdam (MRA).

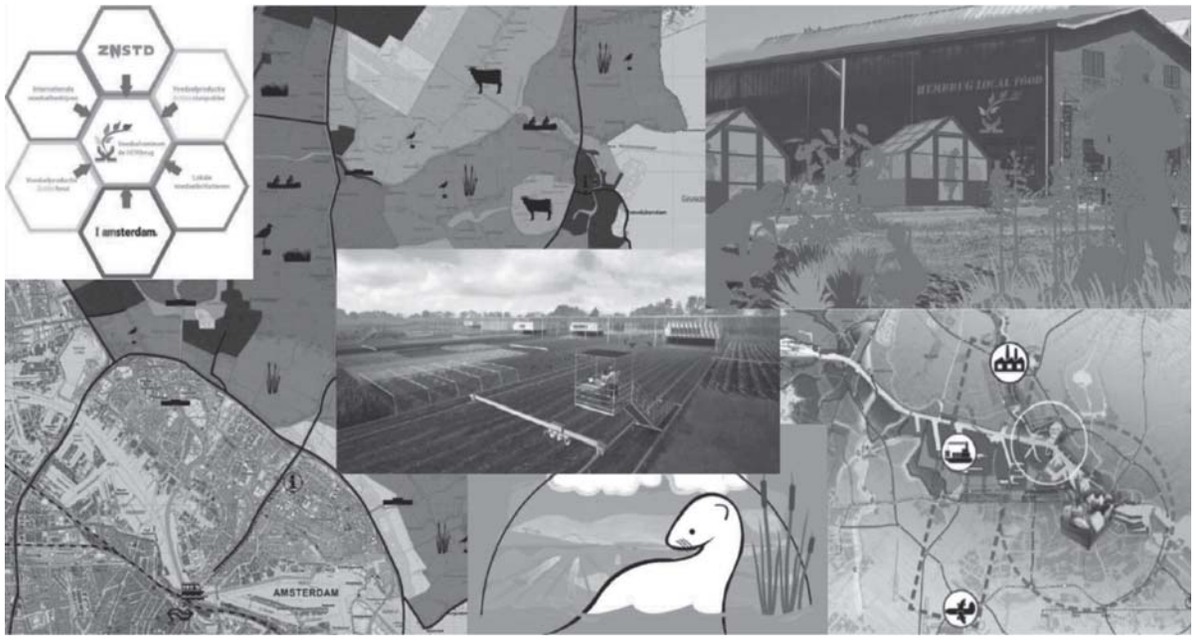


**Figure 3.** Examples of scenario products.

## Discussion

During the final presentation in the region, the client and stakeholders responded with enthusiasm on the presented results as these showed some new perspectives on the future developments in the region. Moreover, the students were invited to participate in upcoming events in the region that aim to initiate the discussion between various actors in the region. From that perspective it can be concluded that the results of the scenario approach were considered relevant to stimulate this discussion. Of course, it should be realized that the results are products of four weeks work, so consequently will have deficiencies and lack sufficient detailed analyses. This also raises the question if such results can actually support regional innovation. This aspect was assessed for three similar projects in other regions in the Netherlands (Carsjens *et al.,* 2013). The assessment was carried out using semi-structured interviews with clients and stakeholders. The assessment focused on three aspects: content related results, process related results and personal and professional development. The assessment results showed that the content related results (vision, scenarios and strategies) did not contribute directly to regional innovation, but only indirectly through the process and personal and professional development. For example, the creative visions stimulated new initiatives and follow-up projects by raising awareness and enthusiasm among clients and stakeholders. The lasting effects on regional development in these projects were evident (Carsjens *et al.,* 2013). These conclusions are supported by Dammers (2010) who also found evidence that participants in scenario processes learn more from the process itself than from the resulting scenarios.

## REFERENCES

**Albrechts L.** 2004. Strategic (spatial) planning reexamined. Environment and Planning B: Planning and Design 31: 743-758.

**Baldwin C J (Ed.).** 2009. Sustainability in the Food Industry. Wiley-Blackwell and the Institute of Food Technologists.

**Börjeson L, Höjer M, Dreborg K H, Ekvall T, Finnveden G.** 2006. Scenario types and techniques: Towards a user's guide. Futures 38: 723-739.

**Carsjens G.J.** 2009. Supporting strategic spatial planning: Planning support systems for the spatial planning of metropolitan landscapes. Dissertation Wageningen University, The Netherlands.

**Carsjens G.J.** 2015. Food in space: the spatial organization of food systems. Agric. Eng. Int. CIGR Journal, Special Issue 2015: 10-17.

**Carsjens G J, van Nieuwenhuize J P A, Kleinrensink G.** 2013. Regional learning: Integrating the science and practice of strategic spatial planning. In: C. Newman, Y. Nussaume, B. Pedroli (Eds.), Landscape & imagination: Towards a new baseline for education in a changing world. Uniscape conference, Paris, 2-4 May 2013, Bandecchi & Vivaldi, Pontedera, pp. 639-644.

**Chen W, Carsjens G J, Zhao L, Li H.** 2015. A spatial optimization model for sustainable land use at regional level in China: A case study for Poyang Lake Region. Sustainability 7, 35-55.

**Dammers E.** 2010. Making territorial scenarios for Europe. Futures 42: 785-793.

**Dreborg K H.** 2004. Scenarios and structural uncertainty: Explorations in the field of sustainable transportation. Dissertation Royal Institute of Technology, Stockholm, Sweden.

**Foorthuis W R, Lutz S.** 2012. Knowledge arrangement for the learning region: Kenniswerkplaats as a method for regional learning and lifelong learning. AOC Terra, Groningen, The Netherlands.

**Lang T, Barling D, Caraher M.** 2009. Food Policy: Integrating health, environment & society, Oxford University Press.

**Morgan K, Marsden T, Murdoch J.** 2006. Worlds of food: Place, power and provenance in the food chain. Oxford University Press, Oxford, UK, 225 p.

**Pretty J N, Ball A S, Lang T, Morison J I L.** 2005. Farm costs and food miles: An assessment of the full costs of the UK weekly food basket. Food Policy 30: 1-19.

**Pirog R, Champion B, Crosby T, Kaplan S, Rasmussen R.** 2009. Distribution. In: C.J. Baldwin (Ed.), Sustainability in the food industry. Wiley-Blackwell and the Institute of Food Technologists. pp. 61-99.

**Ratcliffe J, Krawczyk E.** 2011. Imagineering city futures: The use of prospective through scenarios in urban planning. Futures 43: 642-653.

**Steel, C.** 2013. Hungry city: How food shapes our lives. Vintage, London.