SUSMETRO

Impact Assessment Tools for Food Planning in Metropolitan Regions

IA Tools and Serious Gaming in Support of Sustainability Targets for Food Planning, Nature Conservation and Recreation

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Phase 2 Final Project Report

ALTERRA WAGENINGEN UR

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Preamble

This report covers the second phase of the SUSMETRO project that was spanning over a time period of about two years from November 2008 until January 2011. The first phase had been finalised in Autumn 2009 and described in the Phase 1 Report (Wascher et al. 2009). In TransForum's formal feedback (21 July 2009), the SUSMETRO team was asked to first develop a mature methodology for the interactive game *as a pre-requisition* for a Mode-2-oriented second phase of the research foreseeing a stronger involvement of stakeholder involvement. All Phase 2 activities, namely the Landscape Character Assessment exercise, the identification of appropriate innovation options as well as the sustainability impact assessment require stakeholder participation.

At this place I would like to thank the co-authors Janneke Roos-Klein Lankhorst for developing the modelling approach for the SUSMETRO IA tool, Arjan de Jong for preparing and operating the Maptable, and Herman Agricola for contributing on agricultural land use dynamics in The Netherlands. I also appreciate the collaborative efforts of many colleagues, such as the input by Marjan Stuiver on Knowledge Brokerage, Michiel van Eupen on the rural-urban typology of The Netherlands and Europe, Igor Staritsky for developing software support for the Maptable, Frank Veeneklaas (Alterra) and Martin van Ittersum (Wageningen University) to constructively engage in the debate on the Dutch ecological footprint, Rolf Michels, Stijn Reinhard and Jan Willem van der Schans (LEI) to comment on the economic references of SUSMETRO, Ineke den Heijer and André Jellema (Prov Zuid-Holland) for their support when preparing the Rotterdam session and of course PJ Beers and Rik Eweg (TransForum) for their overall project guidance and facilitation.

Executive Summary

By offering a series of decision support tools for stakeholders of metropolitan regions, SUSMETRO facilitates and enables evidence-based decision making by means of 'serious gaming'. Making use of the Phase 1 thematic maps such as on agricultural competitiveness, nature conservation and recreational values, stakeholders can compare impacts of traditional versus innovative forms of agricultural production. The SUSMETRO Impact Assessment tool provides information on the expected effects of spatial planning with regard to the self-supportive capacities of the region (ecological footprint) and the share of recreational and nature conservation facilities (land use functions), offering cost-benefit calculations regarding the expected economic revenues. The whole process is embedded in a Landscape Character Assessment process and guided by Knowledge Brokerage procedures to strengthen the science-policy interface. In sum, the SUSMETRO approach allows a wide range of stakeholders to co-develop images for sustainable Metropolitan Agriculture.

Building upon SUSMETRO Phase 1 (Wascher et al. 2009) this report covers the following items:

- **Development of the Stakeholder Game** towards a mature tool for identifying preferences and priorities for future agricultural land use options by judging gains as well as trade-offs(impacts) at various scales and for various stakeholder groups
- **Sustainability Impact Assessment (SIA)** to assess the impacts of current and future land use related to regional food production on sustainability with regard to environmental, social and economic aspects ;
- **Implement Stakeholder Events** in various locations of The Netherlands and other European locations to test the game and to receive feedback by potential users.

After explaining the underlying rationales and references, namely spatial planning, agricultural competitiveness, and the principles of ecological footprint analysis, landscape character assessment and land use functions, the report presents the SUSMETRO conceptual framework which links policy and science by applying a triple bottom-line approach. During the process, stakeholders have been asked to choose a mix of agriculture in which more intensive and more multifunctional agriculture both have a place. The SUSMETRO game is implemented in the Excel and ESRI ArcGIS software. The ArcGIS software is used to display maps, to draw sketches and to compute the areas of the current and the new Land Use Functions (LUF). The user-interface is a digital Maptable which allows users to directly draw on the screen and to immediately retrieve results of the impact assessments for each of their design proposals.

In order to guide and facilitate the process, Knowledge Brokerage (KB) tools have been developed and combined with alternative forms of Landscape Character Assessment (LCA). From KB perspectives, science-policy interactions are seen as dynamic exercises that evolve over time, occur sequentially and often iteratively, and typically involve long-term interactions between scientists, policy-makers, interest groups and citizens.

The report ends with describing the preparation and implementation of the SUSMETRO Stakeholder Game during the 1st Global Summit on Metropolitan Agriculture in Rotterdam (28 September 2010) and with providing a summary of the lessons learned.

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1. Introduction

1.1 Lessons learned from Phase 1

The overarching goal of the research project SUSMETRO was to assess the social, economic and environmental impacts of TransForum's vision for metropolitan agriculture on sustainable land use in The Netherlands as well as in adjacent Northwest European regions. Acknowledging the fact that 'metropolitan agriculture' (MA) must be considered as an emerging concept not yet widely understood and an object of diverging interpretations by science and policy, the first phase took considerable efforts to set MA apart from 'urban agriculture' (see Susmetro Phase 1 Final Report, Wascher et al 2009).

Taking TransForum's vision of MA as *sustainable and largely self-supportive system-networks at the scale of larger metropolitan regions* as a starting point, the analysis resulted in the following three main characteristics:

(1) spatial-functional entities with boundaries which are determined by system integration at the production level thereby defining what constitutes a metropolitan area;
(2) sustainable principles, among them the limitation of agriculture's ecological footprint by improved use of resources, conditions and infrastructure that are available in the area of demand;
(3) a multifunctional approach by covering society's material as well as immaterial demands (commodity and non-commodity goods and services).

Another important aspect of MA is the *co-existence of mono-functional industrial* on the one hand (namely 'Vital Cluster') and *multi-functional* agricultural systems within the same region, both affecting and driven by the strong presence of urban dynamics.

Designed to build upon recently developed European Impact Assessment tools such as SENSOR, SEAMLESS and PLUREL, SUSMETRO was asked to upscale innovative forms of agricultural production as developed through TransForum's portfolio of *Innovation Projects* when generating input to the current Knowledge Infra-Structure (KIS) at both the national and international level. The project addressed the following research questions:

- *What are the conceptual, design and learning principles of metropolitan agricultural landscapes and how do they fit into other geo-references, such a landscape typologies or a future Dutch AHS (Agrarische Hoofdstructuur = Agricultural Main Structure) ?*
- *Which decision-support tools can provide stakeholders and decision makers with the means for measuring the potential impact of TransForum's metropolitan agricultural vision on sustainable land use objectives (PPP) at the national and international level?*
- *How does TransForum's metropolitan agricultural vision translate into spatially explicit design proposals at the landscape level, taking into account the variety of ongoing national and international approaches towards 'green and blue service' around cities?*

This goal has been pursued by compiling a range of state-of-the-art data sets on agricultural and environmental parameters at both the national and European level, addressing the following three dimensions: (1) the bio-physical environment (*stock*), (2) the supra-regional socio economic forces (*drivers*) and (3) the intra-regional land use change dynamics (*flows*). The results have been presented at several occasions in the form of interactive sessions, allowing professionals in the field of policy, planning, and the environment to develop there own vision of an Agricultural Mainstructure for The

Netherlands and to discuss the adequacy of the information that has been offered. Based on these experiences, Phase 1 allowed the following observations:

- the set of **six innovation characteristics** (*spatial impact, foot-loose production, urban rural link, multi-functional land use, sustainable development objectives, and science-practise link*) have been perceived as useful references for profiling the different Innovation Projects and when developing up-scaling procedures.
- Focusing on **vital clusters and regional development projects** (e.g. Greenport NL, New Mixed Farms, Dairy Adventures, Streamlining Greenport Venlo, Green Care, Northern Frisian Woods, and NMVC Heuvelland), the SUSMETRO approach allowed spatial allocations and Mode 2 value propositions when engaging with stakeholders.
- Offering perspectives beyond national boundaries as in the case of the **ABC-Region (Amsterdam-Brussels-Cologne)**, the link with European datasets resulted in broadening the spectrum of the interpretation and allow to 'export' the assessment to other countries and regions in Europe.
- A key spatial data set of Phase 1 was the **Map of Agricultural Competitiveness** (integrating data on economic performance and accessibility to services, share of agricultural areas, average ESU/holding and average ESU/ha. This map is considered to play a crucial role when forecasting future perspectives of agricultural land use developments (e.g. *land claims*).
- A **final integrated cross-analysis** offered spatial 'windows of opportunity' for future agricultural innovative projects by projecting the results against the larger protected areas, recreational zones and valuable cultural landscapes.

The methodological tools and criteria as well as the spatial concepts developed by SUSMETRO allow interpretations for how TransForum Innovative projects could possibly be placed or up-scaled into suitable rural and peri-urban spaces.

An early example for using the SUSMETRO spatial references for developing sustainable design proposals for a metropolitan region was a preliminary version of the SUSMETRO Game played during the final presentation of Phase 1 on June 16th 2009. After having introduced the four basic SUSMETRO map layers (rural-urban typology, agricultural competitiveness, nature conservation and recreational landscapes), the participants split up into three groups (with 3 – 5 members each), supplied with transparency copies(folios) to be used as overlays on top of the hardcopy version of the rural-urban typology. Making use of tabular information on the innovation characteristics for the six selected TransForum Innovation Projects (Greenport NL, New Mixed Farms, Dairy Adventures, Streamlining Greenport Venlo, Green Care, Northern Frisian Woods, and NMVC Heuvelland), participants have been asked to find appropriate locations for these projects, taking into account the limitations and opportunities indicated in the spatial reference maps. The opportunity of engaging in a *game* - thus an alternative to the rather one-directional science-policy interface encountered in traditional research projects – had been welcomed with enthusiasm. It showed that the groups did not only come up with different design proposals, but also tested and critically reviewed the innovation characteristics as well as the data references. The subsequent discussion on the results showed, that the chosen approach was in line with the Mode-2 approach and that the results were even considered to potentially lead to designing – not identifying – the main components of a Dutch Agricultural Main Structure. It should be noted, however, that because participants have been exclusively members of the TransForum team – and not real regional stakeholders and professionally biased towards a methodology deriving

from a research project commissioned by TransForum – the test must be considered as being only partially valid.

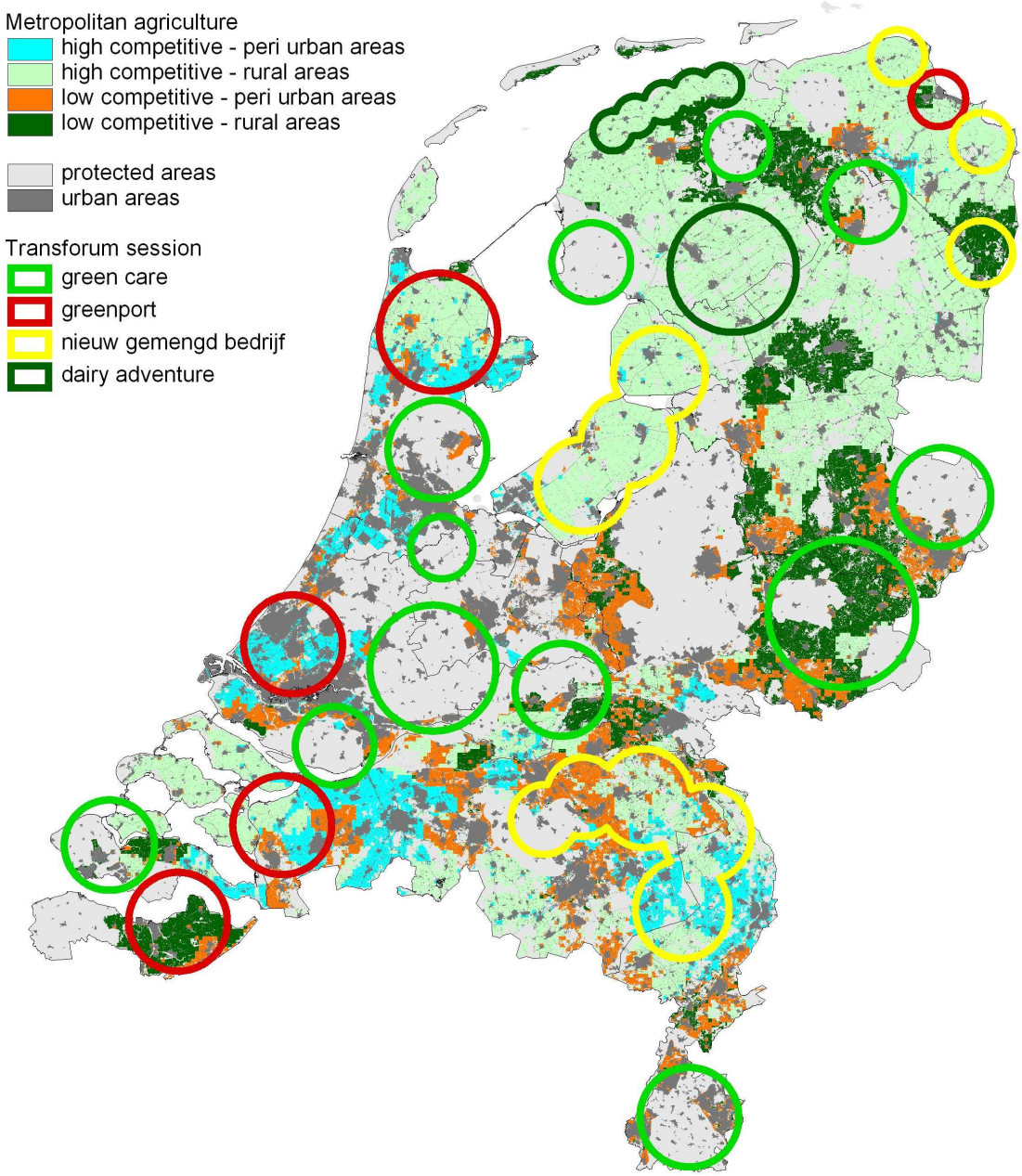


Figure 1: Results of the TransForum SUSMETRO Game played on the event of the Phase 1 project presentation on June 16th 2009.

1.2 Goal Setting and Scope for Phase 2

Though building upon the results of Phase 1, Phase 2 was meant to take new opportunities and initiatives into account, thereby altering the earlier working programme as laid down in the original proposal. The following initiatives had been under consideration[1]:

[1] Internal planning document dating from March 2010

- The continuing discussion on the strategic approach towards agricultural innovation processes in the light of parallel studies that are being undertaken such as by Peter Smeets on the future of agroparks ('Expedition Agroparks'), by Rijksadviseur voor Het Landschap Yttje Feddes on the future of livestock keeping, by Marco van Steekelenburg's Xplorelab initiative on global dimensions of metropolitan agriculture, as well as by Arnold van der Valk and Han Wiskerke of Wageningen University in on a European approach towards Sustainable Food Planning in the context of the AESOP initiative.
- The need to link up with existing studies and projects that are being implemented as parts of TransForum's running Innovative Projects, but also in their wider Dutch proximity such as the assessment of the food production potential of Dutch cities, e.g. Amsterdam (Proeftuin Amsterdam, DRO), Tilburg (Communication Science, Nutrient and Health studies) as well as other.
- In the international context to cooperate closely with the TransForum partner at Michigan State University, US, possibly to engage with food planning specialist Jerry Kaufman of Madison University, and to seek cooperation with a comparable European metropolitan region such as the wider Hamburg region in Germany (Hafen University Hamburg).

While the above initiatives are considered as relevant reference points, SUSMETRO Phase 2 needed to maintain a strict implementation schedule in terms of available financial and time resources. In TransForum's formal feedback (21 July 2009), SUSMETRO was asked to first develop a more mature methodology for the interactive game *as a pre-requisition* for a more solid and target-oriented stakeholder involvement. The reason why this was considered to have priority is because both the up-scaling as well as the sustainability impact assessment is supposed to require input resulting from the stakeholder interaction. The main objectives of Phase 2 was hence to make use of TransForum's trans-disciplinary KOMBI approach ('Kennis, Overheid, Maatschappelijke en Bedrijfsinstellingen voor Innovatie') for both metropolitan agriculture scenarios and the subsequent sustainability impact assessment tools generating a variety of design proposals for metropolitan regions by means of graphic and digital visualisation techniques. Ideally the envisioned processes should be iterative – this means that stakeholders should have the opportunity to receive information on the likely impacts of their preferences while being able to revise these preferences if it should turn out that the expected impacts are going beyond certain thresholds – related to e.g. economic performance, biodiversity, landscape aesthetics, air quality, etc. In terms of the project planning, this means that several of the activities need to be planned in parallel and to be revisited once first results are becoming available.

(1) Development of the Stakeholder Game

Based on the proto-type developed in Phase 1, develop the 'stakeholder game' towards a mature tool for identifying preferences and priorities for future agricultural land use options by judging gains as well as trade-offs(impacts) at various scales and for various stakeholder groups (1) review the data sets and assessment criteria of the Phase 1 game, e.g. Innovation Characteristics, to form the basis for stakeholder interaction at the national as well as at the regional level; (2) develop visualisation tools for the previous data plus additional contextual data at three spatial scales (national, regional and site-specific) and make them operational by means of map-table technology ; (3) and run stakeholder events at one national and at least two regional level at IP sites.

(2) Sustainability Impact Assessment (SIA)

Based on the up-scaling exercise in Step 2.1, make use of existing European methodologies to assess the impacts of current and future land use related to regional food production on sustainability with regard to environmental, social and economic aspects ;

(3) Stakeholder Event on Food Planning in Metropolitan Regions
Based on the selected innovative projects identified in Phase 1, (1) undertake a full approach for Dutch case study locations, (2) full approaches in European locations where there is research collaboration (e.g. Hamburg); and (3) initiate and guide experts for undertaking a simplified approaches in other European locations as well as in the US.

During the implementation of Phase 2, a number of deviations from the above scheme became necessary, as resources and practical obstacles as well as the arrival of alternative opportunities forced the project team to adjust their planning. Considerable resources had been invested in getting the stakeholder event in Hamburg, Brighton and the Frisian Woods (Netherlands) off the ground. In the end, none of these partners managed to raise the necessary co-funding and organisational capacities for their input. Other stakeholder event opportunities have been on the rise (e.g. in Antwerp, Bratislava, and Leipzig) but lacked maturity to be implemented within the SUSMETRO timeframe. Due to these efforts and resource inputs, the contact with the American TransForum Partners did not materialize and became ultimately out of reach.

Another field of exploration, namely the development of visualisation techniques, did not lead to the anticipated results: the 3D-project developed at Alterra required more programming and adaptation or were ultimately considered as being too cost-intensive and as too coarse given the purpose of providing stakeholders with semi-realistic illustrations of future perspectives. During the project implementation the SUSMETRO team also realised that it was not possible to cover the originally envisioned scope of TransForum Innovation Projects (IPs) because of the inherent complexity with regard to impact parameters and upscaling requirements. It was hence decided to be selective with regard to the type of IPs and the use of innovation characteristics.

Fortunately, a wide range of complimentary objectives could be realised and new research opportunities came up. SUSMETRO's investment into the ecological footprint research when building a sustainability impact assessment tool generated valuable results, and a refined methodology for the SUSMETRO Game for the Rotterdam Metropolitan Region could be successfully tested in Wageningen (September 17th 2010) and during the international event of the 1st Global Summit on Metropolitan Agriculture (September 28th 2010).

2. Rationales and References

2.1 Expanding Spatial Planning: from Agricultural Policy towards Food Planning

The term 'food planning' addresses all planning that is related to procedural steps associated with the human food system such as production, processing, distribution, retailing, transport, consumption as well as its disposal and recycling. Having its roots in niche-initiative (e.g. Slow Food Movement in Italy) but also in principles of regional organic farming, the notion of food planning suggests to take a more comprehensive approach towards the supply with food, an approach that goes beyond the agricultural domain by introducing sustainable concepts of spatial and organisational planning.

The reason that the concept of 'food planning' did – until now – enter regional and spatial planning has historical and institutional origins. Historically, agriculture has always been considered as an independent sector with its own management, marketing and planning responsibilities. In contrast to East-European countries where governmental schemes existed to comprehensively develop and rigidly implement agricultural production and master plans, Western countries put much emphasis and pride on their free-market-based and entrepreneur-driven initiatives. This did not leave much space for centrally or politically developed spatial planning schemes, depriving landowners of their right to manage their land according to their financial and technical capabilities. At the same time, also in Western countries such as Germany, Austria and Netherlands, agriculture organized itself and developed – supported by agricultural agencies and planners – sectoral land use schemes for the optimisation and infrastructural development of agricultural land, especially in the early phase of cultivation history when peatlands, flooding and remoteness were considered as major obstacles. To compensate negative impacts of sectoral plans such as from agriculture, forestry or transport, *landscape planning* has taken the role of a largely horizontal and integrative policy instrument (Wascher and Schröder 2009).

In terms of the institutional dimension there is to note that – with the exception of the fairly generic 'Less-Favoured-Area'-concept – Europe's powerful Common Agricultural Policy has no spatial planning tools in place. Furthermore, spatial planning is one of the few policy areas which the European Union has left untouched considering it a cornerstones of Member State autonomy.

Consequently, little attention has been given to food in planning science (Pothukuchi and Kaufman, 2000) until the year 2000. Given the enormous economic and environmental impact of agriculture on the way food is being produced and consumed, the lack of integrated business and planning schemes is surprising (Holtslag 2010). However, food planners are increasingly seeking ways of enhancing the interaction between mainstream, industrial food production and the regional capacities to provide high quality food (Kaufman 2005). One striking example are the recently adopted policy guidelines of the American Planning Association (APS 2007) which is paving the ground for more integrative spatial planning procedures to ensure that food planning is systematically programmed into all future considerations of planners and decision makers. It should be stressed that there does and never shall exist *one* type of food system – at least in Western democracies as we know and support it. Instead several – even many – different 'worlds of food' coexist (Morgan et al. 2006). Promoting the concept of food planning as a new pathway towards more sustainable metropolitan regions is hence meant to add a new – as we feel urgently needed – layer to the currently dominating food systems. This new layer will need to be woven of existing networks of regional entrepreneurs, consumer organisations and public agencies interested in more sustainable ways of food production and consumption around cities.

2.2 Agricultural Competitiveness as a Driving Force

One of the key assessment tools that is being offered during the SUSMETRO Stakeholder Game is the map of Agricultural Competitiveness. This map allows the participants to identify those areas where land use change dynamics can be expected to be high or low, hence where agriculture is likely to put pressure on competing land use types such as recreation and nature.

The degree of urbanisation determines to a large extent how agriculture can develop. A high urban pressure is generally associated with high land prices. The past has shown that agricultural production has intensified with high yield per unit of surface area in many places. The emergence of the Westland Greenhouse Complex between Le Hague and Rotterdam with horticulture in glasshouses is in this perspective a prime example. On the other hand, parts of The Netherlands have low urban pressure and relatively good perspectives for agriculture, like in the North where arable and dairy farming- thanks to economies of scale - can continue to focus on production for the world market. At the same time, the prospects for agricultural production is limited in many Dutch regions because of poor competitiveness. This chapter presents a typology of agricultural areas based on the degree of urbanity in combination with agricultural competitiveness in order to give perspectives for area development.

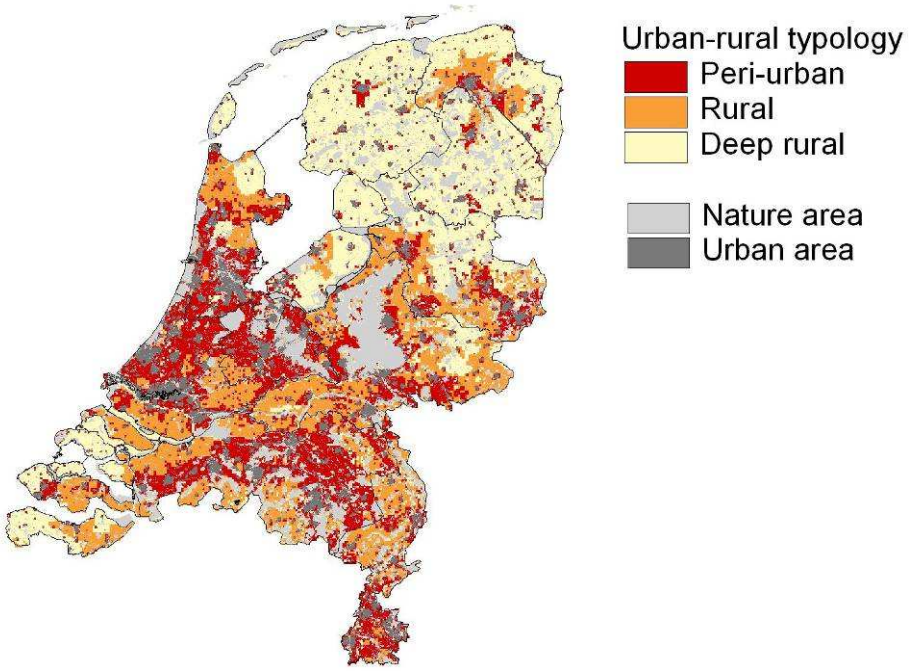


Figure 2: Urban-Rural typology for The Netherlands (van Eupen 2009).

One of the key factors for the level of agricultural competitiveness is the urban-rural gradient, thus the degree to which areas outside city boundaries are influenced by urban lifestyle and processes. A map with typology of urban-rural areas (van Eupen, 2009) has been developed on the basis of economic density and accessibility. Economic density is determined on the basis of "Gross Domestic Production', a measure of the economic added value. The degree of accessibility is calculated on the basis of the accessibility of services. Combination of the two indicators result in a relative image of The Netherlands for the degree of urbanity.

Figure 2 shows the typology addressed to areas outside the urban areas it self.
The most urbanised areas both have a high economic density and are well accessible. On the other hand, the most rural areas have low economic density and poor accessibility.

Agricultural areas are located outside urban areas. On a regional level agricultural areas differ in competitiveness. In this study agricultural competitiveness is determined by three factors, as indicated in the Figure 3.

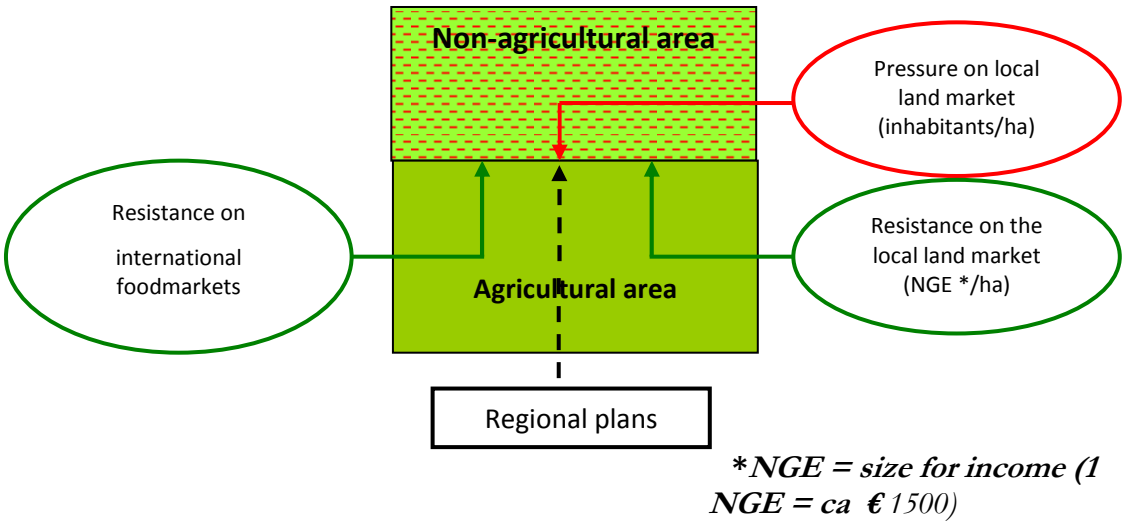


Figure 3. Transition to non-agricultural use of the agricultural grounds as a result of growing urban pressures in combination with waning agricultural resistance on international food markets and local land market. (Vereijken & Agricola, 2004)

The three indicators are scored by Dutch municipality, and then arranged. In this context municipalities with a relatively high number of large and intensive farms and low urban pressure, are of major agricultural competitiveness. The model shows in this case conservation of the size of the agricultural area. On the other hand, municipalities with many small farms, relatively extensive production and a high urban pressure are hardly competitive, as a result the agricultural areal will decrease. Figure 3 also shows that, until now, regional plans have protected the agricultural areas in The Netherlands. Combination of the 3 indicators result in a relative map for agricultural competitiveness (Figure 4).

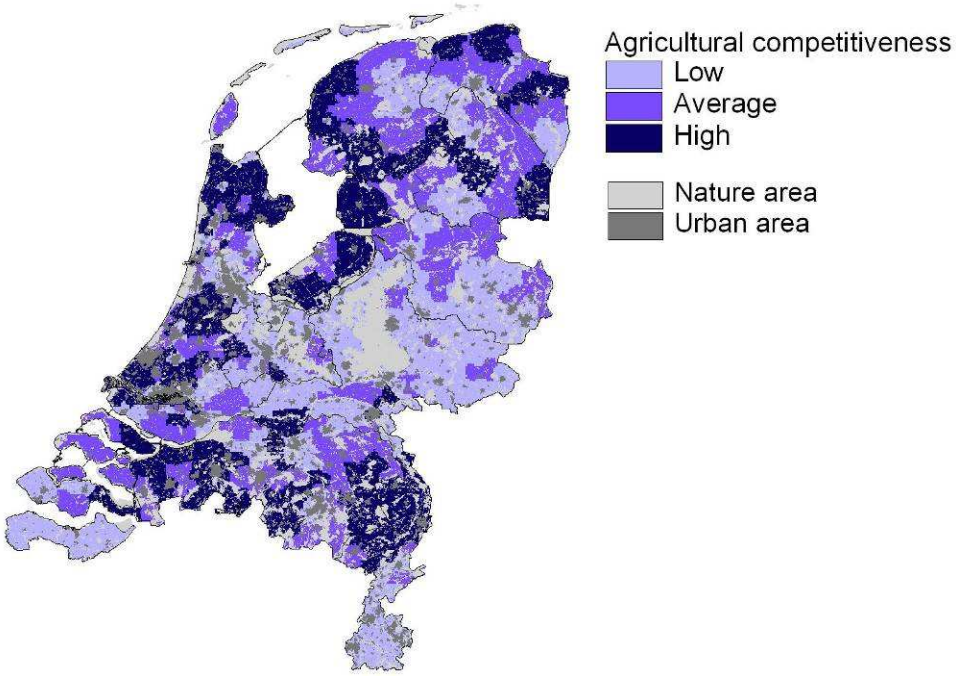


Figure 4: Agricultural competitiveness related to the Urban-rural typology (Agricola 2010)

Combination of the previous maps result in a typology of agricultural areas. In theory it gives 3x3= 9 combinations. For the sake of clarity the 9 combinations are reduced to four classes as shown in Figure5.

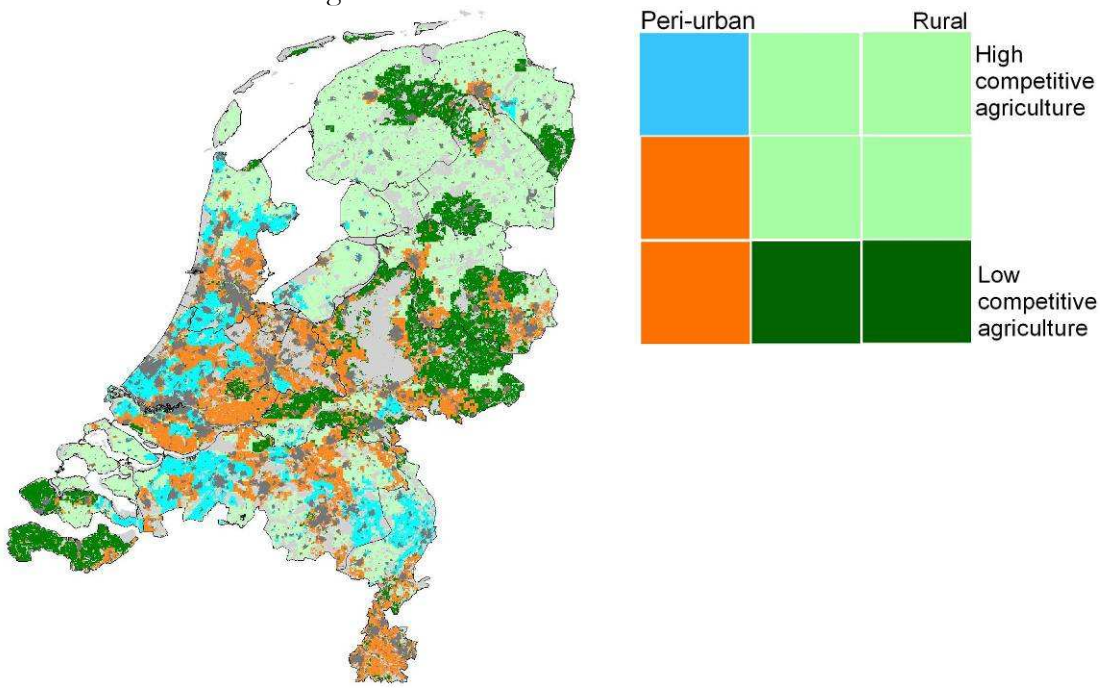


Figure 5: Final typology of Agricultural Competitiveness for The Netherlands (Agricola 2010)

High-quality agriculture

This type of agriculture in peri-urban areas with competitive agriculture is mainly characterised by horticulture in glasshouses, outdoor horticulture and permanent crops. The importance of the areas is often designated in National Spatial Planning as Greenports or agricultural development areas. Next to intensive agricultural land use these areas generally have a good infrastructure for the marketing and transportation of products. Because of high land prices there is hardly any space for competing arable and dairy farming. It is expected for the future that high-quality agriculture will further intensify through innovations and will continue to produce for the world market. At the same time the agricultural area will further decline because of urbanization.

Multifunctional urban agriculture

Peri urban areas with low competitive agriculture have an increased risk of transition towards non agricultural land use. At the same time there are opportunities for multifunctional urban agriculture. Multifunctional land use is more likely as many bottlenecks meet, in peri-urban areas this is often the case. For example climate adaptation can be executed by multifunctional land use. In addition to production for the world market farmers can make their business less vulnerable by offering services that fit the needs of an urban environment. The government can play an important role in facilitating the transition to a multifunctional agricultural landscape.

Large-scale agriculture

Most of the arable and dairy farming in The Netherlands is found in the non-urbanized rural areas. An important advantage here are the opportunities for large scale farming, because land prices are significant lower than in peri-urban areas. This area extends mainly over the north part of The Netherlands (Drenthe, Flevoland, Friesland and Groningen). Because of the opportunities for large-scale farming these areas also have a relatively good perspective for land based agriculture in the future.

Multifunctional rural agriculture

In rural areas with many small and relatively extensive farms, agricultural is hardly competitive and thus under pressure. Because the urban market is at distance an adaptation has to focus more on landscape- end ecological services. Tourism In some areas can offer a complement too. The Government probably has to encourage these markets actively, in return this multifunctional land use can strongly benefit to climate adaptation and nature conservation.

As mentioned in the introduction to this section. The map of Agricultural Competitiveness is considered as one of the key outputs of the SUSMETRO project and much effort have been invested to develop and apply it during the test runs and games.

2.3 Ecological Footprint for Impact Assessment: Opportunities and Pitfalls

According to the European Environment Agency (2006) approximately 80 % of Europeans will be living in urban areas by the year 2020; in seven countries it will be even more than 90 %. The EEA states: 'As a consequence, urban demands for land in and around cities are becoming increasingly acute'. In the light of these demands, Europe's metropolitan landscapes will need to provide more region-oriented, more diverse and more sustainable land use functions. In order to implement the related European and national strategies (CEC 2001) at the regional level, spatial planning is considered to play a pivotal role as it can offer the tools, skills and references for shifting responsibilities from government to the less formalised practices of 'governance'.

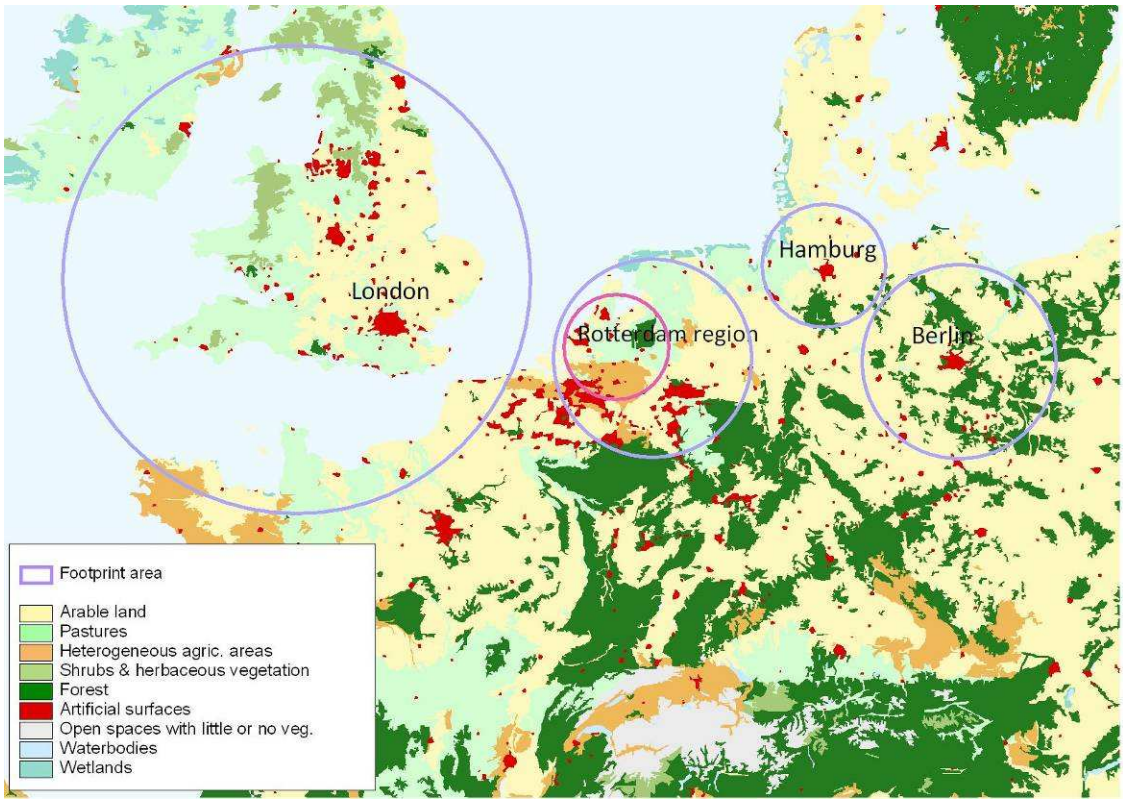


Figure 6: Ecological footprint of London, Rotterdam Metropolitan Region, Hamburg and Berlin based on food consumption. Large blue circles represents required brut carbon footprint; the small red circle of Rotterdam represents the net regional food planning area (see text for further explanation)

The European Sustainable Development Strategy (CEC 2001, CEU 2006) addresses a broad range of 'unsustainable trends' ranging from public health, poverty and social exclusion to climate change, energy use and management of natural resources. A key objective of the SDS is to promote development that does not exceed ecosystem carrying capacity and to decouple economic growth from negative environmental impacts. A recent report commissioned by the European Commission (2008) came to the conclusion that the Ecological Footprint should be used by EU institutions within the Sustainable Development Indicators (SDI) framework.

The Ecological Footprint measures how much biologically productive land and water area is required to provide the resources consumed and absorb the wastes generated by a human population, taking into account prevailing technology. The annual production of biologically provided resources, called bio-capacity, is also measured as part of the methodology. The Ecological Footprint and bio-capacity are each measured in *global hectares*, a standardised unit of measurement equal to 1 hectare with global average (CEC 2008).

Box 1: A concise description of the Ecological Footprint indicator

The Ecological Footprint measures how much biologically productive land and water area is required to provide the resources consumed and absorb the wastes generated by a population, taking into account prevailing technology. The standard unit of measurement is a *global hectare*, which is equal to one hectare with global average bioproductivity.29 Use of this normalised unit allows Ecological Footprints to be expressed in comparable area terms, despite differences in bio-productivity among land types, regions and countries. Humanity's Ecological Footprint can also be expressed in terms of the „number of planet Earths" required to support human resource use and waste generation.

The Ecological Footprint tracks the use of six categories of productive areas: cropland, grazing land, fishing grounds, forest area, built-up land, and carbon demand on land.30 The areas of these six land types are translated into global hectares using *yield factors* and *equivalence factors*, which relate the bio-productivity of each land type to the global average bio-productivity. Because the bio-productivity of land types varies by country, *yield factors* are used to relate national yields in each category of land to the global average yields. Equivalence factors adjust for the relative productivity of the six categories of land and water area.

The annual production of biologically provided resources, called *bio-capacity*, is also measured as part of the Ecological Footprint methodology, and is also accounted for in terms of global hectares.

If the Ecological Footprint of the residents within a region exceeds the bio-capacity of the region, the region is said to be in *ecological deficit*. The opposite of an ecological deficit is an *ecological reserve*. An ecological deficit at the global level is referred to as *ecological overshoot* and signifies that in the year in question, humanity used more of the Earth's bio-capacity than was available that year, which can only happen if the natural asset base (which produces bio-capacity) is also being consumed. Long-term consumption of the natural asset base yields a degradation in some forms of natural capital.

Source: Condensed summary based on GFN (2006).

The Commission's report on the Ecological Footprint puts much emphasis on the fact that methodologies need to be based on national approaches and data as production volume, energy and labour costs can differ substantially from country to country, even between regions of the same country.

Table 1, comparing the agricultural productivity of The Netherlands with five neighbouring countries, demonstrates the point: The Netherlands scores substantially higher than all other countries, which means that higher production volume delivers potentially more food per hectare for the local market as well as elsewhere. However, the figures for energy and labour costs are not taken into account in this example

Table 1 Land prices en production volume of The Netherlands (NL) compared to neighbouring countries (NL = 100) [2]

	NL	Belgium	Denmark	Germany	France	UK
Land prices	100	78	74	25		38
Yield crop per ha	100	63	53	41	36	37
Yield milk per ha[a)]	100	73		52	44	58

a) specialised diary farms, 2005

Source: Veeneklaas after Eurostat; *Landbouwatlas van Nederland,* 2009, page 118 (LEI, LEB 2010, Tabel 8.7)

[2] Yield cropland NL: € 4420 /year (average 2005-2007); milk yield/cow NL: 7710 kg/year (average 2005-2007), Livestock density milk cows NL: 2,6 cows/ha (2005), milk production per ha NL: 20.000 kg/year

In 2005 humanity's ecological footprint exceeded the Earth's total bio-capacity – that is its ability to renew the resources the human world community consumes – by 30 per cent (WWF 2008), thereby further increasing the pressure on its environmental and social systems. Especially the industrial countries take the role as 'debtors' by leaning heavily upon environmental goods services produced in often remote 'creditor' countries. For example, approximately 25 per cent of each Hamburg citizen's ecological footprint – namely 1.44 ha - can be attributed to food consumption only (see Table 2). The remaining ecological footprint of Hamburg (3.17 ha) related to housing, traffic and material goods is based on necessary CO_2-compensatory measures, e.g. planting new forests. Only a fraction of the real land use impacts are affecting the metropolitan region of Hamburg; most food comes from remote locations in Europe and elsewhere. Figure 6 shows the virtual ecological food prints for the cities of Berlin, Hamburg, London and Rotterdam Region as global hectares (see Table 2) multiplied by inhabitants.

Table 2: average ecological footprint as global hectares per person and year for food consumption for different European cities

	Energy	Crops	Pasture	Total	Inhabitants	Source
Berlin	0,12	0,28	0,91	**1,31**	3,4 mill	Schnauss 2006
Hamburg	0,12	0.72	0,60	**1,44**	1,8 mill	Jancke, 1999
London	-	-	-	**2,80**	7,5 mill	Best Foot Forward 2002
Amsterdam	-	-	-	**1,66**	1,4 mill	De Kleine Aarde 2001

Though only one example, these figures are in line with the overall trends and point at a strong link between urban consumption and the global decline of biodiversity, the increase of greenhouse gas emissions and diminishing water resources (WWF 2008) - hence at a failure of the agricultural market to operate within sustainable boundaries. Furthermore, the associated negative impacts also affect the regional level of many 'debtor' countries such as The Netherlands (Wiskerke and van der Ploeg 2004). Here, multiple landscape functions such as recreation, cultural identity, ecological resilience and healthy agricultural products – to name just an important few – are under severe pressure by fierce competition against export-driven, industrial forms of agriculture as well as against other potent economic sectors such as urban sprawl, infrastructure and energy (Pedroli et al. 2007; Jaeger et al. 2010).

While hothouse structures are further expanding in the Randstad and elsewhere, Randstad citizens not only consume their food in supermarkets which themselves import most of it from remote locations, they also experience that the former open metropolitan landscape becomes increasingly fragmented, visually affected (due to night time light emissions) and is likely to disappear altogether with severe impacts on the region's ecological and recreational values (Wulp et al. 2009). Despite the designation of 'national landscapes' and 'national buffer zone' to safeguard the remaining open space, cultural values and biodiversity, the loss of biodiversity and landscape identity continues.

The project has demonstrated that making methodological choices regarding the Ecological Footprint of food consumption is not a trivial matter. A large variety of studies and expert opinions (co-) exist and until today there are no nationally or scientifically accepted benchmarks. For example, compared to the global hectare calculations offered for different European cities (see Table 2), a national report on the consumption patterns of Dutch people (RIVM 2000) suggests a yearly demand of 0,71 ha (0,45 ha crop & 0,26 ha diary) per citizen – which is less than half of the amount used

by Kleine Aarde for Amsterdam (2001). RIVM amended earlier assessments by den Hoek, focusing only on the foodstuff for meat. The example shows the type of difficulties that are to be encountered when entering the national debate on Ecological Footprint. A personal communication with scientist Martin v. Ittersum (2010) pointed at an even lower footprint, namely 0.5 ha. The main reason for these substantial differences is the fact that other than global calculations that take into account the whole food processing, transport, packaging and waste management dimension of food consumption, conservative figures focus on the net demand of hectares that are actually needed to produce the food that is being consumed - assuming that all the required food for the inhabitants would be produced in the direct vicinity of the inhabitants using the Dutch advanced technology.

The small red circle in Figure 6 illustrates the difference of using the 0.5 hectare 'local' footprint as compared to the 1.4 hectare global footprint for the approximately 3 million persons living in the larger Rotterdam metropolitan region. Since SUSMETRO proposes to measure the advantages of innovative agricultural methods for providing people with regionally grown food, we actually decided to use the 0.5 ha in the Rotterdam test case (see Section 4.3). However, even regionally grown food will need to take into account external costs such as for processing, packaging and (regional) transporting.

Despite the difficulties encountered in the way the Ecological Footprint can be applied and (mis-)interpreted, we felt encouraged by our own practical experiences and by the literature in this field. The main objective, namely to reduce the resource consumptions in our Western societies is still valid and the Ecological Footprint has proven to be a useful indicator when running Impact Assessments at the level of metropolitan regions. Global hectares should be considered as virtual, though valid indications for the total human consumption. Together with 'local' hectare figures, both figures help to guide the discussion of stakeholders when shifting between different levels of scales, e.g. from the local to the cross-boundary, European and even global dimension of the problem.

2.4 Landscape Character Assessment as a Participative Tool

In order to meet the complex topical and societal demands of metropolitan regions, spatial planning needs to be based on broader and more exploratory problem solving strategies that result in solutions that are essentially 'consensual' (Potschin & Haines-Young, 2008) instead of reductionist and instrumental. Building upon a legacy of nationwide applications in England, Scotland and Wales, Landscape Character Assessment (LCA) has proven to offer the type of bottom-up, 'consensus'-driven and region-oriented procedures that appear to be in demand in contemporary spatial planning.

According to Countryside Agency & Scottish Natural Heritage (Swanwick 2002), Landscape Character is *"a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse"*. Rather than being carried out by scientific experts, the description of landscape character constitutes a paradigm for seeking a common understanding of regional identity – in fact the genius loci – for the landscape at stake.

Since landscape research does have roots in environmental sciences it is frequently overlooked that landscape planning has a strong tradition in combining the positivist, fact finding capacities of natural sciences with the foundationalist and critical realist approach of social sciences. The close link between landscape ecology, sustainability and

global land use change phenomena has therefore been frequently stressed (Naveh 2007; Opdam & Wascher 2004). For example, landscape scientists often take historical anthropological background information as a starting point, use traces and imprints of human activities in the land as guiding principles for design proposals and engage in bottom-up stakeholder processes in order to commonly work towards a design proposal (Zoppi & Lai 2010).

In concrete terms, spatial boundaries and descriptive criteria of a landscape are developed on the basis of inquiry, negotiation and interpretation, rather than linear science models. The major challenge of introducing LCA-style techniques as the integrative tool in the science-policy interface is hence the need to avoid scientifically based thresholds to frustrate the participatory process. Equally, there is need for a unifying and broadly interpreted notion of 'regional identity' – hence not restricted to images of traditional, cultural landscapes of the past, but open towards innovation-driven, multi-functional land use concepts of today.

An explorative study on the potential role of Landscape Character Assessment (LCA) linked with Knowledge Brokerage (KB) tools as the basis of spatial planning in metropolitan landscapes calls for qualitative research methods and hence for a 'grounded theory', a methodology based on abduction. Through the research design building upon a series of well structured stakeholder events, the intention is to undertake a systematic generation of theory from systematic research.

The proposed method entails three steps:
1. Preparation: Minimizing preconceptions by designing the LCA-KB as open and non-normative as possible.
2. Data Collection: (1) quantitative data collection on sustainability of selected metropolitan regions by means of GIS analysis (case studies); (2) Stakeholder events employing LCA-KB in selected case studies with participant observation. Initial analysis determines where to go and what to look for next in data collection. Analysis and data collection continually inform one another.
3. Analysis: Building a theory for the contribution of local food systems planning to sustainable development in metropolitan regions, by constant comparative analysis of data and evolving ideas. For this purpose there is need to establish a textual database by means of 'field notes' on the application of LCA. The main body of the research will be based on concrete cases of stakeholder processes around spatial planning towards sustainable metropolitan areas. The learning principles will derive from Landscape Character studies deriving from Natural England (United Kingdom) and are based on both methodological papers as well as practical experiences.

With regard to the SUSMETRO Stakeholder Game, the use of landscape-based assessment methods, such as for the identification of the metropolitan regional boundaries, identities and key land use functions is considered as an important step towards an integrative approach to food planning.

2.5 Land Use Functions for Gauging Societal Demand

Regarding the origins of the multifunctional land use concept, the summary report on the Conference on the Multifunctional Character of Agricultural Land and Land in Maastricht (IISD 1999), particularly with regard to food security and sustainable development, points at Chapter 14 of Agenda 21, the 1992 United Nations Conference on Environment and Development (UNCED) and more specifically at the establishment

of a framework for the consideration of integrated land management and sustainable agriculture and rural development (SARD). Later OECD (2001) and the European Commission (CEC 2003) took up the concept of multi-functionality, however strictly with reference to agricultural land use. The European Commission stresses especially the importance of less-favoured regions and the multifunctional nature of agriculture, confirming the importance of the second pillar (CEC 2003, page 3). Most of the recent policy initiatives are indeed mainly focusing on the multi-functional aspects of agriculture, specifically addressing the distinction between commodity and non-commodity outputs, the latter thus related to the until now inherent externalization of effects, impacts and costs. Wiggering et al. (2006), adddressing the need for societal and monetary valuation for non-commodity outputs, sees a close link between multi-functional agriculture on the one hand and multi-functional landscapes on the other hand, thereby defining landscape per se as a multi-sectoral phenomenon. In this interpretation, shortages with regard to non-commodity outputs (e.g. biodiversity, aesthetically pleasing landscapes) create a new "market potential" for farmers receiving financial (though mainly public) support when offering multi-functional land use.

Table 3: SENSOR's 9 Land Use Functions (LUFs)

SOCIETAL	ECONOMICAL	ENVIRONMENTAL
Provision of work Employment provision for all, according to activities in relation with natural resources ; quality of jobs, lack of job security, localisation of jobs (constraints / commuting)	**Residential and non land based industrial and services** Space where residential, social and productive human activity take place in a concentrated mode. The utilisation of the space is mainly irreversible due to the high concentrations of the buildings	**Provision of abiotic resources** Space used for infrastructures that determine changes which are irreversible
Human health & Recreation **(spiritual & physical)** Access to health and recreational services and factors that influence services quality	**Land based production** Human productive activities that determine changes which are mainly reversible (agric, for, natural energy sources, land based industry -mining).	**Support & Provision of habitat (biodiversity, gen pool)** Factors affecting the capacity of the land to provide biodiversity, from the genetic diversity of organisms to a diversity of habitat in the landscape that are in suitable ecological condition.
Cultural (Landscape identity (scenery & cultural heritage) Ffactors influencing the appreciation of landscape aesthetics quality and local culture valorisation	**Infrastructure** Space used for infrastructures that determine changes which are irreversible	**Maintenance of ecosystem processes.** Capacity and factors affecting to vital processes such as water purification, nutrient cycling, etc…)

SENSOR identified 9 key *land use* functions (see Table 3). This land use based approach offers the opportunity to engage in a stakeholder-friendly, quantitative, fact-finding assessment on the simultaneous provision of functions associated with different land use types (Perez-Soba et al. 2008). Besides delivering operational solutions in the assessment of multi-functional land use, the SENSOR approach helped broadening the

multifunctional approach to include also other sector than agriculture. Without covering the full range of LUFs as developed by SENSOR, SUSMETRO adapted the principle of land use function for stakeholders when assigning different forms of agriculture, recreation and nature conservation in the respective metropolitan regions.

3. The SUSMETRO Stakeholder Game

3.1 Conceptual Framework

The wide range of TransForum Innovative Projects has demonstrated that sustainable agricultural development implies advancing through a broad range of innovative experiments. Such experiments can differ widely. Some imply intensifying agricultural production, others build on combining multiple societal functions with traditional agricultural, and again others on transformation of value chains. These types of innovations are in line with very different, sometimes contradictory, value orientations.

The research project SUSMETRO has developed a conceptual framework for assessing the role of agricultural innovation as one of the key services in metropolitan regions. By taking an integrated approach, the methodology is geared to take into account other spatial demands such as recreation and nature conservation when asking regional stakeholder to participate in an interactive sustainability impact assessment for their metropolitan region. The objective is to assess the impacts of land use change under different spatial planning regimes for test sites in different European locations. Main reference base of the SUSMETRO approach is assessing the urban demand for food by means of a land use model that translates population-based figures on ecological footprint into land use claims for different forms of traditional and innovative agricultural production regimes. The resulting spatial allocations and production regimes allow to balance these approaches against other land use claims, namely for recreational and nature conservation functions. Applying an iterative process, the model allows adjusting food-, recreational and nature conservation planning to achieve a balanced optimum. Throughout the process, the models produce the impact assessment figures and maps for all three land use types, allowing iterative re-adjustments.

Exploring the future is a typical example of an activity in which it is very hard to think outside one's own value framework. Based on our own values and interests, we are prone to choose a particular set of innovation options, in line with only one value orientation, instead of keeping a broad playing field. In contrast, the concept of sustainable metropolitan agriculture (as developed in SUSMETRO Phase 1) suggests that it is actually necessary to include a broad mix of innovative agricultural options, one that deliberately crosses the boundaries of multiple value orientations. Specific areas may be best suited to specific options, but the metropolis itself is best served with that broad agricultural mix. So how can decision makers be facilitated in exploring a sustainable future for agriculture?

By offering decision support tools such as maps, figures on sustainability and impact scenarios for stakeholders of metropolitan regions, SUSMETRO facilitates and enables evidence-based decision making by means of a 'serious game'. Figure 1 illustrates how the SUSMETRO Stakeholder Game is configured at the interface between policy and science. Facts and figures specifying regional functional and spatial demands and characteristics contain information that is important from the perspective of metropolitan agriculture. Furthermore, the stakeholders are provided with a set of descriptions of agricultural innovations and their characteristics. Using this information (maps and innovation characteristics), they can decide for each land use type or production system where it fits best, and produce their own, new map with their vision of sustainable agriculture. Finally, the SUSMETRO approach uses computer models to

provide information about the impact of the decision regarding people, planet, and profit values. In sum, the SUSMETRO approach supports making images of Metropolitan Agriculture.

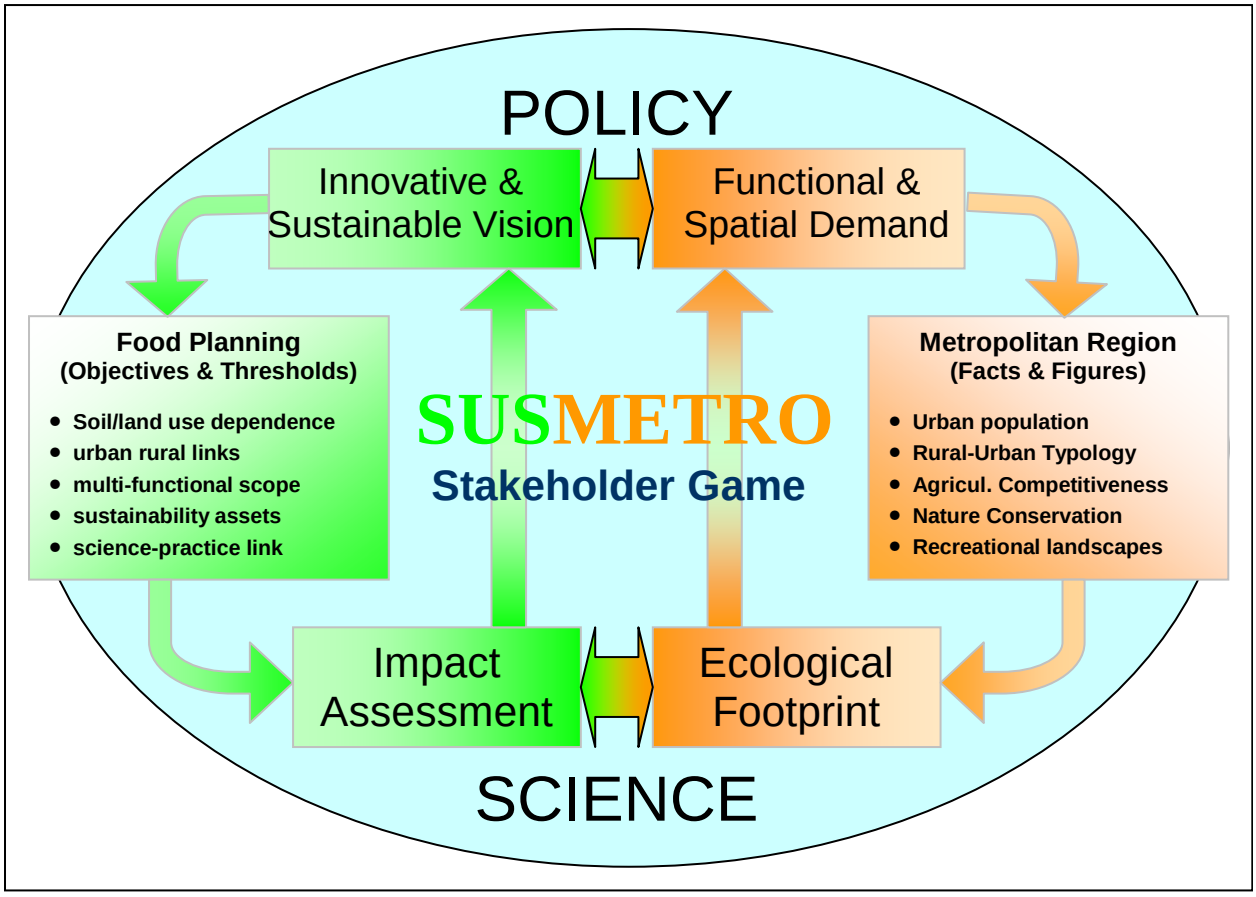


Figure 7: The SUSMETRO Stakeholder Game Conceptual Framework

As a "serious game" in which stakeholders can explore their agriculture preferences, SUSMETRO invites the players to strike trade-offs between different kinds of agriculture in different areas. Furthermore, the use of a triple bottom-line asks stakeholders to choose a mix of agriculture that has a positive triple bottom-line on the whole, a mix in which more intensive and more multifunctional agriculture both have a place.

The principle relationships between the different components are as follows:

- Stake holders make use of the 'facts and figures' (e.g. maps) offered by scientists and planners to identify the boundaries and functional characteristics of a metropolitan region of interest; it is interesting to note that stakeholders can select, reject and amend these references if they like.
- At the same time, these stakeholders develop new visions or draw upon existing societal visions on the sustainable future of this metropolitan region with special attention to the potential role of innovation in Food Planning, thereby agreeing on certain thresholds and objectives of sustainable land use;
- The facts and figures – especially the population numbers of the metropolitan region in question in combination with its agricultural self-supportive productivity allow the calculation of a current ecological footprint for food consumption in the region and beyond;

- The resulting ecological footprint is object of debate among stakeholders who are invited to identify opportunities for agricultural innovation to improve regional food planning, but also to adjust if necessary the demand for nature and recreation in the metropolitan region.
- The resulting new thresholds and land use change objectives are fed into SUSMETRO's Impact Assessment tool which re-calculates the ecological footprint, spatial demands and economic revenues.
- This information is re-entering the stakeholder debate and the iterative process can continue until the most desirable result has been reached.

The interactions between stakeholders of different backgrounds – including e.g. scientists, planners, politicians as well as farmers and citizen groups – is potentially more complex than the schematic representation depicted in Figure 7 suggests. There are also more feed-back loops between the different actions and input-output processes.

3.2 The SUSMETRO Footprint Model as an IA Tool

The software

The SUSMETRO game is implemented in Excel and the ESRI ArcGIS software. The ArcGIS software is used to display maps, to draw sketches on the Maptable (see section 3.3) and to compute the areas of the current and the new Land Use Functions (LUF). The computed areas are stored in two separate files that are input for the Excel model: one for the current situation (T0-*casename*.csv) and one for the visional situation, designed by the players (T1-*casename*.csv).

The Excel model calculates the ecological footprint (supply assessment), the expected profit (economic assessment) and the percentage of the target nature area reached by the sketched situation, and compares this with the current situation. The results of the assessments are shown in simple tables and graphs and can be displayed on the map table or on the wall with a digital projector.

Excel is chosen because most of the end users are familiar with this program. Part of the game is a discussion on defining Landscape Character Areas (LCA) of the region of interest. In the Excel model file a sheet is reserved to fill in the legend and a description of the LCAs. The participants are also invited to look at the calculations and to change input values in the Excel sheets if they do not agree with the initial values, or to experiment with these values.

Interaction with the players

The game is explained by a "service provider" and technically assisted by a facilitator. It can be played by a group of maximum 15 persons (see also section 3.4).

The game works with two types of sketches that are usually both drawn on the map table by the players (using a set of existing maps as reference).

LCA-sketches: The end users are first invited to divide the region of interest in a limited set of Landscape Character Areas. They have to draw the LCAs on a map of the region. While drawing, the reference map can be changed: e.g. a soil map, nature or recreational map might help to decide where the borders between the different LCAs should be drawn. A part of this first step is to fill in the legend and a description of the LCA map in

the Excel sheet "LCA". The LCA sketch is a means to reach an agreement among the participants on the characterisation of the region as it is now. It can also be used as a reference while drawing LUF-sketches.

LUF-sketches: the set of Land Use Functions is not to be discussed, and is a fixed set for each region (case study). However, the content of the LUFs can be discussed during the game, and the descriptions, the assumptions and input values related to the LUFs can be changed by the players in the Excel sheet "input values". There can be a distinction between current LUFs that only occur in the sketch of the current situation, and future LUFs, that can be drawn in ketches of new, visional situations, invented by the players. The LUF-sketch of the current situation is usually drawn in advance. During the game the players are invited to draw new situations by copying current LUFs from the current situation sketch if they remain the same, and by drawing (new) LUFs on new locations (see Table 4).

Table 4: Land Use Functions for the Dutch case study in the Rotterdam region:

Conventional Agriculture	
Multi-functional agriculture	mix of +/- 75% agriculture and 25% rural recreation
Agriculture (crops/grass)	conventional production of 50% crops and 50% milk products
Greenhouse production	concentrated food production under glass, usually in clusters
Innovative Agriculture	*Can be drawn in visional sketches of new situations, designed by the players*
Multi-functional agriculture	mix of +/- 75% innovative agriculture and 25% rural recreation
Agriculture (crops/grass)	innovative production of 50% crops and 50% milk products
Integrated food production & processing	innovative, very concentrated in "high tech" agro food parks
Recreation	
Low density recreation	requires small facilities in mainly forested areas or beach (like parking lots, hiking/cycle tracks and a few benches)
High density recreation	requires sites with special facilities for (outdoor) recreation and sports
Nature	
Nature management by organisations	Nature management, including costs of purchase and lay-out of the land
Nature management by farmers	who usually own the land and get paid by the government for lost income (subsidy)

N.B. Agriculture contains both grassland and crops. The reason why there is no distinction between grassland and crops is to avoid that participants sketch cropland on unsuitable locations: in the majority of The Netherlands the main crop areas are situated on the most suitable areas, while the main grassland areas are on locations that are too wed for crops (and this is certainly the case in the Rotterdam region).

After the sketches have been drawn, the facilitator uses the ArcGIS software to compute and store the areas of the drawn LUFs. Next he uses the Excel model sheets to compute the assessments (with the calculated LUF-areas as input) and to display the results.

The assessments

(1) The most important is the supply assessment which calculates what % of the population in the region can be fed by the available and/or planned agricultural areas, except for meat and eggs. SUSMETRO did not have the resources to build in this dimension. The input for this assessment is:

- the number of current or expected inhabitants (for a future situation) in the region

- the areas of the available and/or planned (innovative) (multifunctional) agriculture in ha
- the areas of the available and/or planned greenhouse production in ha
- the areas of the planned integrated food production & processing in ha
- the food capacity for each of these LUFs in inhabitants/ha.

Output is the % of the population that can be fed. This is calculated as follows: ((food capacity x area) / nr of inhabitants) x 100 summed for all agricultural LUFs.
N.B. The supply assessment of the current situation gives an approximation of what % of the population could theoretically be fed if the existing agriculture and green house areas would only produce food for the population in the region.

The supply assessment also calculates if the amount of recreational space is adequate in % of inhabitants. Input for this assessment is:

- the areas of the available and/or planned low and high density recreational space in ha
- the areas of the available and/or planned (innovative) multifunctional agriculture in ha
- the recreational capacity of each of these LUFs in inhabitants/ha
- the simultaneous recreation %: this is the percentage of the population that is expected to recreate at the same time (e.g. if 10% of the inhabitants recreate at the same time, then there is enough recreational space for the whole population in a tenth of the amount of recreational space).

Output is the % of the population that has sufficient recreational space per sketch. This is calculated as follows: (((recr.capacity x recr.space x (100 / sim.recr%)) / nr of inhabitants) x 100, summed for the three recreational LUFs.

(2) The second is the economic assessment that calculates the expected profit: the revenues from agriculture and recreation, substracted by the costs of Nature management. Input for this assessment is:

- the areas of the available and/or planned LUFs in ha
- the revenues of each of the agricultural and recreational LUFs in Keuro/ha
- the costs of the management of the available and/or planned nature areas in Keuro/ha

The expected profit in Keuro is calculated per sketch as follows:
Summed (revenues x area) of the agricultural and recreational LUFs – summed (costs x nature area) of the 2 nature LUFs.

(3) The third assessment checks what % of the target nature area (input by the players) can be reached with the nature areas in the current situation and in visional sketches. Input for this assessment is:

- the areas of the available and/or planned nature areas managed by organisations in ha
- the areas of the available and/or planned nature areas managed by farmers in ha
- the target nature area in ha (input by the players)

The output is calculated per sketch as follows:
(sum of available and/or planned nature areas / target nature area) x 100

The results are computed and stored In the Excel "calculation" sheet for the current situation and for one sketched (future) situation. The results are displayed in tables and graphs in the sheet "results". The graphs can also be shown separately in the sheets:

SUPPLY ASSESSMENT, ECONOMIC ASSESSMENT and NATURE TARGET ASS. They compare the results of the current situation and one visional sketch by the players.

If several new sketches are produced in a session, the facilitator saves the complete Excel file under a different name after each assessment (otherwise the results of the previous visional sketch will be overwritten). After a session the players can receive the produced Excel files and compare themselves the results of different visional sketches by copying the different results in one Excel sheet.

3.3 Maptable: an Interactive Visualisation Tool for Information Management

The current Maptable and its software was created on the basis of a search for GIS participation software. The Maptable offers a combination of a large computer screen (more then a meter wide) and user interaction through systems other than a mouse or a keyboard. However, there was no available software for the system that was needed. So the software needed to be developed in-house on basis of ArcGIS to have a GIS oriented tool with multiple user interaction.

The Maptable is basically a touch-sensitive large computer screen which can be tilted and lowered, so it functions like a table. On this computer screen users can draw directly with their fingers or with the aid of a pen. The drawings are directly made on top off geo-referenced maps.
See the photographs in Figure 8 for an impression of the use of the Maptable and its software.

The main purpose of the system is to improve the process of spatial planning and designing. Two questions arise from this aim:

- How can we improve the participation and communication (process-oriented)
- How can we make working with spatial information easier (technological-oriented)

To successfully introduce the Maptable and its software in participation processes three things are important:

- the level of participation of the user or stakeholder
- the phase in the process of decision making
- physical barriers (money, technical).

The Maptable system tries to create a plane working field for all the participants/ stakeholders in the process. During the so called drawing sessions, participants discuss the studied area, expressing their ideas about it.

Figure 8: Maptable use in practice

All stakeholders can communicate their vision of the studied area with appropriate maps, and use the drawing capabilities to clarify their opinions or proposals for the studied area. It is therefore important to have enough background data (GIS data) of the studied area, because depending on how discussions go, other data or new data is needed. These data in the form of maps must be prepared in advance.

During the sessions multiple roles other then stakeholders are also important. Because it takes some time to get familiar with the software, one person with enough knowledge of the system should be available. And a person taking the lead of the whole discussions as a chairman, so all stakeholders and opinions can be heard. Depending on the complexity of the studied area or the goal of the session (a simple drawing or a multiple criteria analysis, etc.) one or more 'neutral' experts are needed.

Using the Maptable for the Susmetro game has demonstrated that the use of simple models – even on the basis of Excel-files – in combination with the Maptable allows to combine geographical data and models for directly calculating impacts.

3.4 Knowledge Brokerage as part of the Game (Contribution by M. Stuiver)

Division of Roles

Sustainability issues such as those addressed by SUSMETRO are characterized by complexity, governance, a high diversity of actors, interests and views and by the

presence of risks and uncertainties (see Beck, 1992). The move towards sustainability therefore implies new roles for scientists that are considered more helpful in reconciling knowledge demand and supply and dealing with complex environmental issues. This links up with a general trend to move from scientific endeavour in a traditional research context to knowledge production that is engaged with other communities and useful for multiple audiences (see Nowotny et al. 2001)
A variety of different roles in knowledge production for sustainability (Turnhout, 2009) emerge over the years. Some of these roles are considered to fit well with traditional and straightforward policy issues. In those cases, scientist can act as pure scientists by delivering the facts to serve as the basis for decision making (Pielke 2007). However, in our case, this will not suffice.

Performing the science-policy interface in the SUSMETRO game has implications for the different roles that the involved scientists play and the effectiveness of these roles during the facilitation of the game. While dealing with complex problems such as in the challenge of the SUSMETRO game, the scientists engage with policy makers and other participants in the landscape in order to produce usable knowledge for the future. However, this is not at all unproblematic and the key issue at stake is to avoid accusations of science advocacy (Huitema & Turnhout 2009; Pielke 2007). Thus, in a methodology as SUSMETRO where usable knowledge and the facilitation of knowledge of others are important scientists balance between the expert and the facilitator, being involved and at distance.

When engaging in a SUSMETRO Stakeholder game it is important to be clear and consistent regarding the division of roles between the participating parties:

The Problem Holder
The problem holder is the host institute or community that would like to run a SUSMETRO Stakeholder Game for their metropolitan region of interest. SUSMETRO does not offer to engage in all problems of sustainability, but limits the choice to regional food planning, recreation and nature conservation. Other issues such as soils, water quality, energy, or transport can only be addressed in the context of the three priorities, but not independently and in their own right. So we do consider linear waterways such as rivers and creeks to be an important spatial issue for nature conservation and recreation, but we will not give it a central position.

The Service Provider
In the SUSMETRO implementation season 2010, Alterra took the role of the service provider. In the future and in the context of other project environments, it is in principle possible that other institutes are taking this role. In the implementation of SUSMETRO Phase 1 (2008-2009) Alterra has developed a database and practical experience in conducting stakeholder events geared towards collaborative planning towards sustainable metropolitan regions. The three main services that are being offered are (1) targeted information on the spatial-functional characteristics of regional food production, recreational opportunities and nature conservation values; (2) a sustainability impact assessment that is based on the principles of the ecological footprint analysis and providing indicator-based as input; and (3) a Maptable and its software that allows participants to draw their own visions on existing digital maps. All these three services are being offered as part of a collaborative approach to ensure that the problem holder together with regional stakeholders engage into a forward looking and well-informed

fact-finding debate on the sustainable future of their metropolitan region. The indicators that are being offered as SUSMETRO products are compiled in Annex 6. In addition, Alterra will also integrate regional data where available and relevant.

The Knowledge Broker

There is the challenge how to *communicate* the knowledge produced during the game to other times and places. There is a risk that its robustness is scrutinized within other policy domains. One challenging aspect in this respect is the fact that the 'social' construction of the knowledge produced during the game is made more transparent to outsiders, and that it becomes clear that scientists are actively engaged in this process even when this is accompanied by struggle and conflicts about competing knowledge claims.

A further aspect is that all knowledge production contains processes of *conflict management* and alignment. The conflicts that take place during the game can serve as a good way to discover these various sources of knowledge and epistemologies. The conflicts sharpen the different standpoints and make the different sources of knowledge and their possible contributions to the visualization of metropolitan landscapes and their policy implications more visible.

Requiring a fair amount of neutral standing *between* the different parties, the Facilitator should ideally not be taken by the same scientist or expert who is providing the key scientific services (see below), nor by the problem holder – both being too much engaged in promoting certain positions.

The KB model proceeds from the assumption that processes of knowledge production and use are symbolic or communicative actions involving two or more parties who reciprocally affect the acceptance and rejection of knowledge claims through argument and persuasion (Dunn 1993). In contrast to the linear transfer model, the KB model conceptualises the science-policy interface not as a sharp line of demarcation but rather as a permeable, dynamically shifting "boundary" (Gieryn 1995). Science and politics come together in a hybrid "*brokerage domain*" in which they "negotiate" the relevance and cogency of knowledge claims – while still keeping their particular identities and operating conditions as specific societal sub-systems. As mentioned in the introduction, we consider KB and LCA as complementary tools in the policy-science interface. From KB perspectives, science-policy interactions are seen as dynamic exercises that evolve over time, occur sequentially and often iteratively, and typically involve long-term interactions between scientists, policy-makers, interest groups and citizens (Miller et al. 1997). Analogously, scientific input into policy-making cannot be reduced to the production and transfer of a product – often in the form of a written report – but rather has to be seen as a social *process*. Much about what makes some exercises of science-policy advice more credible, more salient, and more legitimate than others seems to be associated with the process by which they are developed, rather than just the product itself (Cash & Clark 2001).

Against the background of such a differentiated assessment of impacts, effective knowledge brokerage has to fulfil at least four functions, abbreviated in the following "**4 Cs**":

- **Contents**: giving easy *access* to relevant data, information, and knowledge, both in the sense of providing knowledge on "scientific state-of-the-art" for policy makers and Stakeholders and structuring it in a way so that it is easily readable, understandable and usable by relevant stakeholders in framing and/or evaluating

policies, as well as providing knowledge on "state of policy-making" for researchers;

- **Consciousness**: *setting agendas* for sustainability-related problems, both in the policy realm (by raising awareness for the scientific knowledge base underpinning those problems among policy makers, Stakeholders and the broader public), as well as in the scientific realm (by creating consciousness for the policy implications of scientific findings among researchers);
- **Consensus**: fostering processes of *learning* and *consensus building* on a scientifically defensible and politically acceptable definition, handling, and solution of sustainability-related problems among researchers, policy makers, and civil society actors;
- **Capacities**: building capacities among all actors operating at the *science-policy interface*, i.e. those who are responsible for framing and funding research policies, those who are utilising research results in their day-to-day operations, as well as those who coordinate and conduct policy-relevant research projects.

Preparation

1. Identification social goal/ problem (related to Food, Nature & Recreation)
2. Identification regional metropolitan boundaries
3. Formation of Group
4. Create a roadmap for the game and prepare PROJECT maps.

Implementation

Plenary KB-Contents	1. a. Describe the regional area related to the chosen social goal/ problem by project maps. b. Introducing concept of Landscape Character Assessment
Group KB-Consciousness	2. Landscape Character Assessment, Identify and delineate, the most essential metropolitan areas within project region, making use of PROJECT maps. Taking into account the project criteria and policy case topic. Propose a total of 3 sustainability criteria per area/type, out of 4xPPP=12 sustainability criteria. PROJECT team starts digitizing metropolitan areas.
Plenary KB-Contents	3. Discuss LCA & sustainability criteria, introducing concept of sustainable food planning and sustainable regional planning
Group KB-Consciousness	4. Sustainability Score per metropolitan area/type, based on sustainability criteria from 2.
Plenary KB-Consensus	5. Discuss results, comparison of results of stakeholders and PROJECT team and review of sustainability criteria & model decision rules. Introducing Regional Design Proposals, assignments and ambition level
Group KB-Consciousness	6. Sustainable Regional Design Proposals 6.1 Identifying new locations for innovative agricultural systems (multi-functional, mono-functional, integrated food production and processing). 6.2 Identify new locations for recreational activities (low density and high density) 6.3 Identify new locations for nature management (by state/NGO and/or by farmers.
Training KB-Capacities	7. Implementation role play. The stakeholders are asked to develop implementation script books to specify their future role 8. Alternative Design Proposal, how to develop independently alternative options.

Figure 9: LCA-KB: Stakeholder Process stepwise approach involving KB-tools

In a major review of knowledge brokerage mechanisms for sustainable development, Cash et al. (2002) found that such mechanisms are likely to be effective when they simultaneously enhance: 1. Active, iterative and inclusive communication; 2. mutual understanding, and 3. Mediation in conflicts that are bound to emerge between the legitimacy, salience and credibility of the information flows between multiple actors. The paper Nassauer & Opdam (2008) seems to be an excellent foundation. Sketching out approaches to salience, legitimacy and credibility and best practices in avoiding paradoxes and inconsistencies as to the three qualities is a promising road.

In concrete terms, spatial boundaries and descriptive criteria of a landscape are developed on the basis of inquiry, negotiation and interpretation, rather than linear

science models. The major challenge of introducing LCA as the integrative tool in the science-policy interface is hence the need to avoid scientifically based thresholds to frustrate the participatory process. Equally, there is need for a unifying and broadly interpreted notion of 'regional identity' – hence not restricted to images of traditional, cultural landscapes of the past, but open towards innovation-driven, multi-functional land use concepts of today. The way LCA is meant to achieve this goal is by employing Knowledge Brokerage tools as presented in the previous section. Figure 9 illustrates how the "4C's" of KB are integrated in the stepwise approach for LCA.

The rules and procedures of LCA-KB as presented in Figure 9 will be applied to three concrete 'real-life' cases located in The Netherlands (Randstad), offering the following design tools:

(1) Status quo assessment of metropolitan regions at various levels of scale (region–country–Europe);
(2) Assessment models for calculating regional demand vs. carrying capacities, including cost-benefit analysis and environmental impacts;
(3) Ex-ante policy scenarios as input to sustainable design proposals for future land use planning;
(4) Communication tools to address issues such as regional identity and a sense of place.

The knowledge-based and participative approach allows participants to engage in a LCA-KB process for commonly developing sustainable future perspectives for *their* metropolitan region (see stepwise procedure indicating KB-Tools in Figure 9). Throughout the iterative processes (see scheme on this page), participants will not only make use of the data and tools that are being offered, they also will establish their on region-specific sustainability criteria and develop their own design proposal.

Evaluation and policy development are considered as two separate processes independent from LCA. While LCA seeks to describe, analyse and classify landscapes, landscape evaluation is generally linked to policy and guidelines at different scales. In the case of this project, the key strategic objective is to decrease the ecological footprint of a given urban centre by improving the regional food production of its metropolitan landscapes. However, the project is not only based on such normative, environmentally motivated concepts but leaves space to issues such as regional identity and aesthetic judgments which are considered of equal importance because subjectivity should not be avoided when developing visions of future landscapes (Thompson 2000).

SUSMETRO is designed to offer a knowledge-based and participative approach by allowing participants to engage in a 'game' for commonly developing sustainable future perspectives for *their* metropolitan region. Throughout the iterative processes (see Figure 9), participants will not only make use of the data and tools that are being offered, they also will establish their own region-specific sustainability criteria and develop their own design proposal. The Stakeholder Game is set out to be implemented with a minimum effort for preparations on the side of the host institute or community that has signalled interest to participate.

4. SUSMETRO in Action: Practical Experience

4.1 Introduction

The project has entered a rather active Phase 2 with the peak of activities still ahead for most of 2010 (namely the development of a software application that scores sustainability on the basis of ecological footprint) and the implementation of various stakeholder events (playing the game) at the national (Rotterdam, Noord Friese Wouden, Alphen-Chaam) and international locations (Brighton, Bratislava and Antwerp).

Before Summer 2010, Alterra had been asked by TransForum to explore possibilities for a contribution from out the SUSMETRO project to the TransForum Conference '1st Global Summit on Metropolitan Agriculture in Rotterdam on 28-30 September 2010. The possible contribution that has been anticipated by TransForum member and WUR contact person J Beers has been a demonstration of the SUSMETRO Stakeholder Game. Already since the beginning of 2010, the SUSMETRO project team had been frequently in close contact with the Province of South-Holland (PZH) which had indicated interest in SUSMETRO as part of their own TransForum project 'Green in the City'. Throughout the process PZH maintained its principle interest and welcomed the Global Summit as a valuable opportunity to test the SUSMETRO game for the larger Rotterdam Metropolitan Region.

Another part of the preparations for the Global Summit was the close exchange with LEI, themselves involved in 'Green in the City' and a valuable partner due to their expertise in agricultural economics in general and the personal involvement of senior scientist Jan Willem van der Schans (LEI/WUR) who is largely dedicated to promoting and researching a range of Dutch urban and metropolitan agricultural projects.

4.2 The Prototype Development

After having completed SUSMETRO Phase 1, the development of the Stakeholder Game took several steps and was driven by a series of external events and meetings. A first decisive event was the "Atelier-Week" on the Hof van Delfland from January 18 – 22, 2010 with the title "one beautiful, vital and connected metropolitan landscape" (see Annex I). Inviting a wide range of stakeholders from policy, NGO and planning/research, the organisers landscape architects Bosch Slabbers together with process managers KaapZ, Gemma van der Ploeg en Eric Spaans invited to develop a spatial vision for a development strategy for Hof van Delfland 2025.

Though Alterra participated at the Delfland 'Atelier' merely as 'passive' observers and interested scientist, the event has been extremely helpful with regard to further developing SUSMETRO. The Delfland experience showed that access to contextual information on the region (quantitative and qualitative data) was either difficult, random or dominated by individuals. While the strength of the event was its openness and the inspiring group dynamics, the effects of planning considerations could not be assessed and be made part of the exercise

Figure 10: Stakeholders' sketch of spatial functions for Hof van Delfland during 'Atelierweek' (18-22 Jan 2010)

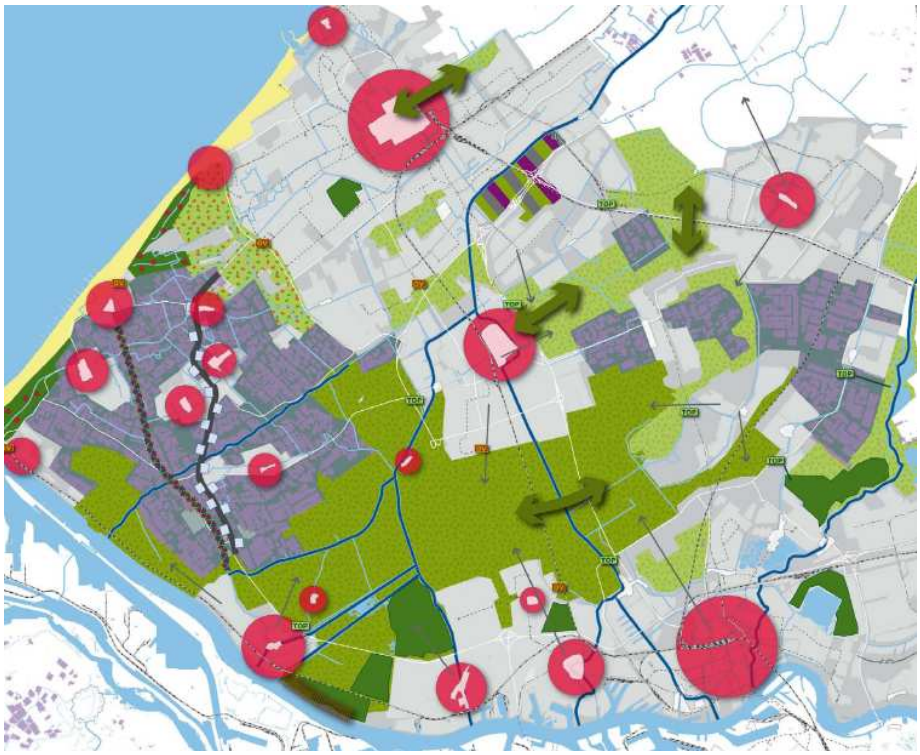


Figure 11: Graphic translation of stakeholder vision from Fig. 10

The 'Atelierweek' on Hof van Delfland laid the foundations for further preparatory activities with PZH and ultimately also for the planning of a SUSMETRO Game as part of the Global Summit conference. Already during a small international workshop

'Farming at the Edge of Town" (see Annex II), participant Jan Willem van der Schanz (LEI) had pointed at the role of food planning during crisis times such as hunger, war and environmental disaster. LEI has a long-standing tradition (exemplified by the model DRAM) in researching the topic food planning from this specific angle; however, the peak has been in the 80ties. It needs to be seen whether a contribution on Food Planning during crisis times is the most appropriate item for LEI to focus on. In more general terms, LEI has done a lot of work on the economic effects of multi-functional agriculture which could be a useful input to SUSMETRO.

Before launching the SUSMETRO Stakeholder Game as a demonstration during the 1st Global Summit on Metropolitan Agriculture in Rotterdam (September 28th 2010), it was deemed necessary to organize a test run in time for amending the game if necessary. This test run happened about 10 days before the Summit and involved next to Alterra scientists, representatives from LEI and TransForum. This event must be considered as extremely useful, as it provided valuable input on the calculations and references of the ecological footprint of food consumption in The Netherlands (see Section 2.3). Essentially, it prompted the SUSMTRO research team to decrease the hectare consumption from originally 1.3 ha per person to 0.5 ha, mainly because the shift from food import to self-supportive structures within metropolitan regions required using *local* hectares instead of *global* hectares. Another point of attention was the need to include meat production as part of the footprint scheme, simply because of the key role livestock farming is playing the Rotterdam metropolitan region.

4.3 The Global Summit Game (Rotterdam)

Entering their last year of the programme, TransForum invited Susmetro to the 1st Global Summit of Metropolitan Agriculture in Rotterdam to become "part of this groundbreaking and innovative approach that lets cities harness the potential that agriculture and food systems can provide for sustainable development." Other than a classical science conference with paper presentations, the organizers had designed an 'open space' process leaving ample opportunities for playful interaction during so-called 'project market place' and 'Learning Journey'-events, with special attention to addressing the science-policy interface.

The planning and implementation of the 1st Global Summit was largely driven by the practical experiences gathered in six global metropoles, namely Amsterdam, Chennai, London, the Detroit-Flint region, Johannesburg and São Paulo, who participated as cross-sectoral teams. The teams develop and begin implementing various pilot projects in areas such as:

- sustainable food production
- innovative supply chain models
- new agricultural services
- effective water, energy and waste management
- logistics and integrated production
- food security and food safety
- retail sales and economic growth
- land use and blight reduction
- animal welfare and disease prevention
- the connection to nature, landscape and the environment

The presence and influence of the international teams must be considered as one of the key characteristics of the event.

The SUSMETRO Stakeholder Game was programmed into two separate 2-hour events as part of the Learning Journey experience – essentially field trips – on the Summit's second day. For this purpose the facilities for playing the game (Maptable, computers, screens, hard copy maps, transparencies, drawing materials and working tables) had to be set up in an external location, namely in the pancake restaurant 'Het Sonnetje' in Maasland, about 20 minutes traveling distance from the conference venue 'Van Nelle Factory' in Rotterdam.

Clearly deviating from the envisioned standard framework conditions – international participants relatively unfamiliar with the Rotterdam Metropolitan Region and limitation to two hours – the SUSMETRO Game could not be expected to deliver the type of targeted, region- and problem-oriented decision-support tool services it had been developed for. Especially the knowledge-brokerage component addressing the science-policy interface could only be touched upon, but not fully exploited. On the other hand, the experience of actually playing the game with a wide range of interested conference participants – among them agricultural experts, policy makers and planner – demonstrated its capabilities and led to satisfying results.

Implementation

1. Preparation

For running the SUSMETRO Stakeholder Game at the Global Summit (29 September 2010) the Maptable software was adapted allowing to export data to an excel sheet for further calculations. Normally the stakeholders would have to produce drawings or make sketches of their ideas for the studied area. In this case we used the pre-prepared LCA-set from the Prototype-Session with people from LEI and transforum.

2. Introduction to SUSMETRO

Before beginning the actual game – hence the work with data, maps and planning – the project leader provides a brief powerpoint introduction to SUSMETRO, the concept of Metropolitan Agriculture, principles of Landscape Character Assessment, the main data references (especially to the map of Agricultural Competitiveness) and the rules of the game. The information provided is crucial for reaching a common understanding on what is expected and how the game is supposed to be played. At the same time, the information that is being offered is complex in terms of the underlying assumptions, methods and data sources. When playing the game with 'real' regional stakeholders – rather than with international conference guests – this type of information is expected to be disseminated at a much earlier phase prior to playing the game.

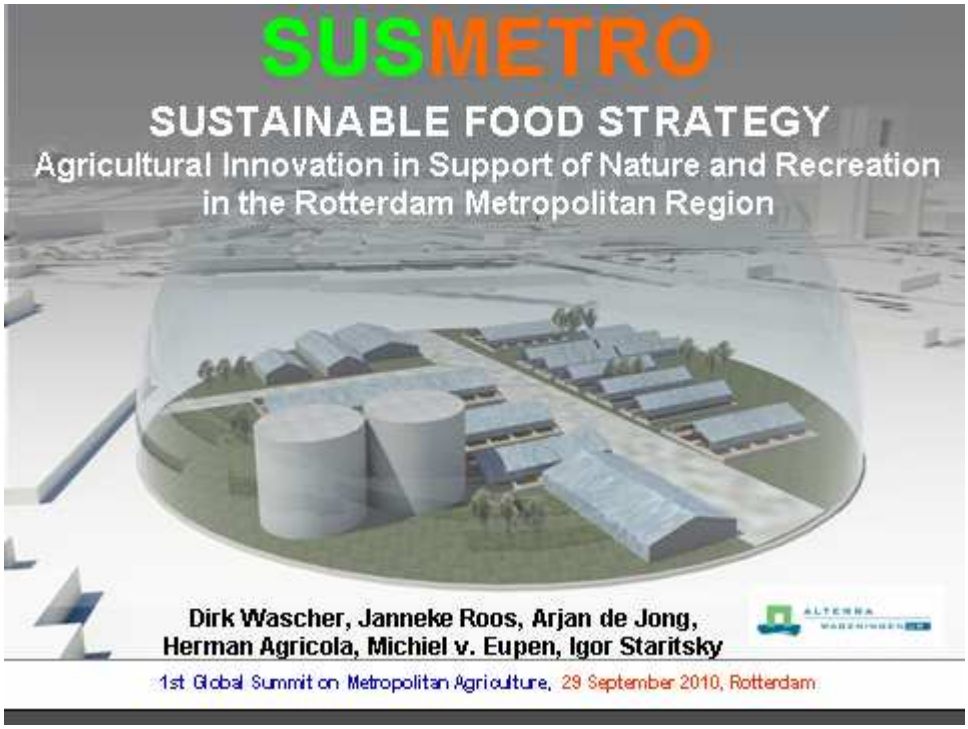


Figure 12: Opening slide of the powerpoint presentation during the Global Summit.

Given the technical and scientific education of most participants, however, the introduction was well received and met its purpose to 'set the scene' for beginning to play the game.

3. Introduction to the Maptable

Using the Maptable as a medium for retrieving geo-information, creating overlay comparisons and drawing design proposals requires a certain amount of technical-procedural understanding and tactile-behavioral sophistication for moving the digital pen over the screen. Maptable expert Arjan de Jong provided a short lesson giving practical instructions for all participants and explaining the different components of the basic SUSMETRO opening window showing the Rotterdam region and the different action buttons. Part of this introduction also included to offer the hardcopy maps and drawing utensils prepared for those participants who prefer not to use the Maptable.

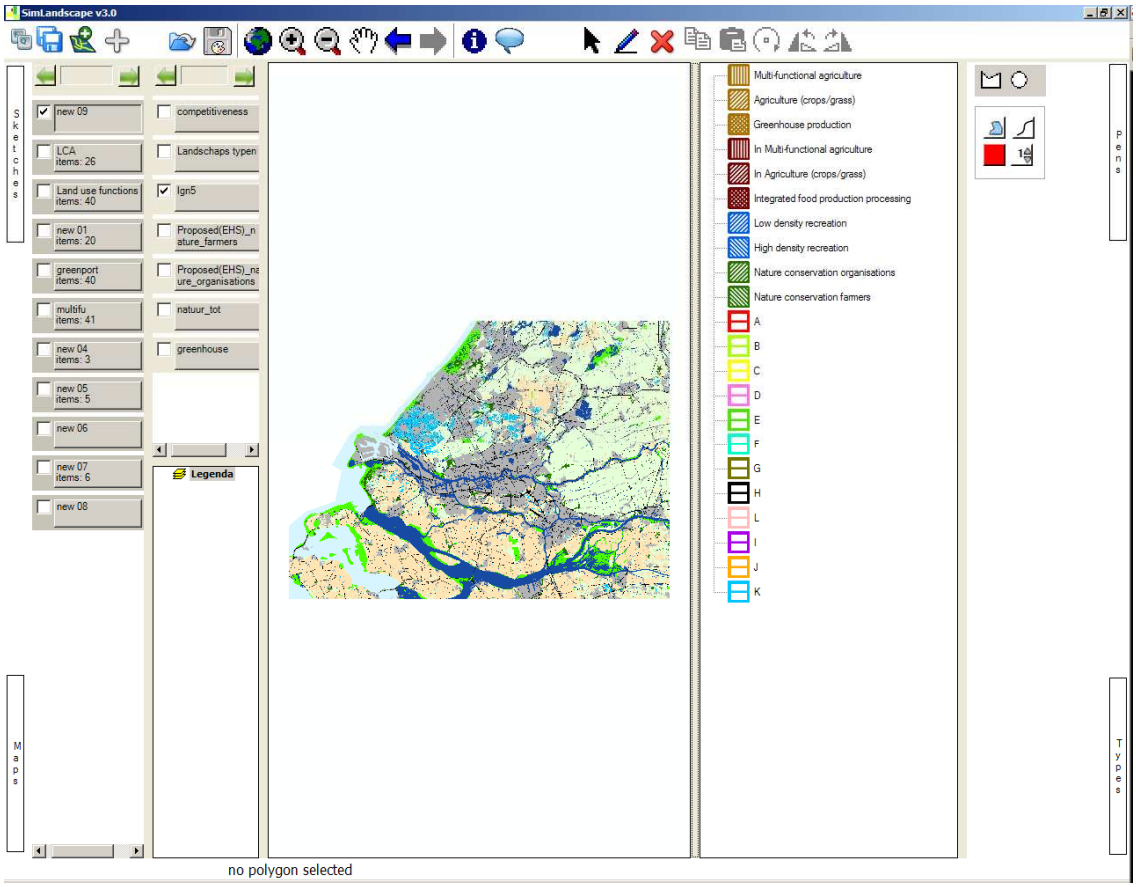


Figure 13: Screenshot of basic SUSMETRO window as produced by Maptable

Figure 13 shows on the top of the screen the toolbar with default GIS functionalities such as Zooming, Panning, whole extent, previous extent, etc. The gray cross (4th from left in top menu) allows to start the export of the drawing to the excel calculation sheet. On the right side of the toolbar are the tools located for sketching and drawing.

On the left side of the screen shot are two lists of buttons. The first list of buttons represents the so called-up sketch layers. Each can be put on top of the list of default maps which are represented in the list at the right list. The sketch layer acts like a transparent, on which the sketch is made. Different sketches can be made visible at the same time, on top of each other, in the same way as the basic maps.

On the right side of the screen the legend for the land use functions (see Figure 14 left side) for details and the LCA (landscape character areas) are shown (see Figure 14 right side). Normally, users are being asked to first designate the Landscape Character Areas with the help of the labels A – K. In the case of the Summit Game, a pre-drawn designation has been offered by the project team, in order to save time and because the participants did not have much regional knowledge.

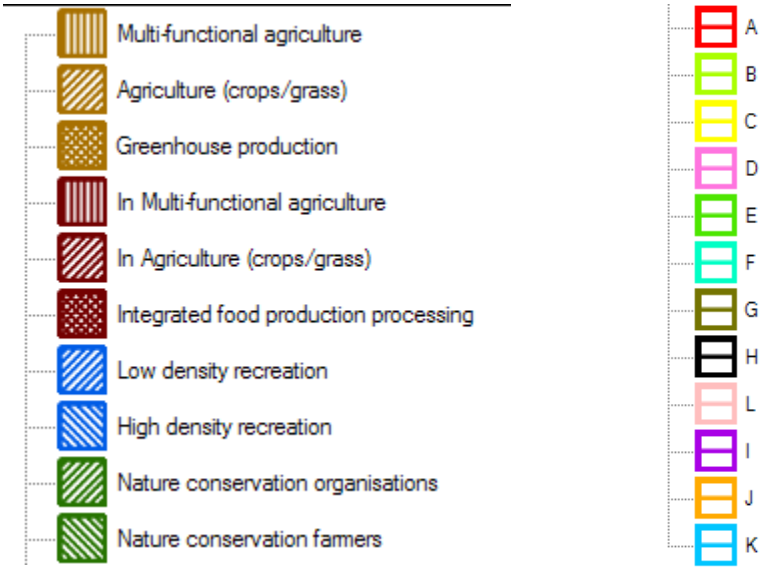


Figure 14: Enlargement of the land use functions tools (left) and the Landscape Character Assessment tools (right)

4. Drawing and sketching exercises

The first stage of the drawing and sketching session with the stakeholders is to explore the area. At the global summit conference this was important because most of the participants were not familiar with the area. In this so called first stage the participants learn to use the Maptable software and explore the available maps. Resulting in a first sketch with the important features for further discussions highlighted.

Lanscape Character Areas of the region of Rotterdam

	A	Cities	A = Stad
	B	Biesbosch (Nature area)	B = Biesbosch
	C	Dunes	C = Duingebied, *en BiesBosch, uitsplitsen?* ja
	D	Western harbour	D = Westelijk havengebied
	E	Between the cities	E = Stadsrand
	F	Open grassland area	F = Open grasland gebied
	G	Open crop area	G = Open uitwaai gebied, akkerland
	H	Greenhouse area (Westland & Oostland)	H = Westland en Oostland (kassengebied) – graag opsplitsen
	I	Other harbours and industry	I = Overig Haven en Industrie
	J	Estates (Wassenaar)	J = Wassenaar
	K	Estuaries	K = Zeearmen
	L	Grassland with much water	L = waterrijk grasland

Figure 15: Legend for the Landscape Character Areas of the Rotterdam region

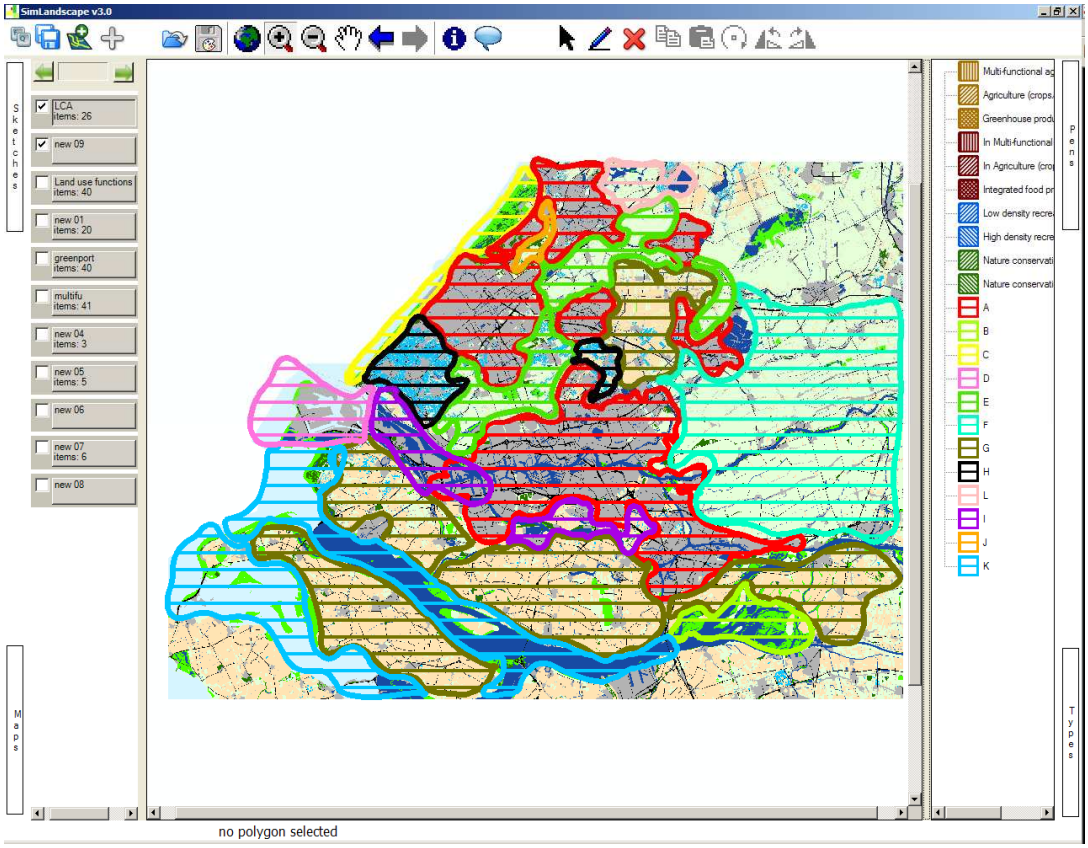


Figure 16: Pre-drawn map of LCA (developed during a preparatory workshop)

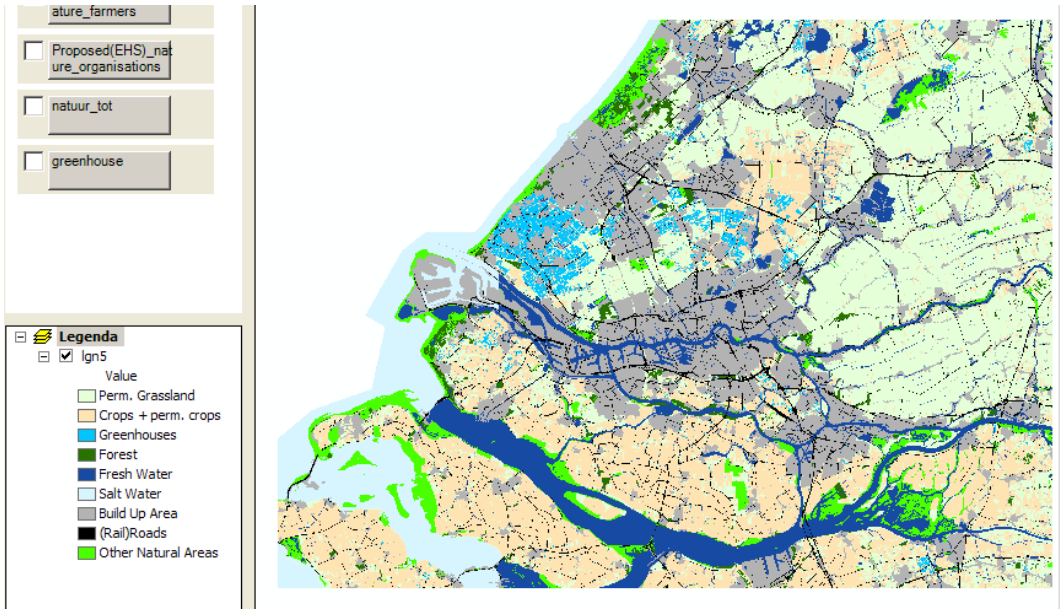


Figure 18: The basic land use map behind the LCA sketch

As can be seen in the Maptable drawing around the cities present there is greenhouse activity, a large open grassland area on the east side, crop areas in the south with estuaries in between. The most important map for discussion is a base map with some dominant land use functions (Figure 16). It should be noted, that the original idea of LCA units is

to address regionally acknowledged landscapes or areas with their locally accepted, traditional names – e.g. Groene Hart for the national landscape in the north, or Biesbosch for the National Park in the South. But it also could simply be Rotterdam Harbor. Again, such connotations require regional knowledge.

5. Allocation of existing and projected Land Use Functions (T0 & T1)

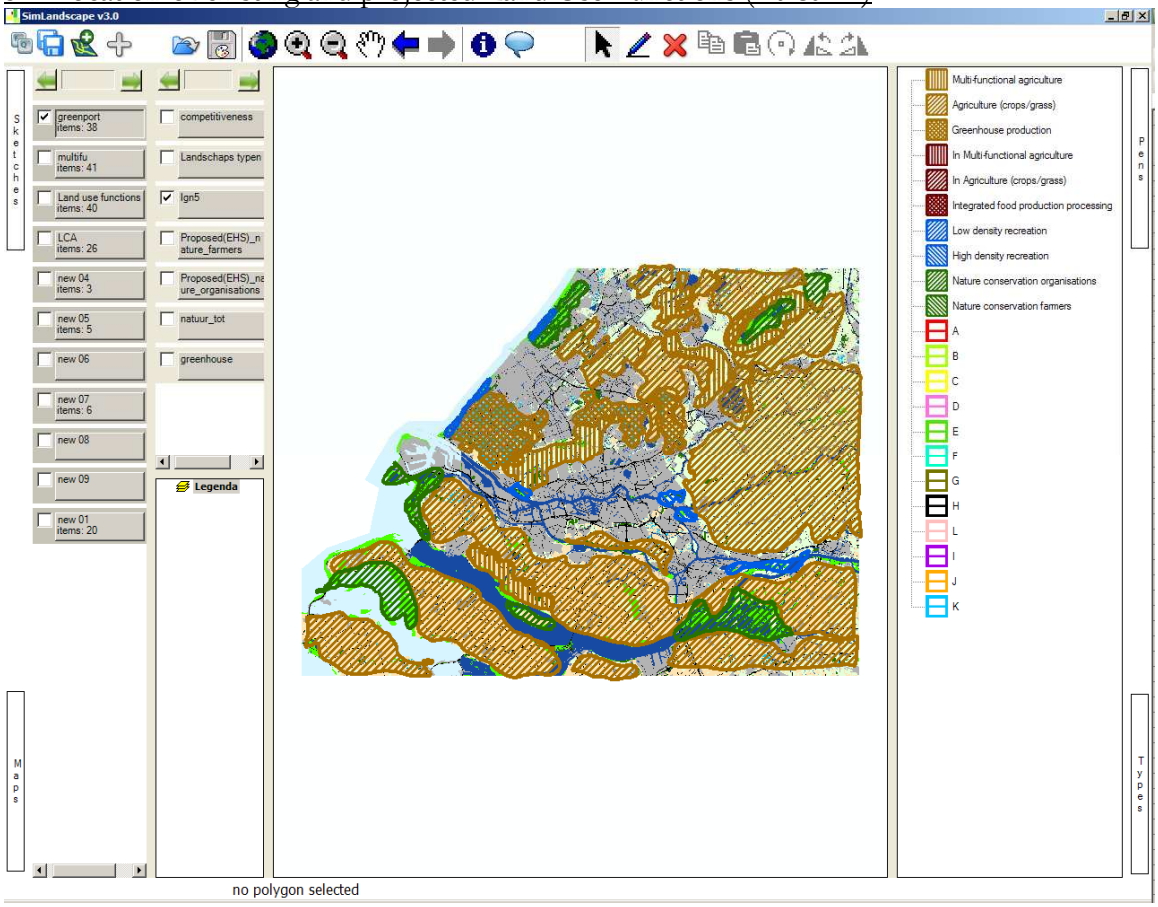


Figure 19: Pre-drawn current allocation of Land Use Functions (T0 baseline)

On basis of the LCA sketch a more detailed land use functions sketch of the current situation (T0 baseline) needed to be made by the participants. But due to the time limit the Land Use Function map developed by the stakeholders during the preparatory workshop in Wageningen has been offered. This map with the functions has been used as the baseline situation against which one or more projected situations is compared in the impact calculations in the Excel sheet.

At the summit itself, after some discussions on how to redevelop the whole area, a visionary sketch was made (T1 projection). The focus was on developing a greenport at the mouth of the river and on allocating innovative forms of (mostly multi-functional) agriculture (see Figure 20). According to the SUSMETRO terminology, 'greenports' belong to the innovation type 'Integrated Food Production Processing' facility.

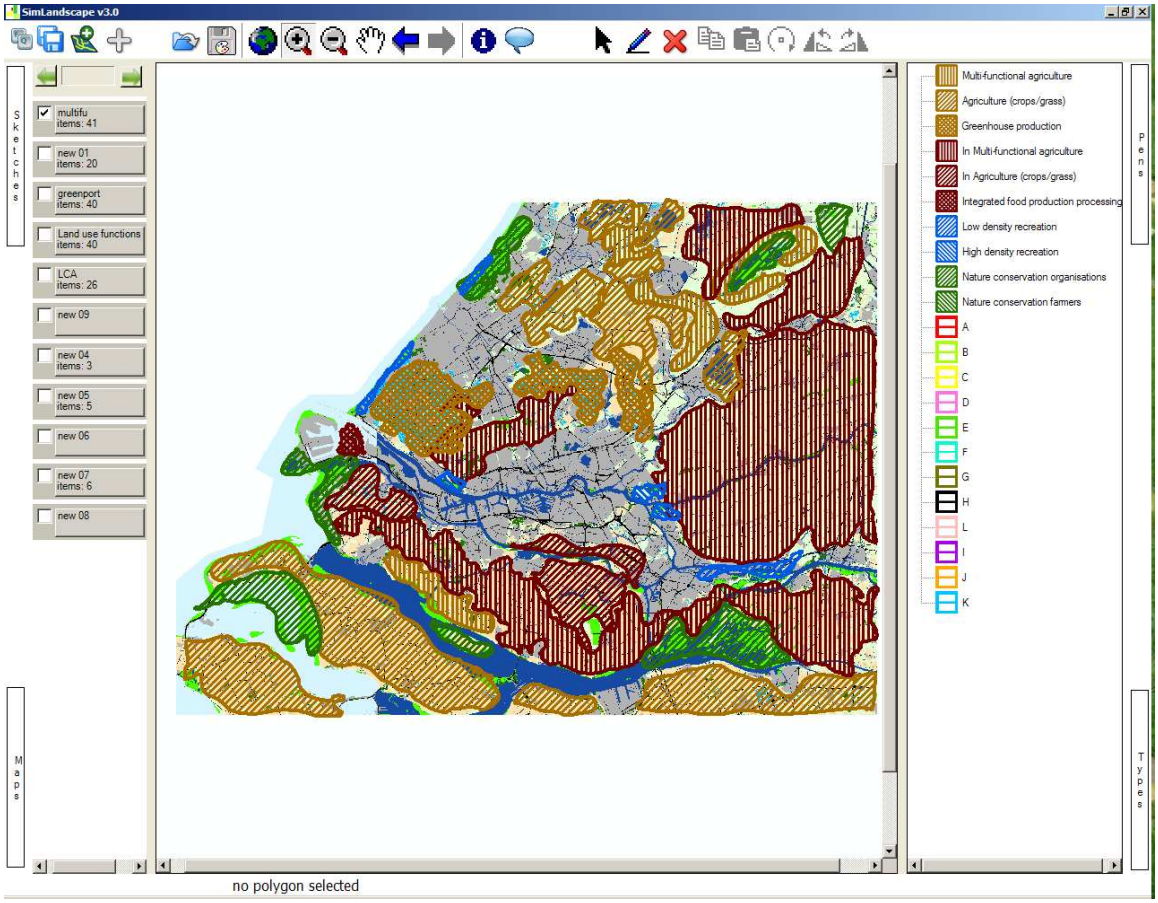


Figure 20: Stakeholder-drawn allocation of Land Use Functions (T1 projection)

6. Impact Assessment

For both the T0 baseline and the T1 projection, the SUSMETRO model calculates the expected impact on the metropolitan supply with local food, nature and the economic revenues (see Figures 21 and 22)

Land use function	Ha T0	Ha T1
Multi-functional agriculture	20891	13367
Agriculture (crops/grass)	183644	63206
Greenhouse production	15456	15456
In. Multi-functional agriculture	0	111007
In. Agriculture (crops/grass)	0	11773
In. Integrated food production & processing	0	698
Total food	**219991**	**215506**
Low density recreation	1335	1335
High density recreation	2225	2225
Total recreation	**3560**	**3560**
Nature conservation by organisations	22709	0
Nature conservation by farmers	0	22709
Total area Nature	**22709**	**22709**
Total area all LU functions	**246260**	**241775**

Figure 21: Calculated areas for the T0 baseline scenario

SUSMETRO GAME
GLOBAL SUMMIT

RESULTS:

SUPPLY ASSESSMENT in % of inhabitants	T0	T1
Metropolitan capacity for food supply	20	22
Metropoltan capacity for recreational supply	39	65

ECONOMIC ASSESSMENT in Keuro	T0	T1
Costs nature conservation management	-43147	-15896
Revenues food production	1030363	1120801
Revenues recreation	16754	16754
Profit (revenues - costs)	**1003971**	**1121659**

NATURE TARGET ASSESSMENT	T0	T1
% of Nature target area reached	45	45

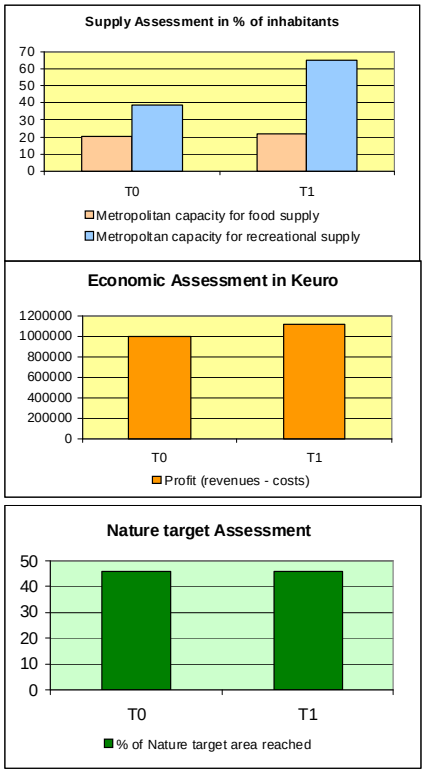


Figure 22: Calculated areas for the T0 baseline and T1 projection in comparison

With the help of some basic parameters the impact of both scenario's T0 and T1 could be seen and discussed in the session.

Conclusions

The session during the Global Summit in Rotterdam demonstrated that participants engage positively and as intended in the SUSMETRO Stakeholder Game. The use of the Maptable is not acceptable for everyone, some prefer to make drawings on hardcopies at tables rather than to stand in front of a group and to 'lead the way' in the design. There also have been some shortcomings observed regarding technical aspects: the Maptable does not easily display all assessments and design results back to the participants. This means that important references for the discussion or further development are sometimes missing. At certain instances, the Maptable was 'crashing' and needed to be re-started. But many participants felt positively intrigued and enjoyed using the capacities of the table. The open and interactive display of design options led to inspiring discussions and – as hoped – to the comparison of option and impact results. The latter must be considered as the main strength of the approach.

As visible in Figures 22, the introduction of a new greenport – though almost 700ha large – did not translate into substantial increases of regional food supply. This is mainly because the baseline data used during the SUSMETRO Game in Rotterdam was treating the existing agricultural production as if it would be entirely available for the regional market. This is clearly not the case. Instead we know that more than 90% of all greenhouse products are exported and a large percentage of all other agricultural products as well. The reason of not applying these figures was to focus on the land use aspects of the game, and not on the trade dimension about which we did not have reliable figures to work with. Nevertheless we did a re-calculation in which we used

different baseline figures, namely 10% and 50% availability for the local market only. Figures 23 and 24 show the fictive results for the Rotterdam Metropolitan Region, assuming the other extreme, namely that all traditional land use functions are transferred into innovative form of land use functions, and to increase in parallel the low density recreation and **move nature management by organisations to nature management by farmers (see Figure 23).**

Figure 24 shows the results for this assumption: a clear increase in the metropolitan capacity for food supply, and substantial economic improvements as well as an increase for recreation.

AREAS FOR ASSESSMENTS in ha
T0 = current situation (derive from existing maps or imported from map table: read from worksheet **cur**)
T1 = sketched situation (imported from map table: read from worksheet **csv**)

Land use function	**Ha T0**	**Ha T1**
Multi-functional agriculture	20891	0
Agriculture (crops/grass)	173912	0
Greenhouse production	15456	0
In. Multi-functional agriculture	0	60891
In. Agriculture (crops/grass)	0	113912
In. Integrated food production & processing	0	17456
Total food	**210259**	**192259**
Low density recreation	11067	31067
High density recreation	2637	2637
Total recreation	**13704**	**33704**
Nature conservation by organisations	22709	0
Nature conservation by farmers	0	22709
Total area Nature	**22709**	**22709**
Total area all LU functions	**246671**	**248672**

Target Nature area **T1**	50000

Figure 23: Input data for fictive SUSMETRO Game

Land use function	**Ha T0**	**Ha T1**
Multi-functional agriculture	20891	13367
Agriculture (crops/grass)	183644	63206
Greenhouse production	15456	15456
In. Multi-functional agriculture	0	111007
In. Agriculture (crops/grass)	0	11773
In. Integrated food production & processing	0	698
Total food	**219991**	**215506**
Low density recreation	1335	1335
High density recreation	2225	2225
Total recreation	**3560**	**3560**
Nature conservation by organisations	22709	0
Nature conservation by farmers	0	22709
Total area Nature	**22709**	**22709**
Total area all LU functions	**246260**	**241775**

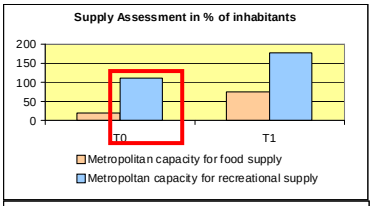
SUSMETRO fictive game

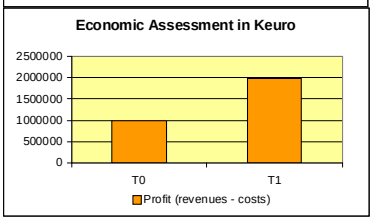
RESULTS:

SUPPLY ASSESSMENT in % of inhabitants	T0	T1
Metropolitan capacity for food supply	20	76
Metropoltan capacity for recreational supply	113	179

ECONOMIC ASSESSMENT in Keuro	T0	T1
Costs nature conservation management	-43147	-15896
Revenues food production	1014013	1973179
Revenues recreation	20327	21330
Profit (revenues - costs)	**991194**	**1978614**

NATURE TARGET ASSESSMENT	T0	T1
% of Nature target area reached	45	45





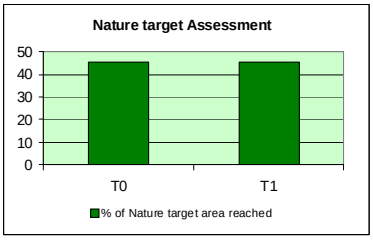


Figure 24: Results for SUSMETRO Fictive Game.

5. Output, Relevance and Recommendations

5.1 Scientific Results and their Societal Relevance

Scientific relevance: This project has filled gaps in linking regional impact assessment to ecological footprint calculation, developing procedural spatial planning methodologies and offering process-oriented policy-science interfaces. The substantive part delivered building blocks for the role of sustainable food production and landscape planning and design. The procedural part focuses on the knowledge-action nexus.

Societal relevance: The societal challenge was to elaborate on one of the key emerging themes in spatial planning: the link between landscape and food. The primary aim was to provide national, regional authorities as well as stakeholders with participatory tools to cooperate and contribute to the assessment and planning at the regional level; the secondary aim was to provide methodological feedback to European institutions' strategic policies goals on sustainable development.

Food planning is a young branch at the very interface between social and environmental sciences. The project makes a contribution to the substantive and the procedural body of knowledge. Thus it strengthens the scientific foundations of the emerging discipline. Also it provides building blocks for interdisciplinary research crossing boundaries with the humanities (local identity, cultural landscape) and natural science (environmental impact, food technology).

5.2 Evaluation of the Process-oriented Dimension of the Project

The process-oriented dimension of SUSMETRO was focussing on (1) the testing of the Maptable as an interactive technical medium for stakeholders, and (2) the development of Knowledge-Brokerage as a tool for facilitating the science-policy interface.

Maptable

The use of the Maptable could be compared to the manual drawing of hardcopy works as tested in Phase 1. Because of the success of direct manual involvement in the design process, there had been serious concerns regarding the use of digital drawing methods such as Maptable. Would participants engage as freely and creatively when offered computer tools? Would Maptable offer more opportunities or would it inhibit players? A post-application questionnaire raised these and other related questions. The answers highlight the experience:

- Some of the shortcomings was the over-sensitivity of the touch-screen against motions (even a fly would prompt a digital reaction, e.g. a point). The other was that the system sometimes crashed, making the re-start difficult and stopping the flow of the event.
- The two groups reacted differently and within the groups there were also different reactions. It was clear that these reactions were culturally guided. E.g. one American participant voiced her concern that such a tool could be misused in the hands of 'powerful' people like majors etc. They had a clear person in mind who would use such data and table for manipulating his politics. Some people missed that they could not simply sit down and make drawings. But at the same time, many others were impressed and felt that it was professionally done.

- Keeping results that have been developed in earlier work sessions visible or at hand was a problem. They were often 'gone' and there was need to 'capture' and to compare.
- Legend needs to be bigger and all the time present. Titles of the maps need to be displayed in large characters throughout the session. There must be easier ways to store results and to easily access them.

In summary, the software of the Maptable will require improvement and more testing in order to improve the interaction with it and to generate results that are easy accessible and better readable.

Knowledge Brokerage

The Knowledge Brokerage tools did not get full exposure during the practical testing of the SUSMETRO Game. This was mainly because the envisioned real 'stakeholder'-event involving representatives from a Metropolitan Region did not materialise. Only a preliminary version of The SUSMETRO game had been played during the 1st Global Summit on Metropolitan Agriculture with international participants from the conference and beforehand during the prototype testing. In both cases KB-style methods had been applied, however not in a systematic fashion but in a rather improvised way. The KB-function was mainly filled in by the project coordinator who acted in both instances as the facilitator and instructor in one. In the intended complete implementation, these roles require separation and there is need for a third person to monitor the process and gather information on the interaction between scientists, planners, policymakers, NGOs, lay persons or others.

From the experience of running the SUSMETRO session, the project coordinator had the impression that KB-methods are well applicable and are likely to lead to good results if sessions are well prepared.

5.3 List of All Scientific Products

Table 5: Conclusive comparison between expected and delivered products for Phases 1 and 2[3]

Deliverables	Status	Comments
Phase 1		
D1.1.1 List of Selection Criteria	yes	Phase 1 Report: Table 1: Characteristics of MetroAgri vs UrbAgri Box 1: Innovation Characteristics
D1.1.2 Selection of Innovative Projects (incl. SWOT-Score)	yes	Phase 1 Report Table 3: Checklist of TransForum IPs Chapter 3.3 (selected IPs)
D1.2.1 Key functions and services offered by metropolitan landscapes (report and map)	yes	Phase 1 Report Table 1: Characteristics of MetroAgri vs UrbAgri Table 2: Comparison industry/multi-funct. Agri Maps 1 – 10 (stocks & flows)
D1.2.2 Tentative agricultural main structure (AHS) for The Netherlands and NW-EU (GIS map)	yes	Phase 1 Report Map 11 & Map 12: Dutch Agricultural Competiti. Phase 2 Report Figure 1: Results of the TransForum session (inclusion of NW-European information in base maps 1-10)
D1.2.3 Journal publication on	no	Wascher & Andersen (Landscape & Urban Planning)

[3] See Annex VIII for the official Deliverable Excel Sheet provided for TransForum

AHS & metropolitan agriculture		System Innovation as a Driving Force for Sustainable Dutch Metropolitan Agriculture (in print)
D1.3.1 Report on key components of EU projects under consideration	yes	Phase 1 report
D1.3.2 Detailed conceptual approach for Phase 2 D1.3.3 Time, activity and (contra-)funding plan for Phase 2	yes	Phase 1 report See also amendments with final version in Annex V
D1.3.4 Phase 2 Project team and committee (agreements)	yes	
Phase 2		
D2.1.1 Review data sets and assessment criteria of Stakeholder Game	yes	Especially the urban-rural typology (M.v. Eupen) and the Map of Agric. Competitiveness (H. Agricola) has been reviewed and further developed (see Section 2.2) See also overview Annex 6
D2.1.2 Development of visualisation tools (3 sets)	Yes/no	Substantial efforts went into the development of such tools with various 'trials' being made at Alterra. The result was that the tools would have been too resource intensive. So we settled for the Maptable as the main and only visualisation tool – because of its interactive qualities
D2.1.3 Stakeholder participatory events (3 sessions)	Yes/no	Again, substantial efforts went into planning an event in Hamburg/Germany (several visits and communications with the university and stakeholders), but finally no support could be generated. We also put in major efforts to run a full event in Brighton during the AESOP Conference (Oct. 2010) – again the request for local support failed. Another effort were the preparations and meetings for the Noord-Friese Wouden (initiative by Rik Eweg) – also this did not work out because of the difficult internal processes. So we settled for the prototype testing, internal test runs at Alterra and the 1st Global Summit event.
D2.2.1 Impact assessment on land use functions (SENSOR 1)	yes	A fully operational SUSMETRO Model has been developed (see example Annex VII); the assessment has been extended to include a cost-benefit analysis and to link with the ecological footprint.
D2.2.2 Assessment of landscape functions (SENSOR 2)	Yes/no	We had to settle for developing a Landscape Character Area approach only; it did not seem appropriate to assess also Landscape functions.
D2.3.1 European Case Study	yes	Rotterdam Metropolitan Region
D2.3.2 American Case Study	no	The contacts with Michigan University did not materialise on time.
D2.4.1 DVD/CD-Rom	no	The information is only available on paper. There was no funding left for making a DVD.

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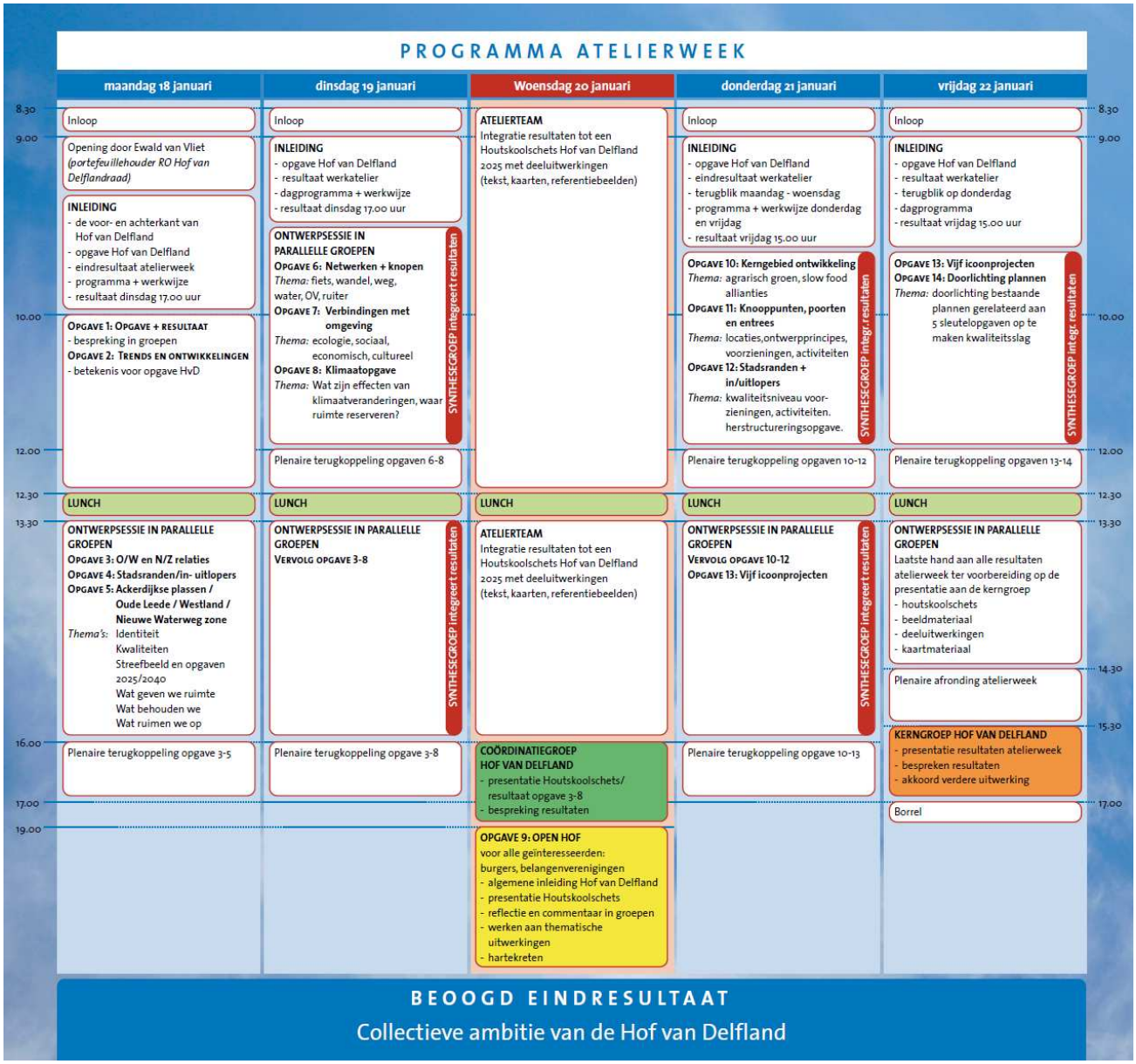
Annex I: Programme Atelierweek Hof van Delfland (Jan 18-22, 2010)



Annex II: Agenda Intern. Workshop 'Farming at the Edge of Town'

Multi-functional Land Use in Metropolitan Regions

According to the European Environment Agency (2006) approximately 80 % of Europeans will be living in urban areas by the year 2020; in seven countries it will be even more than 90 %. The EEA states: 'As a consequence, urban demands for land in and around cities are becoming increasingly acute'. Other than the traditional countryside, *metropolitan landscape* are hence:

- more dynamic in terms of land use change and land price development;
- attract more developers, planners and a larger variety of interest groups;
- combine an increase of agricultural innovation and biological farming techniques, offering a wide range of recreational, educational and therapeutic facilities.

This symposium seeks to highlight concepts of metropolitan landscapes at the international level as well as concrete topical issues on the basis of contributions from the Dutch Randstad and the Danish Copenhagen Metropolitan regions.

Agenda

13:00 Opening
13:15 Metropolitan Agriculture in NW-Europe (Dirk Wascher & Herman Agricola, Alterra)
13:45 Discussion
14:00 Multi-functional land use of the Copenhagen Metropolitan Region (Jørgen Primdahl & Lone Kristensen, University of Copenhagen)
14:30 Discussion
14:45 Coffee break
15:15 Land Use Planning Issues of the Randstad Metropolitan Region (Jan Willem van der Schans, LEI)
15:45 Discussion
16:15 Drink

Annex III: Agenda SUSMETRO Prototype test (Sep 17m 2010)

SUSMETRO

SUSTAINABLE FOOD STRATEGY

Agricultural Innovation in Support of Nature and Recreation in the Rotterdam Metropolitan Region

Preparatory Meeting

for the 1st Global Summit on Metropolitan Agriculture on the SUSMETRO Stakeholder Game Test Run at Alterra Wageningen, Gaia-Building, Room C 011

Agenda

13:00	The SUSMETRO project and game (D. Wascher)
13:15	Introduction to the Maptable (Arjan de Jong)
13:30	Start of the game for the Rotterdam Metropolitan Region

- Defining Landscape Character Areas (local names) 15 min
- Drawing of the current situation (LGN) 30min
- Sustainability score 1: comparison current situation with innovation potential 15 min
- Discussion 30

15:00	Coffee break
15:15	Continuation of the game

- Drawing alternative innovative land use option 45 min
- Sustainability score 2: analyzing the new results 15 min

16:15	final discussion and issues to improve
16:30	End of the Meeting/departure

ALTERRA WAGENINGEN UR

TRANSFORUM

Annex IV: Minutes SUSMETRO Prototype test, Sep. 17 2010

Notulen inhoudelijke test Susmetro Game 17 sept. 2010 Alterra Gaia C011

Aanwezig:
Alterra: Dirk Wascher, Marjan Stuiver, Arjan de Jong, Michiel van Eupen, Igor Staritsky, Herman Agricola, Frank Veeneklaas, Janneke Roos (notulen)
LEI: Rolf Michels, Stijn Reinhard, (PJ Beers)
Prov Zuid-Holland: André Jellema; Ineke den Heijer (proj leider transforum project Green in the city)
Transforum: Rik Eweg

Discussie na de introductie door Dirk Wascher (zie ppt)
Vraag Rik: hoe zit het met vlees en zuivel? Antwoord Dirk: is niet meegenomen omdat het te complex is om dit mee te nemen.
Vraag Marjan: moeten de stakeholders het eens zijn met de insteek dat een regio zelfvoorzienend moet zijn. Antwoord Dirk: nee.
Janneke: in het model wordt ook target Nature area meegenomen als ondereel van sustainability (ontbrak in inleiding van Dirk)
Rik: metropolitane landbouw heeft veel meer verschillende vormen van landbouw, die zouden ook in de game moeten worden meegenomen.
Frank: resultaat van een discussie kan ook zijn de legenda samen opstellen
Maar hangt van de schaal af hoeveel detail je moet inzetten, hangt ook van de stakeholders af (boeren kijken anders dan mensen van de provincie).
Marjan: je moet stakeholders kiezen die op de schaal mee kunnen denken waarvoor je resultaten wilt boeken.
Jellema: meer symbolen gebruiken dan hoef je veel minder uitleggen
Jellema: ontbreken van veehouderij (Zuid-Holland) is wel een groot probleem, doe dit wel, maar dan heel kort door de bocht. Of je moet een ander gebied nemen waar akkerbouw dominant is, bijv Goeree-Overflakee, en dat zal best een interessante case zijn voor de Summit. Daar ligt de vraag: moet landbouw de drager worden of recreatie.
Marjan: je legt met dit spel al een trend vast, maar er zijn andere trends zoals mobilisering, urbanisatie, waterclaims. Hoe verhoudt jouw visie op landbouw zich tot de visies van de stakeholders. De visies van de stakeholders kun je niet in het spel meenemen, omdat daarin bij voorbaat wordt uitgegaan van zelfvoorziening..
Jellema: in fases spelen: eerst gemeenschappelijke legenda vast stellen, en dan pas die legenda-eenheden toekennen.
Opmerking Janneke: In het spel wordt ervan uitgegaan dat de eigen legenda wordt gedefinieerd voor de Landscape Character Areas, dat is de eerste stap. De legenda voor de Land Use Functions ligt vast omdat die worden doorgerekend.
Marjan: de terminologie moet per stap duidelijker worden uitgelegd.

Stap 1: Bepalen van "Landscape Character Areas"
Dirk heeft al een indeling gemaakt en vraagt of deze moet worden aangepast.
Voorstel Rik: er zou ook plaats moeten zijn voor stadslandbouw in het stedelijk gebied. Reactie anderen: dit hangt af van de schaal waarop je werkt. De kleinere gebieden tussen de stedelijke kernen zou eerder voor stadslandbouw geschikt zijn.
Dirk: De bedoeling van de LCA's is om het huidige landschap in te delen en te benoemen. Vervolgens wordt de indeling bediscussieerd, waarbij enkele gebieden nader worden onderverdeeld, en de gebieden worden benoemd en op de Flip-over gezet.

Vraag Frank: kunnen we deze stap niet overslaan? Antwoord Dirk: in Engeland is geconstateerd dat het goed is om participanten in een workshop eerst een gezamenlijk beeld te laten maken van een gebied, dat voorkomt dat mensen meteen stelling nemen. Conclusie: het is niet handig om eerst uit te leggen welke stappen er allemaal worden gedaan, dat werkt verwarrend. Stel meteen

de vraag: "welk beeld heeft u bij dit gebied? Moet deze indeling nog worden aangepast, en hoe zou u deze noemen?" Dat er daarna nog andere stappen volgen hoort men daarna wel.

Stap 2: de huidige landbouw wordt ingetekend en doorgerekend
Vraag: wat moet ik me voorstellen bij multifunctionele landbouw? Antwoord: 75% graan en vollegrondsgroenten, 25% bosjes en paden voor recreatie.
Opmerking: plaatjes gebruiken voor de uitleg van de legenda (zoals bij multifunctionele landbouw een groenten + brood + fietser.)
Vraag: welke kaart gebruik je nu als ondergrond? Antwoord: een kaart die de concurrentiekracht van de agrarische bedrijven weergeeft.

Discussie n.a.v. de berekening van de Supply (hoeveel van de inwoners kunnen worden gevoed met de aangegeven landbouwarealen?)
Er ontstaat discussie over de aanname voor de benodigde hoeveelheid ha per persoon (1,7 ha pp). Deze wordt door het model alleen toegepast voor de "crop areas" (graan/vollegrondsgroente) maar niet voor grasland, terwijl zuivel en vlees ook is meegeteld bij die 1,7 ha, Dit getal is uitgerekend door Britse onderzoekers die uit zijn gegaan van het Nederlandse eetpatroon. Maar een deel van de aanwezigen denkt dat dit getal veel te klein is voor de Nederlandse situatie. Er wordt aangeraden om dit na te vragen bij Martin van Ittersum. Hij zou in staat moeten zijn om aan te geven het dieet van de Nederlander te vertalen naar het benodigde areaal graan, groenten en grasland. Maar het zal moeilijk zijn om vlees mee te nemen.
Frank stelt voor om de hoeveelheid eiwit als uitgangspunt te nemen, en dan alleen plantaardige eiwitten, en de intensieve vleesproductie eruit laten.
Conclusie voor het spel: De meest eenvoudige oplossing is om de legenda "crop production" te vervangen door agri/horticulture waaronder naast akkers ook graslanden vallen. Je hoeft dan geen rekening te houden met een juiste verhouding van grasland tov akkers die nodig is voor een goed uitgebalanceerd dieet. Daarnaast moet het areaal van 1,7ha/pp worden vervangen door een areaal waarbij vlees niet wordt meegerekend. We nemen dan even gemakshalve aan dat iedereen vegetariër is. Aktie: Dirk vraagt aan **Martin van Ittersum** wat de hh ha per inwoner moet zijn uitgaande van een vleesloos dieet (moet lager zijn dan 1.7).

Stap 3: Toedelen van innovatieve functies aan de huidige arealen:
Uit deze stap blijkt dat ook dan slechts een zeer klein % van de inwoners zouden kunnen worden gevoed met de beschikbare ha. Deze stap wordt niet zinvol geacht, kan beter worden overgeslagen.

Stap 4: Het intekenen van een visie: waar zouden welke Land Use Functions moeten liggen?
Hiertoe werd de map table horizontaal gezet en zijn de participanten om de tafel gaan staan. In korte tijd werd een visie voor het gebied in kaart gebracht. Na berekening blijkt dat de mate van zelfvoorziening wat betreft voedsel nog steeds erg laag is. De recreatieve capaciteit is wel flink toegenomen.

Idee voor de workshop in Rotterdam:
Er wordt een korte inleiding gehouden over het gebied door Ineke den Heijer
Daarna legt Dirk heel kort de bedoeling van het spel uit (zonder in te gaan op de detials).
De verdere uitleg gebeurt per stap (dan terminologie uitleggen).
Het "doewerk" wordt onderverdeeld in de volgende stappen:
1) Plenair: LCA's benoemen op basis van de bestaande getekende indeling; deze tekening blijft op de map table zichtbaar als ruggesteun voor stap 2). (*)
2) Door groepen van ca. 5 deelnemers: het gewenste landgebruik laten intekenen op doorzichtig papier, over een afdruk van lgn (kaar LandGebruik Nederland)(*)
3) Plenair: wordt een map table versie gemaakt van het gewenste landgebruik *op basis van de papieren versies*; dit zal wel in verticale stand moeten gebeuren als er meer dan 5 deelnemers zijn.

4) Daarna wordt de gewenste situatie doorgerekend en vergeleken met de (door ons al eerder berekende) bestaande situatie
5) Daarna volgt een discussie waarbij indien gewenst de aannames bij de berekening wordt getoond en bediscussieerd.

(*) Een bedenking bij dit voorstel:
Stap 2: we zijn bang dat met name buitenlandse deelnemers zullen afhaken als ze zelf moeten gaan tekenen, omdat ze het gebied niet kennen en/of omdat ze niet zijn ingesteld op een actieve bijdrage. Als dit het geval is, dan kan stap 2 ook worden overgeslagen, en wordt stap 3 door een beperkt aantal mensen uitgevoerd, terwijl de rest observeert. ***Vraag aan Ineke:*** *denkt zij hier ook zo over? En moeten we die groepsessie op papier dan wel voorstellen in R'dam?*
Stap1: Ook moet je je afvragen in hoeverre het zinvol is om de LCA's te benoemen met mensen die het gebied niet kennen. Veel logischer is het om een indeling in LCA's te presenteren die aansluit bij de inleiding die de provincie houdt over het gebied. ***Vraag aan Ineke:*** *Kunnen we daarvoor de indeling aanhouden die tijdens de test op 17 sept is gemaakt?*

Annex V: Work Programme SUSMETRO Phase 2, March 2010

Vision, Assessment and Design for Sustainable Metropolitan Agriculture (SUSMETRO)

Phase 2

The implementation of Phase 2 is being scheduled for the time between October 2009 and February 2011. It is meant to include a revision of the final report of Phase 1 and to build upon its very results. At the same time, the research that has been conducted in Phase 1 constitutes only one element to be taken into account when entering the next phase. The following initiatives are also considered as relevant:

- The continuing discussion on the strategic approach towards agricultural innovation processes in the light of parallel studies that are being undertaken such as by Peter Smeets on the future of agroparks ('Expedition Agroparks'), by Rijksadviseur voor Het Landschap Yttje Feddes on the future of livestock keeping, by Marco van Steekelenburg's Xplorelab initiative on global dimensions of metropolitan agriculture, as well as by Arnold van der Valk and Han Wiskerke of Wageningen University in on a European approach towards Sustainable Food Planning in the context of the AESOP initiative.
- The need to link up with existing studies and projects that are being implemented as parts of TransForum's running Innovative Projects, but also in their wider Dutch proximity such the assessment of the food production potential of Dutch cities, e.g. Amsterdam (Proeftuin Amsterdam, DRO), Tilburg (Communication Science, Nutrient and Health studies) as well as other.
- In the international context it is intended to cooperate closely with the TransForum partner at Michigan State University, US, possibly to engage with food planning specialist Jerry Kaufman of Madison University, and to seek cooperation with a comparable European metropolitan region such as the wider Hamburg region in Germany (Hafen University Hamburg).

While the above initiatives are considered as relevant reference points, SUSMETRO Phase 2 will need to maintain a strict implementation schedule in terms of available financial and time resources. Given TransForum's formal feedback (21 July 2009), the original sequence of the programmed actions will need to be slightly revised and made more explicit. It is hence proposed to first develop a more mature methodology for the interactive game *as a pre-requisition* for a more solid and target-oriented stakeholder involvement. The reason why this is considered to have priority is because both the up-scaling as well as the sustainability impact assessment is supposed to require input resulting from the stakeholder interaction. Ideally the envisioned processes are going to be iterative – this means that stakeholders should have the opportunity to receive information on the likely impacts of their preferences while being able to revise these preferences if it should turn out that the expected impacts are going beyond certain thresholds – related to e.g. biodiversity, landscape aesthetics, air quality, etc. In terms of the project planning, this means that several of the activities need to be planned in parallel and to be revisited once first results are becoming available.

2.1 Development of the Stakeholder Game

Based on the proto-type developed in Phase 1, develop the 'stakeholder game' towards a mature tool for identifying preferences and priorities for future agricultural land use options by judging gains as well as trade-offs(impacts) at various scales and for various stakeholder groups (1) review the data sets and assessment criteria of the Phase 1 game, e.g. Innovation Characteristics, to form the basis for stakeholder interaction at the national as well as at the regional level; (2) develop visualisation tools for the previous data plus additional contextual data at three spatial scales (national, regional and site-specific) and make them operational by means of map-table technology ; (3) and run stakeholder events at one national and at least two regional level at IP sites.

2.1.1 Develop the Stakeholder Game (**DW & HA**)

The game that has been tested randomly at two occasions (TransForum in June 2009 and IOP in February 2010) needs to be developed towards a full interactive/iterative process.

Methodology: Review the game procedure, design step-by-step approach and publish the results as part of an information brochure.

2.1.2 Review and prepare data sets for food planning sessions

Methodology: (a) Review all national data sets (included updated versions) of Phase 1 and add relevant data on food planning (GIAB + EU statistics) to form the basic set of SUSMETRO references when playing the game. Prepare the resulting maps and legends in the standard SUSMETRO layout (**HA**); (b) analyse the regionally available data for food planning for different cities with special attention to (b1) the producer network with their geographic location and products; and (b2) the retailer network with their urban/rural sales locations – with special emphasis on the market chains. Task (b) also requires basic calculations of the urban footprint based on food consumption and the specific role of hothouse production in The Netherlands (**AvD**).

2.1.3 Develop visualisation tools for Stakeholder Game (**RvL**)

Methodology: The intention is to allow stakeholders at the level of regions and sites to zoom into concrete images of metropolitan landscapes to assess and comment upon expected changes. The envisioned levels are: (1) international/national making use of Geso/Gesocializing tools (google-Earth) showing large-scale land use changes and allowing manipulations; (2) include the landscape visualisations as developed for all 20 Dutch National Landscapes and develop additional manipulation tools to link up with SUSMETRO data sets, (3) include all available illustrations for agricultural innovation (e.g. initiative Stallen in het Landschap, www.nbks.nl) to be included as pop-up images to contribute to stakeholder dialogue.

Make all three information sets available for the Maptable.

2.2 Sustainability Impact Assessment (SIA)

Based on the up-scaling exercise in Step 2.1, make use of existing European methodologies to assess the impacts of current and future land use related to regional food production on sustainability with regard to environmental, social and economic aspects ;

2.2.1 SIA of current Land Use in Metropolitan Landscape Character Areas (MLCAs)

Methodology: The identification of the MLCAs will be undertaken by the stakeholder groups during the sessions (game). Drawing upon SENSOR indicators and making use of the SUSMETRO data set (see 2.1), the goal is to provide a score of impact of current land use on sustainability for each MLCA. The assessment needs to make special reference to ecological footprint of current consumption/production system inside and outside the metropolitan region under consideration. The SIA needs to be performed by an existing, model with user-friendly interface (**PV**).

2.2.2 Ex-ante SIA for Metropolitan Landscape Character Areas (MLCAs)
Methodology: Based on a set of policy and planning options deriving from sustainable design options (as produced by TransForum Innovative Projects as well as Stakeholder input) with special attention to regional production schemes for food planning, re-assess the sustainability impact of the related land use change scenarios (**PV**)

2.3 Stakeholder Event on Food Planning in Metropolitan Regions

Based on the selected innovative projects identified in Phase 1, (1) undertake a full approach for Dutch case study locations, (2) full approaches in European locations where there is research collaboration (e..g Hamburg); and (3) initiate and guide experts for undertaking a simplified approaches in other European locations as well as in the US.

2.3.1 Dutch Case Studies: Hof van Delfland – Noord-Friese Wouden
Methodology: Making use of the results from 2.1. and 2.2, prepare and implement on location full-fletched SUSMETRO-Stakeholder Game – addressing food planning, nature conservation and recreational aspects of metropolitan regions.

2.3.2 European case study: Hamburg – Leipzig – Bratislava – Tallinn - Milano
Methodology: Cooperation with Hafencity University Hamburg and Landscape Europe partners, organise stakeholder sessions on food planning in the respective locations. Application of the SUSMETRO-tool set (integrating regional information) to perform a stakeholder session.

2.3.3 American case study: selected cities
Methodology: cooperation with Michigan State University and with University of Wisconsin develop a SUSMETRO-style approach for assessing the spatial dimension of food planning strategies in the US.

2.4 Reporting and Dissemination

2.4.1 Promotional SUSMETRO DVD/CD-Rom
Methodology: compilation of all relevant SUSMETRO results in form of an interactive DVD/CD-Rom demonstrating all graphical results (maps, publications), stakeholder sessions and visualisations.

Phase 2 Deliverables:

D2.1.1 Review data sets and assessment criteria of Stakeholder Game

D2.1.2 Development of visualisation tools (3 sets)
D2.1.3 Stakeholder participatory events (3 sessions)

D2.2.1 Impact assessment on land use functions (SENSOR 1)
D2.2.2 Assessment of landscape functions (SENSOR 2)

D2.3.1 European Case Study
D2.3.2 American Case Study

D2.4.1 SUSMETRO DVD/CD-Rom

	2.1.1	**2.1.2**	**2.1.3**	**2.2.1**	**2.2.2**	**2.3.1**	**2.3.2**	**2.3.3**	**2.4.1**
mar	DW								
apr		AH/AvD	RvL	PV	PV				
mai		AH/AvD	RvL	PV	PV	DW&			
jun						DW&	DW&		
jul							DW&	DW&	
aug		AH/AvD	RvL				DW&	DW&	
sep								DW&	DW&
oct									DW&
nov									DW&
dec									DW&

Annex VI: SUSMETRO Spatial References and Indicators

	Sustainability Impact Indicators		
	Environmental	**Social**	**Economic**
Agriculture	• **Ecological footprint x residents/total ha agriculture** • **Regional consumption/total ha agriculture** • **HNV Farmland/total ha agriculture**	• **No care/health farms/ character area** • **No of educational facilities per citizen** • **No of regional product outlets**	**Profit:** • **Multi-functional farmland** • **Regional cropland** • **Regional hothouse production** • **Supra-regional greenports**
Nature & Landscape	• **Share of protected areas/character area** • **Share of EHS+Nat2000/character area**	• **No of visitors per landscape unit** • **Continuity of Landscape heritage**	**Costs:** • **Management Costs Farmers** • **Management Costs Public Institutions**
Recreation	• **conflict with nature values**	• **recreational space / character area** • **no of hotel/camp per character area** • **no residents / open landscape**	**Profit:** • **extensive recreation** • **intensive recreation**

Annex VII: SUSMETRO Model Input Values (example fictive game)

Values per Land use function: can be adapted during session

VALUES FOR SUPPLY ASSESSMENT in food production and recreation space in inhabitants / ha			
Agriculture (conventional)	**inhabitants / ha**	**assumptions supply values**	**assumptions economic va**
Multi-functional agriculture: food	1.50	75% of Agriculture	75% of agri-horticulture
Agriculture (crops/grass)	2.00	is 0.5 ha per inhabitant (lit.)	50% average revenues 200
Greenhouse production	20.00	10 x Agriculture (lit.)	average of 2006-2008 in Ho
Innovative Agriculture			
In. Multi-functional agriculture	2.25	75% of Innov. Agriculture	75% of innovative crop proc
In. Agriculture (crops/grass)	3.00	1.5 x conv agriculture	1.5 x conv. agriculture
Integrated food production & processing	40.00	2 x greenhouse production	2 x greenhouse production
Recreation			
Multi-funct. agriculture: rural recreation	1.80	from model AVANAR (kolom I)	no costs and no revenues
Low density recreation	8.40	from model AVANAR (kolom I)	very small revenue / ha
High density recreation	100.00	from model AVANAR (kolom I)	high revenue / ha

VALUES FOR ECONOMIC ASSESSMENT in Keuro per ha			
Nature	**costs in Keuro/ha**	**Remarks**	
Nature management by organisations	1.90	including costs of purchase and lay-out of the land (would be	
Nature management by farmers	0.70	who usually own the land and get paid by the government for	
Agriculture (conventional)	**revenues in Keuro/ha**		
Multi-functional agriculture	1.26	mix of +/- 75% agriculture and 25% rural recreation	
Agriculture (crops/grass)	1.68	convential production of 50% crops and 50% milk products	
Greenhouse production	45.00	concentrated food production under glass, usually in clusters	
Innovative Agriculture	**revenues in Keuro/ha**		
In. Multi-functional agriculture	1.89	mix of +/- 75% innov. agriculture and 25% rural recreation	
In. Agriculture (crops/grass)	2.52	innovative production of 50% crops and 50% milk products	
Integrated food production & processing	90.00	innovative, very concentrated in "high tech" agro food parks	
Recreation	**revenues in Keuro/ha**		
Low density recreation	0.05	requires small facilities in mainly forested areas or beach (lik	
High density recreation	7.50	requires sites with special facilities for (outdoor) recreation ar	

Target nature area in ha	50000

Number of inhabitants in current and sketched situation		
	T0: current nr of inhabitants	**T1: expected nr of inhabitants**
	nr T0	**nr T1**
Number of inhabitants	3500000	3535000
% of inh for simultaneous recreation (*)	10	10
(*) What % of the population must be able to recreate simultaneously?		

Annex VIII: Final Deliverable Table for TransForum

PROJECT DELIVERABLES	**Voldaan**	**Verantwoording**
Phase 1		
REPORT and MAP Key functions and services offered by metropolitan landscapes	x	Zie eindrapport Fase 1
GIS MAP Tentative agricultural main structure (AHS) for the Netherlands and NW-EU	x	Zie eindrapport Fase 1
JOURNAL PUBLICATION on AHS & metropolitan agriculture	Nee	Publicatie is “in press”, dus geaccepteerd en in aantocht.
REPORT on key components of EU projects under consideration	x	
Detailed conceptual approach for Phase 2	x	
Phase 2		
THEMATIC MAPS	Nee	In overleg met Tom Veldkamp en PJ Beers vervangen door één sessie op de Metropolitan Agriculture Summit, trials bij Alterra en observatie-studies bij onder meer Province Zuid Holland
National Up-scaling Exercise (3 - 5 thematic maps)	Zie THEMATIC MAPS	
Transfer TransForum upscaling to NW-European regions (3 - 5 thematic maps)	Zie THEMATIC MAPS	
Transfer TransForum upscaling to Michigan, US (3 - 5 thematic maps)	Zie THEMATIC MAPS	
Introduce EU scenario parameters to TransForum’s upscaling results (3 scenarios)	x	Zie eindrapport Fase 2
REPORT - kombi approach for scenario development and interpretation (Report)	x	Zie eindrapport Fase 2, Hoofdstuk 3.4
REPORT + MAP Special case of metropolitan agriculture as a sensitive area (Report + Map)	x	Zie eindrapport Fase 2, Hoofdstuk 4.3 (voorbeeld Rotterdam)
International meeting to present SUSMETRO (proceedings)	x	AESOP Conference Brighton (30.10.2011) & Berlin Sustainability Talk (18.1.2011)
Specific physical plans for the selected 3 design cases	(x)	Results from the 1st Gobal Summit (2 visions for future agricultural plans of Rotterdam Region)
artist impressions (drawings and computer animation) for 3 cases	Nee	Dit is vervangen door de ontwikkeling van het Maptables tool voor SUSMETRO
FINAL PROJECT REPORT with all technical details	x	
DVD - 500 copies of DVD with SUSMETRO visualization and project portfolio	Nee	Wegens uiteindelijk gebrek aan budget in overleg met Tom Veldkamp en PJ Beers geschrapt