Tools for Metropolitan Food Planning:
A New View on the Food Security of Cities

Dirk Wascher[1], Ingo Zasada[2] & Guido Sali[3]

[1]Alterra, Wageningen, The Netherlands
[2]Leibniz Centre for Agricultural Landscape Research, Müncheberg, Germany
[3]University of Milano, Italy

FOOD METRES
Food Planning and Innovation for Sustainable Metropolitan Regions

WAGENINGEN UR
For quality of life

zalf

UNIVERSITÀ DEGLI STUDI DI MILANO

Content

- Introduction: Why agro-food systems at the metropolitan scale?
- A Dynamic Zonation for Producing Food
- The FoodMetres Approach: 3 tools

  - Metropolitan Area Profile and Scenario (MAPS)

  - Metropolitan Foodscape Planner (MFP)

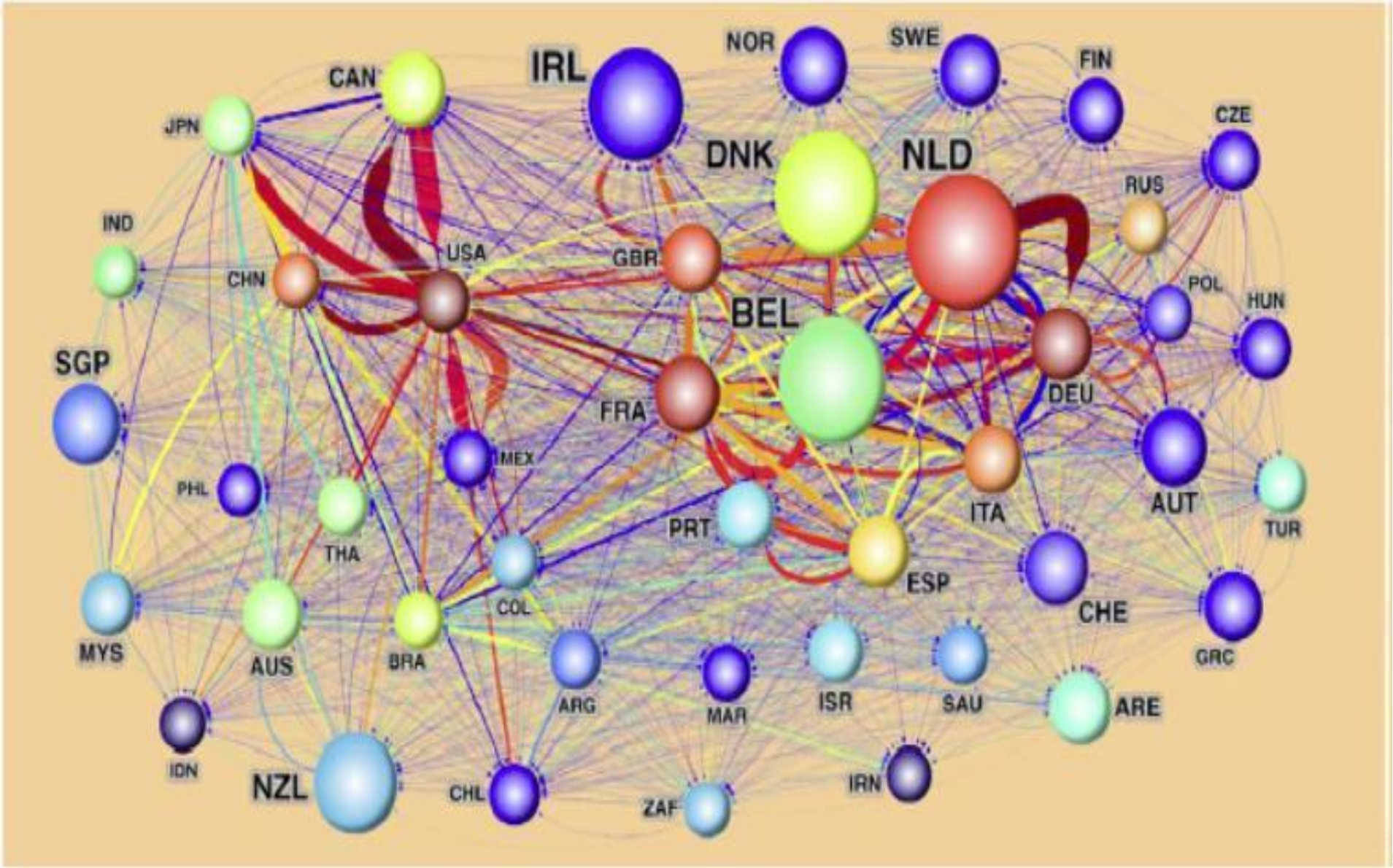
  - Metropolitan Economic Balance Assessment (MEBA)
- Summary of Tools
- Towards a new Food System Paradigm

Why agro-food systems at the metropolitan scale?

Following the **City-Region Food System** approach (FAO and RUAF Foundation, 2015): "Improved rural-urban connectivity is critical to achieve sustainable food systems".

The **"reconnection" of agricultural production to urban food consumption** is not just targeting at shorter food chains, but at more sustainable and more resilient strategies for increasing food security and food safety at the level of metropolitan regions.

Why agro-food systems at the metropolitan scale?



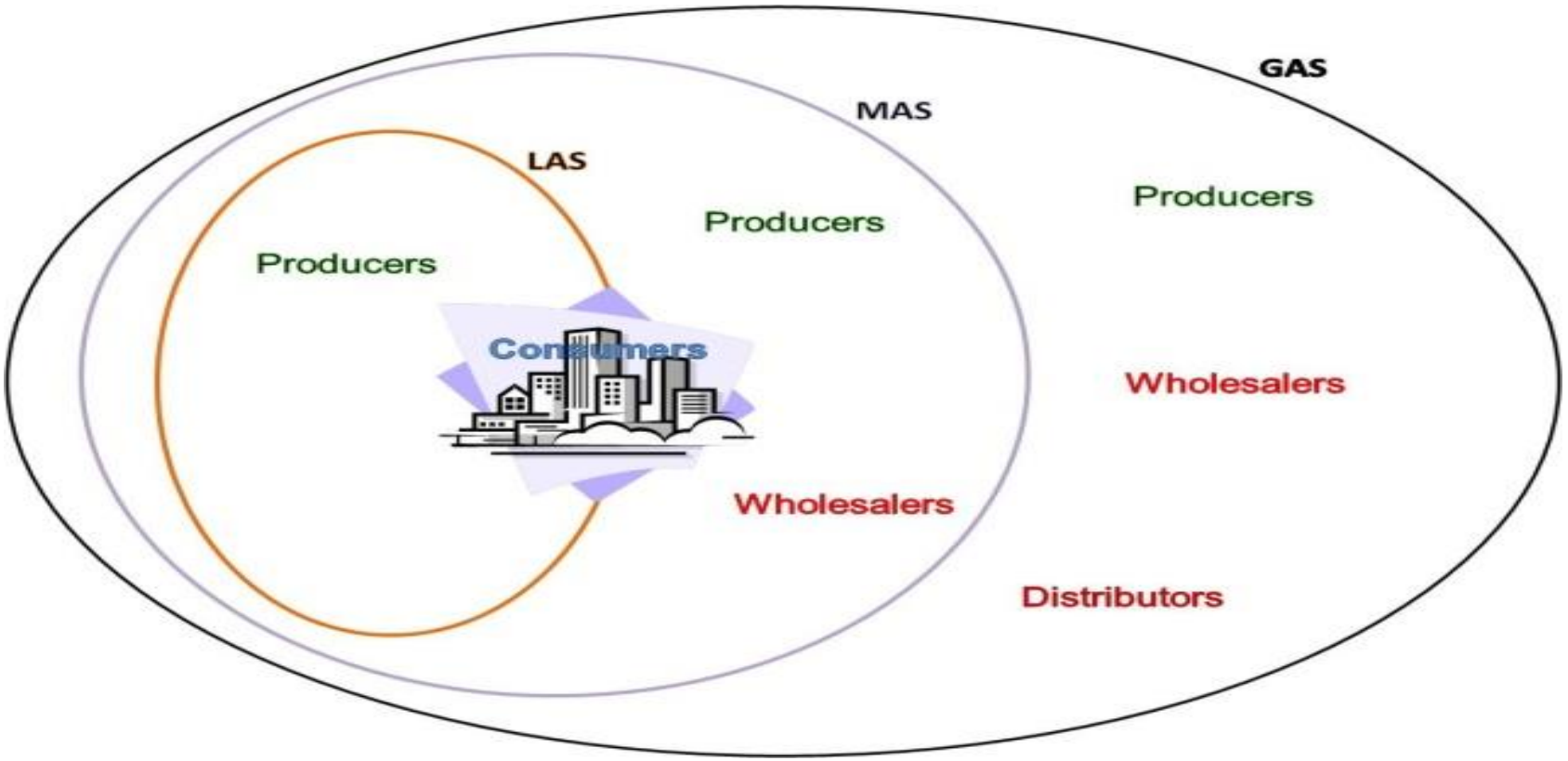
Why agro-food systems at the metropolitan scale?

Decentralising the agro-food sector means strengthening regions in the face global risk and market failures, allowing for more competition, higher multi-functionality, stronger food-resilience and resource efficiency, and improved social cohesion and fairness.

Why agro-food systems at the metropolitan scale?

Key to these considerations is **role of metropolitan regions**. It is only recently – and strongly driven by Dutch planners, researchers and agronomists – that urban demand, lifestyle and business are considered as **'game-changers'** with regard to the notion of rurality, agricultural supply and landscape character in the wider proximity of cities.

Why agro-food systems at the metropolitan scale?



localization of main actors of a food chain

Why agro-food systems at the metropolitan scale?

Expending on the concept of agricultural supply, the Dutch think-tank Transforum specifies **metropolitan agriculture** as

*"a deliberately designed system of intelligently **connected [agricultural] production sites** that uses the available **resources, conditions and infrastructure** in metropolitan areas to produce material and immaterial demands for the same metropolitan area"*

(Latesteijn 2008)

Why agro-food systems at the metropolitan scale?

This description suggests:

- **spatial-functional entities** with boundaries which are determined by system integration at the production level thereby defining what constitutes a metropolitan area;
- **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;
- a **multifunctional approach** by covering society's material as well as immaterial demands (commodity and non-commodity goods and services).

Metropolitan Foodscape – A spatial approach

Quantitative tools:

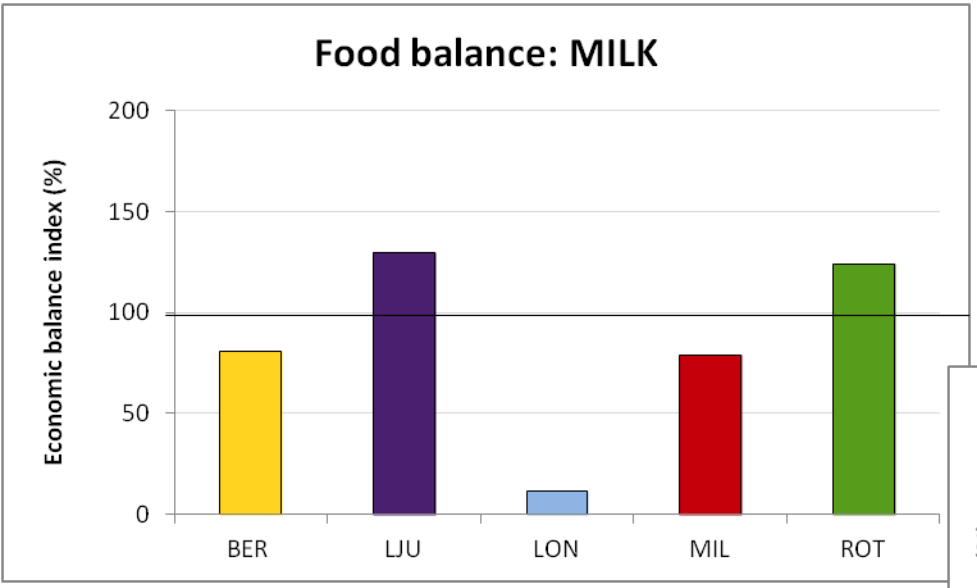
- *Metropolitan Economic Balance Assessment (MEBA)* assessing food balance and market orientation
- *Metropolitan Area Profiles and Scenario* demand tool *(MAPS)* on the basis of regional food demand and supply data, specified for the case study regions,
- *Metropolitan Footscape Planner* supply tool *(MFP)* that allows performance of land allocation for 9 different food groups.

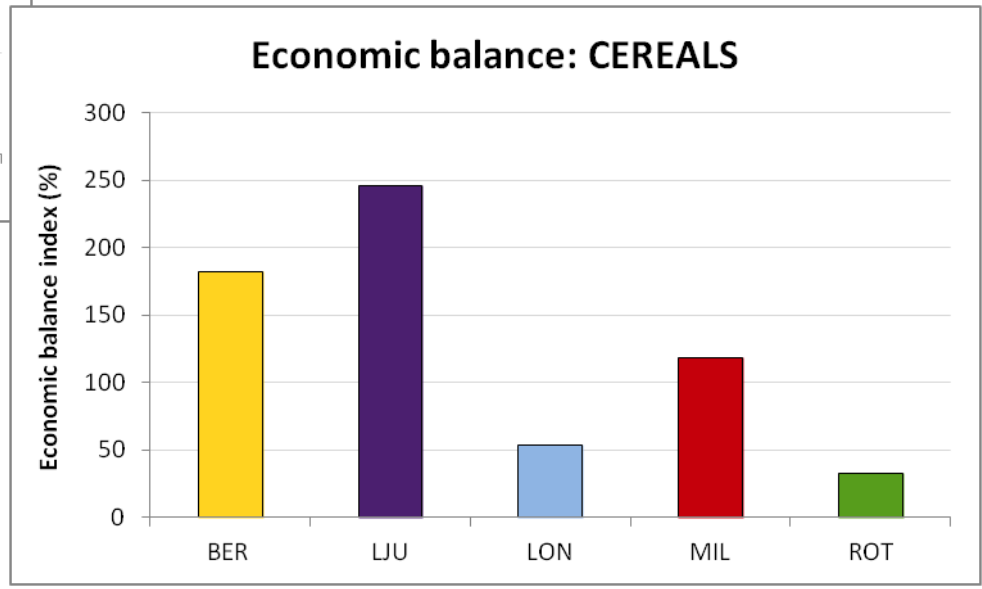
1 Metropolitan Economic Balance Assessment (MEBA)

MEBA is a tool for categorizing a metropolitan/ regional agri-food system on the basis of two indicators:

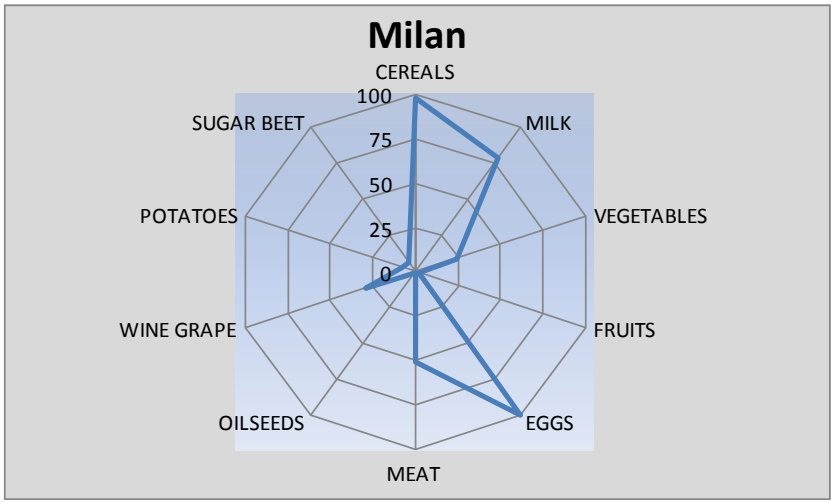
1. **an indicator for evaluating how much the staple food categories produced are able to fulfil food consumptions (Food Balance - FB)**
2. **an indicator for understanding the market orientation of each staple food category (Market Orientation - MO)**

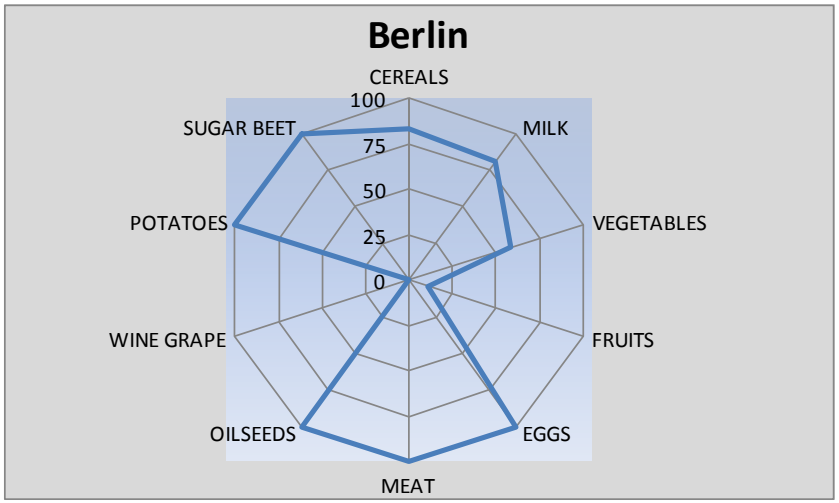
Food Balance

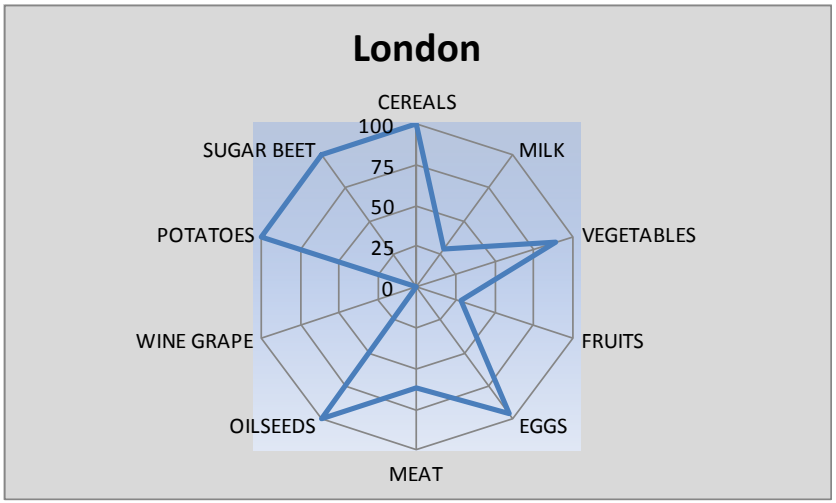


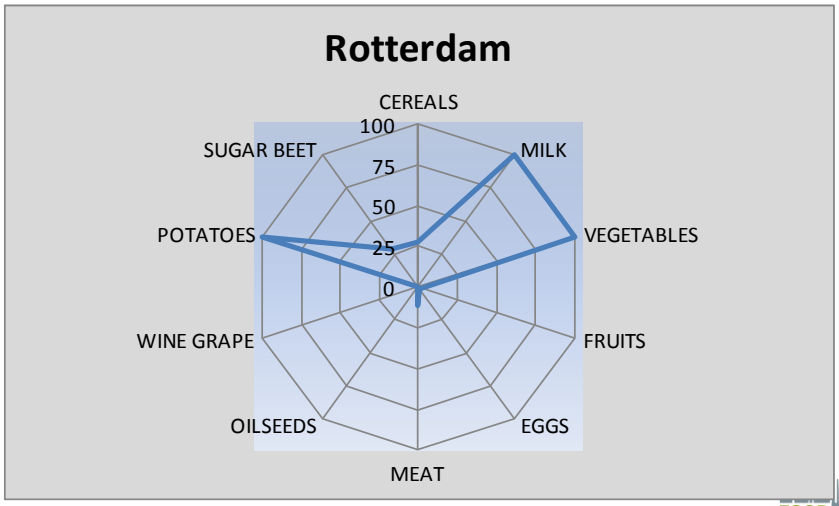


Food Balance

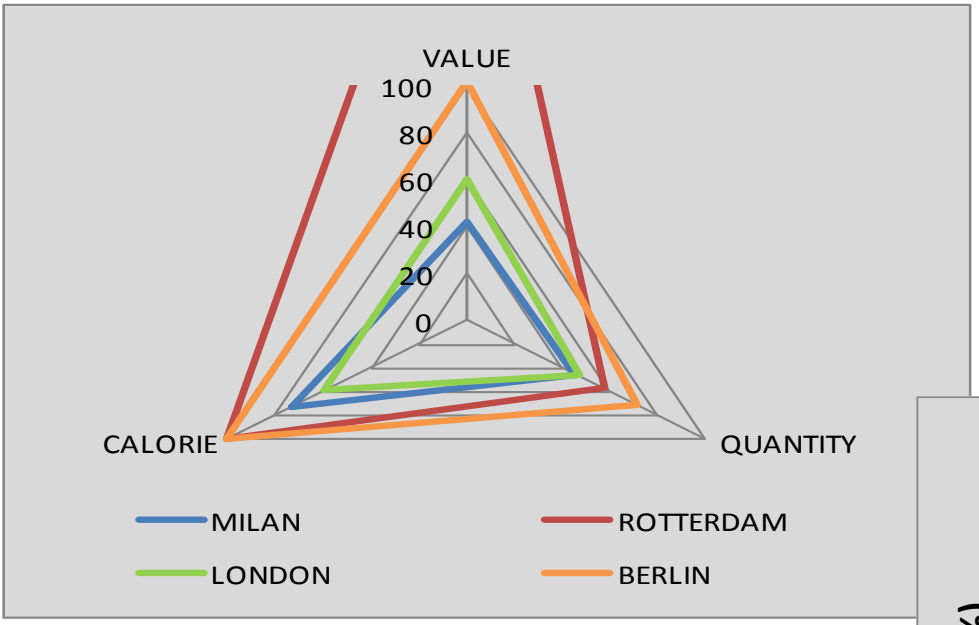


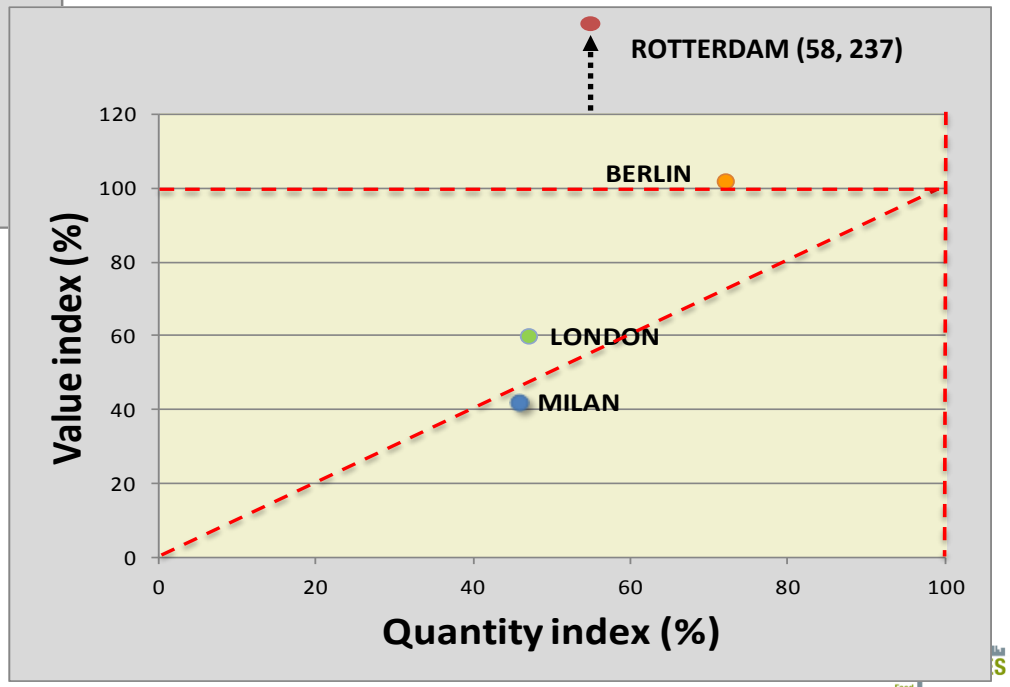






Food Balance

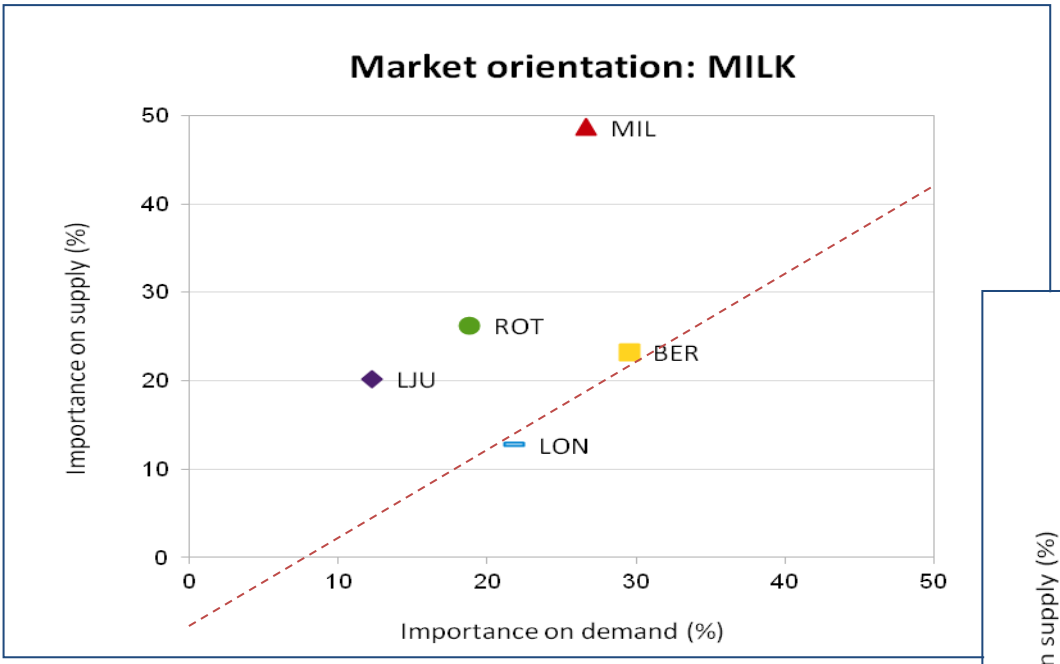




1 Metropolitan Economic Balance Assessment (MEBA)

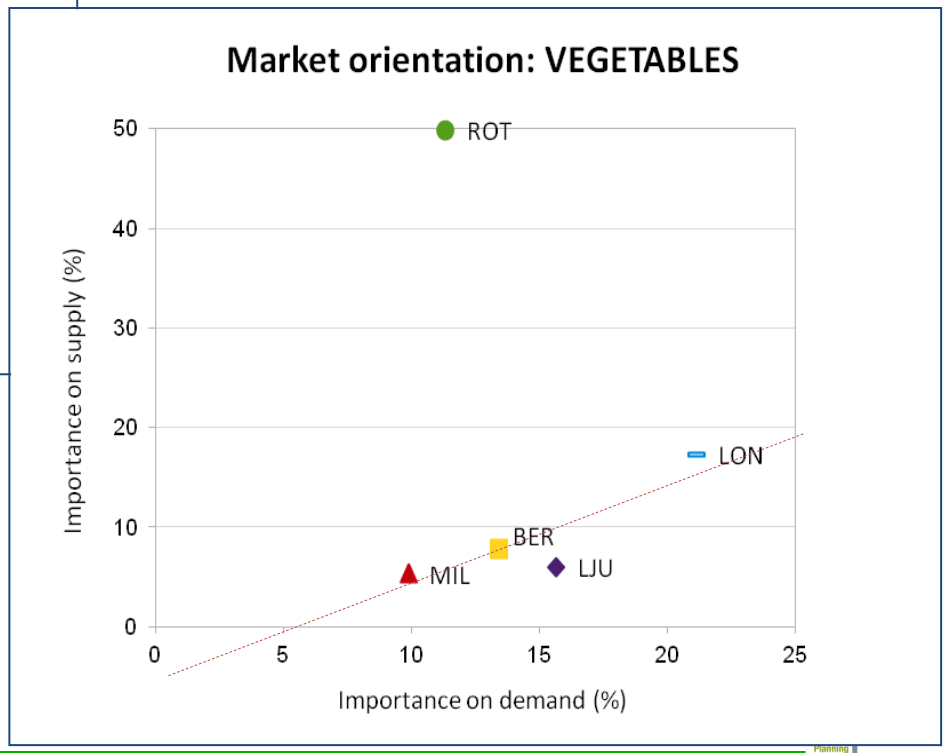
With reference to a specific food category, the FB classifies a region either as deficit region or rather as surplus one

Market orientation



ABOVE RED LINE (DIAGONAL) = GLOBAL

BELOW RED LINE (DIAGONAL) = LOCAL



e.g. In the Milan metropolitan region the value of milk produced is nearly the 50% of total agricultural production value, while the value of milk consumed accounts for less than 30% of total value of consumptions (in terms of raw materials)

2 Metropolitan Area Profiles and Scenario (MAPS)

Objective is to assess:

- the spatial extent of the **regional food-shed**
- how to improve **regional self-sufficiency**
- impacts of different **agricultural production systems** (conventional, organic)
- impacts of different **diets** (healthy diet, vegetarian)
- impacts of **food waste** and **food loss**
- impacts of **change** in population, land use, and climate

2 Metropolitan Area Profiles and Scenario (MAPS)

Output

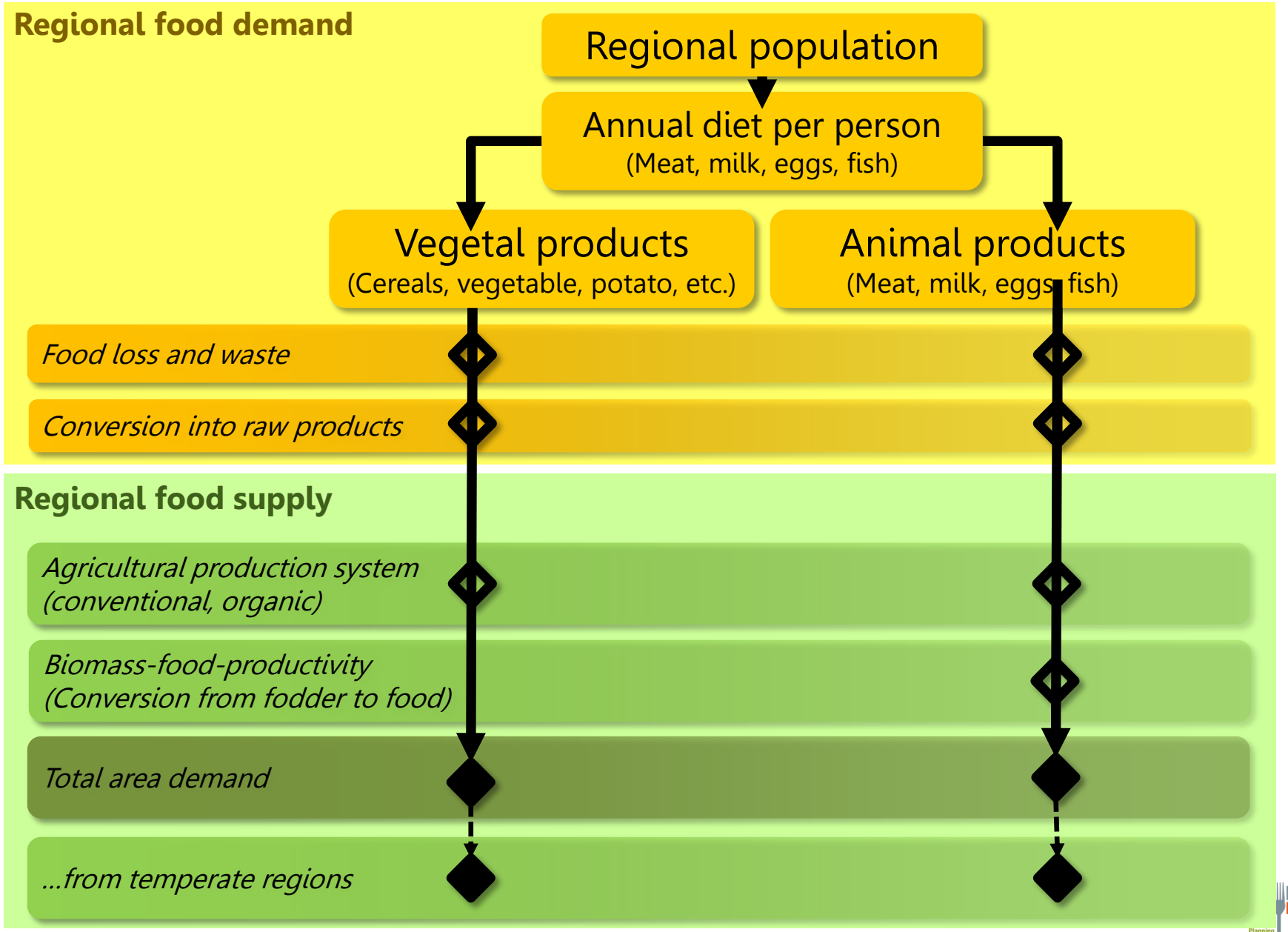
- Quantification and spatial analysis of regional **area demand for food production** (per person)

Input

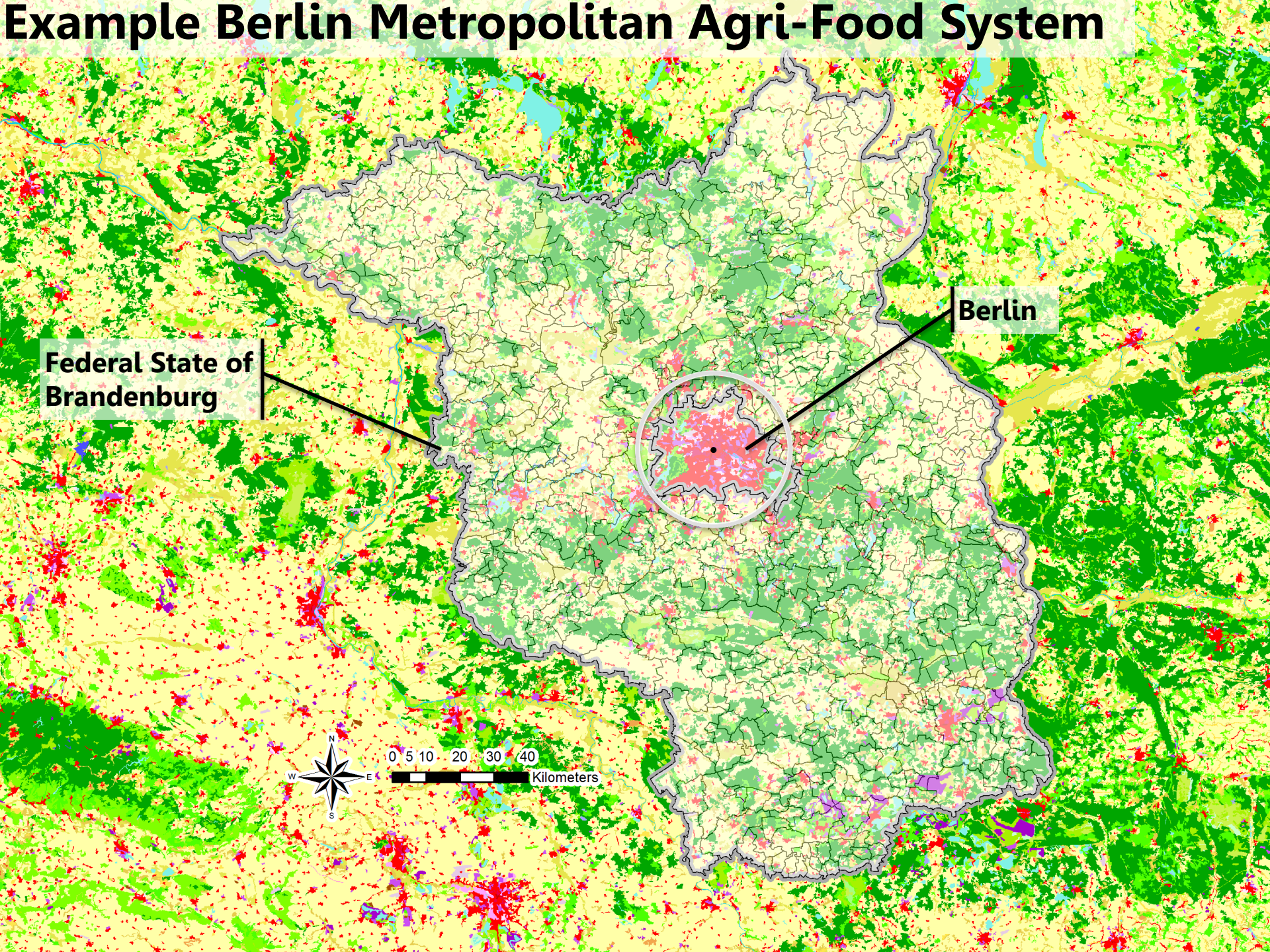
- Regional **food demand**: diets + population size
- Regional agricultural **production** conditions: yields, share of agricultural area
- Regional food waste and food loss

=> Analysis of necessary production area,
NOT area equivalents for energy, water, fertilisers, etc.

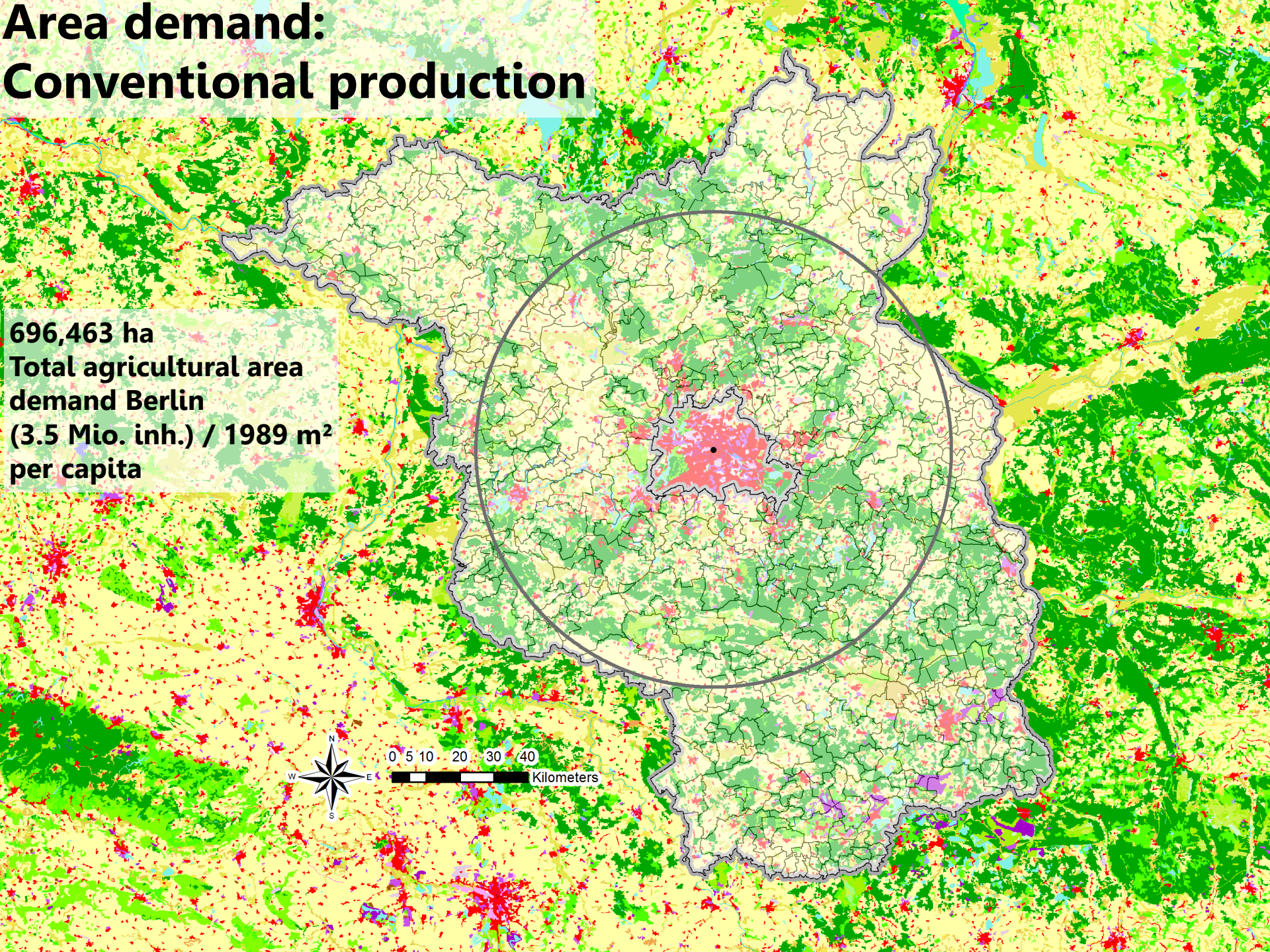
2 Metropolitan Area Profiles and Scenario (MAPS)



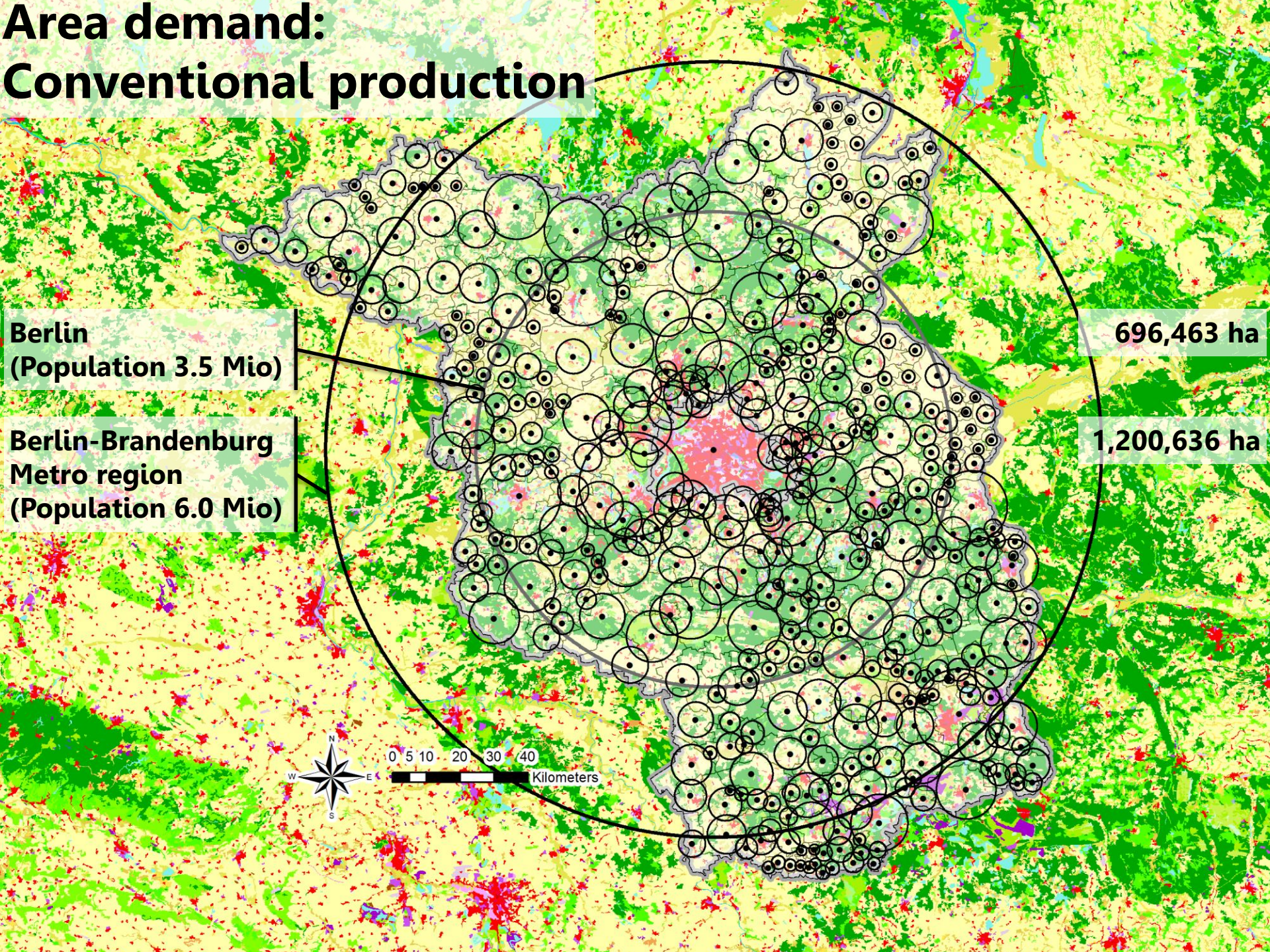
Example Berlin Metropolitan Agri-Food System



Area demand: Conventional production



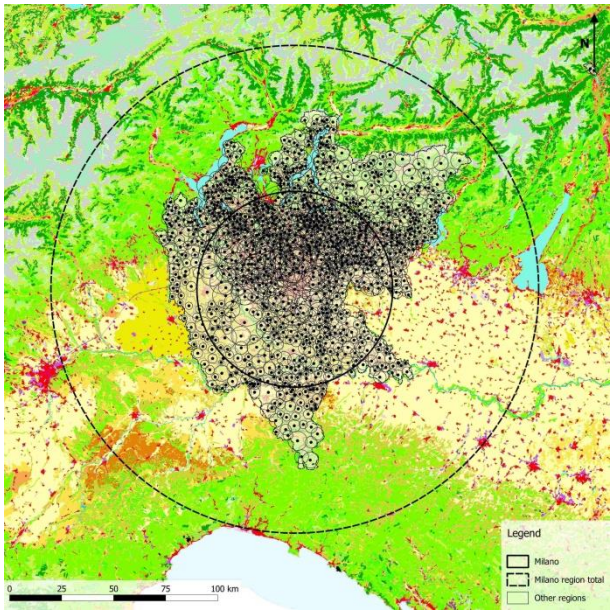
Area demand: Conventional production

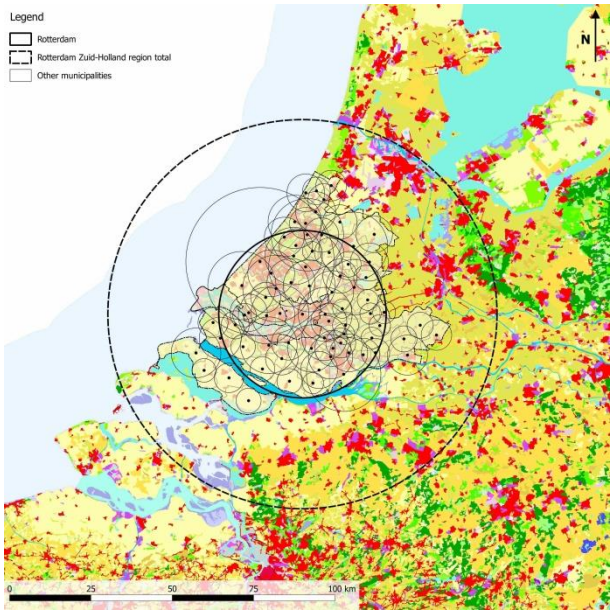


2 Metropolitan Area Profiles and Scenario (MAPS)

Area Demand

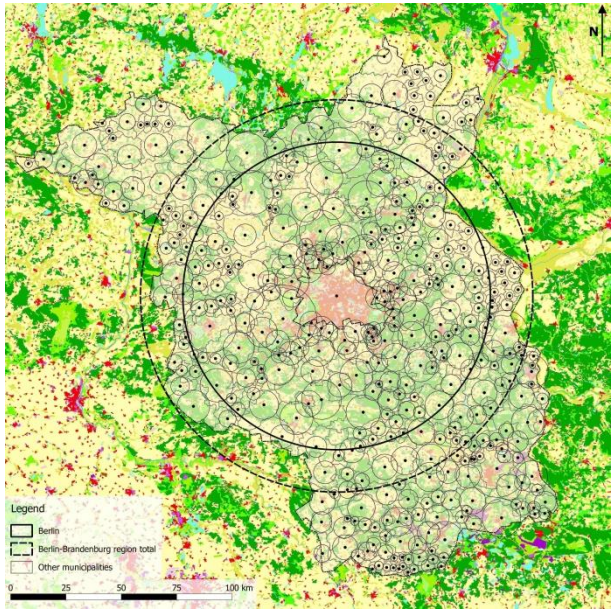
Milan

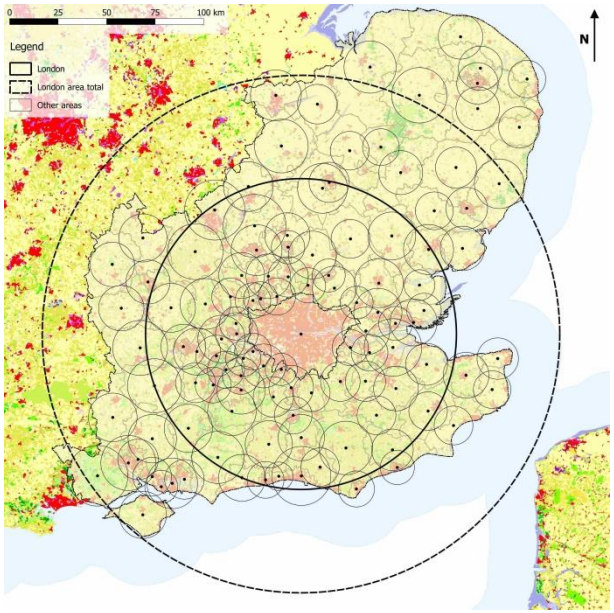




Rotterdam

Berlin



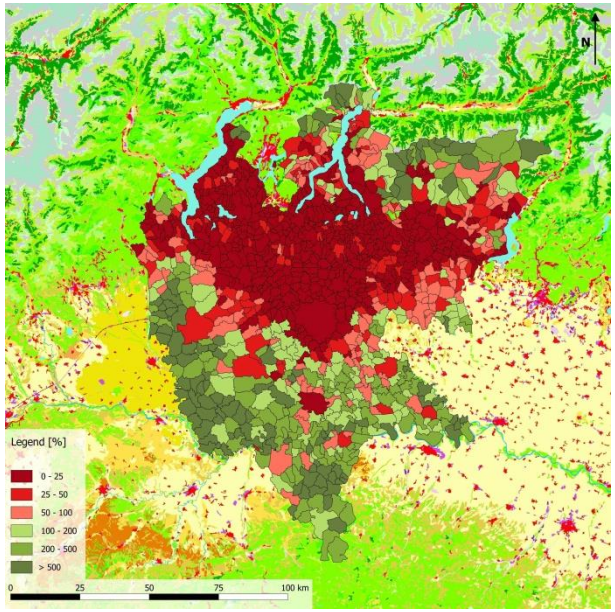


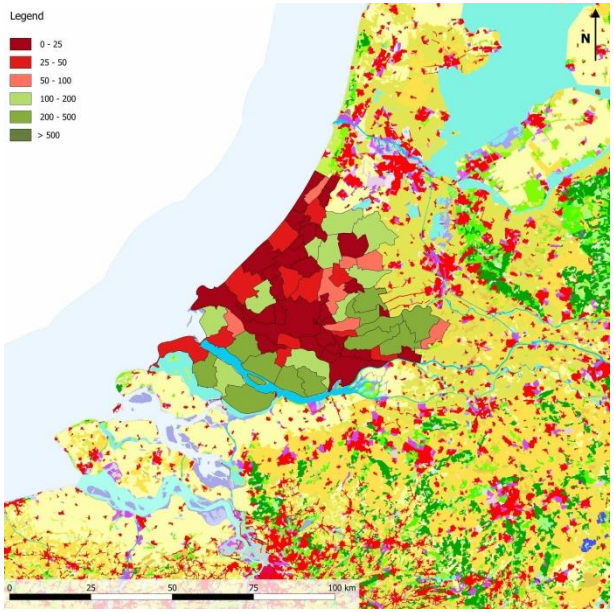
London

2 Metropolitan Area Profiles and Scenario (MAPS)

Self-sufficiency level

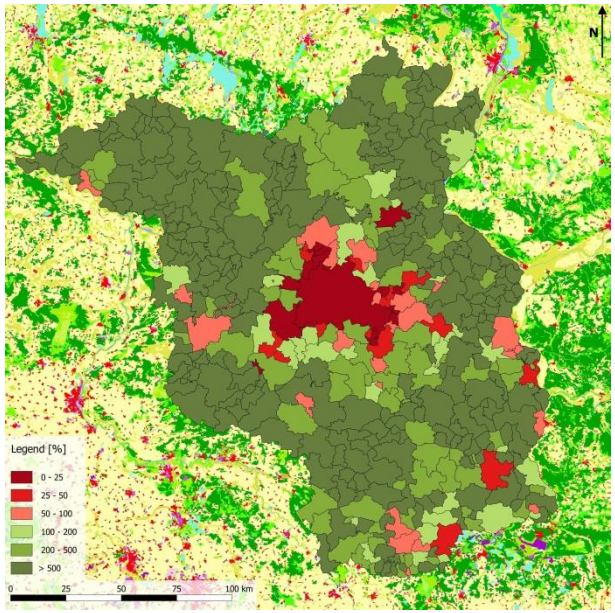
Milan

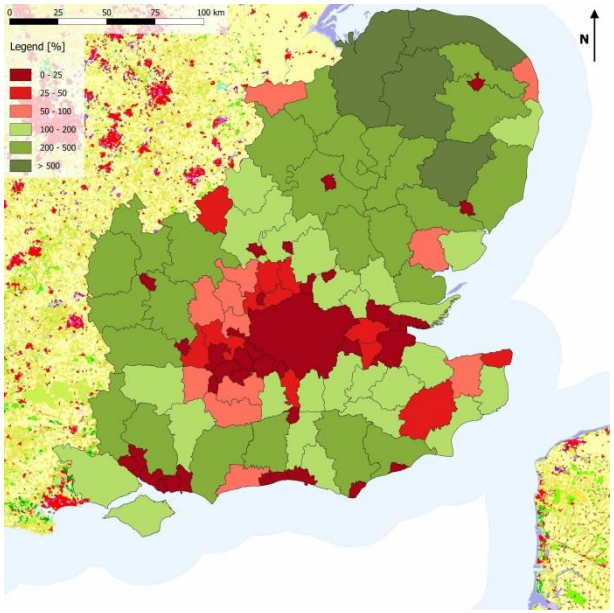




Rotterdam

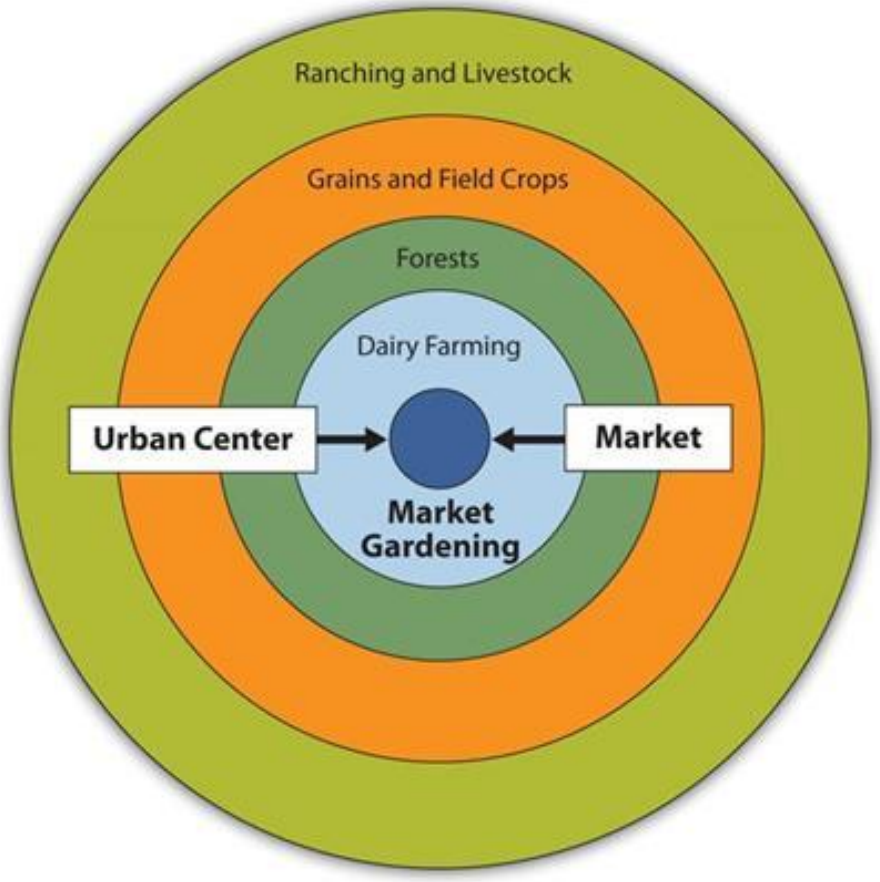
Berlin





London

3 Metropolitan Foodscape – A spatial approach



Von Thünen's model (1823)

Translating the vision of modern **metropolitan agriculture** into a **spatially explicit planning concept** for food security requires a more dynamic approach that is based on multi-functionality, evidence-based planning principles and multi-actor governance.

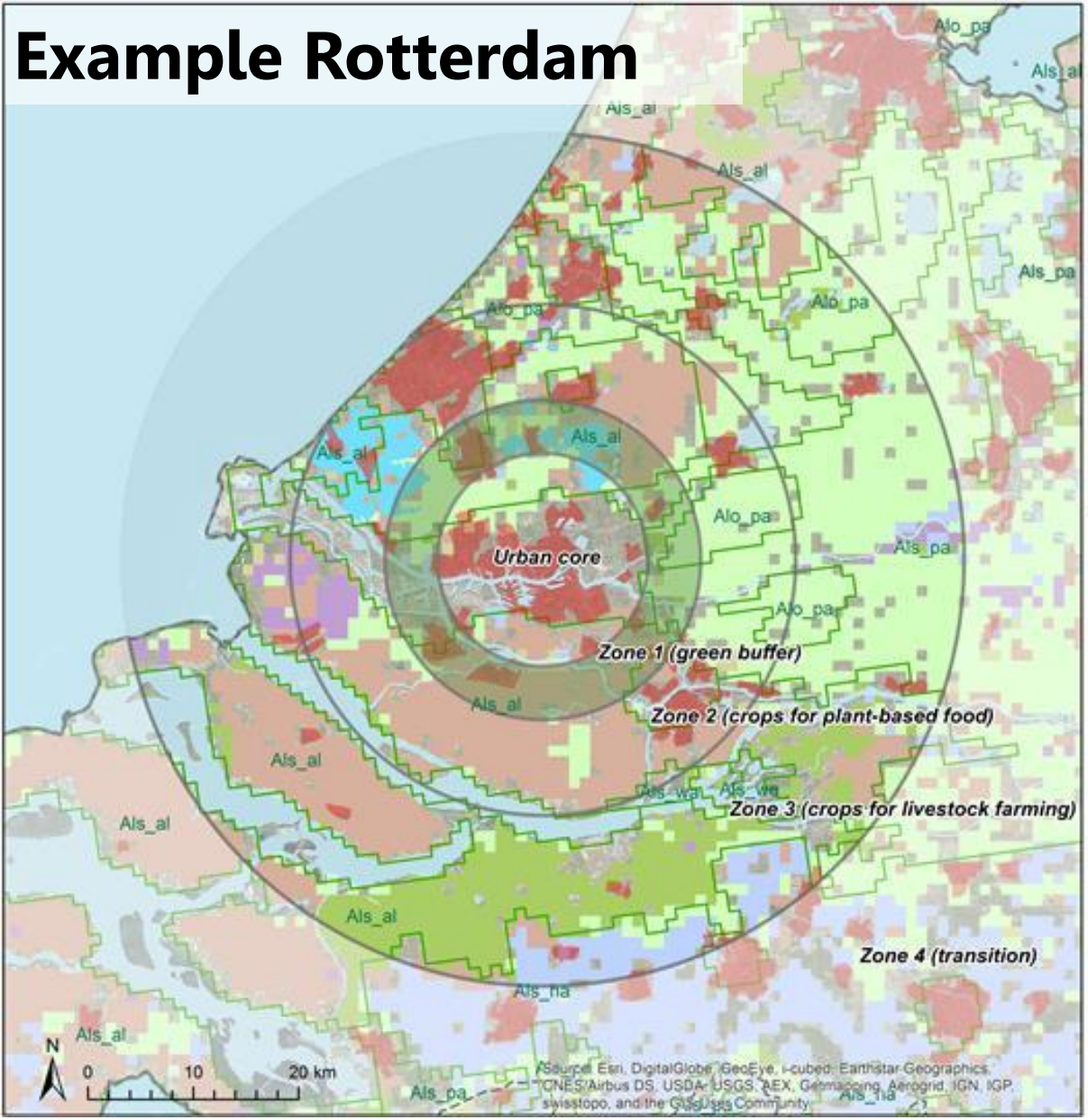
3 Metropolitan Foodscape – A spatial approach

Building upon the classical market-centered von Thünen (1826) model, but translating it into contemporary agri-environmental and spatial planning strategies, we developed the following concept of metropolitan zones:

- urban core area, followed by
- green buffer reserved for nature and recreation,
- metropolitan food production zone differentiating a plant-based and a protein-based supply zone, and
- a transition zone which is meant to provide food also for adjacent urban areas.

3 Metropolitan Foodscape – A spatial approach

Example Rotterdam



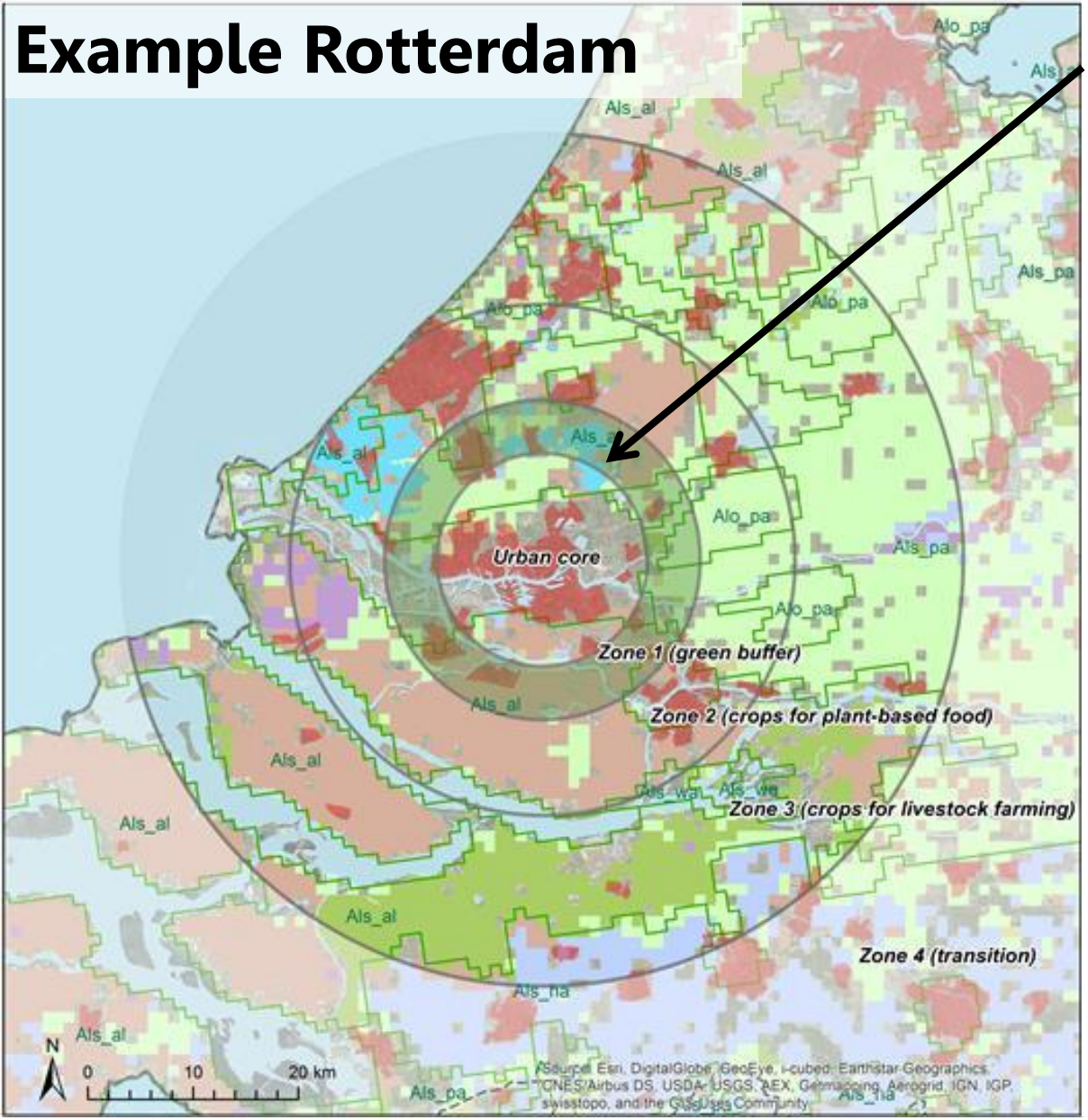
Legend

- Water
- Urbanized area
- LANMAP
- National boundary

Dominant crop type

- Rotation crops (wheat - potato - sugarbeet)
- Other cereals
- Oilseed plants
- Vegetables
- Fruit
- Fodder for livestock
- Grasslands
- Glasshouse

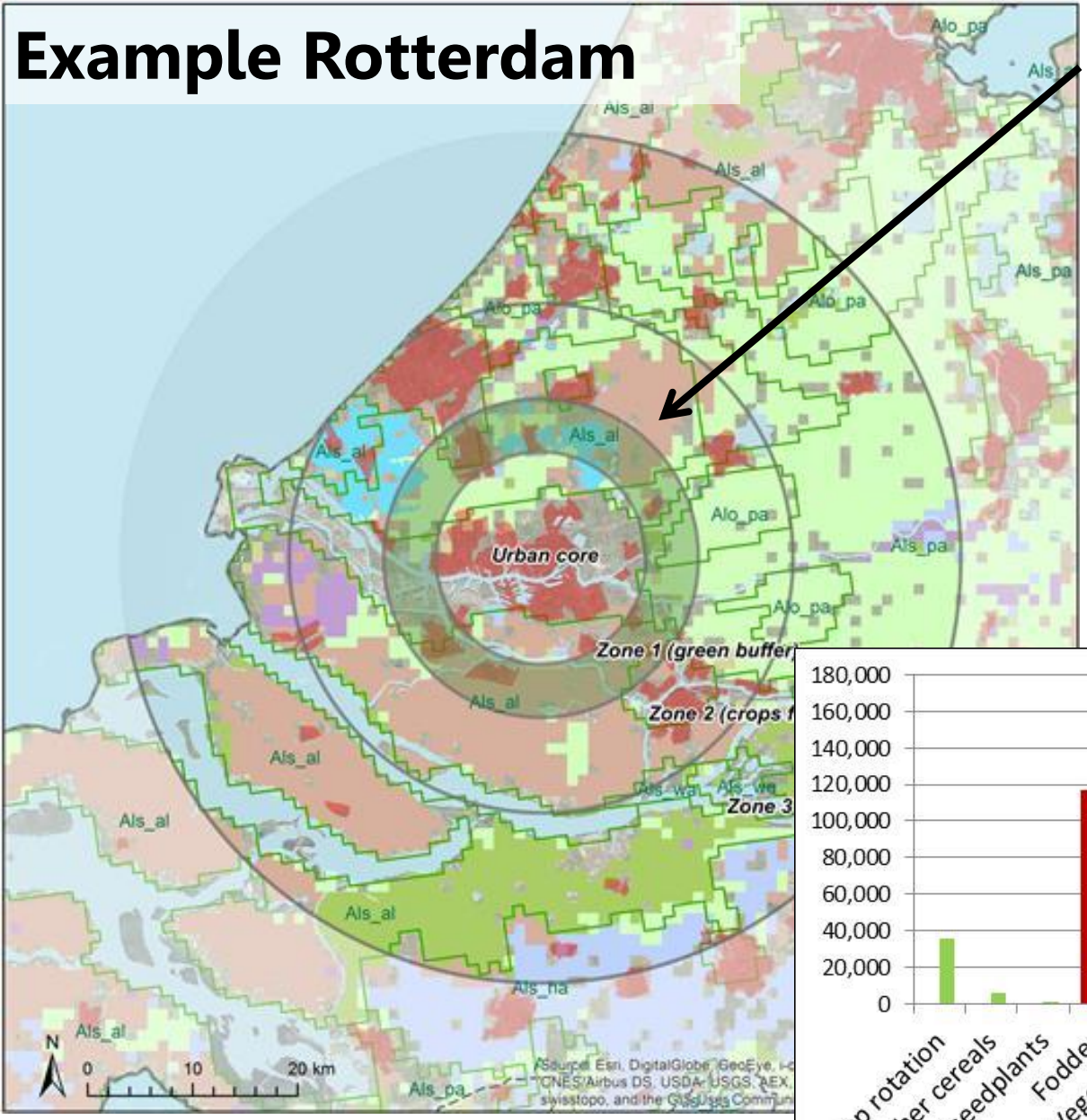
3 Metropolitan Foodscape – A spatial approach



Zone 1 (green buffer) including agricultural land in urban core: divide the area of available grassland by the per capita demand for ecological animal production to determine how many people can feed on animal protein-based diets from Zone

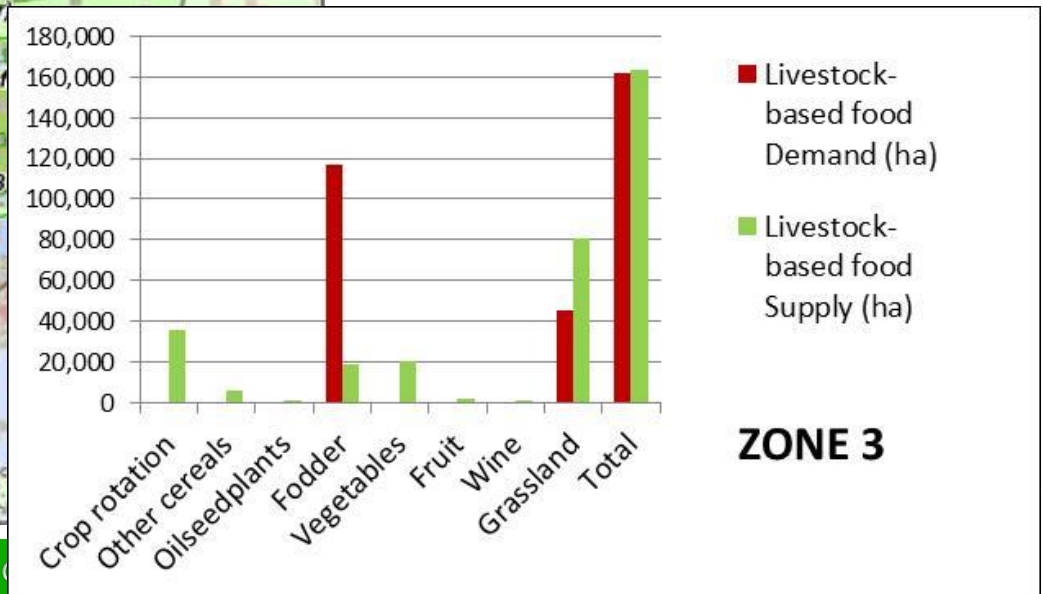
3 Metropolitan Foodscape – A spatial approach

Example Rotterdam



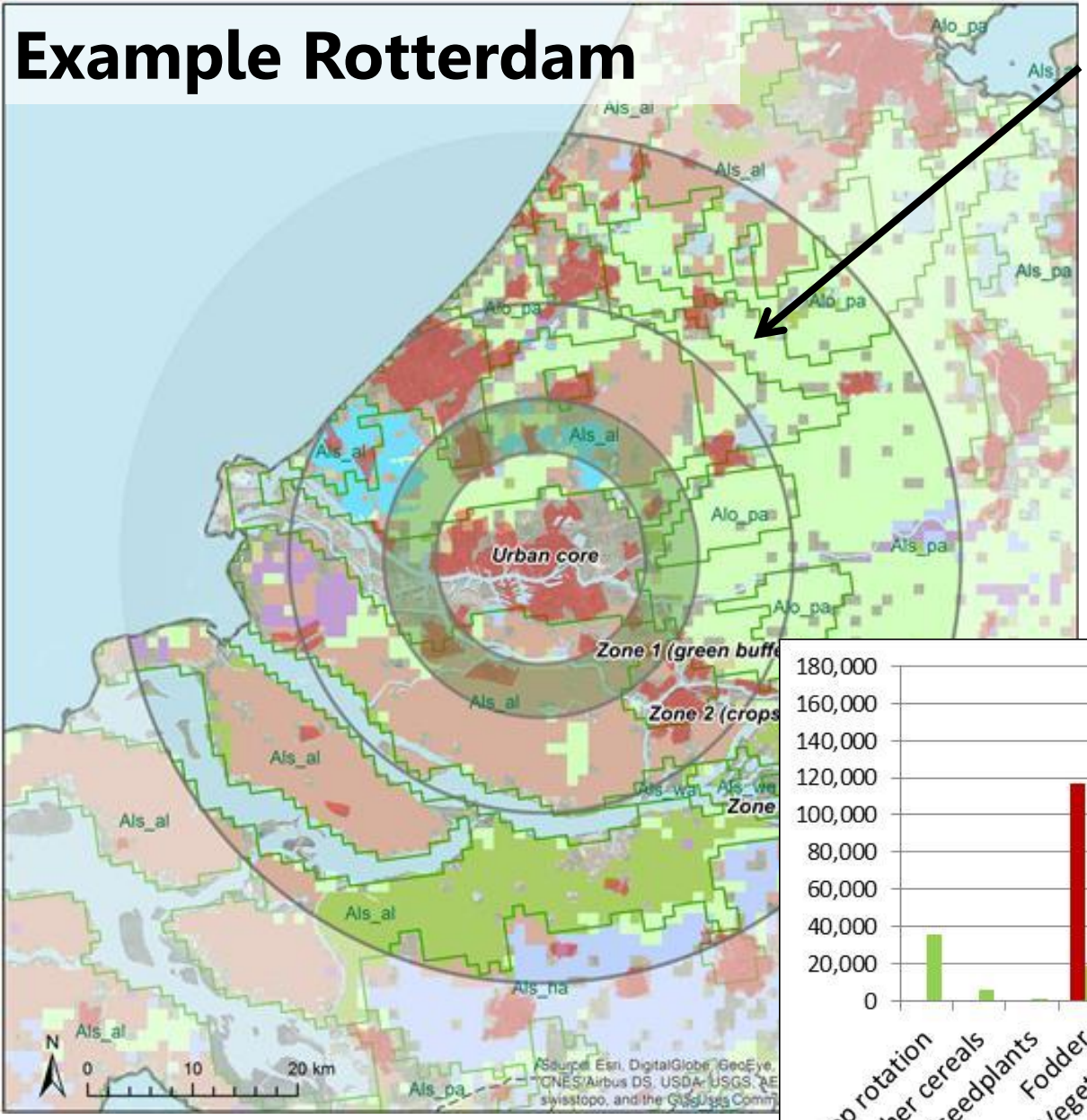
Zone 2 (crops for plant-based food)

city population multiplied with demand factor for plant-based diets, using total available land that is "not grass and not non-agricultural land use"



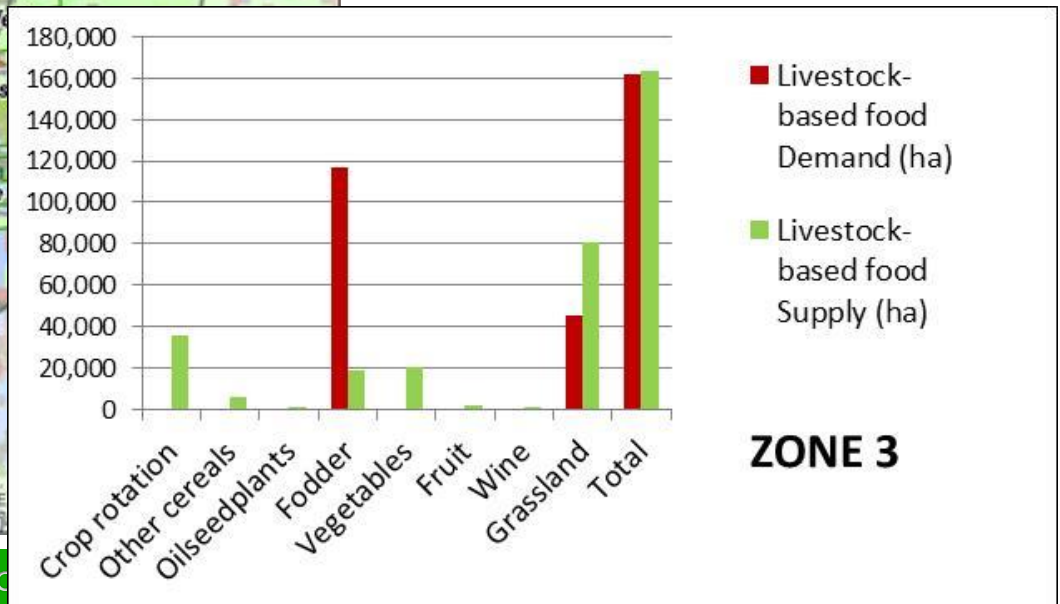
3 Metropolitan Foodscape – A spatial approach

Example Rotterdam



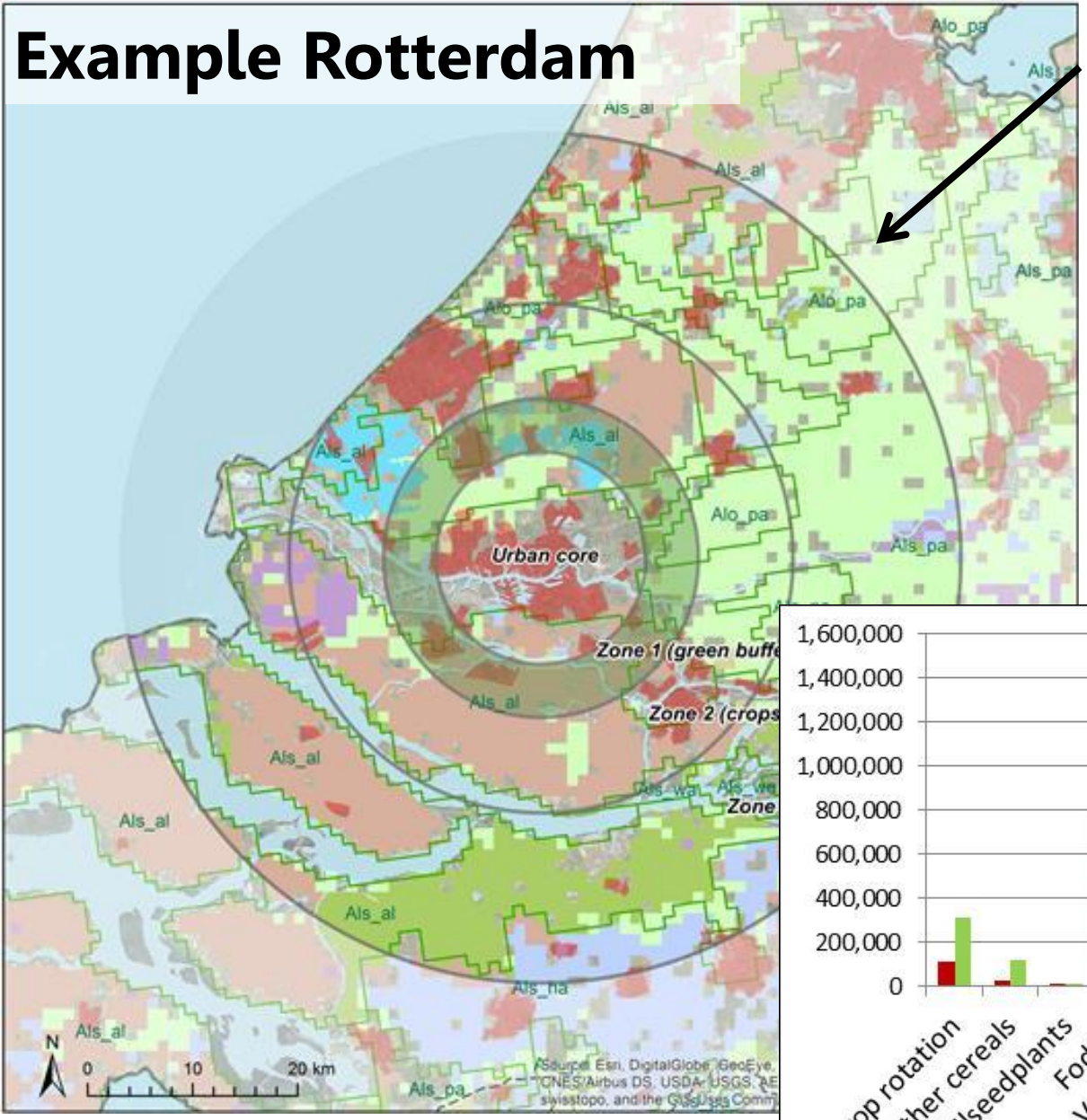
Zone 3 (crops for livestock farming)

city population minus 'Zone 1 animal protein consumers) multiplied with the demand factor for conventional animal products

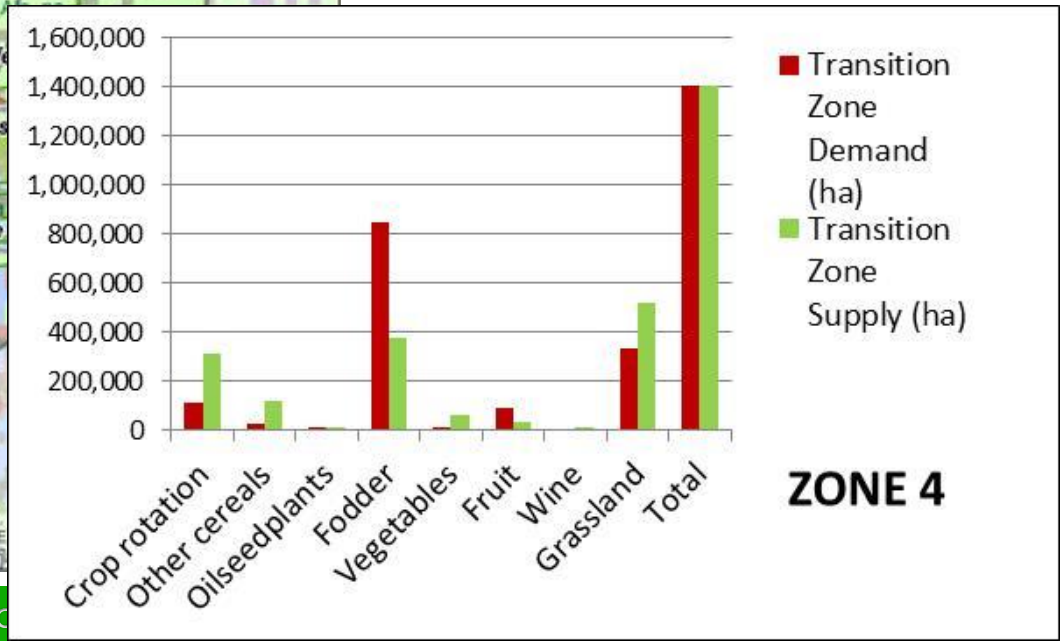


3 Metropolitan Foodscape – A spatial approach

Example Rotterdam

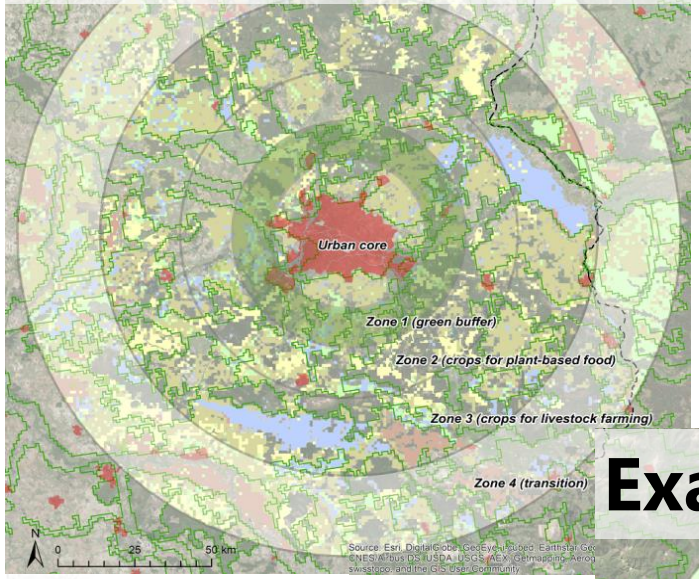


Zone 4 (transition with both crops for both plant-based food and livestock farming): multiply the region population minus the city population with the per-capita demand factor for ecological food products

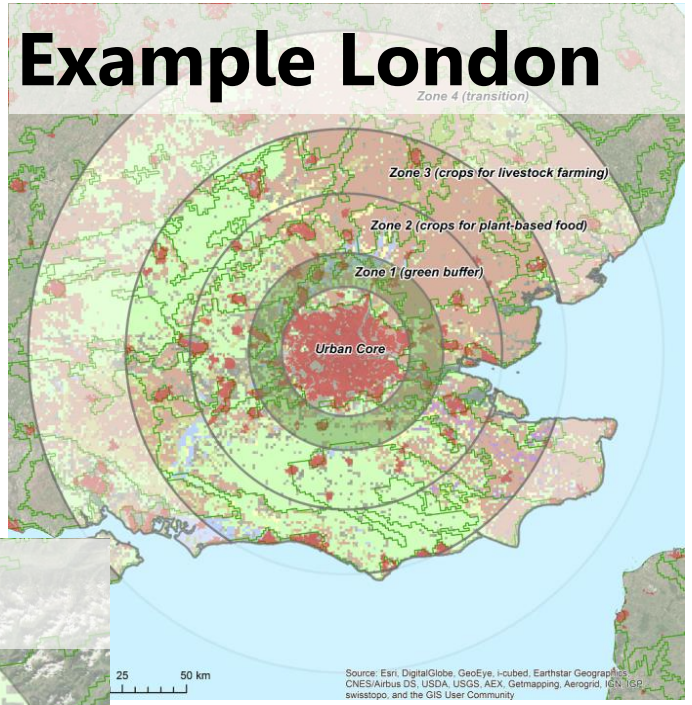


3 Metropolitan Foodscape – A spatial approach

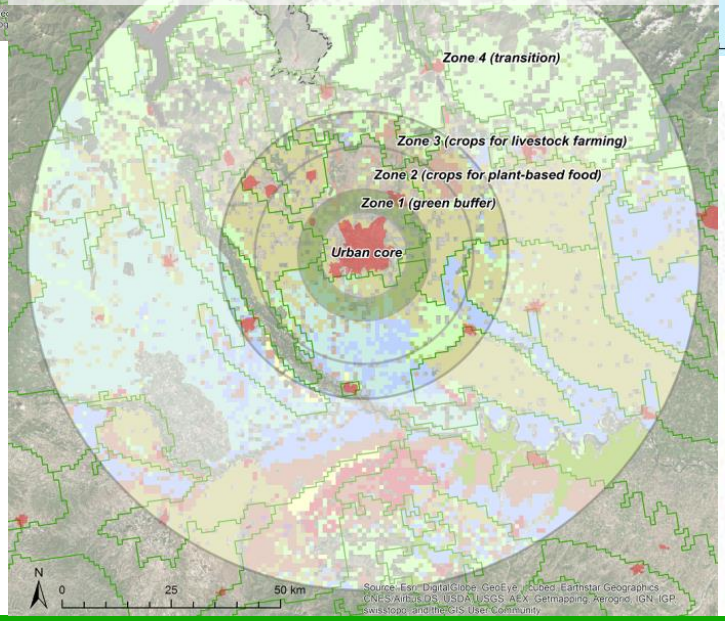
Example Berlin



Example London



Example Milano



Legend

- Urbanized area
- LANMAP
- National boundary

Dominant crop type

- Rotation crops (wheat - potato - sugarbeet)
- Other cereals
- Rice
- Oilseed plants
- Vegetables
- Fruit
- Wine
- Fodder for livestock
- Grasslands

Legend

- Urbanized area
- LANMAP
- National boundary

Dominant crop type

- Rotation crops (wheat - potato - sugarbeet)
- Other cereals
- Rice
- Oilseed plants
- Vegetables
- Fruit
- Wine
- Fodder for livestock
- Grasslands

3 Metropolitan Foodscape Planner (MFP)

Objectives:

(1) Hands-on impact assessment allowing stakeholders to re-allocate commodities on a **Digital Maptable**,

(2) Capacity building and empowerment in developing regional strategies,

(3) the **analysis of self-sufficiency** based on a regional concept consisting of the four metropolitan food zones,

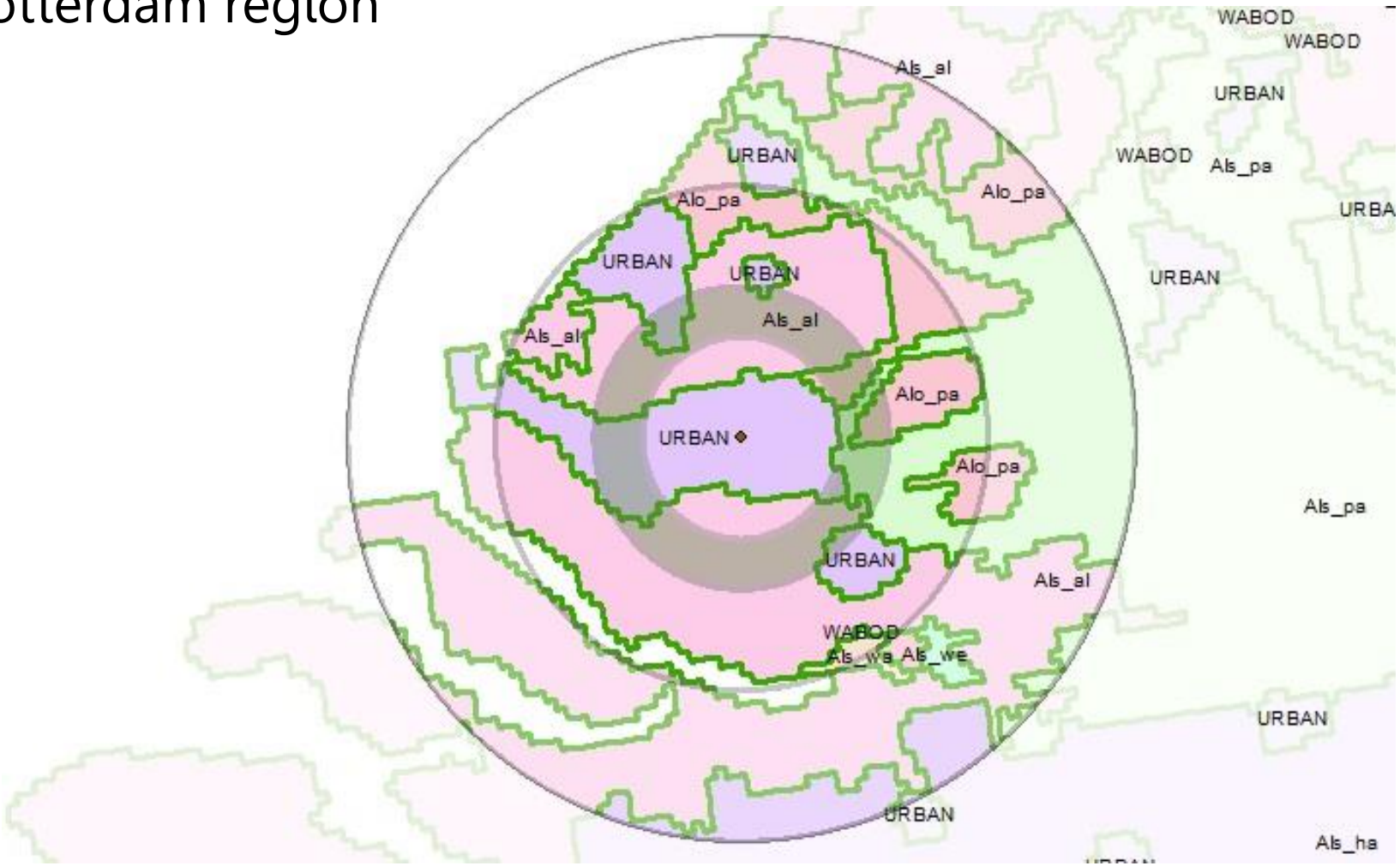
(4) landscape-ecological principles for land use decisions taking into account regional characteristics, and

(5) European data such as EFSA, LANMAP, HSMU and CORINE Land Cover to allow future top-down tool applications for all metropolitan regions throughout the EU

Data Sources

Data Layer	Source
Corine Land Cover 2006	http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2006-raster-3 version 8 april 2014, download 13 jan 2015 in arccat export .tiff als esrigrid in MFT.gdb
Natura2000	http://www.eea.europa.eu/data-and-maps/data/natura-5#tab-gis-data shapefile Natura2000_end2013_rev1.shp
Lanmap2v1	European Landscape Typology (LANMAP) (Mücher et al. 2010) lanmap2_v1_level_4_ls-cod
Multi-ring-buffer around city_startpoint: first calculate radii based on:	combine distance-raster and 3 rasters with the correct legenda and greyed areas total demand per ring
HSMU	Homogenous Soil Mapping Units (HSMU) as modelled by CAPRI (Kempen et al. 2005) and Eurostat crop area data desaggregated to hsmu's by CAPRI. Year per country: NL 2008, BL 2008, DE 2008, PL 2004.

Boundaries and codes of the LANDMAP units for the Rotterdam region

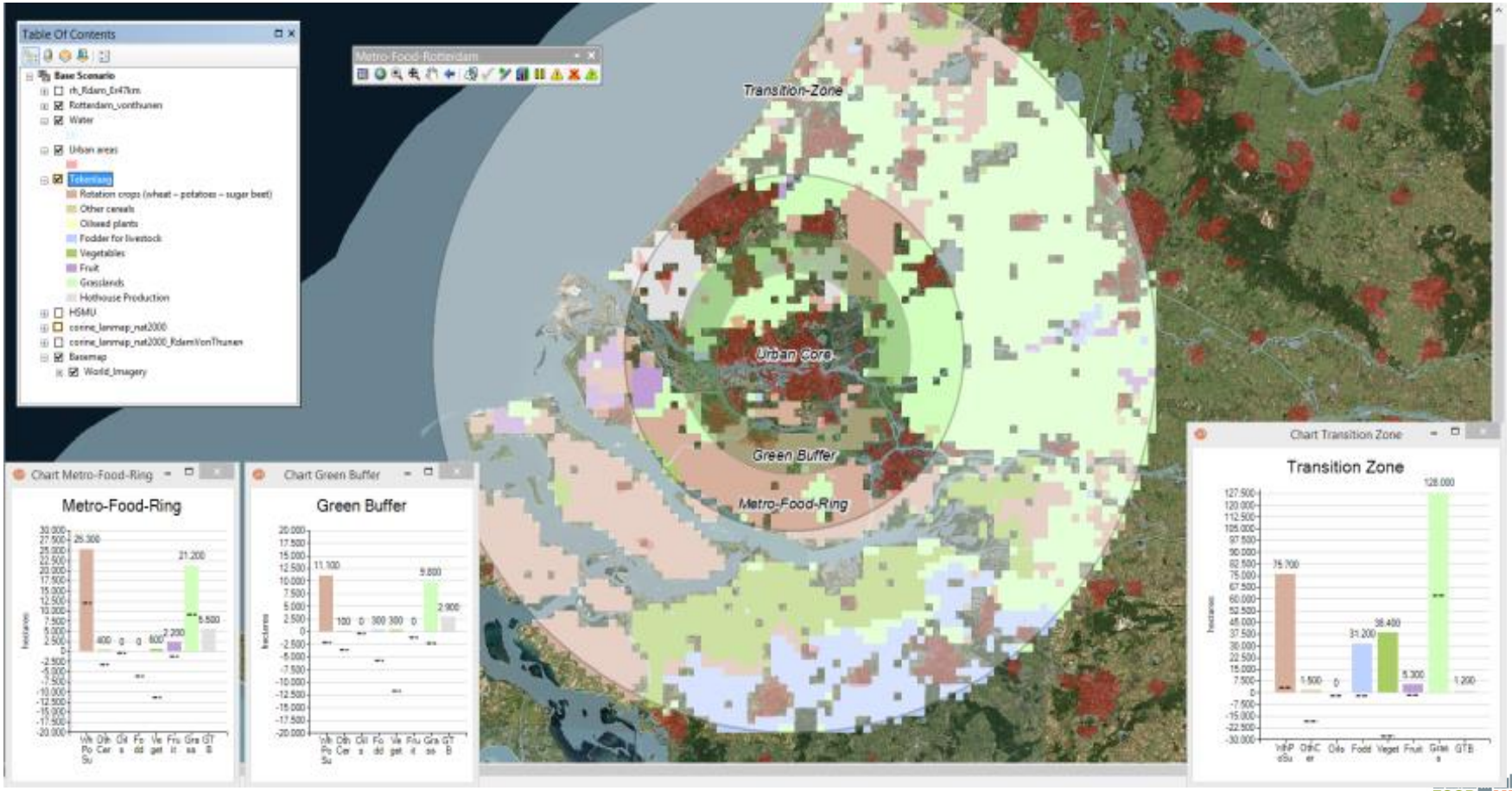


Landscape allocation rules for the Rotterdam region

LANMAP CORINE	WhPoSu	OthCer	Oils	Fodd	Veget	Fruit	Grass	GTB
Atlantic lowlands on organic materials with pastures (Alo_pa)								
12 Non-irrigated arable land	-1	-1	0	0	-1	-1	1	-1
18 Pastures	-1	-1	-1	0	-1	-1	1	-1
Atlantic lowland sediments with arable land (Als_al)								
12 Non-irrigated arable land	0	0	0	0	0	0	1	-1
18 Pastures	-1	-1	-1	-1	-1	-1	1	-1
20 Complex cultivation patterns	0	0	1	0	1	1	1	0
888 Glastuinbouw	-1	-1	-1	-1	-1	-1		1
Atlantic lowland sediments with hetrogenous agri (Als_ha)								
12 Non-irrigated arable land	1	1	1	1	1	1	1	1
20 Complex cultivation patterns	1	1	1	1	1	1	1	1
Atlantic lowland sediments with pastures (Als_pa)								
12 Non-irrigated arable land	-1	-1	-1	0	0	0	1	0
18 Pastures	-1	-1	-1	-1	-1	-1	1	0
Atlantic lowland sediments with water bodies (Als_wa)								
12 Non-irrigated arable land	-1	-1	-1	-1	-1	-1	1	-1

3 Metropolitan Foodscape Planner (MFP)

MFP output in MAPTABLE -format for the metropolitan region of the Rotterdam City Region with inserts for the food-supply scores per zoning-ring



3 Metropolitan Foodscape Planner (MFP)

MFP output in MAPTABLE -format for the metropolitan region of the Rotterdam City Region with inserts for the food-supply scores per zoning-ring

Assessment Tool Summary

The tools and models (MEBA, MAPS, MFP) deliver relevant information on the

(i) food and area demand-supply balance

(ii) ex-ante assessment of changing scenario situations (population sizes and composition, diets), agricultural system and intensity (intensive, greenhouse, organic)

(iii) the role of geographical framework conditions

(iv) potentials to optimise production (spatial distribution, food chain organisation).

Assessment Tool Summary

- Awareness-rising and decision-support for all stakeholders involved in urban food planning - Communication of the spatial dimension of food consumption and production
- Basis to inform food planning and policy making in the case study regions and elsewhere

Towards a new Food System Paradigm

The Global Standard

The first one is the ***agro-industrial paradigm*** where food is considered as a commodity and food security equals resource efficiency interpreted as the combination between soil quality (if not footloose), production costs and technology, independent from the geographic location of food consumption. This is in essence about "going on with the productivity model with a further intensification and maximization in the use of natural resources",

Towards a new Food System Paradigm

The Urban Ideal

The ***socio-ecological paradigm*** where food is considered as a human right with a keen interest in product diversity and importance given to the workforce, knowledge and abilities and where food security, safety and quality increases with the spatial proximity between production and consumption with urban agriculture being considered as its most successful model. This is in principle about “revolutionizing the agro-industrial paradigm with the goal of establishing a bottom-up self-support food system”.

Towards a new Food System Paradigm

The Metropolitan Vision

The ***agro-geographical resilience paradigm*** where food security builds upon bio-geographic food planning strategies that aim for high levels of regional food supply and diversity adhering to the principles of circular/bio-based economy in accordance with governance-controlled standards while supporting the multi-functionality of the metropolitan landscape.

.... considers large-scale food export only as appropriate where this does not negatively affect regional supply potentials, food safety issues, social cohesion, fair competition and landscape quality. The agro-geographical resilience paradigm ultimately seeks to grant these values by *increasing the basic regional food security* for all regions at the global scale.

Potentials for Food Planning and Policy

Thank you