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Assessing the socio-economic benefits of turning brownfields into green/blue spaces: a case study for Eindhoven and Copenhagen

Sustainable Urbanizing Landscape Development
SULD

By:

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Outline presentation

1. Introduction
2. Methodology
3. Case study description
4. Model simulations
5. Final remarks

Problem setting

- Population growth and economic development lead to urbanization, facilitated through urban sprawl and/or in-growth
- Leads to pressure over green/blue spaces, while these have been shown to provide important ecosystem services and values
- However, there is an opportunity to deploy the potential of brownfields in urban landscapes through requalification into green/blue spaces

- There are, nonetheless, many obstacles to achieving medium-long term green/blue space management goals:
  - Green/blue space competes with other public concerns, resulting in insufficient public and political support
  - Stakeholders in the public domain are often unaware of the added value that effective green/blue space management can bring to spatial development
  - Efficient green/blue space management will avoid high costs in the long term and, in turn, result in higher housing/real estate prices
- Knowledge on the functions, services and values of green/blue space is incomplete and not easily accessible for policymakers, spatial planners, developers, entrepreneurs and other stakeholders

Objective

- Hence, Aqua-Add aims to:

"better deploy the potential of green/blue space
in (peri-) urban landscapes
and to improve the implementation of green/blue measures
in local and regional spatial development"

- To this end we developed the Sustainable Urbanizing Landscape Development (SULD) decision support tool, that enables:

more informed decision making
regarding
sustainable urban development and green/blue space management
through
participatory planning, development and assessment of scenarios

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Stakeholder involvement

- Stakeholders are involved in the development and application of SULD, providing input on the information to be produced – hence building confidence in and familiarity with the model and its outputs

- In this participatory process, impacts of green/blue scenarios are determined and illustrated – hence allowing for stakeholders to reflect about their reality and possibilities for the future
- This involvement facilitates the identification, assessment and communication of different views and interests – encouraging effective engagement in the participative design of (peri-) urban development plans

Description

- SULD (Roebeling et al., 2007) is a classic urban-economic model with environmental amenities, based on the Alonso-Muth-Mills bid-rent model (see O'Sullivan, 2000)
- Builds on hedonic pricing theory that determines property values (i.e. peoples' WTP) as a function of proximity to environmental amenities and urban centres

- Hedonic pricing simulation model that identifies the type as well as location of residential development given that the demand for and supply of housing are in equilibrium

Model

- **<u>DEMAND-side:</u>** <u>Households maximize utility</u> trading off utility from residential space, other goods and environmental amenities *versus* land rent and commuting costs *subject to* budget constraint

$$\underset{S_i, Z_i}{Max}\, U_i(S_i, Z_i) = S_i^{\mu} Z_i^{(1-\mu)} e_i^{\varepsilon}$$

$$\text{s.t. } y = p_i^h S_i + Z_i + p_x x_i$$

U_i = household utility
S_i = residential space
Z_i = other goods and services
e_i = environmental amenity value
y = household income
p_i^h = rental price housing
p_x = commuting costs
x_i = distance to urban centre

- **<u>SUPPLY-side:</u>** <u>Developers maximize profit</u> by trading off returns from housing development density *versus* associated development costs *subject to* households' willingness to pay for housing

$$\underset{D_i}{Max}\, \pi_i(D_i) = p_i^h D_i - (l_i + c_0 + D_i^{\eta})$$

$$\text{with } D_i = n_i S_i$$

π_i = developer's profit
D_i = development density
p_i^h = rental price housing
l_i = opportunity cost land
$c_0 + D_i^h$ = construction costs
n_i = household density
S_i = residential space

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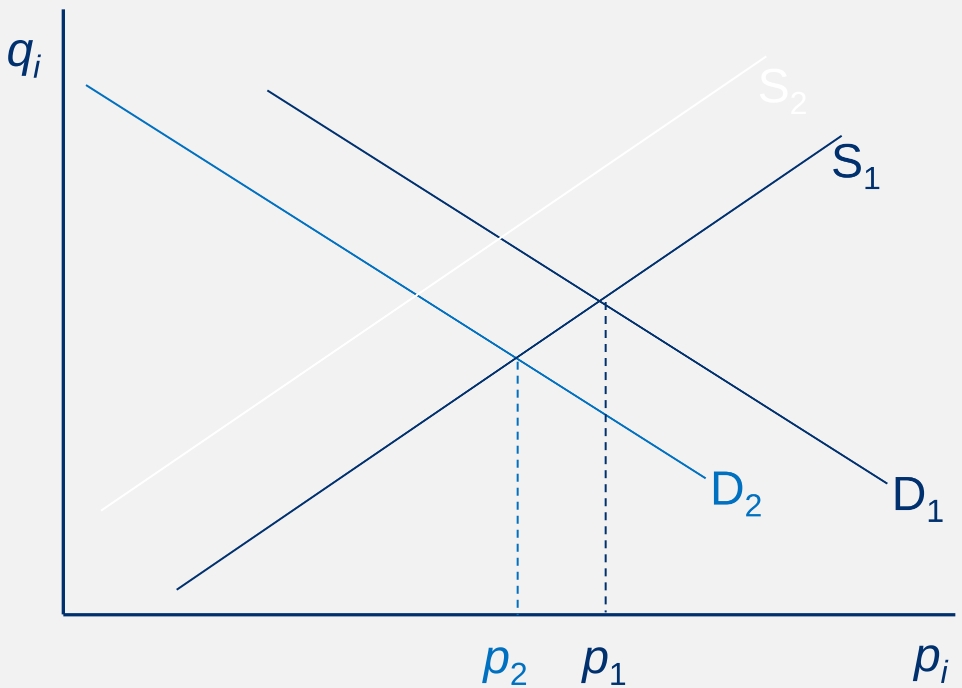
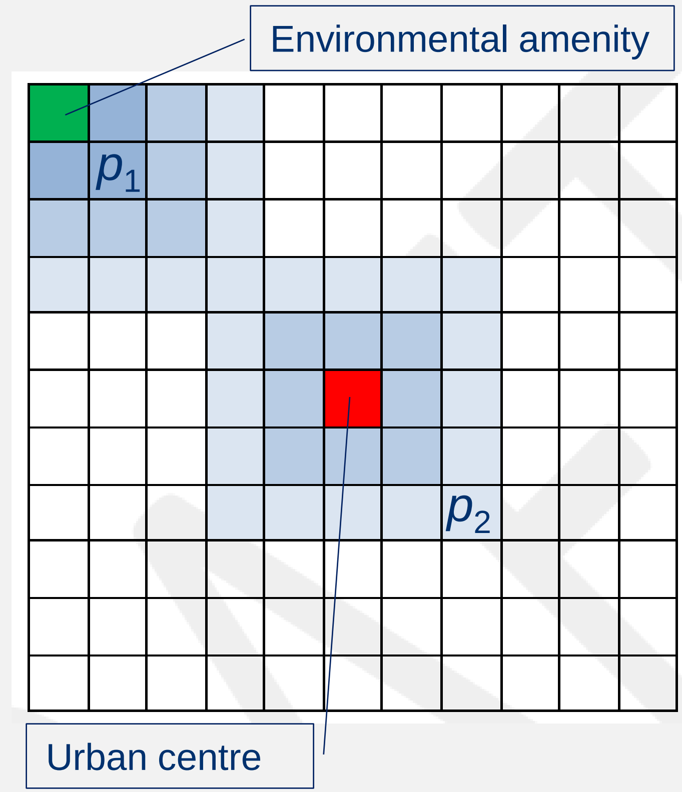
- **Equilibrium:** Residential development takes place where demand equals supply, and residential development patterns for population size are determined given the location of environmental amenities and urban centres





3. Case study description

Study area:

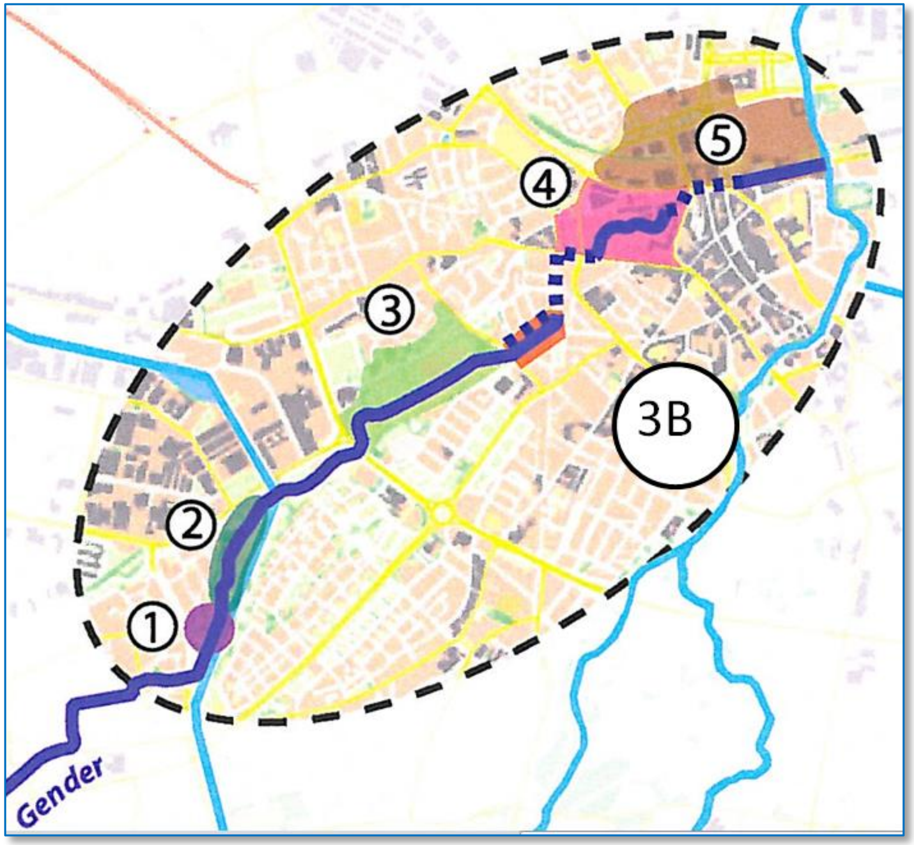
- Inner circle Eindhoven (~16 km^2)
- Population of ~88,023 inhabitants

Background:

- A long term programme has been developed to tackle water & brownfield management issues – linked to planning of other activities in the public space
- Measures include:
  - i) decoupling by changing the sewer system from combined to separate sewers
  - ii) re-opening a number of watercourses throughout the city
  - iii) greening of brownfields
- Our case study will focus on the **‘Nieuwe Gender’**

3. Case study description

- This section of the Nieuwe Gender, includes four interesting parts to be studied:
  - Section 3 (Gendervijver): Renovation of park and pond to a more natural watercourse or maintaining the present configuration
  - Section 3B (Frederika van Pruisenweg): Re-opening of watercourse
  - Section 4 (Emmasingelkwadrant): Brownfield re-developed by re-opening of watercourse in spatial green setting
  - Section 5 (Stationsgebied): Watercourse re-opened and ends in Dommel river



Scenarios to be assessed:

0. Base scenario
1. Emmasingelkwadrant project
2. All projects

Model settings

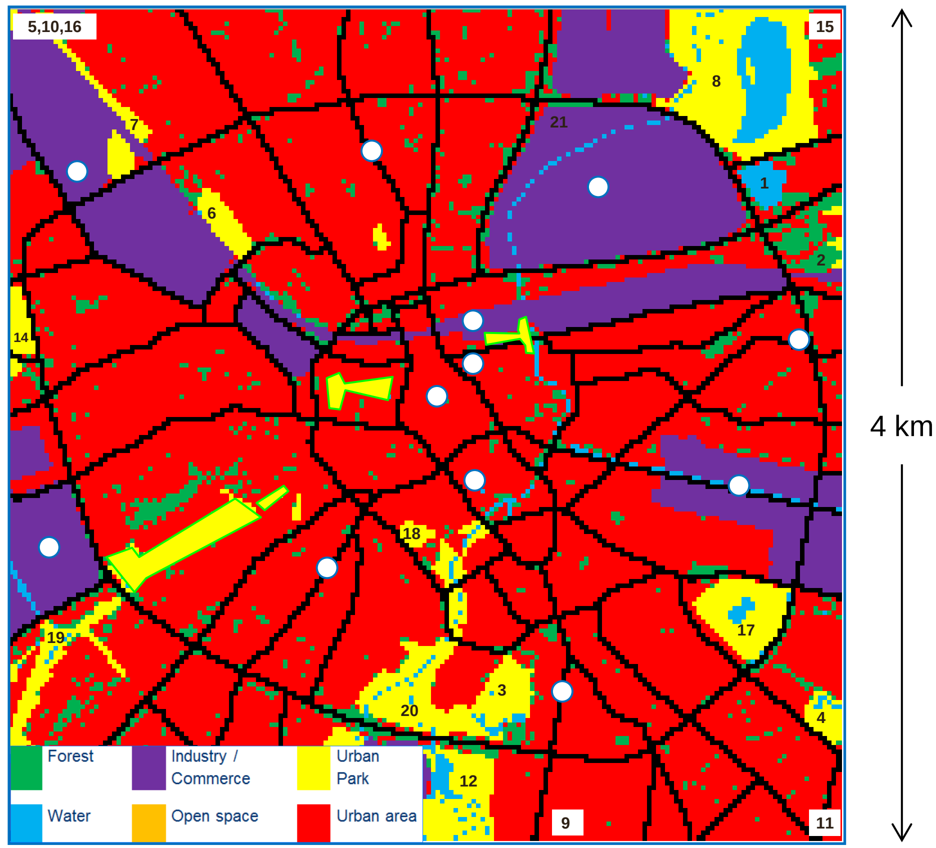
- Land uses (6): Forest, Water, Agriculture, Industry/commerce, Urban park, Residential area
- Household types (3): Clustered according to income level, age, education and composition

		res1	res2	res3	total
Population	#	15,240	29,092	43,692	88,023
Income	€/yr	11,576	22,333	35,362	-

- Green/blue space types (3): Classified according to their quality and services provided
- Urban centres (#): Transport hubs, Business centres, Shoppings, Historical/tourist centres, etc.
- Grid cells: 185 * 185 = 34,225

Scenario definition

- Base:
  - 21 green/blue spaces
  - 12 urban centres
- Scenarios:
  - Emmasingelkwadrant
  - Stationsgebied
  - Gendervijver
  - Frederika v. Pruisenweg



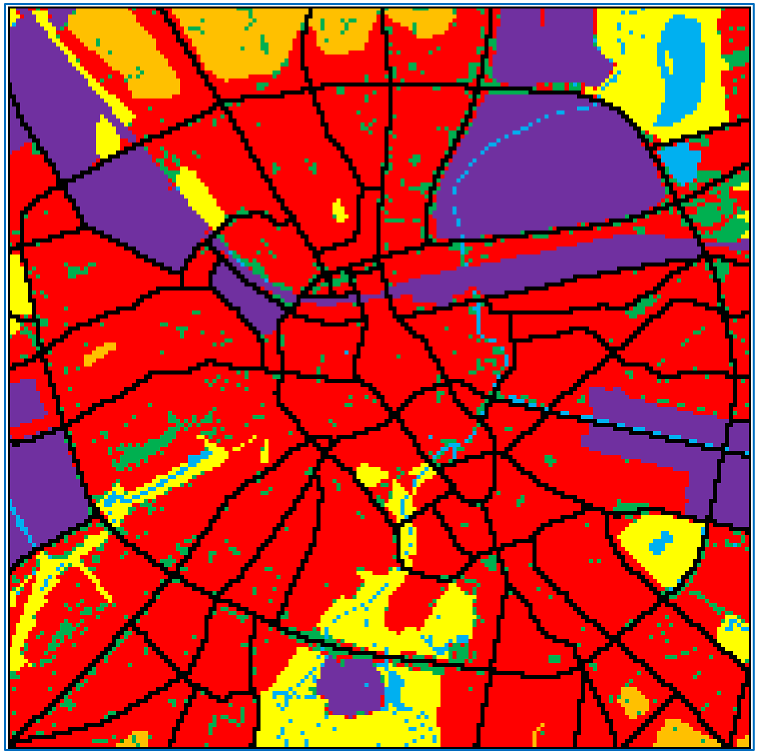
SULD base scenario simulation

	Unit	BaseS	BaseS & Emmasingelkwadrant (Q2)		BaseS & All projects	
Land use:						
- Forest + Water	ha	52	52	0.0%	52	0.0%
- Industry/Commerce	ha	164	164	0.0%	164	0.0%
- Park_urban	ha	49	52	5.3%	54	9.4%
- Roads + Open space	ha	134	131	-2.2%	129	-3.4%
- Urban		625	625	0.0%	625	0.0%
- res1	ha	113	111	-1.9%	110	-2.8%
- res2	ha	221	220	-0.6%	218	-1.6%
- res3	ha	291	294	1.0%	297	2.2%
- Total	ha	1024	1024	0.0%	1024	0.0%
Population:	#					
- res1	#	14424	14430	0.0%	14436	0.1%
- res2	#	24106	24217	0.5%	24276	0.7%
- res3	#	24741	25113	1.5%	25714	3.9%
- total	#	63272	63760	0.8%	64426	1.8%
Housing quantity:						
- res1	1000m2	151.3	147.5	-2.5%	145.8	-3.6%
- res2	1000m2	458.5	454.7	-0.8%	449.0	-2.1%
- res3	1000m2	889.5	896.4	0.8%	904.0	1.6%
- total	1000m2	1499.3	1498.6	0.0%	1498.8	0.0%
Living space:						
- res1	m2/hh	64.2	63.7	-0.7%	63.4	-1.1%
- res2	m2/hh	98.3	98.0	-0.4%	97.5	-0.8%
- res3	m2/hh	144.2	143.9	-0.2%	143.3	-0.6%
- average	m2/hh	108.5	108.3	-0.2%	108.2	-0.3%
Real estate value:						
- res1	€/m2/yr	53.1	53.6	0.8%	53.8	1.2%
- res2	€/m2/yr	63.5	63.7	0.4%	64.1	0.9%
- res3	€/m2/yr	69.4	69.5	0.2%	69.8	0.7%
- average	€/m2/yr	64.3	64.6	0.5%	65.0	1.0%
- total	m€/yr	207.0	209.0	1.0%	212.1	2.5%

4. Model simulations

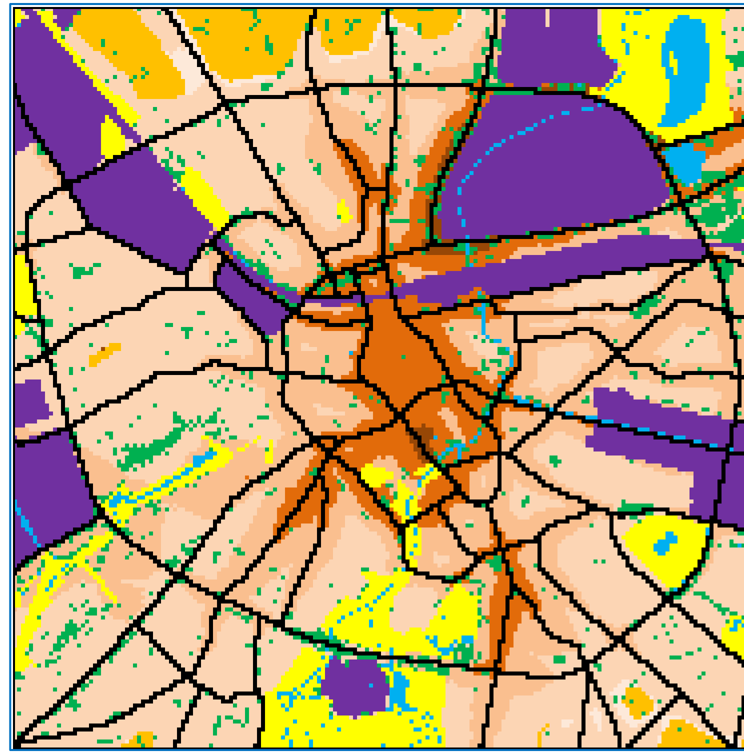
Base scenario simulation

Land use



Forest	Industry / Commerce	Urban Park
Water	Open space	Urban area

Household density

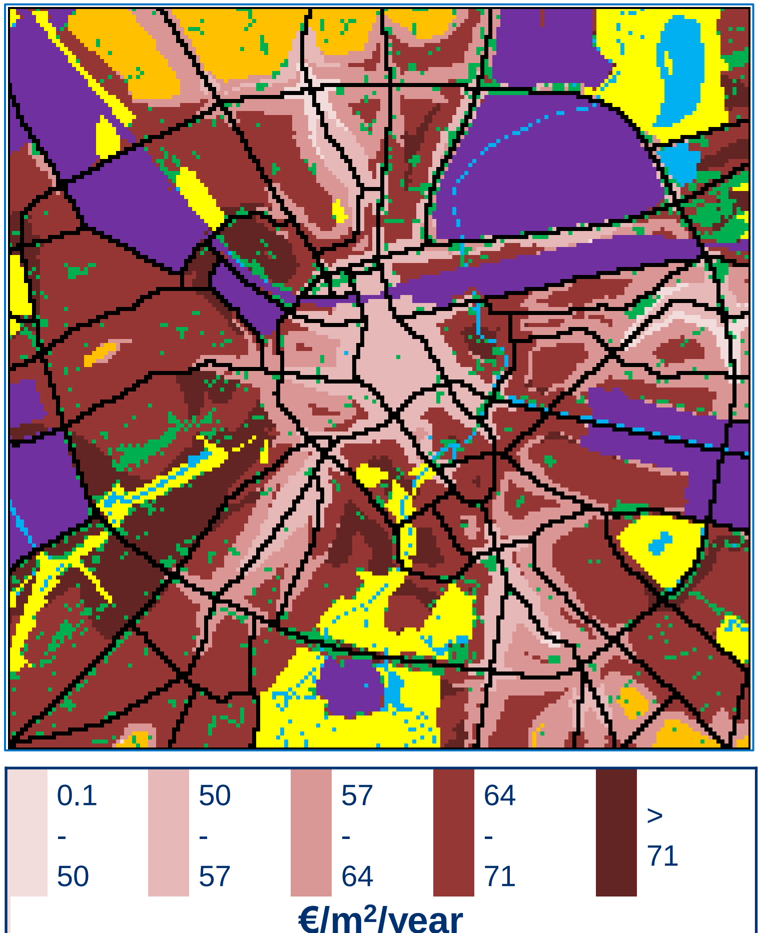


0.10 - 1.50	1.50 - 2.10	2.10 - 2.70	2.70 - 3.30	> 3.30

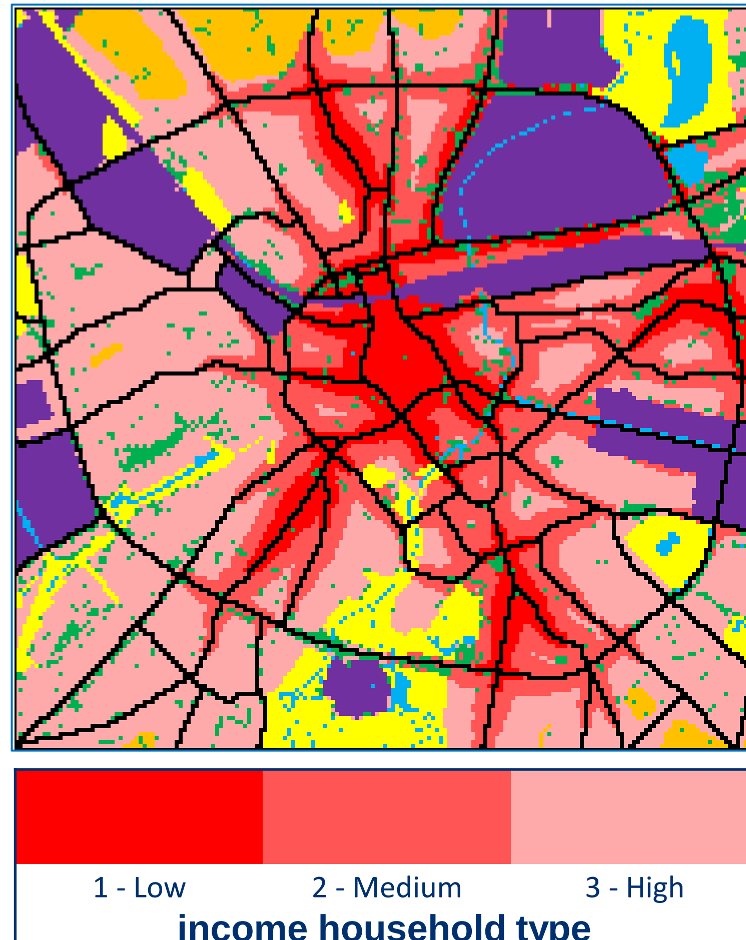
hh/gridcell

Base scenario simulation

Housing price



Household types



Scenarios to be assessed:

0. Base scenario
1. Emmasingelkwadrant project
2. All projects

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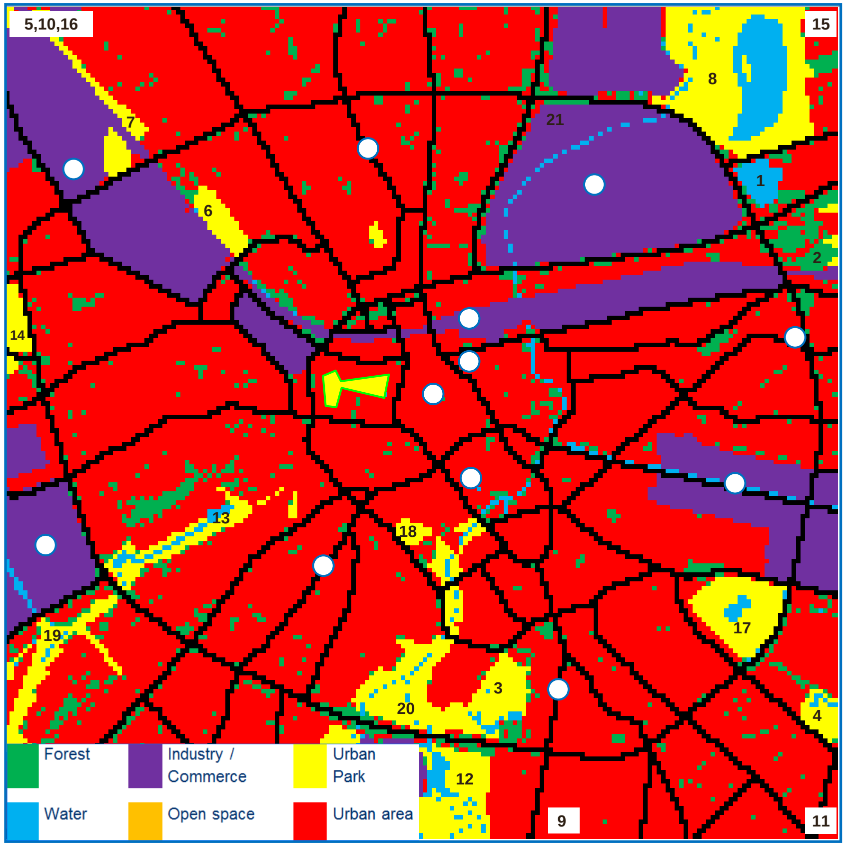
Base + Emmasingelkwandrant project

- Base:
  - 22 green/blue spaces
  - 12 urban centres
- Scenarios:
  - Emmasingelkwadrant



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SULD scenario simulation

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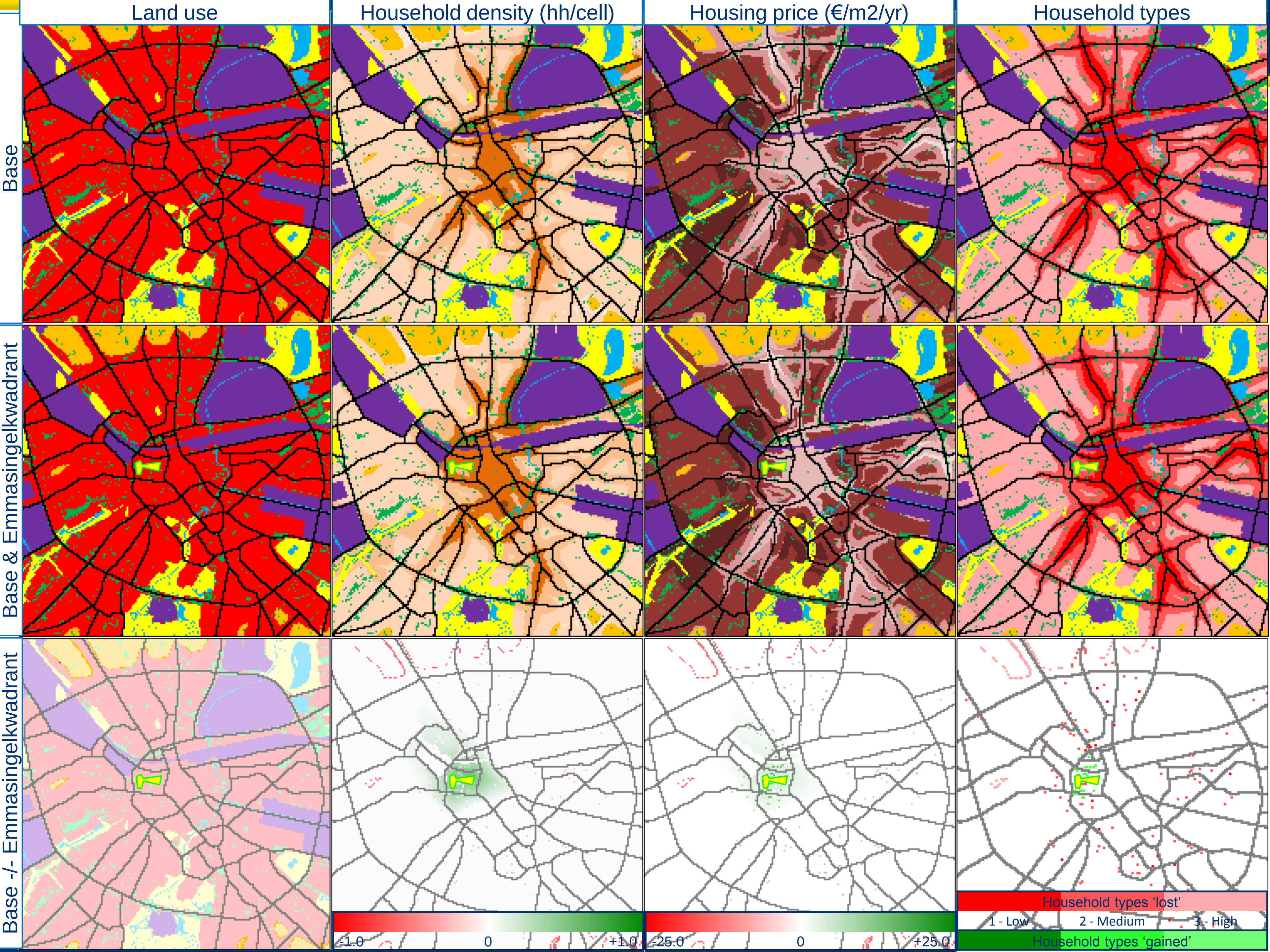

Land use
Household density (hh/cell)
Housing price (€/m2/yr)
Household types
Base
Base & Emmasingelkwadrant
Base -/- Emmasingelkwadrant
-1.0
0
+1.0
-25.0
0
+25.0
Household types 'lost'
1 - Low
2 - Medium
3 - High
Household types 'gained'

4. Model simulations

Scenarios to be assessed:

0. Base scenario
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Base + all projects

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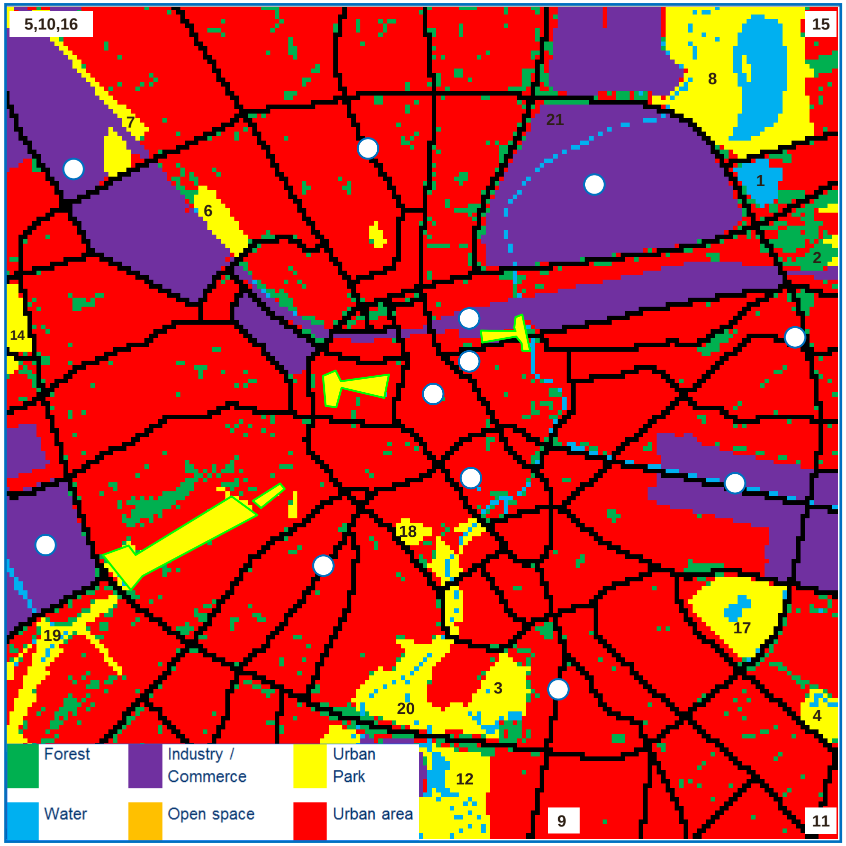

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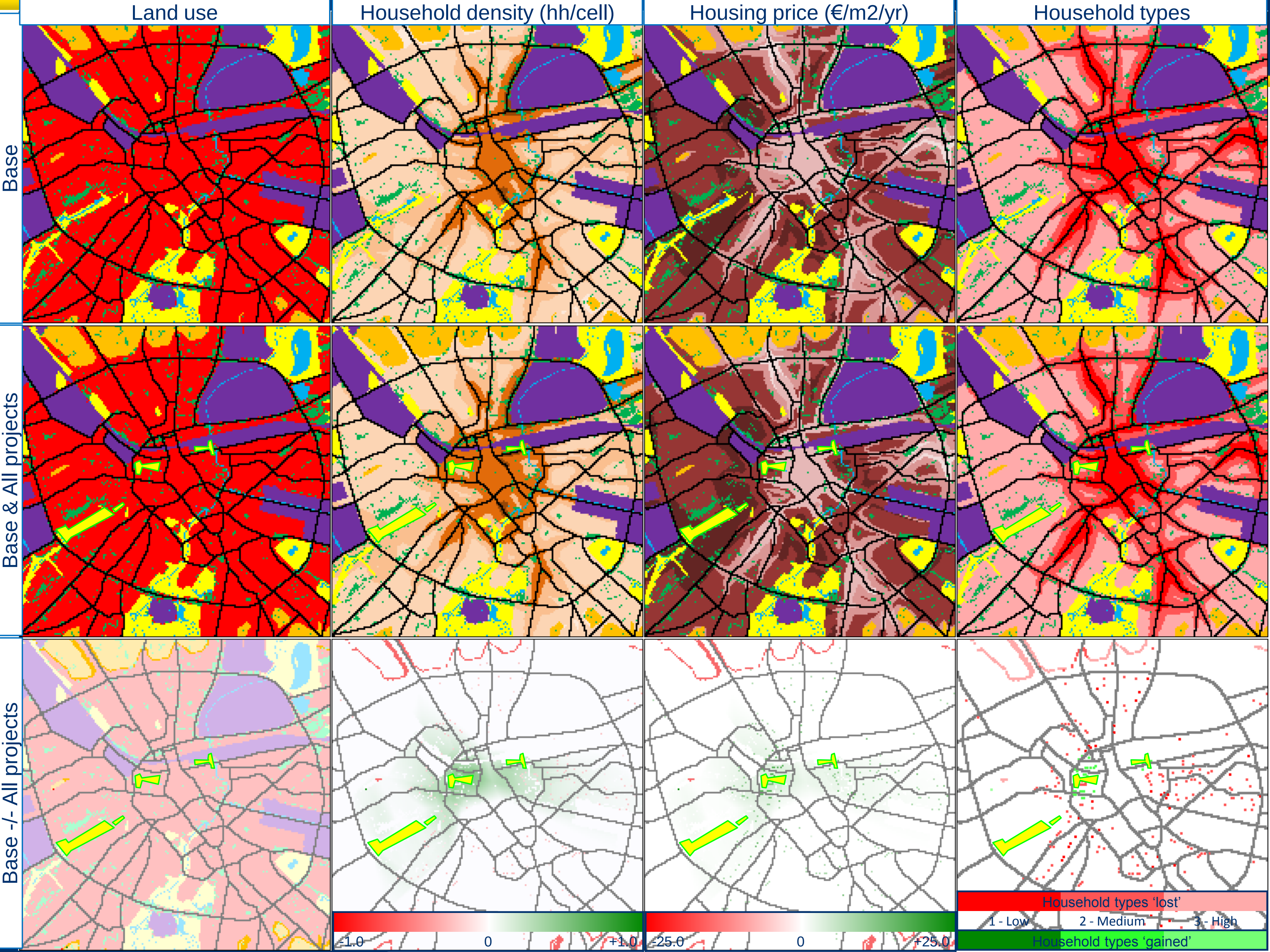


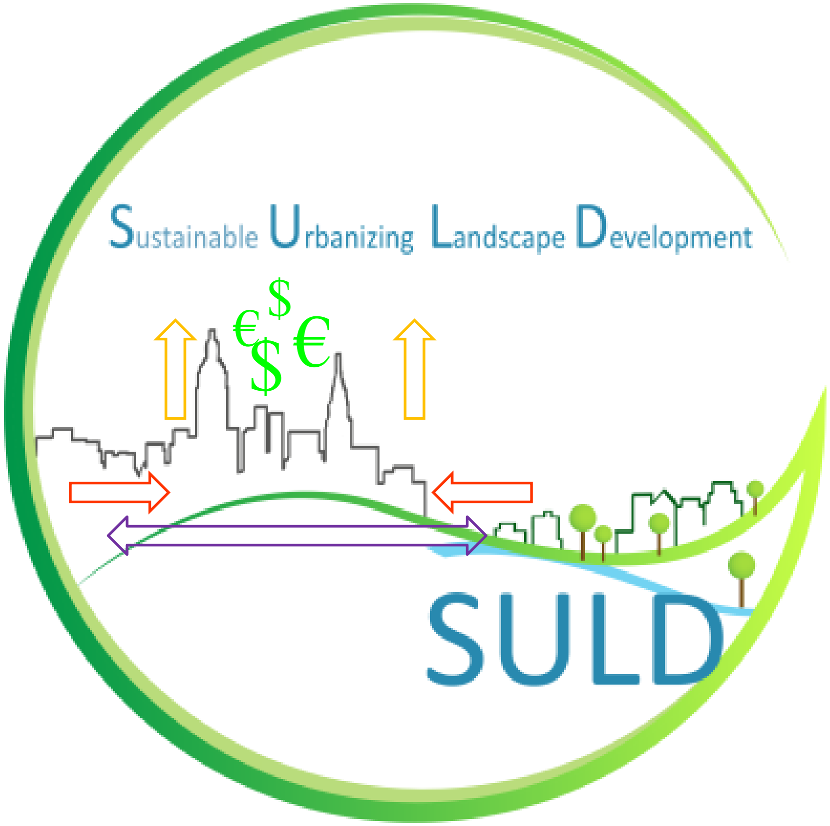
Land use
Household density (hh/cell)
Housing price (€/m2/yr)
Household types
Base
Base & All projects
Base -/- All projects
-1.0
0
+1.0
-25.0
0
+25.0
Household types 'lost'
1 - Low
2 - Medium
3 - High
Household types 'gained'

Summarizing

- SULD allows to assess different types, combinations, locations, shapes and dimensions of green/blue space projects in urban(-izing) areas
- SULD produces residential land use patterns, based on distance to green/blue space and urban centres as well as household characteristics
- Scenarios show how re-introduction of green/blue space impacts on household welfare, demographics and real estate values
- SULD provides an indication on:
  - The number and kind of families attracted to the intervention area
  - The location, size and type of residential development procured by these families

Tendencies

- Establishment / re-introduction / re-qualification of green/blue space leads to:
  - More compact cities
  - Increase in population density
  - Appreciation of real estate values
  - Change in demographic distribution patterns



Tendencies

- Value-added green/blue space depends on:
  - Location of intervention relative to other environmental amenities / urban centres

    "Value added limited when intervention is in proximity of other quality green/blue spaces"

    "Value added limited when intervention is in proximity of urban centres / road infrastructure"

  - Social classes attracted to intervention area:

    "Value added partially captured (+5-10%) when intervention doesn't attract higher income households"

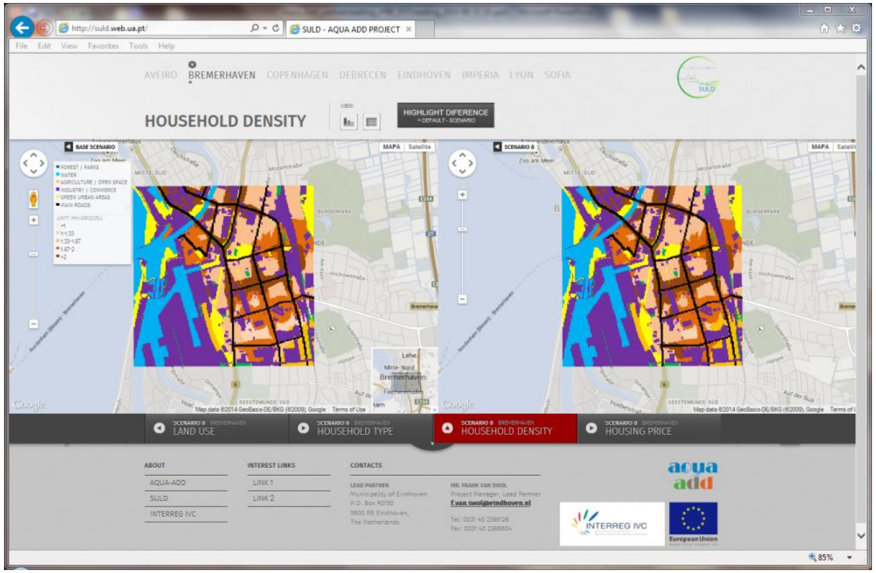
    "Value added fully captured (+20-25%) when the intervention attracts higher income households"

Observations

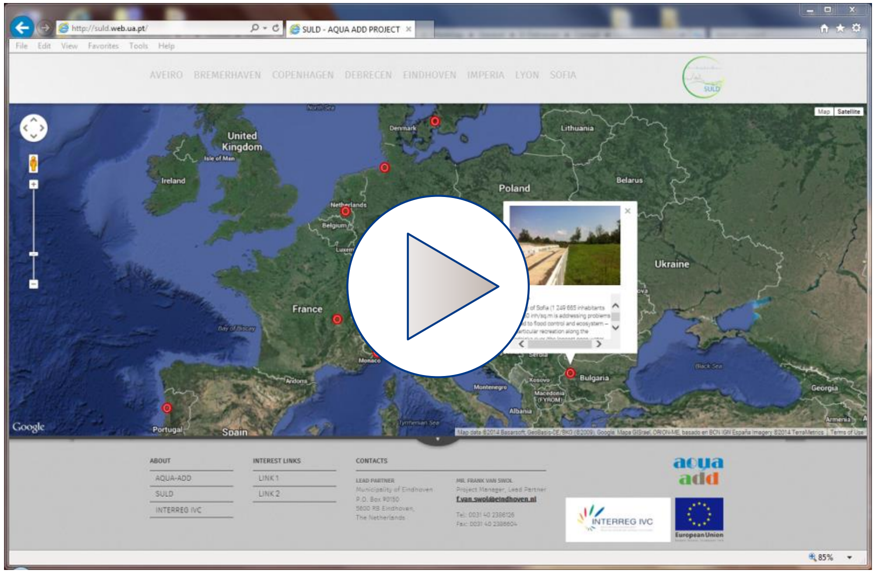
- The DST is not an aim in itself, but a starting point for a process
- It facilitates participatory planning, development and assessment of scenarios – stimulating stakeholders to reflect about their reality and possibilities for future

SULD decision support tool:

- Web-based application:



E-learning module:



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