

EO-based Decision Support  
Services for Integrated Urban  
Governance:  
the DECUMANUS project



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## Motivation

- 21st-century is witnessing the **impact of societal challenges**, including climate change

### Northern Europe

- more damage by winter storms and floods
- sea level rise and increased frequency of storm surges

### North-Western Europe

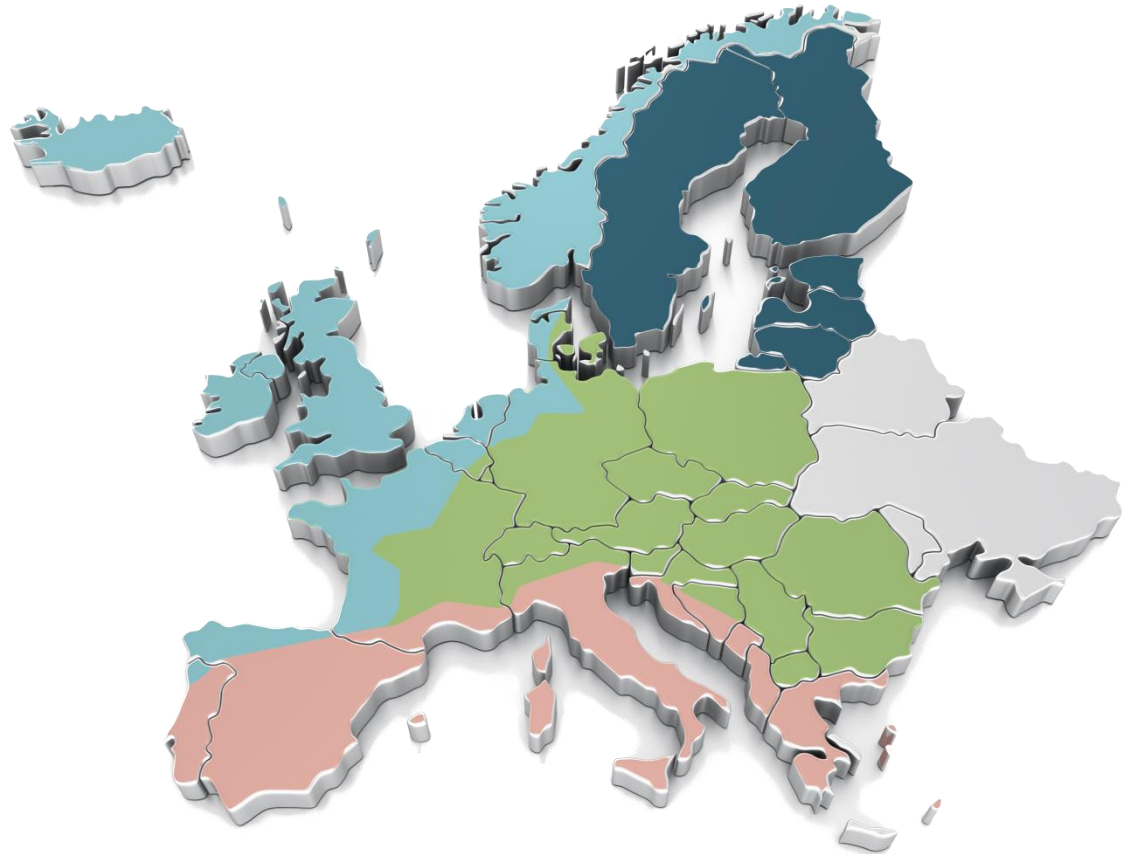
- more droughts
- heat waves
- river floods

### Central and Eastern Europe

- more droughts
- heat waves
- water scarcity

### Mediterranean Region

- more droughts
- heat waves and water scarcity
- sea level rise and increased frequency of storm surges



## How do these impacts affect our life?

- Societal challenges are impacting not only the social fabric of urban life, and the economy of cities, but also the **civil quality of urban environments**



How much does climate change affect our cities?



How green are our cities?



How many people are affected by climate change effects?



How much energy do our buildings lose?



How high is the air pollution in our cities?



How does bad air quality affect our daily life?

## What we do

The key to effective governance of cities is the **generation of the necessary intelligence** to inform decision making by politicians,

- to guide urban policy making and implementation
- to inform and engage all citizens in the delivery of sustainable urban development



**DECUMANUS** is dedicated to **provide this urban intelligence** to urban managers dealing with societal challenges including climate change, based on the philosophy that **it is possible to adapt to, and mitigate, the challenges if you can understand and measure them.**

## User focus

**DECUMANUS** is fundamentally user defined and driven

- development of integrated governance tools is critically dependent on **end user requirements and review of the added value potentials of new applications**



## Business model

Two services levels, according to considerations of scale and detail:

**(1) Strategic Services** → **Generic, large-scale and based on freely available data** i.e. production should be feasible for any European city.

**(2) Local Services** → **local scale, on demand, based on local input data and available to an agreed price.**



## What we provide

The **DECUMANUS** services :

- (1) **Land Monitoring Service** providing land consumption information for urban ecosystems assessment
- (2) **City Energy Efficiency Service** assessing energy consumption thereby improving energy efficiency in cities
- (3) **Population Impact Assessment Service** analysing the impact of climate change scenarios to the population
- (4) **Urban Climate Atlas** assessing urban climate change impacts
- (5) **Citizen Health** tools to alert the population to health risks arising from poor air quality and excessive temperatures in the urban area
- (6) **Water Quality Service**



## Land Monitoring Service



### Motivation

Decision makers need to implement suitable plans to effectively lessen the effects of climate change on urban areas. Thereby, **maintaining and increasing urban green areas** is of great importance, especially for:

- **reducing storm water runoff** (which transports toxic chemicals, dirt and trash from roofs and roads into lakes, streams and rivers but also leads to an increased occurrence of urban flooding events);
- **lowering air pollution** (which is responsible for a variety of respiratory and cardiovascular conditions);
- **mitigating the urban heat island effect** (which causes high-energy consumption for cooling and an increase of heat-related illness/fatalities);
- **enabling biodiversity** and the conservation of several species;
- **enhancing the wellbeing** and quality of life of urban residents.

## Land Monitoring Service

### Products

- Current and Potential Green Roof Mapping
- Tree Location and Canopy Mapping



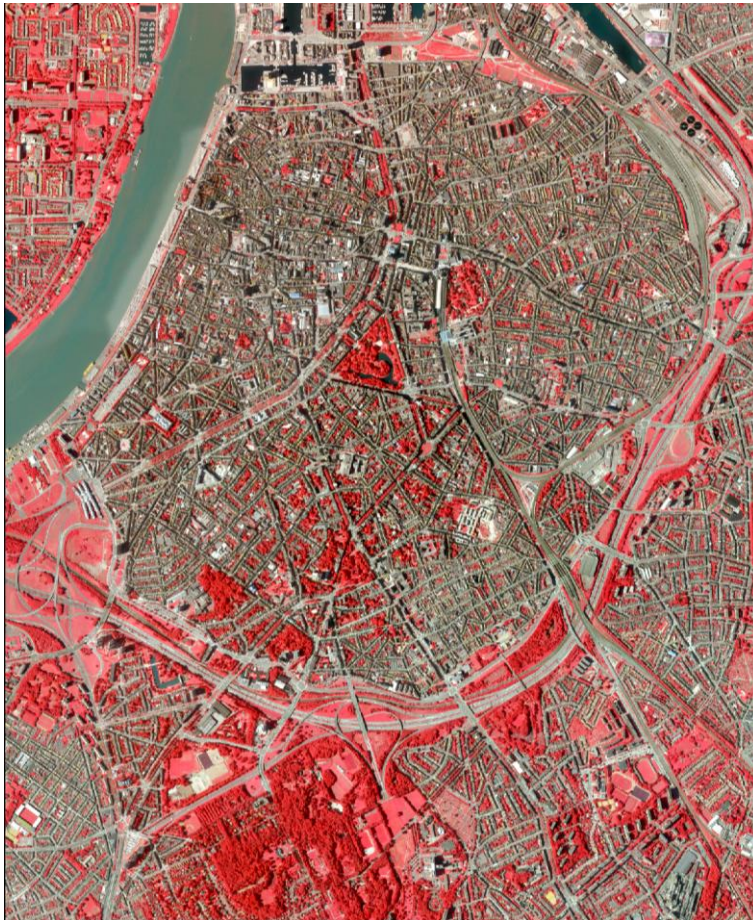
### User demand

- Alternative to extremely costly and time demanding land monitoring products
- Outline **existing green roofs and trees**
- Need for **estimating which roofs can potentially be converted into green roofs**
- Indication of where this **conversion** might be overall more **beneficial**

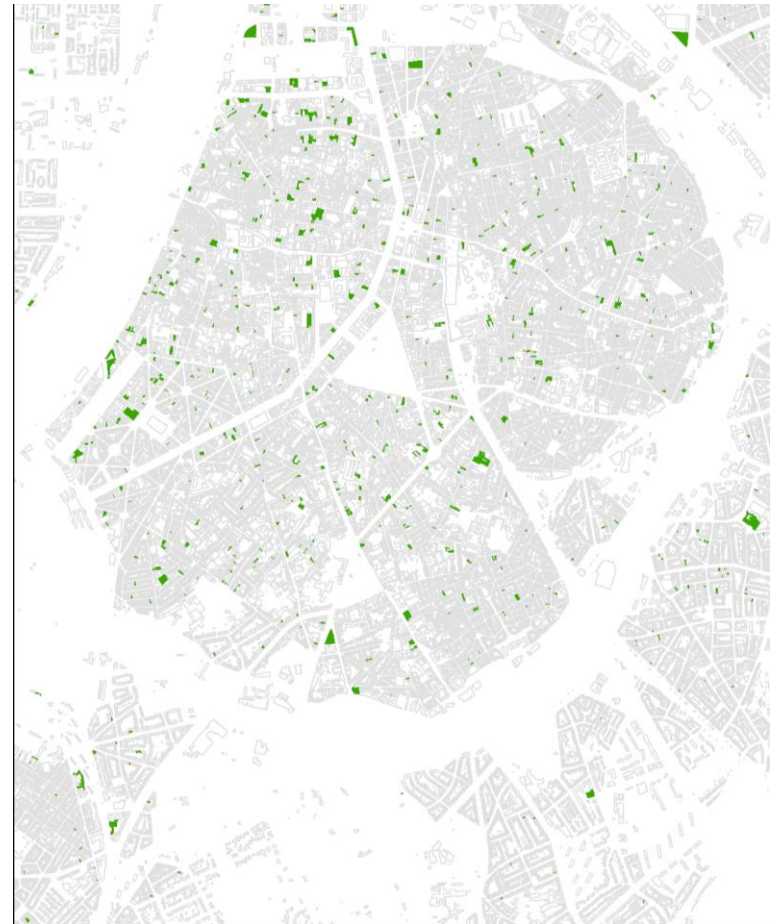


## Land Monitoring Service – Green Roofs

 Antwerp



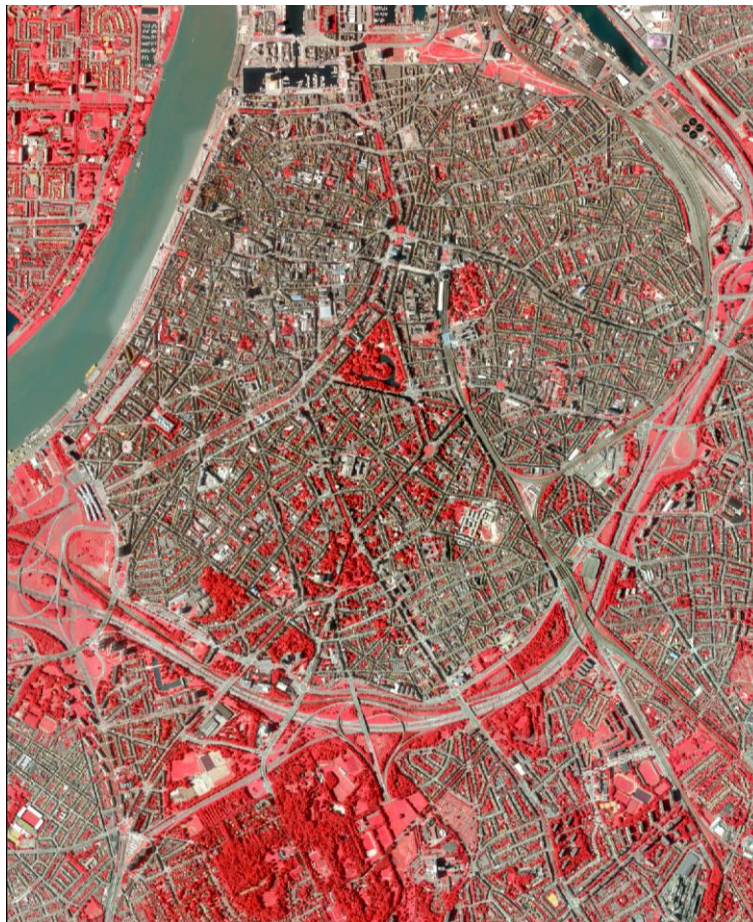
CIR airborne imagery



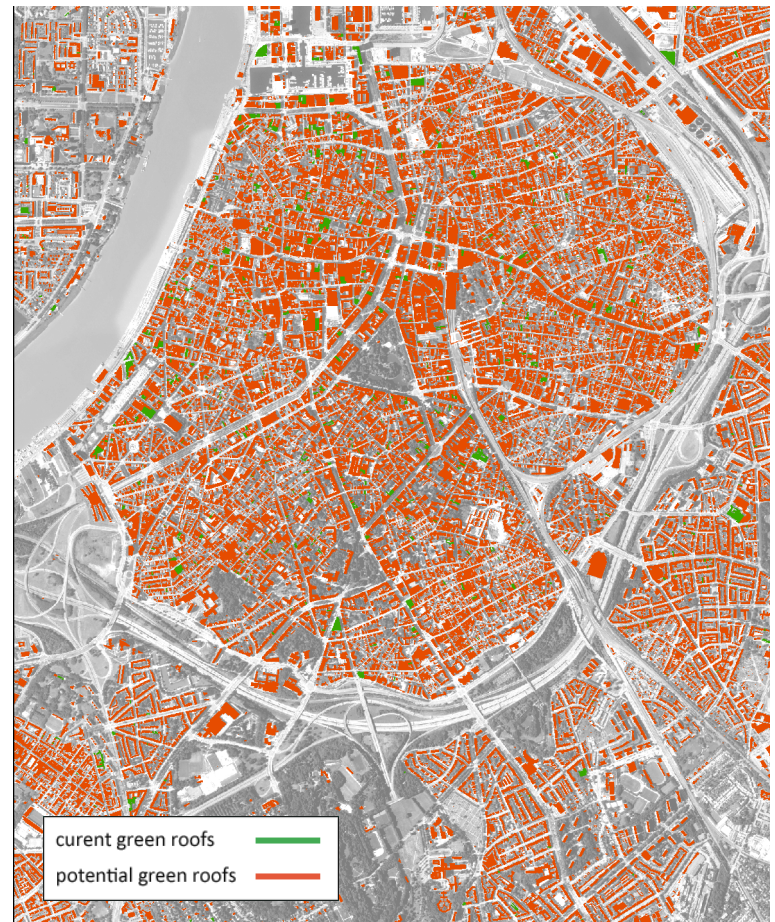
current green roofs



## Land Monitoring Service – Green Roofs



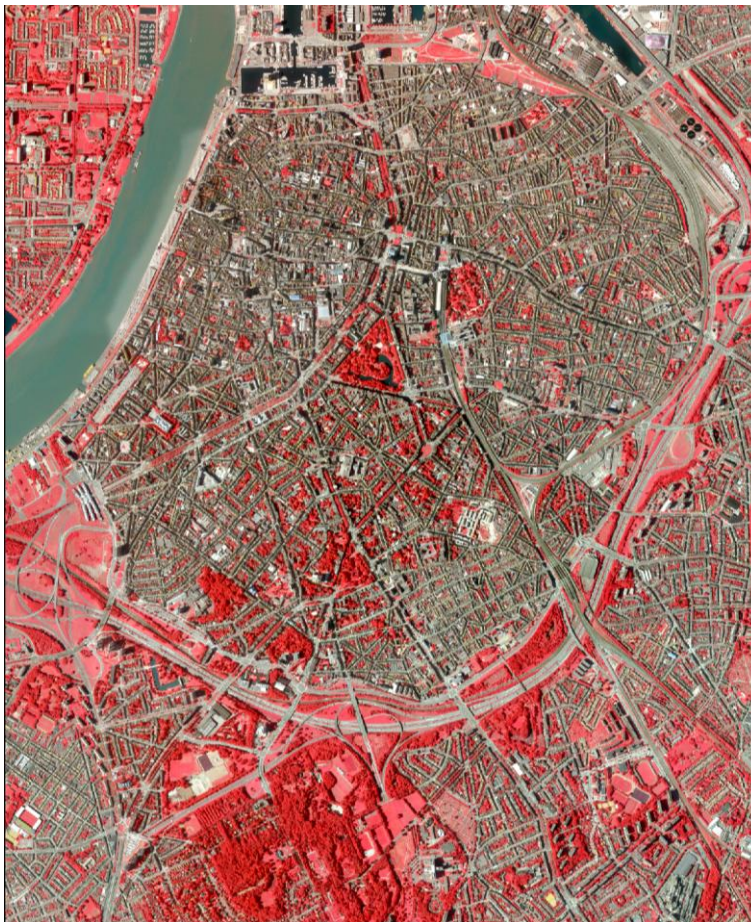
CIR airborne imagery



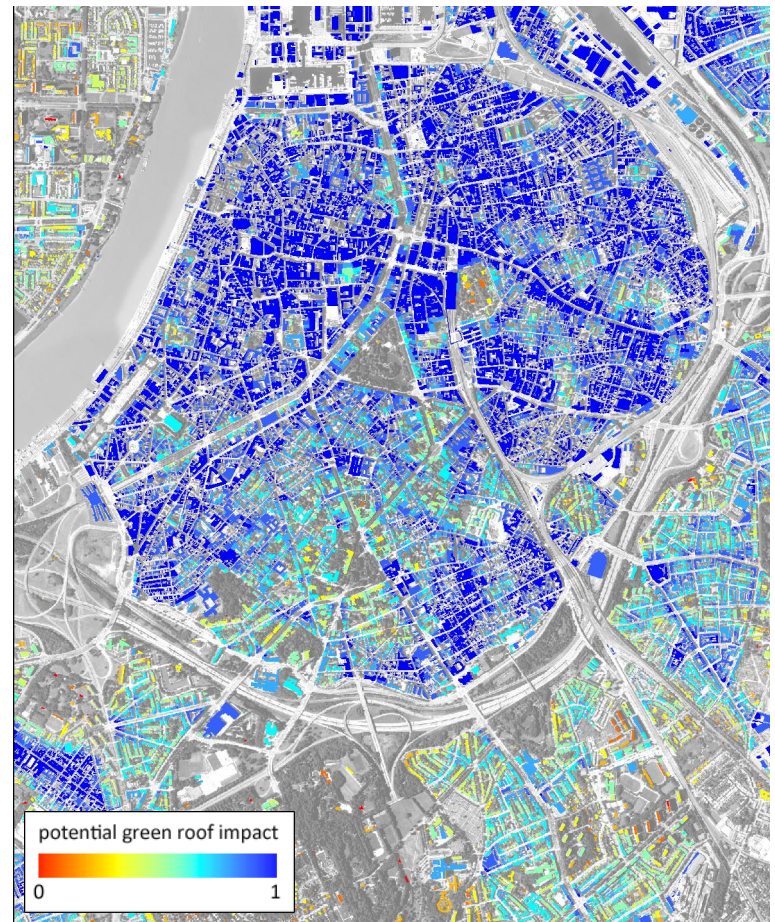
current and potential green roofs



## Land Monitoring Service – Green Roofs



CIR airborne imagery



potential green roof impact

## Land Monitoring Service – Green Roofs



### How are the services used in the cities?

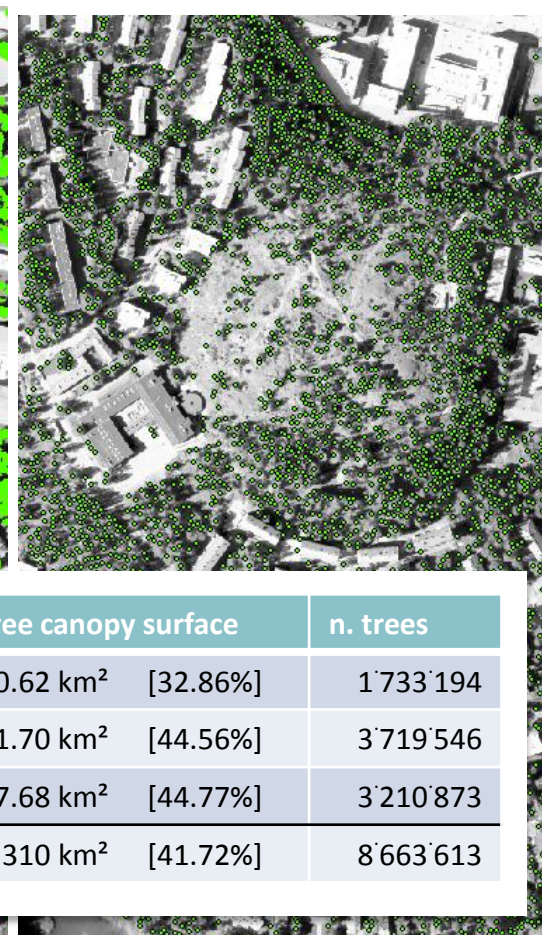
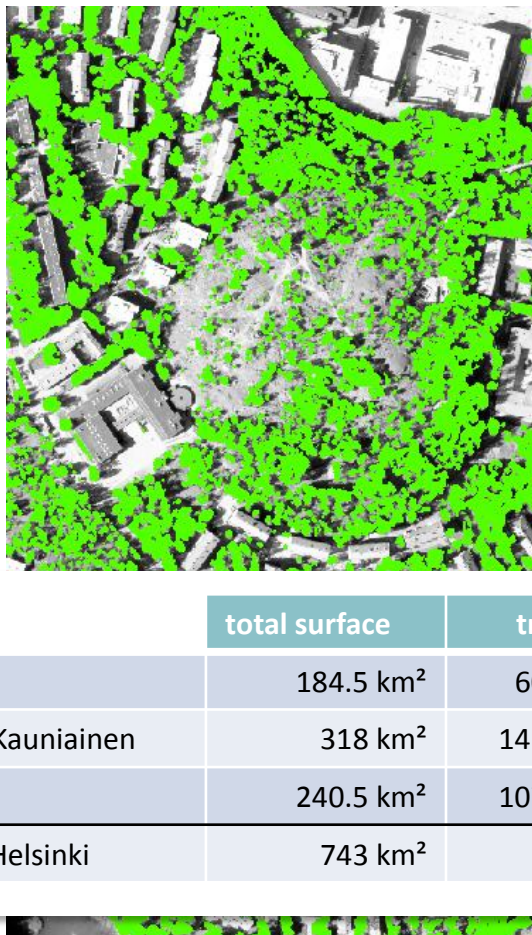
- In October 2016 the municipality of Antwerp will launch a new website and campaign “*Zoom in on your roof*”. Furthermore, people can go to a EcoHouse and look to the potential on their roof for green roofs and get expert advice.
- The produced layers will be used to check the potential of people’s roof to become a green roof e.g. to **target subsidies**.





## Land Monitoring Service – Tree location and canopy mapping

 Greater Helsinki



	total surface	tree canopy surface	n. trees
Helsinki	184.5 km <sup>2</sup>	60.62 km <sup>2</sup> [32.86%]	1'733'194
Espoo + Kauniainen	318 km <sup>2</sup>	141.70 km <sup>2</sup> [44.56%]	3'719'546
Vantaa	240.5 km <sup>2</sup>	107.68 km <sup>2</sup> [44.77%]	3'210'873
Greater Helsinki	743 km <sup>2</sup>	310 km <sup>2</sup> [41.72%]	8'663'613

CIR airborne imagery

Tree canopy

Tree location



## Land Monitoring Service – Tree location and canopy mapping

### How are the services used in the cities?



- The **tree canopy** layer provides a more **precise and comprehensive estimate of the urban area covered by high vegetation** than what previously available at the municipality.
- This information will be used as key component for **calculating the cities biodiversity index** (CBI, Singapore Index). Helsinki is one of the cities which exploiting and promoting the CBI worldwide and it is going to continue this also in the future.
- The dataset can also be used in spatial **air quality modelling** combined with information about traffic and concentration of other polluting elements.

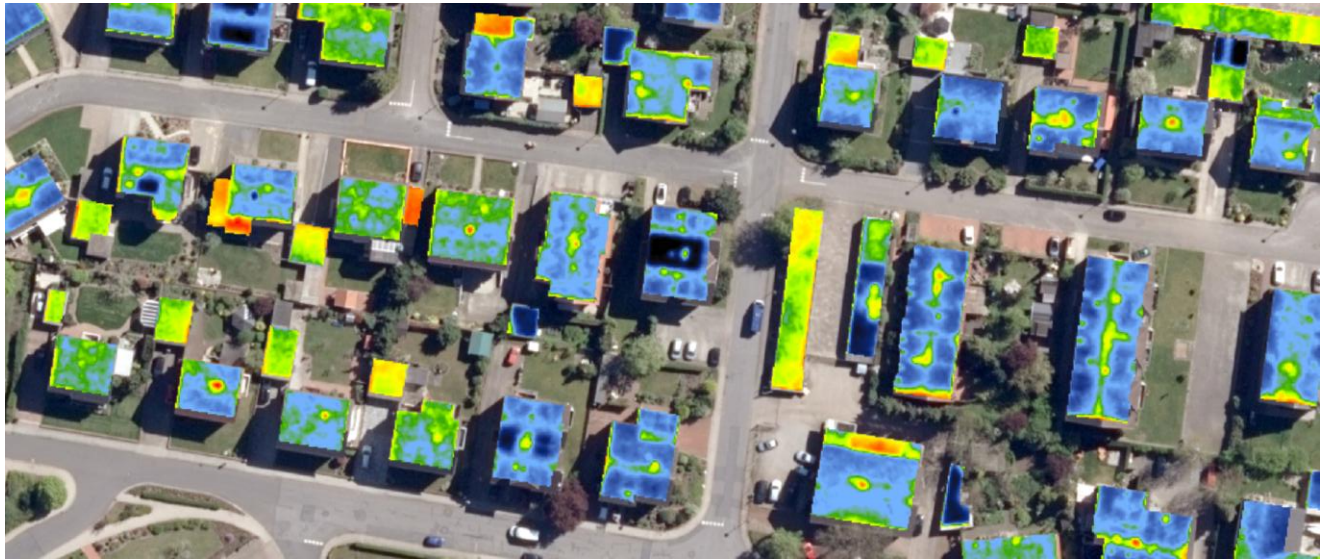


## City Energy Efficiency Service



### Motivation

In the framework of climate change mitigation programs, **energy efficiency is essential** and drives the demand for specific services that **indicate energy loss and potential savings**.



## City Energy Efficiency Service

### Products

- Heat loss
- Light Emission
- Photovoltaic Potential

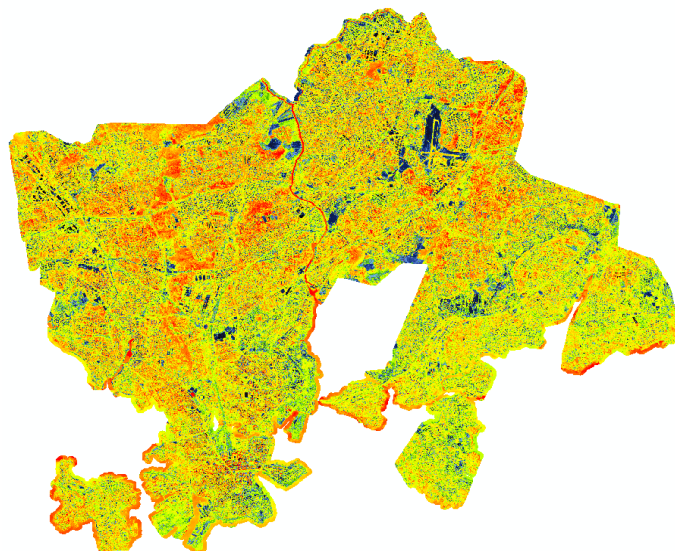


### User demand

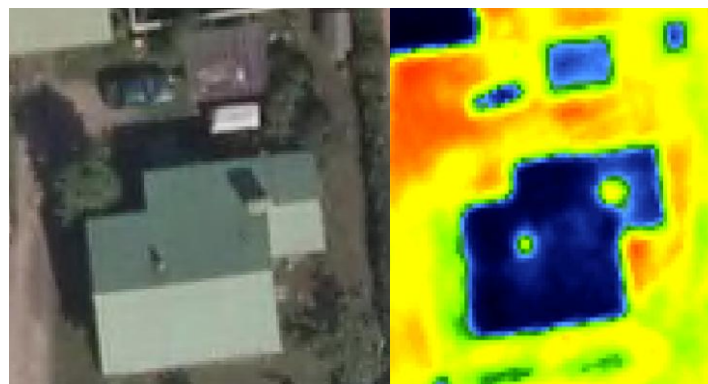
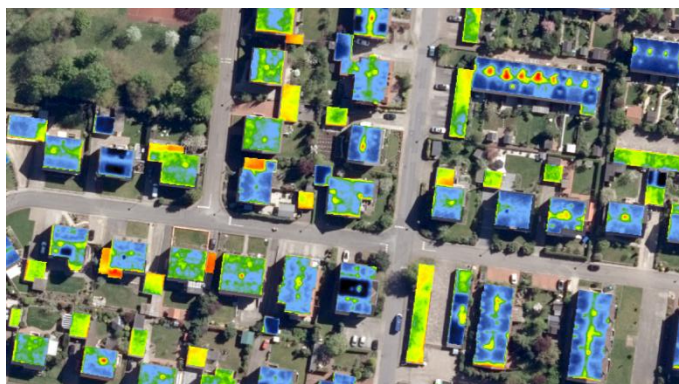
- **Reduce** at least **20% of the cities CO2 emissions** by 2020
- Provide information to **launch campaigns among citizens** to encourage the improvement of their roof insulation and the installation of solar panels
- Each citizen is able to **verify the quality of their roof insulation** on a map, as well as the suitable areas for the installation of solar panels and the corresponding potential electricity yield



# City Energy Efficiency Service – Heat Loss



Aerial thermography map



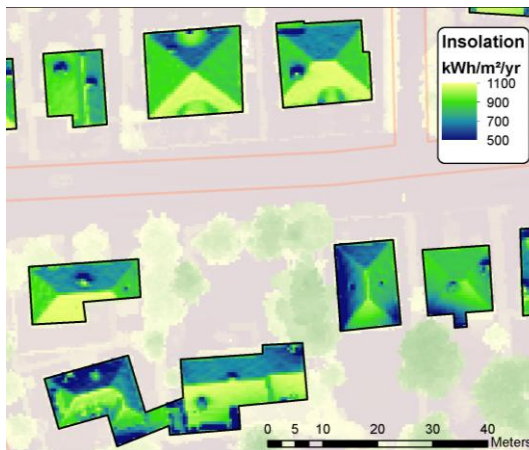
*Very good*

*Average*

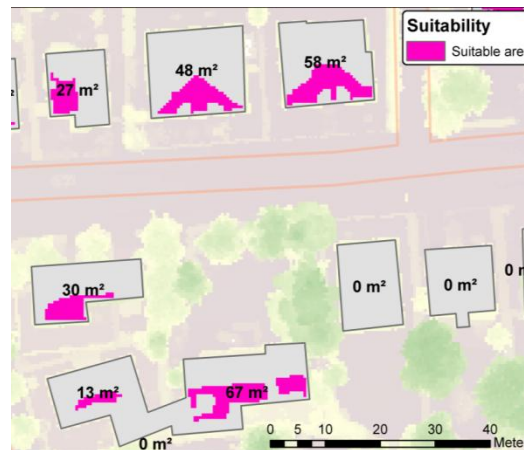
*Very bad/not insulated*

## City Energy Efficiency Service – Photovoltaic Potential

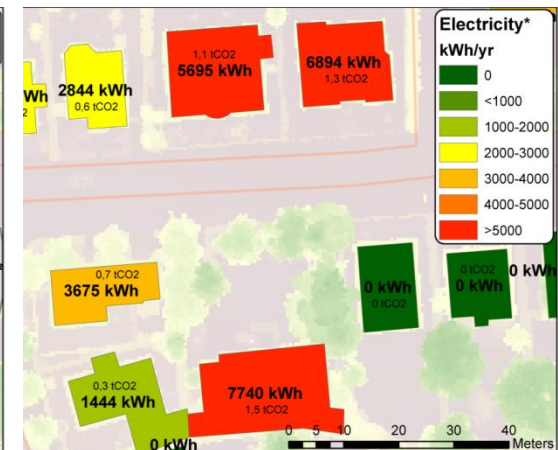
- quantify the suitability of a building roof for installing solar panels, the expected annual electricity yield and the corresponding CO2 savings



Insolation map



Suitable areas for solar panels



Max. potential electricity yield

	Buildings				Suitable area		Potential electricity yield		CO2 Savings per City (kCO2/year)	Current Electricity consumption per City	
	Area (km²)	Number	Area total (km²)	Number suitable	Total (km²)	Average by roof (m²)	Total (GWh/year)	Mean by roof (kWh/year)		GWh/year	Solar potential in % of current consumption
<b>ANTWERP</b>	204,3	157.843	27	107.396	10	66	1.163	7368	227.615	6000	19%
<b>HELSINKI</b>	765,6	261.409	40	114.454	17	66	1.870	7154	356.763	13200	14%
<b>MADRID</b>	604,4	498.534	50	333.062	26	51	4.465	8956	1.299.250	15125	30%



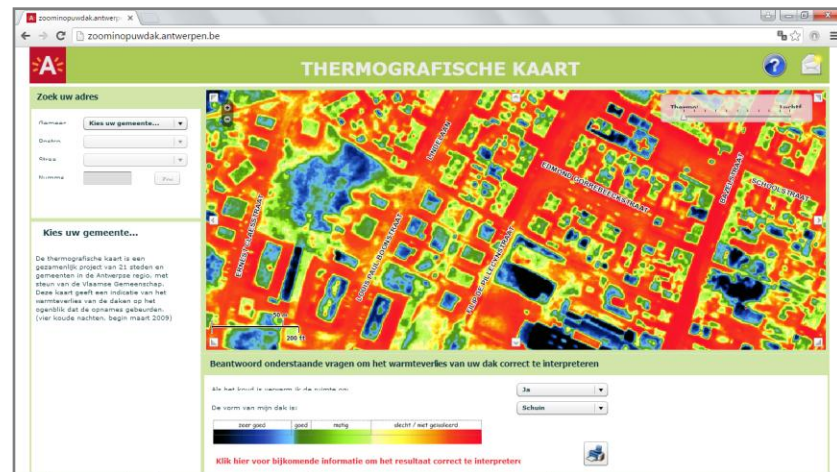
## City Energy Efficiency Service

### How are the services used in the cities?



- Each citizen is able to **verify the quality of their roof insulation** on a map, as well as the suitable areas for the installation of solar panels and the corresponding potential electricity yield.
- Inspiring inhabitants to invest
- Check for inhabitants who have done investments or buy new house

[www.zoominopuwdak.antwerpen.be](http://www.zoominopuwdak.antwerpen.be)



## Population Impact Assessment Service

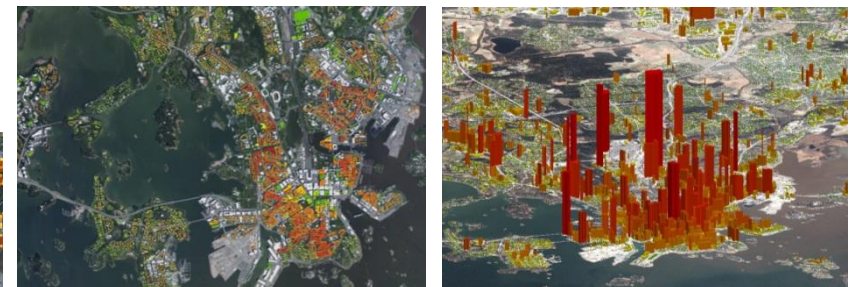
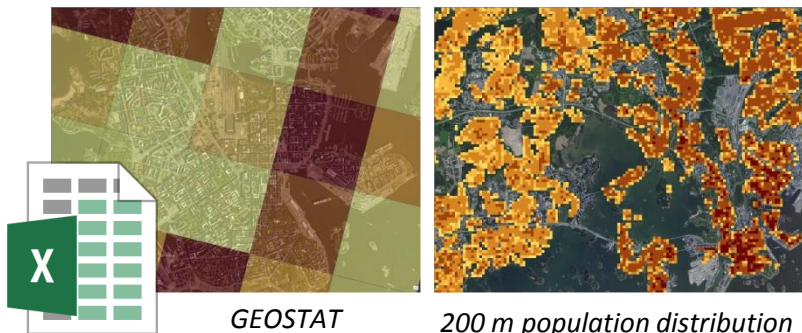


### Motivation

- Population data is normally based on the place of residence
- To better understand where people are, exact measurements are needed to develop better or advanced adaption strategies
- ready-made, easy-to-understand visualizations of the day time population distribution based on a variety of input data (commuting data, work places, etc.)

... to detailed geospatial explicit information

From lump statistics  
on administrative units ...

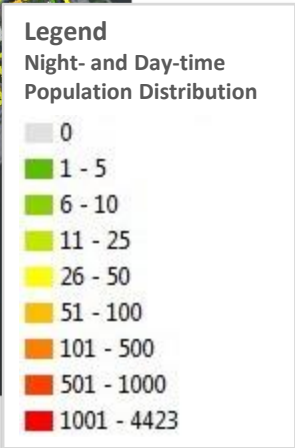
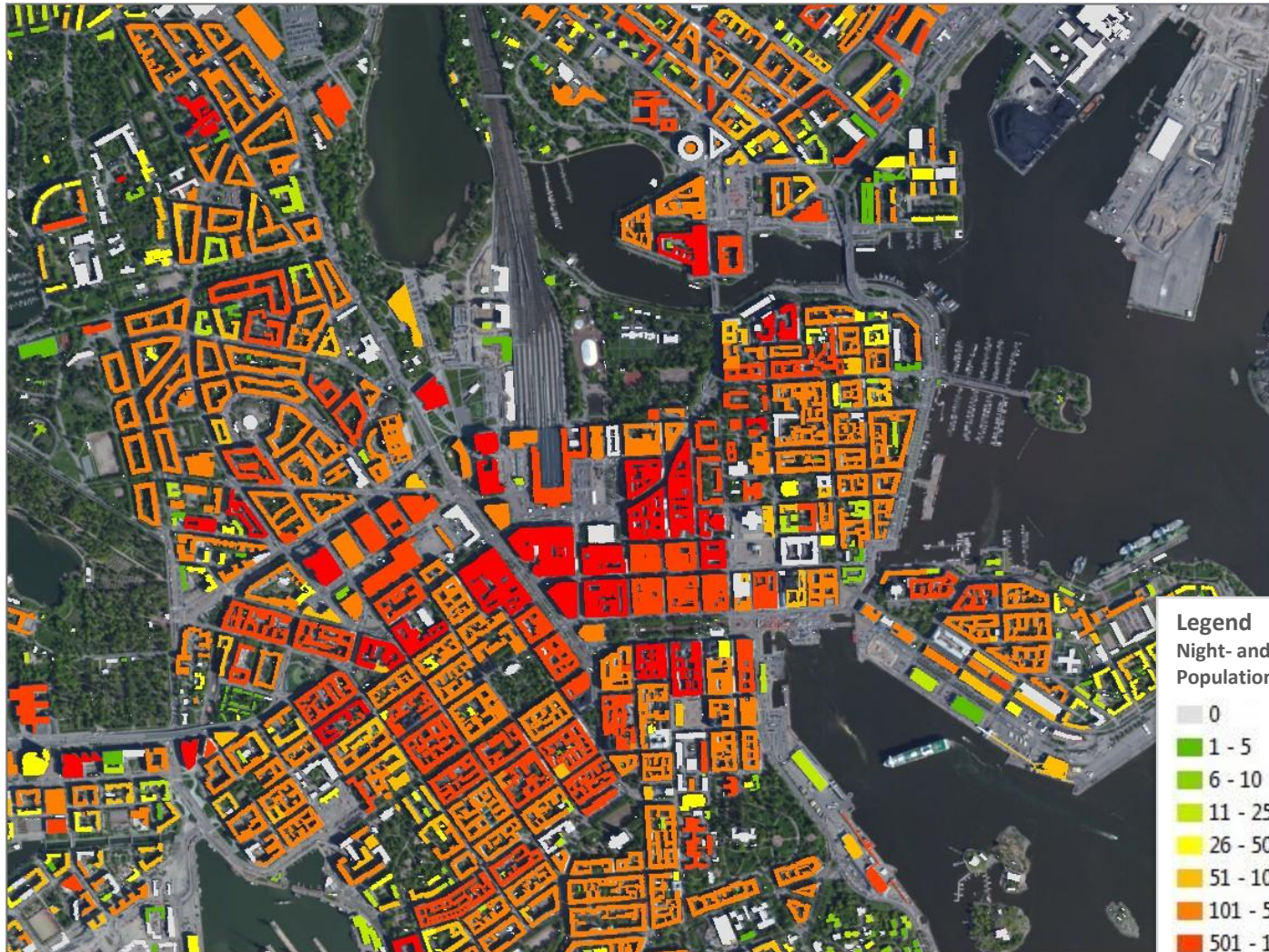


Day-time population  
distribution (building block  
level)





# Population Impact Assessment Service

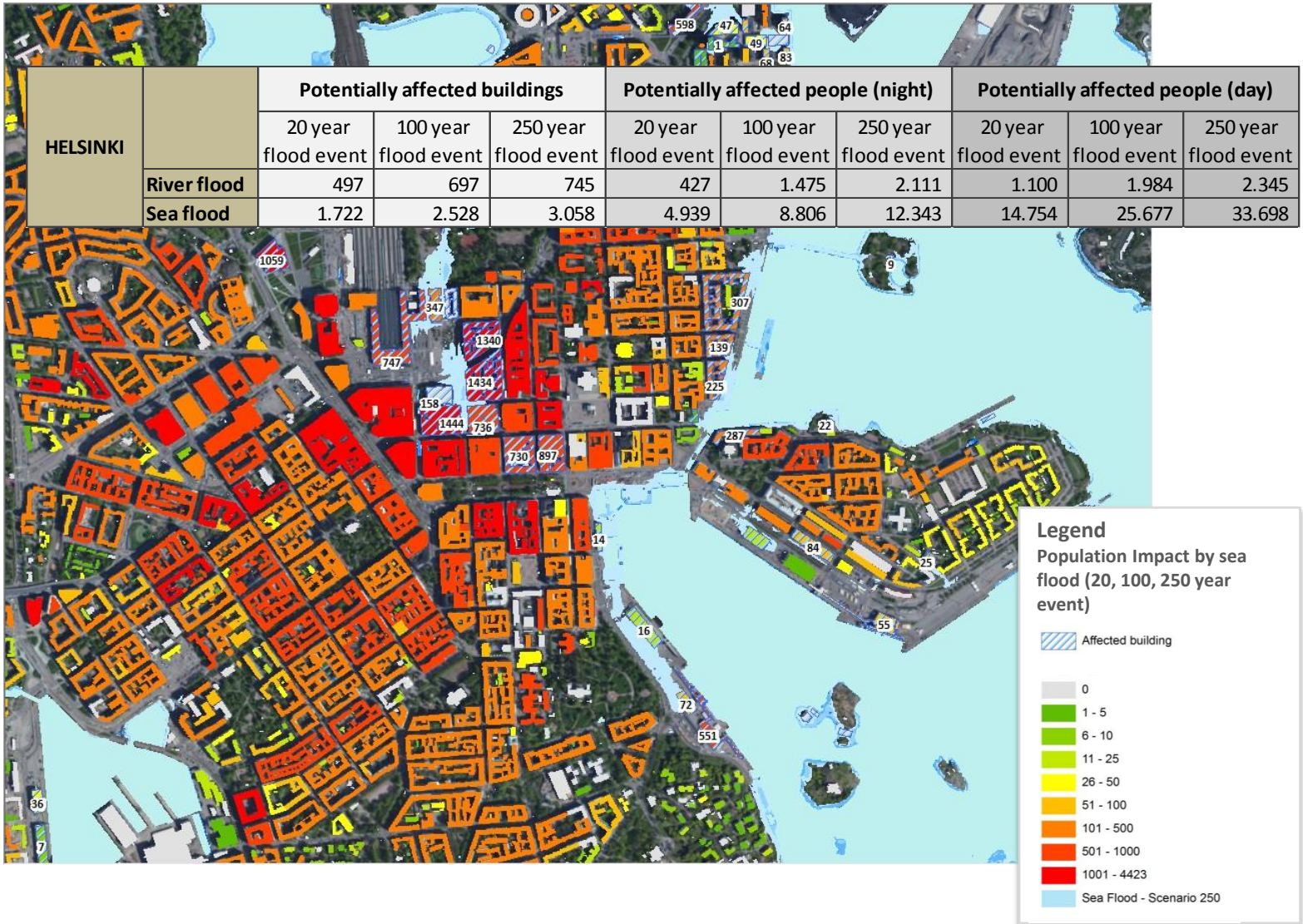




# Population Impact Assessment Service



Sea flood event: 20 - 100- 250 year annuality



## Population Impact Assessment Service

### How are the services used in the cities?

- Innovative dataset is used by the Helsinki City Rescue Department where *“it serves very well the needs of planning and situational management.”*

### Future plans

- Combining the data with the future studies of urban heat island effect and air quality dispersion modelling → exposure/health effect assessments
- The results can be utilized in the **re-visioning of the climate change adaptation policy guidelines** (project starting later this year)



## DECUMANUS services and citizen engagement (some ideas)

- ✓ Engagement of the citizens would be a great resource to further improve the implemented services

### Land Monitoring

- Assess the effectiveness of the final products by performing in situ validation
- Add further value to the generated products by including supplementary key information (type of green roof/tree)

### Energy Efficiency

- Give information about their roof insulation material and by measuring temperature under their roof
- Comment on the reliability of the results and add information

### Population Impact

- Record of movement patterns via mobile APP
- Record citizen actions through phoning, texting, and internet access as well as citizen motion

## Conclusion

- ✓ DECUMANUS services **support the development of a new integrated, hugely more powerful and effective urban governance**
- ✓ Ongoing validation confirmed the **great potential of the services for supporting sustainable urban development strategies** both at district and local level.
- ✓ DECUMANUS tool and methodologies are simultaneously **sources of intelligence, and means of communication, and so perform vital roles in supporting bottom-up engagement** in the planning process as an essential complement of the top-down municipal system of guidance.
- ✓ DECUMANUS has the potential to drive new experiments in the co-design and co-production of plans

**Thank you** for your attention!



**Interested in a tailored solution?**

Then please visit:

[www.decumanus-fp7.eu](http://www.decumanus-fp7.eu) or contact [lemper@geoville.com](mailto:lemper@geoville.com)