Interreg Europe

Co-funded by the European Union

SATSDIFACTION

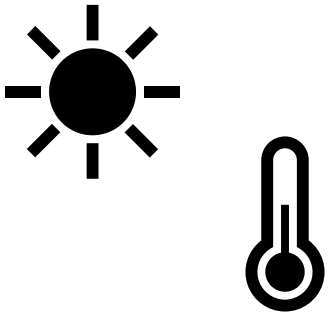
Earth observation and GIS: adaptation tools for urban environments under heat stress

Yasmina Loozen
ISSEP
y.loozen@issep.be

11 September 2025 | Riga

Tirex project Walloon region

Mapping heat health risk in Wallonia



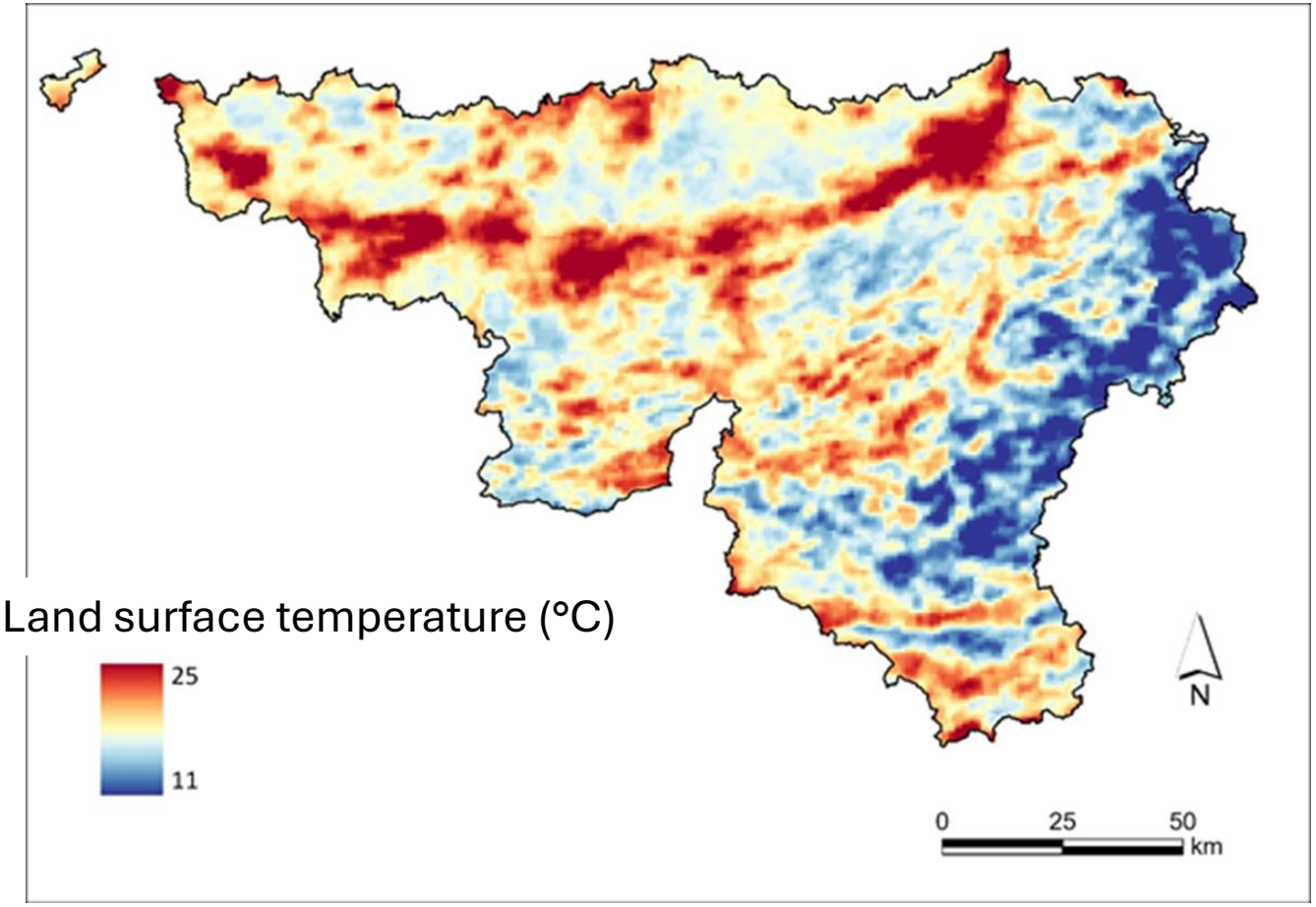
- Heatwaves negatively impact citizens' health
- Worsen chronic conditions: cardiovascular, respiratory and cerebrovascular diseases
- Increase in mortality
    - 2022 heatwave : up to 70.000 premature deaths in Europe
- 75% of Europe's population live in cities

EEA. (2024). *European Climate Risk Assessment*. https://doi.org/10.2800/8671471

Tirex project Walloon region

Mapping heat health risk in Wallonia

- Average surface temperature during a heatwave (2018 – 2023)
- Thermal satellite
- MODIS LST nighttime
- 1 km
- Freely available
- Daily data

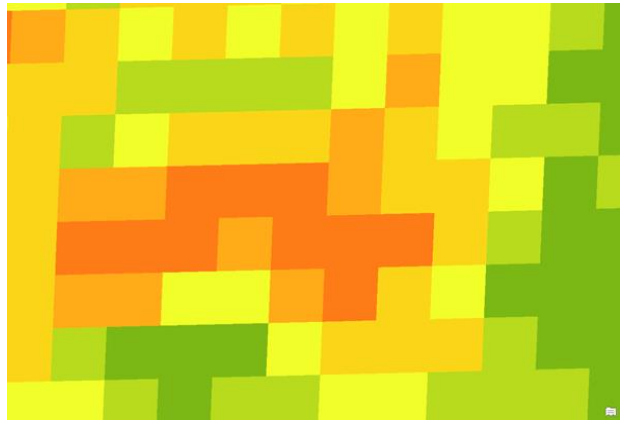


Tirex project Walloon region

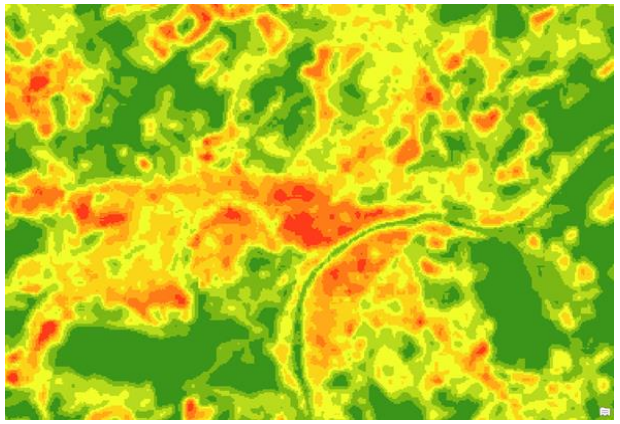
Mapping heat health risk in Wallonia

- Downscaling MODIS LST image using land cover and Landsat
- 1km => 30m

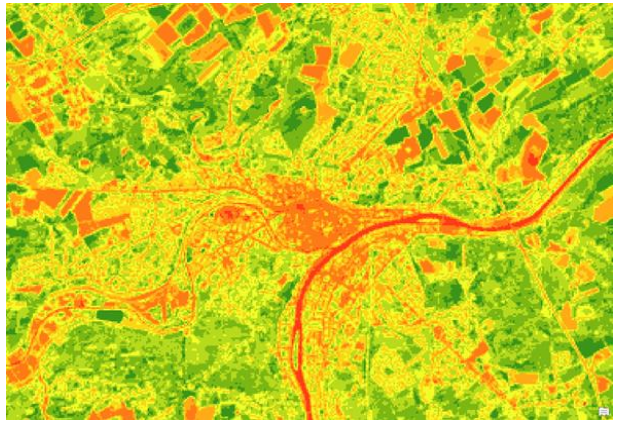
MODIS LST 1km



Landsat 30 m



Downscaled MODIS 30 m



Tirex project Walloon region

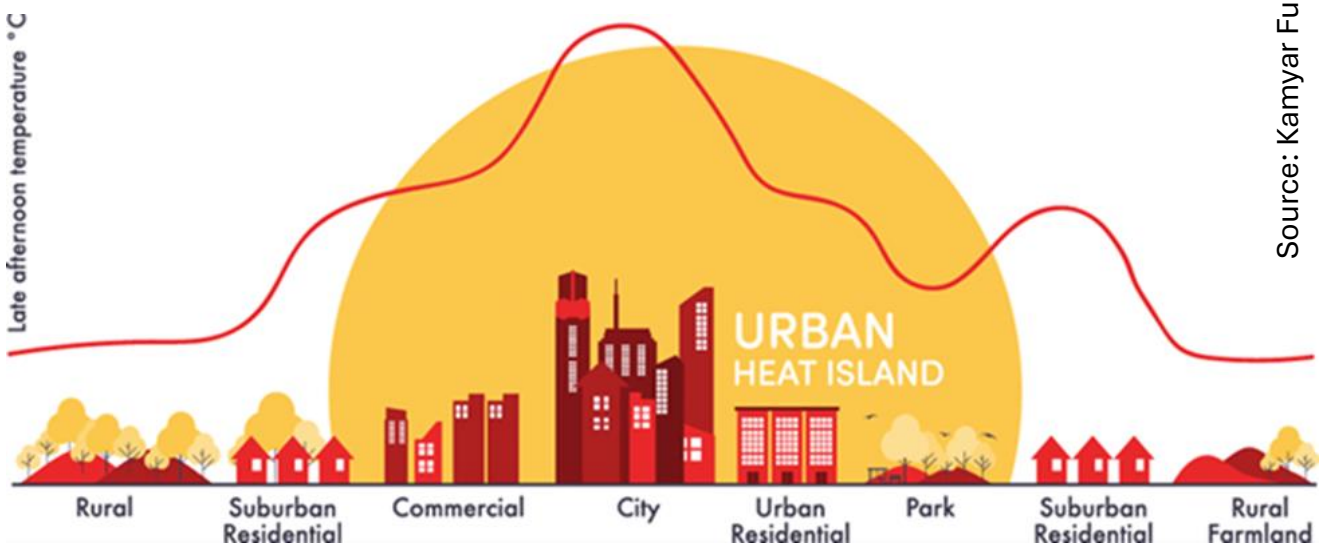
Mapping heat health risk in Wallonia

- Comparison with in-situ temperature data
- Development of low-cost meteorological stations
- Citizen science

Adaptation project Walloon region

Climate risks in Wallonia

- Multi-disciplinary project to assess climate risks and develop practical tools to support climate adaptation
  - Heat hazard and Urban Heat Island
  - Social vulnerability
  - Tree species list

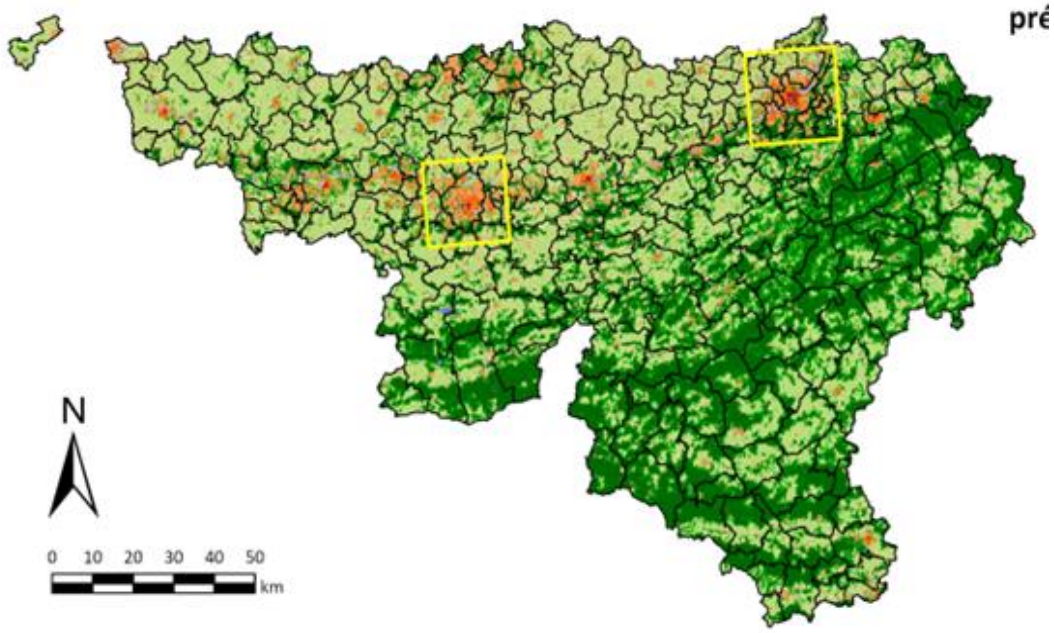


Source: Kamyar Fuladlu

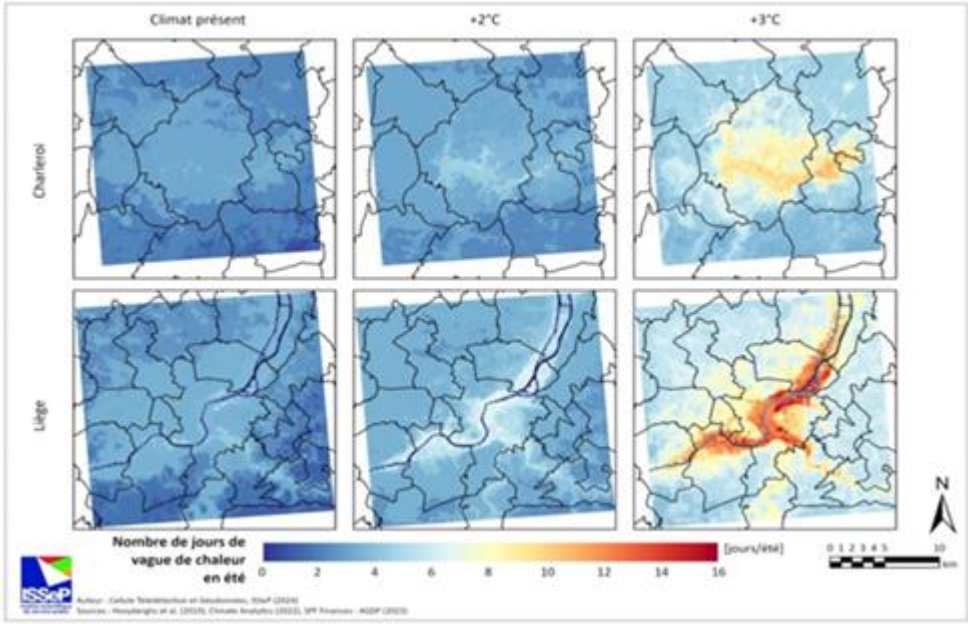
Adaptation project Walloon region

Climate risks in Wallonia – Heat hazard mapping

Local Climate Zones map

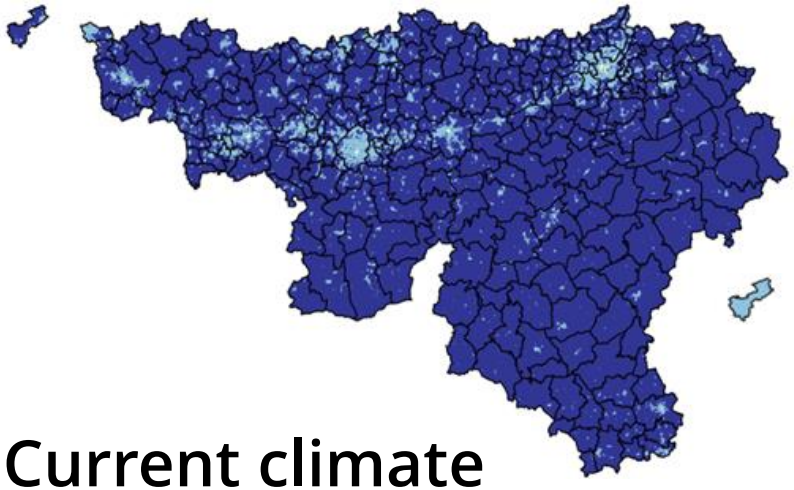


Climate model prediction (UrbClim)



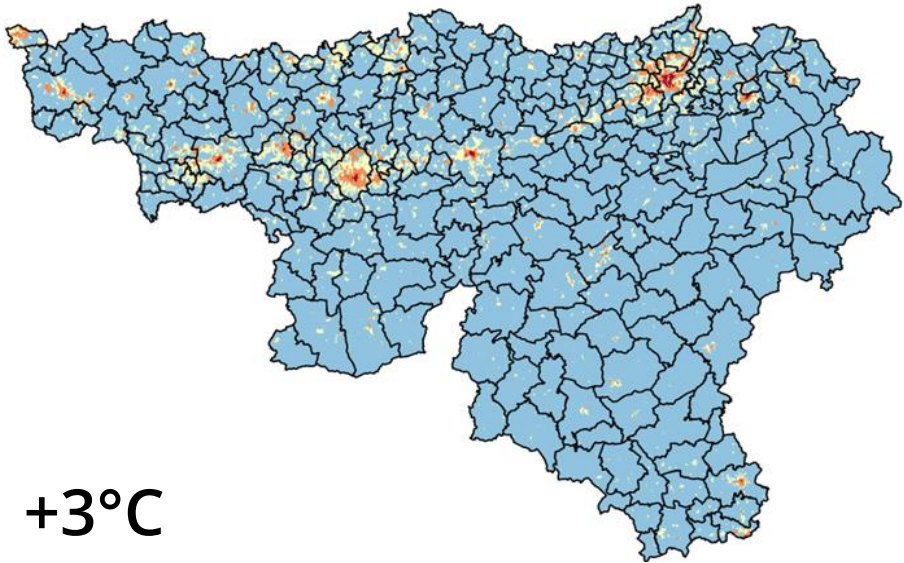
Adaptation project Walloon region

Climate risks in Wallonia – Heat hazard mapping



Current climate

+2°C



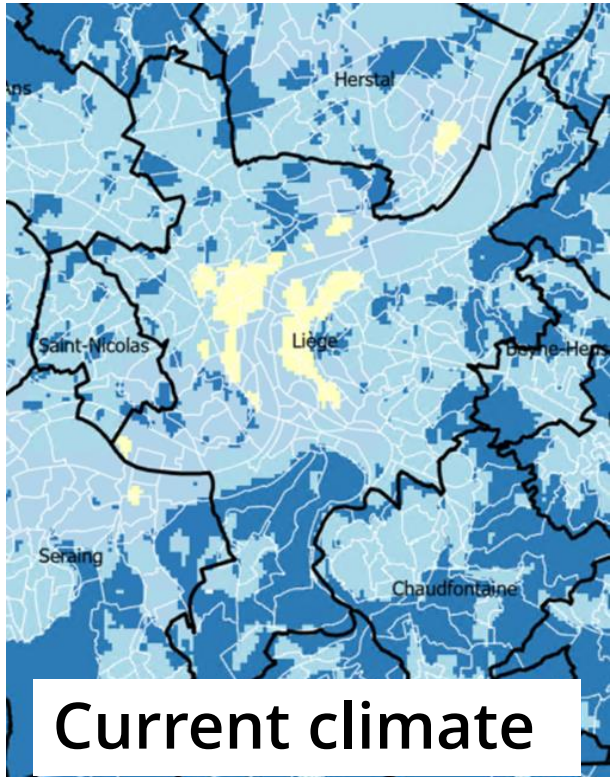
+3°C

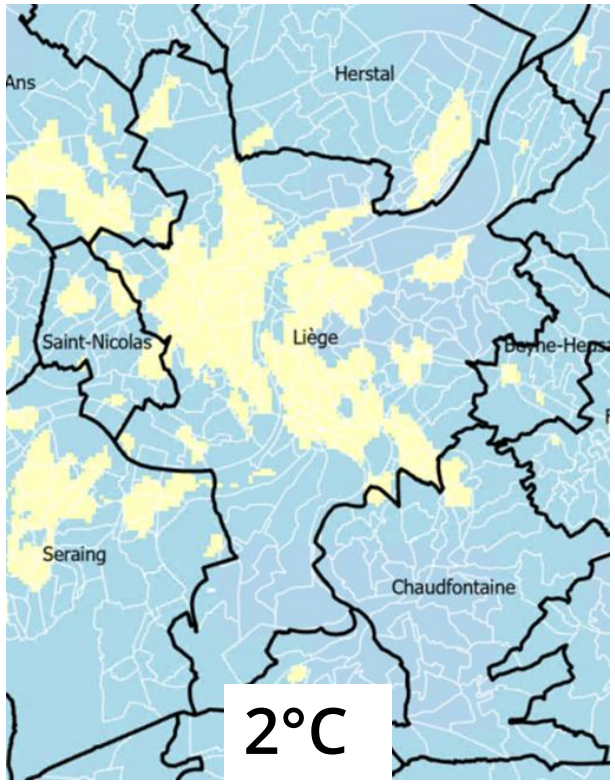
Heat hazard

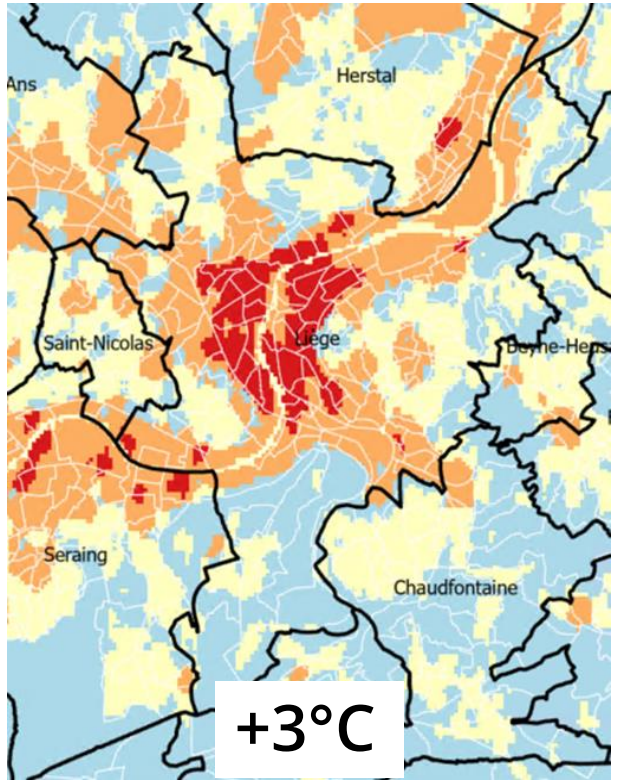
Very low | Low | Moderate | High | Very high

Adaptation project Walloon region

Climate risks in Wallonia – Heat hazard mapping







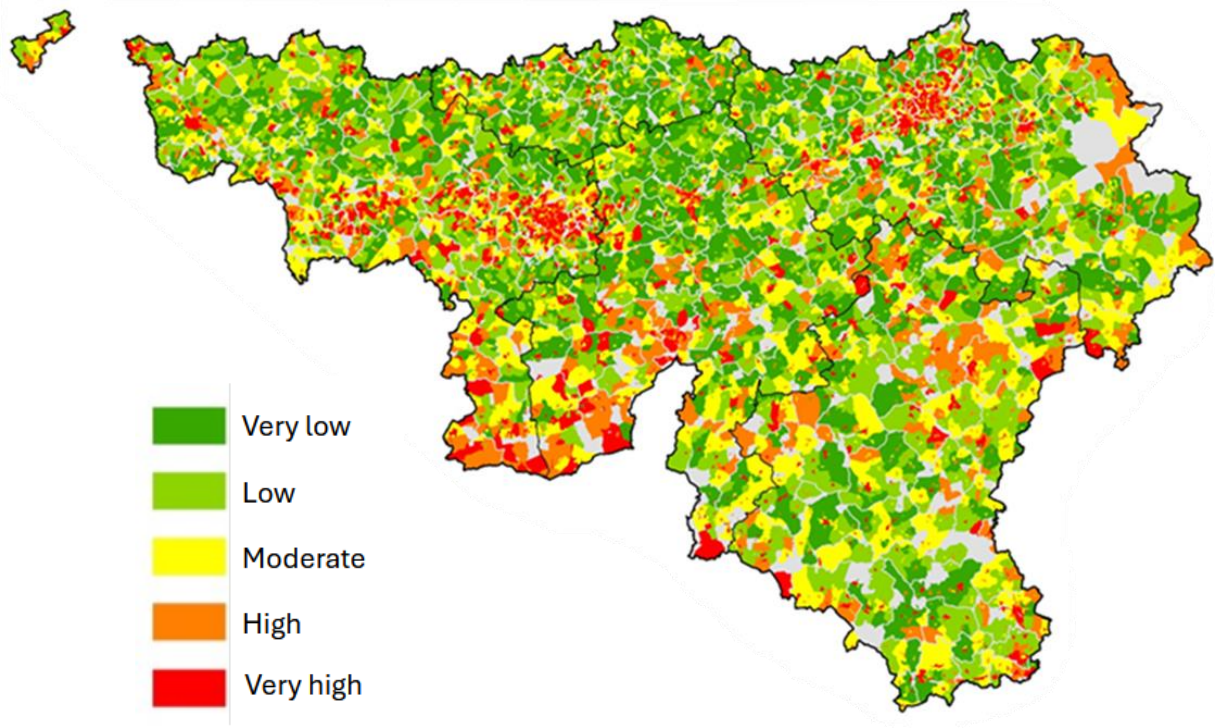
Heat hazard

Very low | Low | Moderate | High | Very high

Adaptation project Walloon region

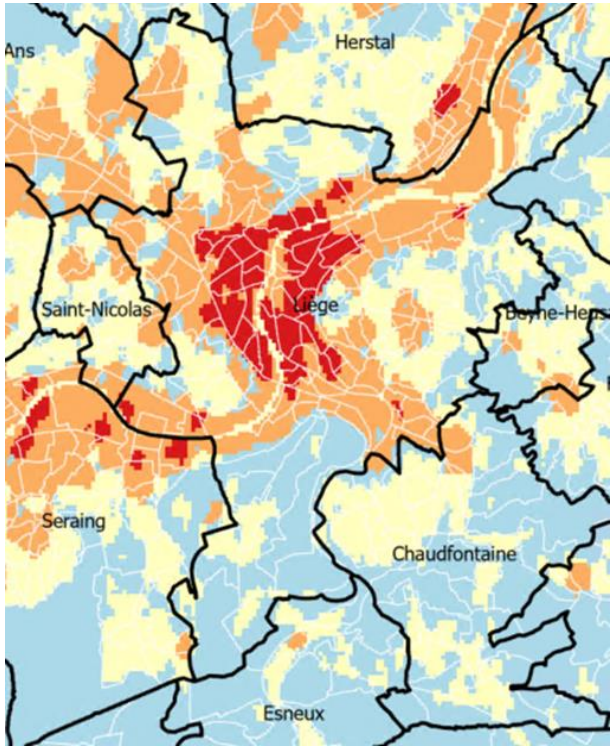
Climate risks in Wallonia – Social vulnerability

- Who is most at risk from climate change impacts ?
- Help to prioritize solutions for adaptation
- Vulnerability depends on multiple factors:
  - Age
  - Chronic disease
  - Social isolation
  - Income & employment
  - Access to healthcare services
  - Access to green-space
  - …

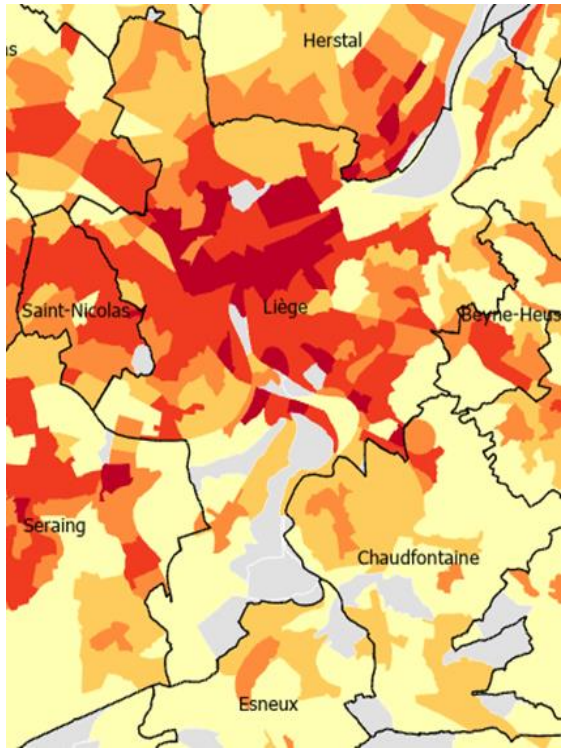


Adaptation project Walloon region

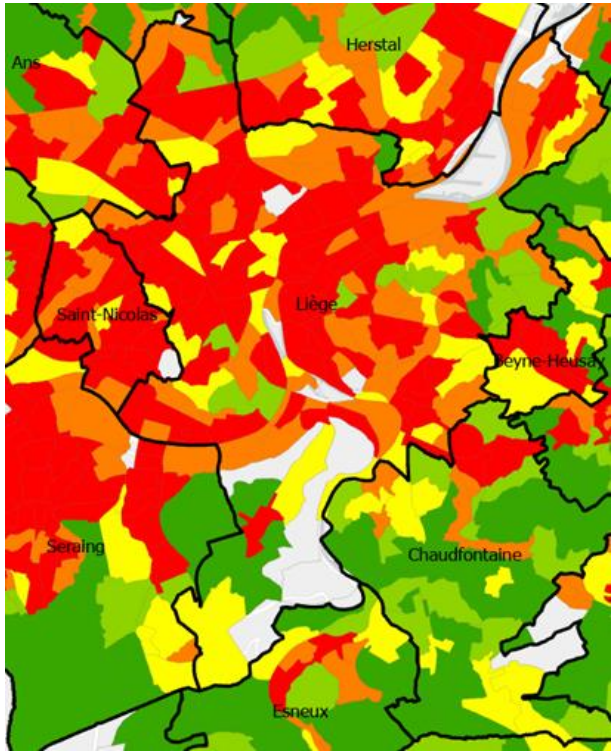
Climate risks in Wallonia – Heat risk



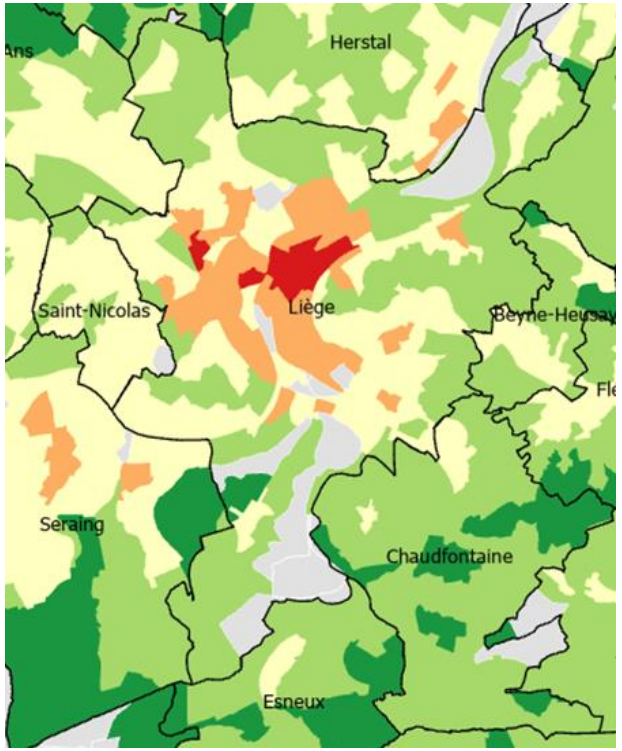
Heat hazard



Population density



Social vulnerability



Risk

Liege Canopy plan

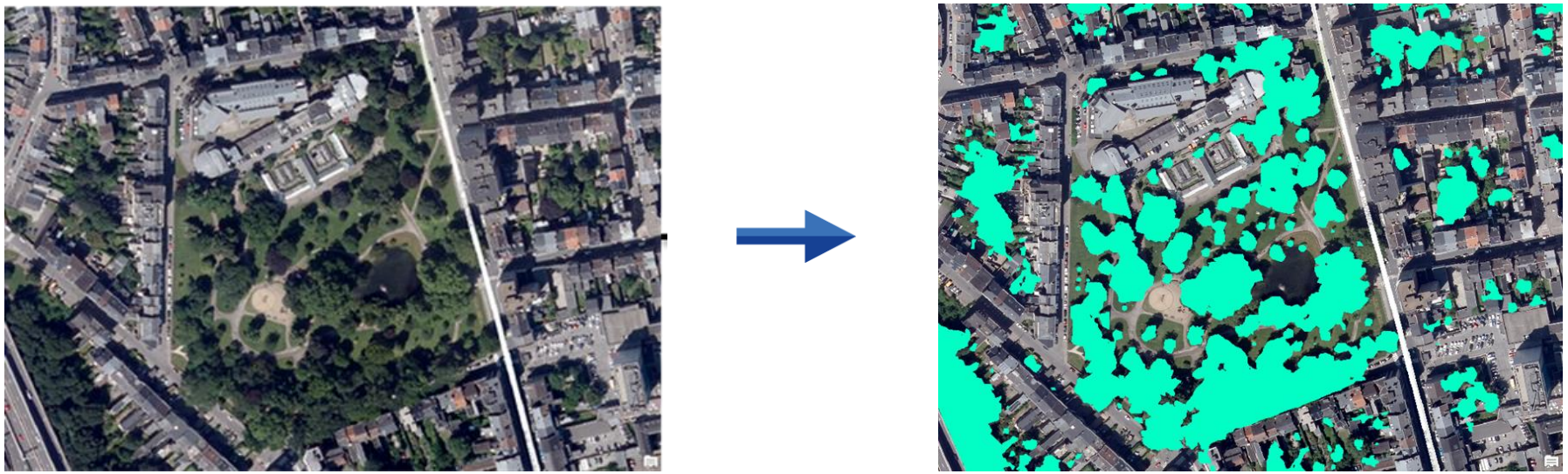
Urban greening by planting trees

- Major citizen survey => citizen support for urban greening
- Urban greening for climate change adaptation
- Fight Urban Heat Island and increase urban resilience
- Ecosystems services

Liege Canopy plan

Urban greening by planting trees

- First step: mapping the canopy cover. Where are the existing trees ?
    - Aerial photographs (25 cm) and geospatial data



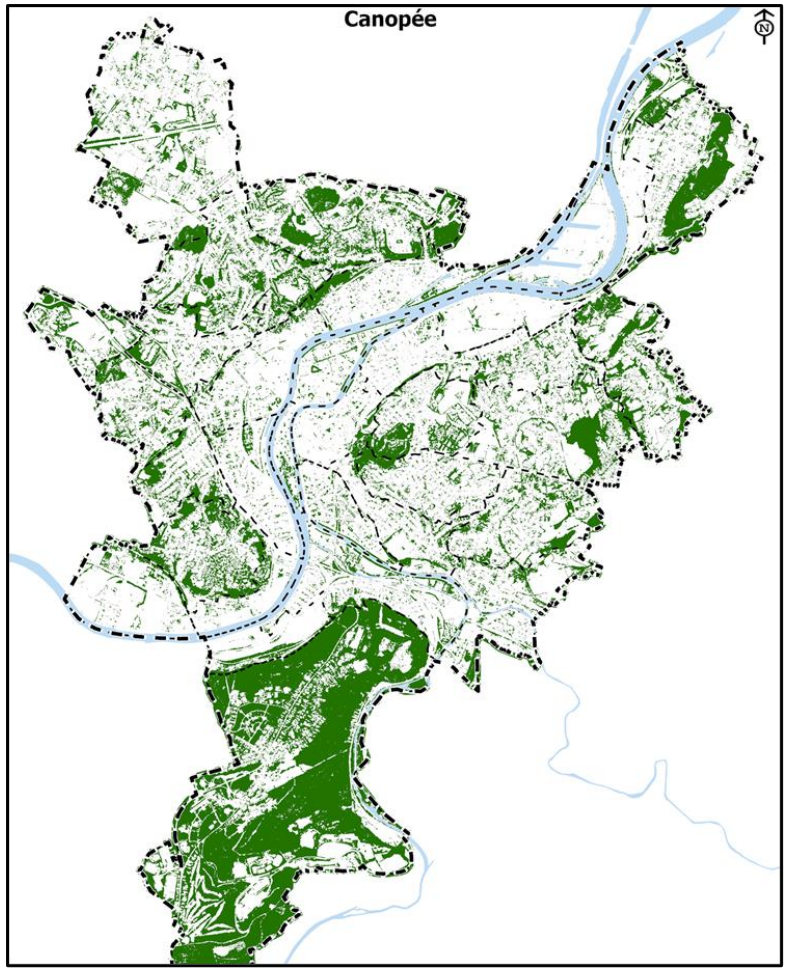
Liege Canopy plan

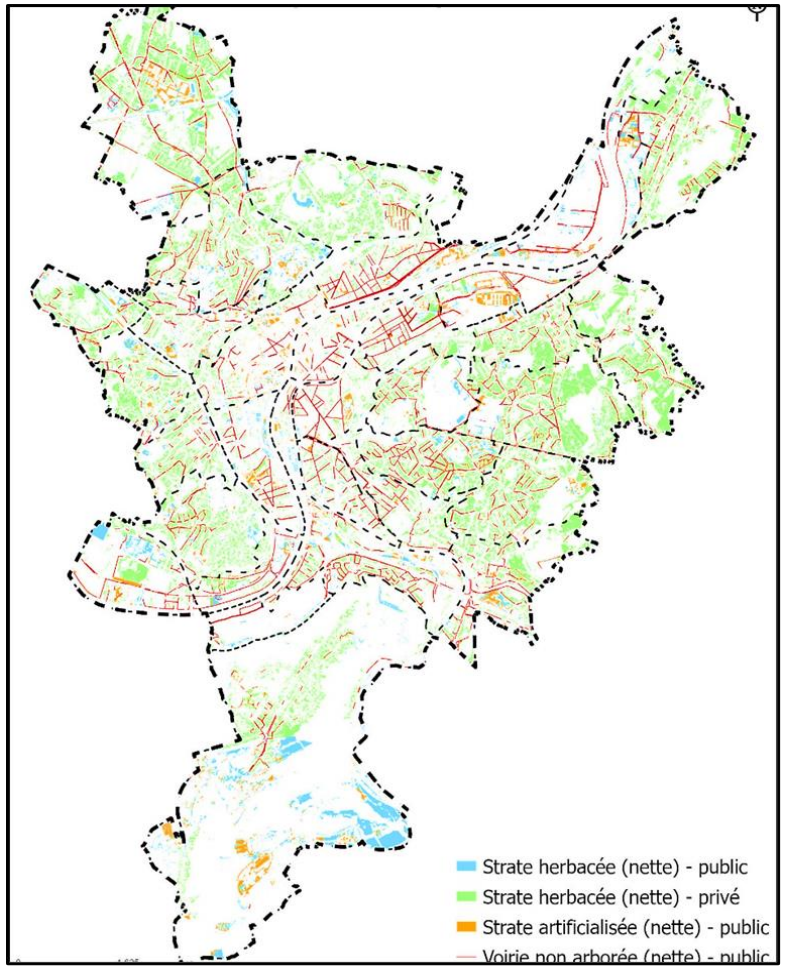
Urban greening by planting trees

- Mapping of the available planting sites:
  - grass
  - artificial surfaces
  - linear road sections

Liege Canopy plan

Urban greening by planting trees

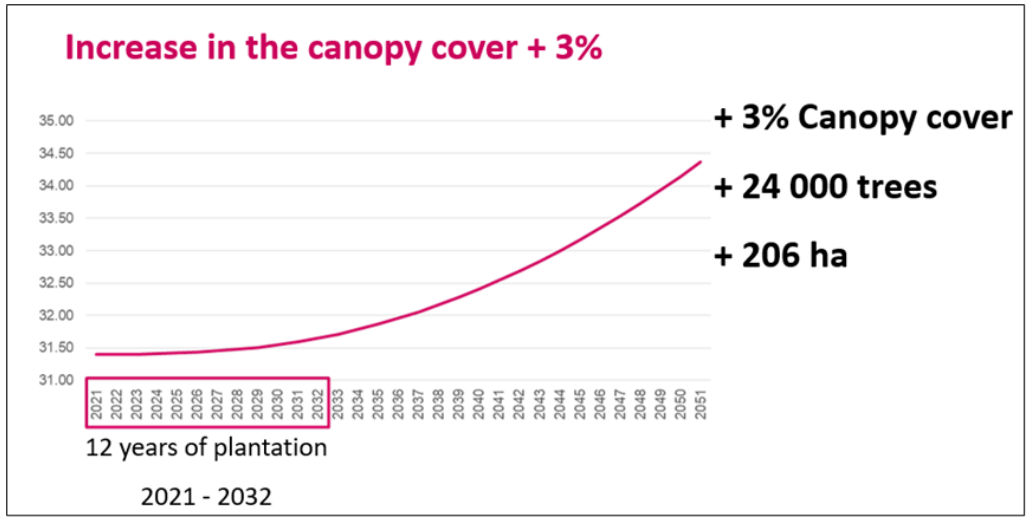


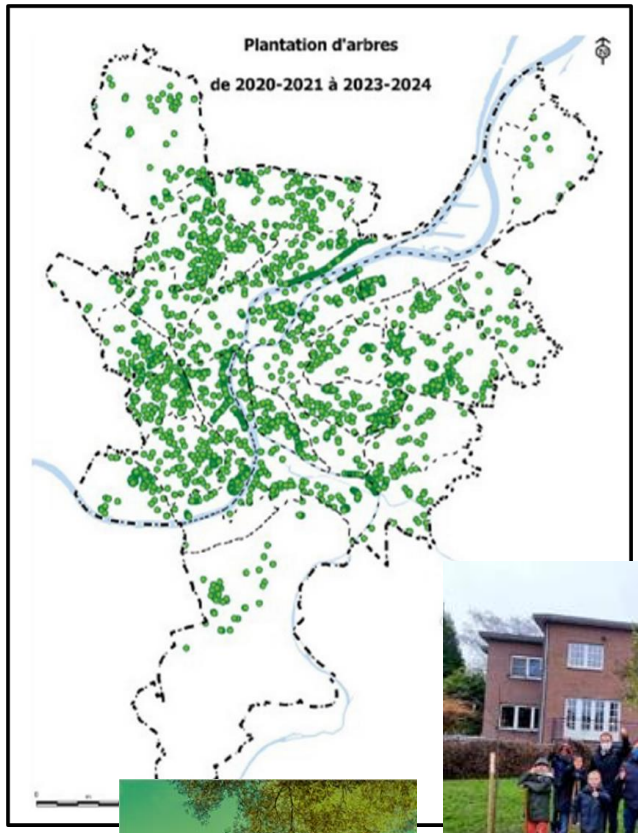


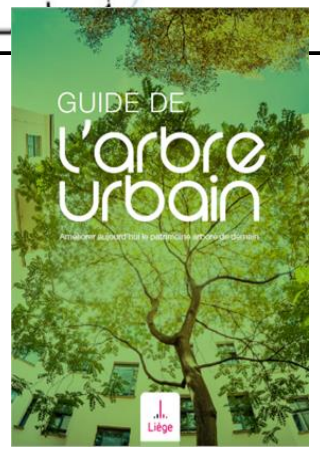
Beaumont, B. et al. (2022). https://doi.org/10.5194/isprs-annals-V-4-2022-243-2022

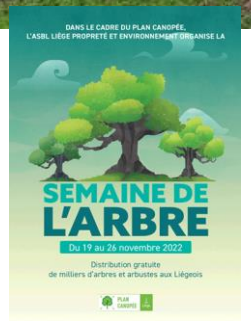
Liege Canopy plan

Urban greening by planting trees









- More than 6000 trees have been planted
- 25% of the goal is achieved

Time for questions

Interreg Europe

Co-funded by the European Union

SATSDIFACTION

From global insights to local actions: Energy transition, change detection and urban greening

François Collette
Geospatial Data Analyst - GIM
francois.collette@gim.be

11 September 2025 | Riga

GIM

Who we are?

Geo solutions for governments, utilities and private companies

- Belgium
- 80 geo-experts
- 750 customers
- Geodata Engineering
- Geospatial AI
- Geo-ICT

www.gim.be

Solar cartography

Evaluate the solar energy production of your home

Simulate cost & return on investment

Input

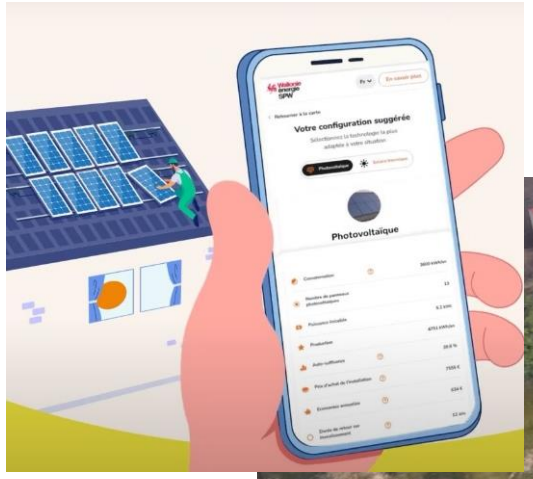
- LiDAR point cloud (6,8 pt/m²)
- 2D building footprints

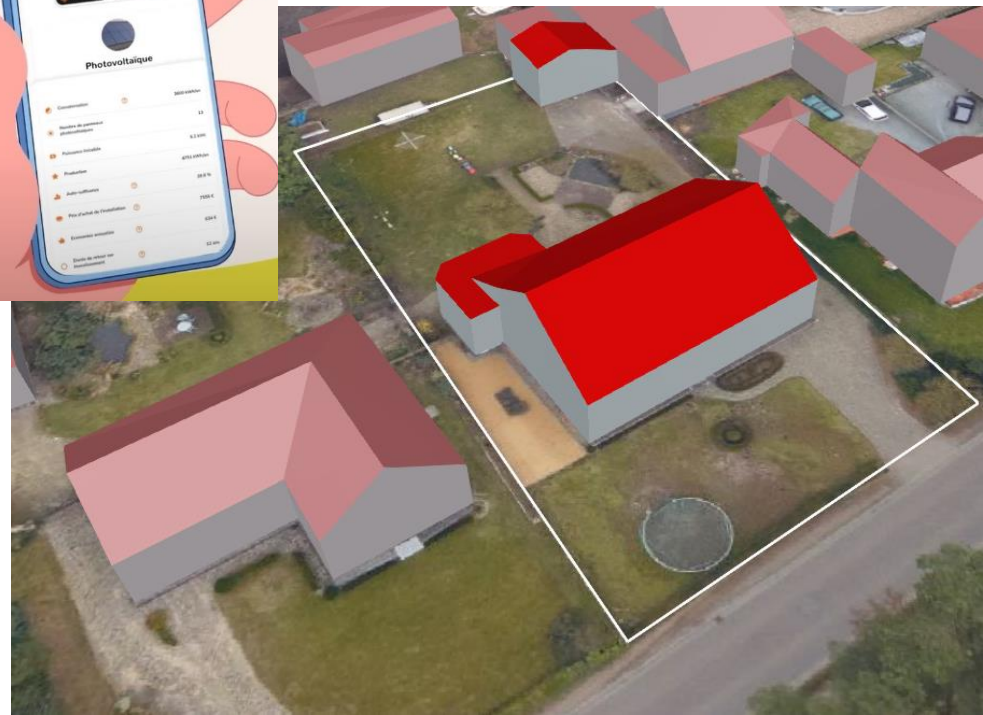
Method

- 3D Reconstruction (Computer Vision)
- Roof orientation
- Mobile web app (UI)

Output

- Quick computation via 3 simple questions
- Fully customized computation on demand
- Cost estimation & payback period
- Certified local installers





Change and object detection

Keeping data up-to-date

IA processing of images

Input

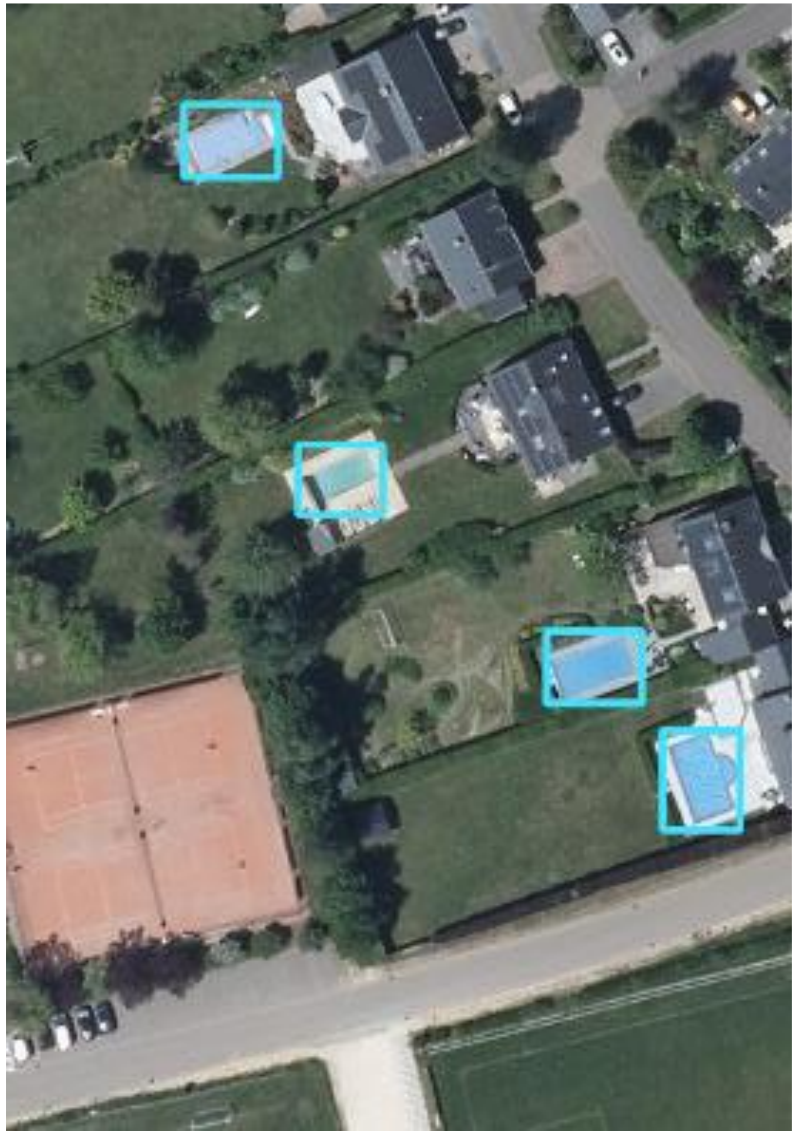
- Orthophoto (4 bands, 25cm GSD, 8-bit)
  - Previous year and current year
- Previous year : Construction inventory

Method

- Deep Learning : Trained on past, executed on current year imagery

Output

- New / removed buildings
- Swimming pools
- Solar panels
- Roof windows
- …



Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

Context

Smartly green the City to…

- Reduce heat islands
- Lower CO_2 emissions
- Promote biodiversity
- Combat pollution
- Enhance quality of life in urban spaces

Objective

- Reach 30% canopy index by 2050

Project area = ± 150 km²

Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

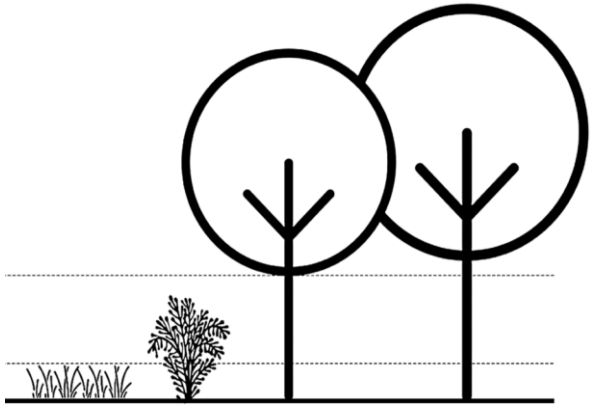
STEP 1 – Current vegetation

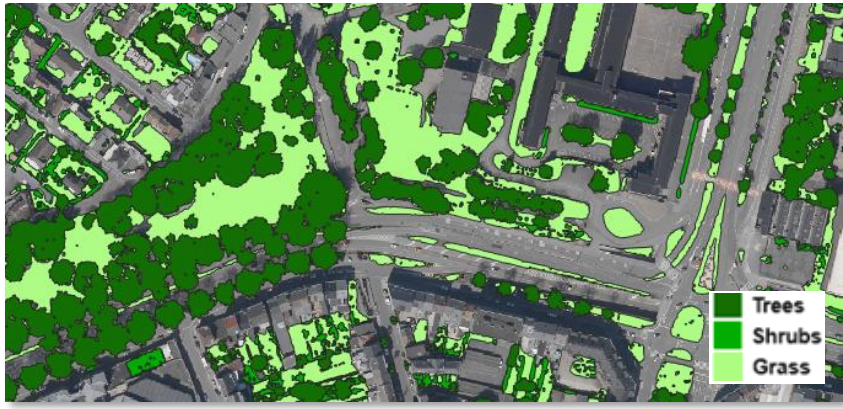
Input

- Orthophoto (4 bands - 25cm GSD - 8-bit)
- LiDAR point cloud (6,8 pt/m²)

Method

- NDVI computation → Vegetation mask
- Point cloud classification





Output

- Vegetation in 3 categories
  - Grass
  - Shrub
  - Trees
- Canopy index = 20%

Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

STEP 2 – Current heat stress

Input

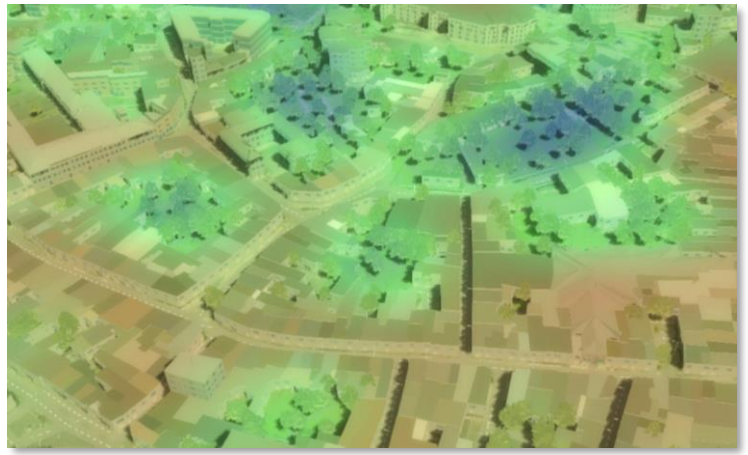
- Current vegetation
- 3D buildings
- Landcover & Land use
- Summer hot day conditions
  - Temperature
  - Sun orientation > Shadows
  - Main winds > Wind-protected areas

Method

- UNESCO model simulation with Tygron

Output

- Heat stress map



Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

STEP 3 – Potential planting locations

Input

- Vegetation
- Heat stress map
- Landcover, Land use, …

Method

1. Finding candidates

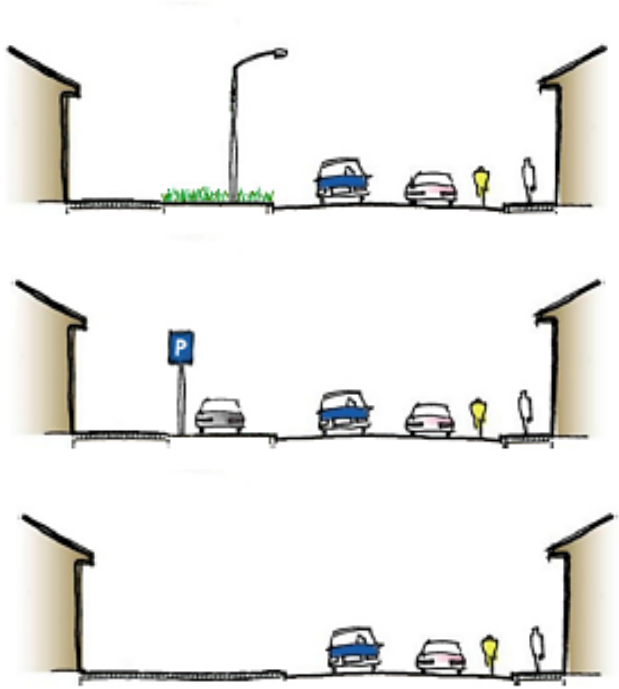
- Ready-to-plan sites
- Sites with sufficient space
- Treeless streets

2. Quantifying interest

- Benefit-cost index

Output

- Potential sites ranked by interest



Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

STEP 4 – Strategy & Action plan

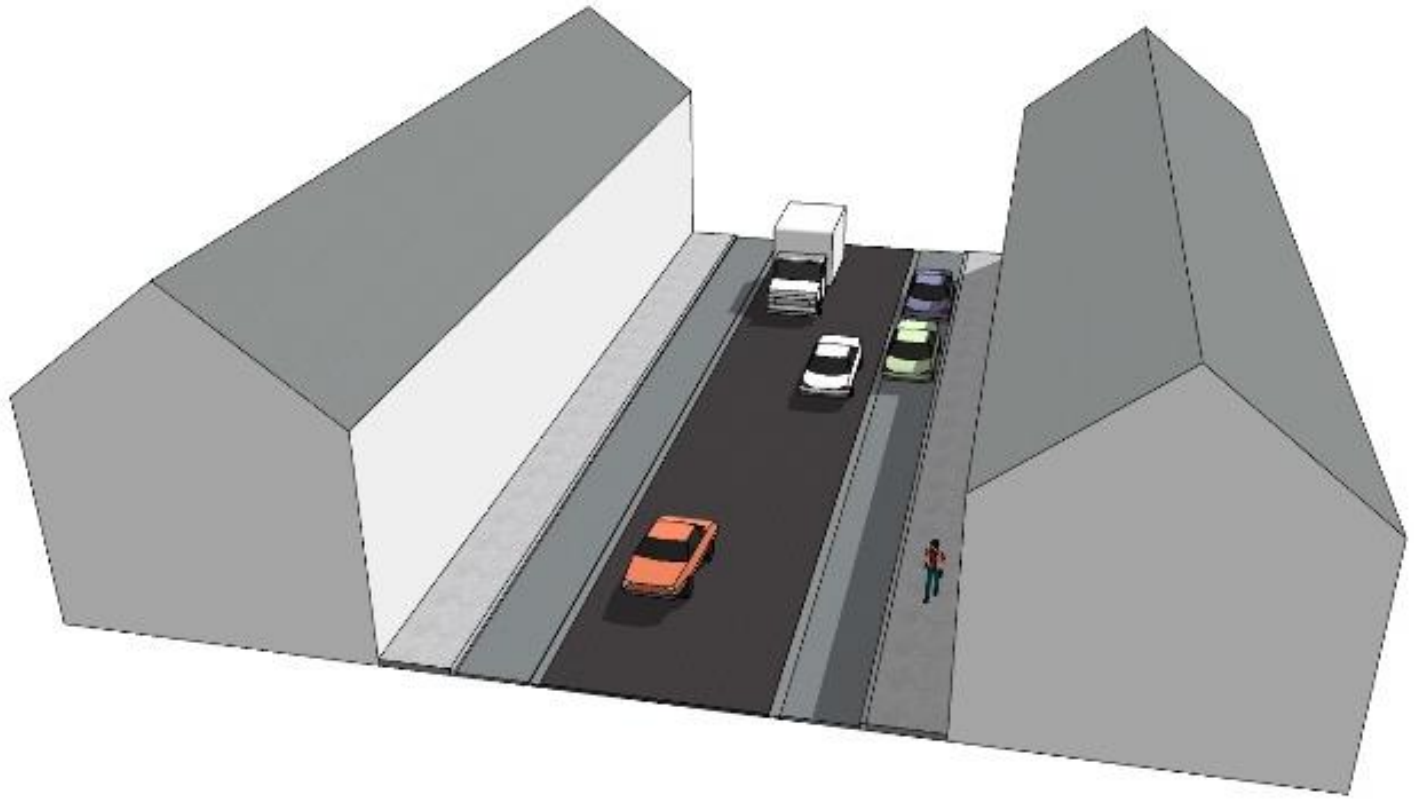
Means of action

Tree plantations

Grass tiles

Vegetalization

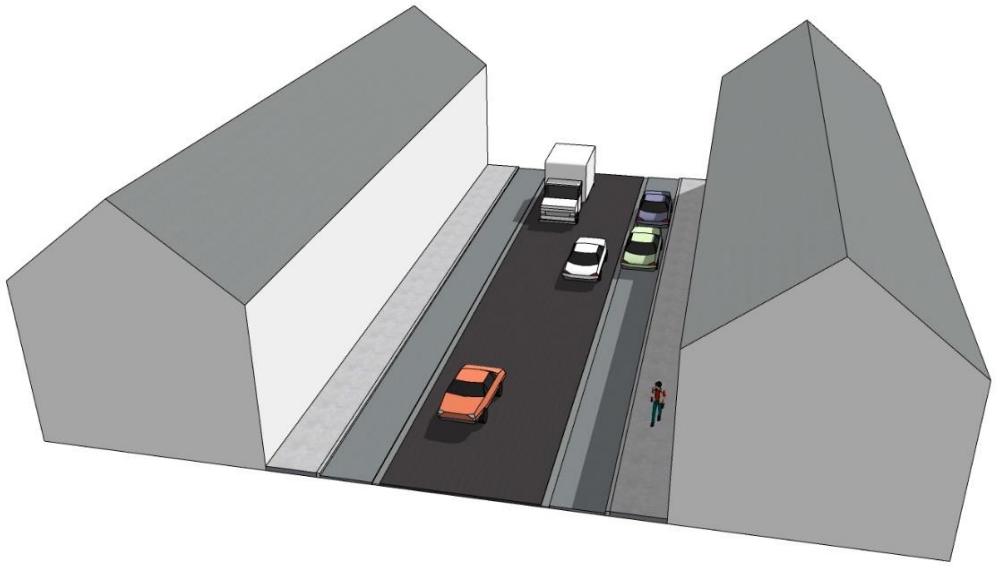
Change of surfacing



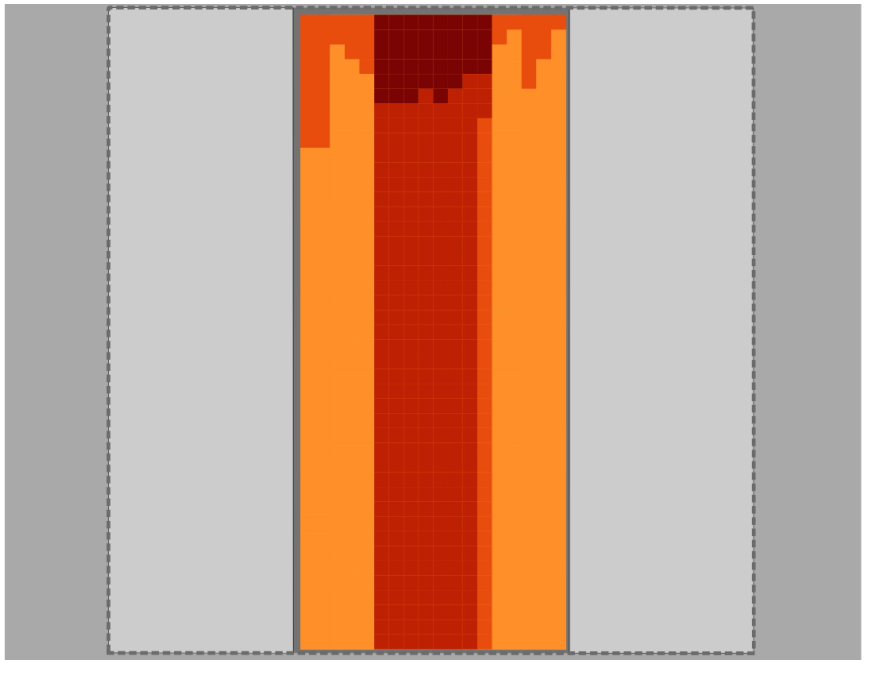
Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

STEP 4 – Strategy & Action plan



Baseline situation

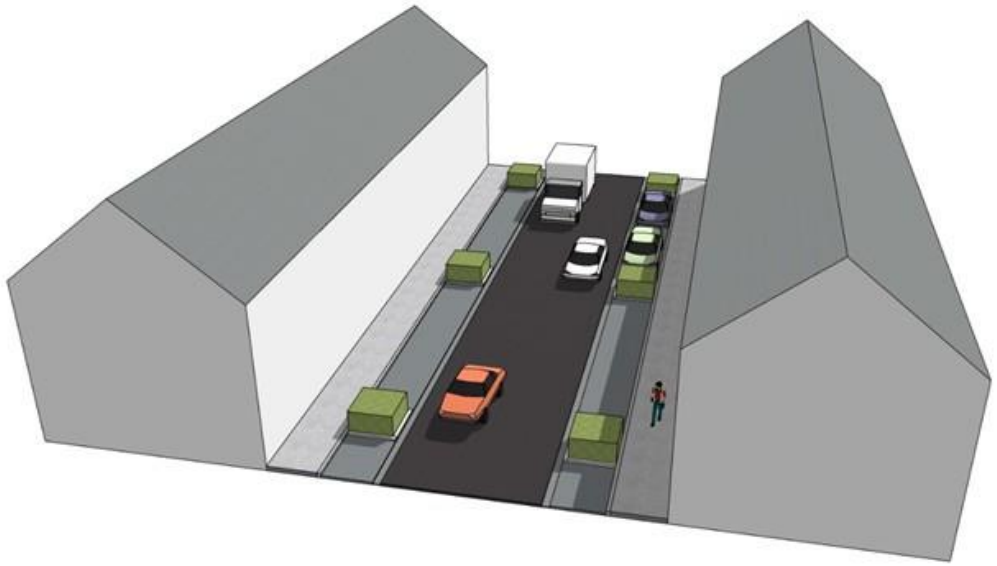


Surface temperature simulation

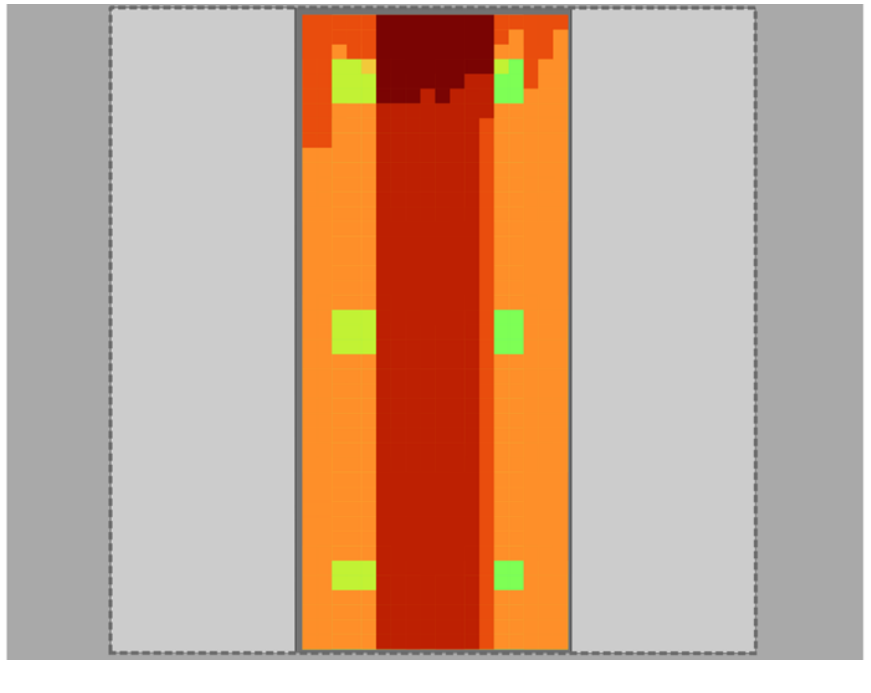
Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

STEP 4 – Strategy & Action plan



Partial vegetalization

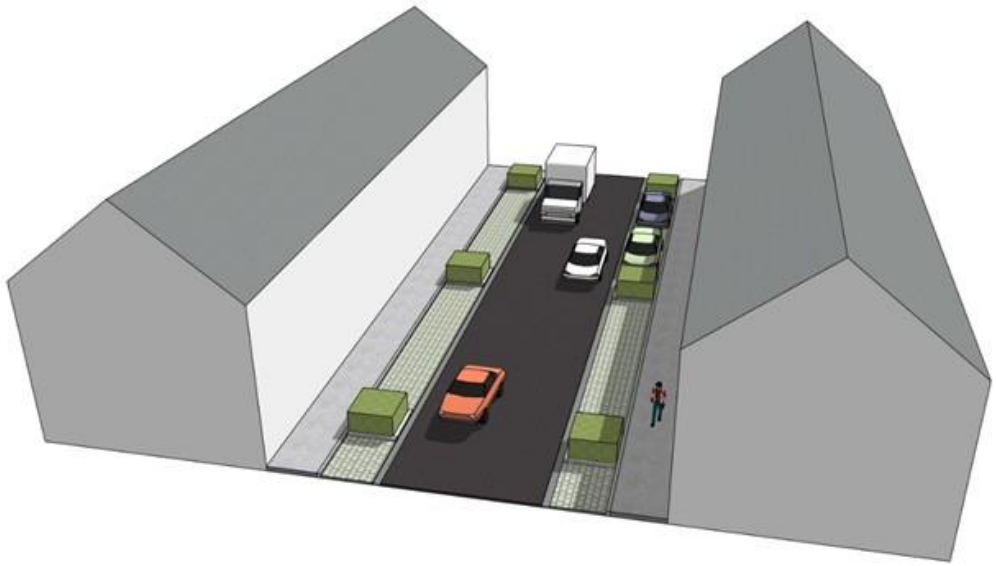


Surface temperature simulation

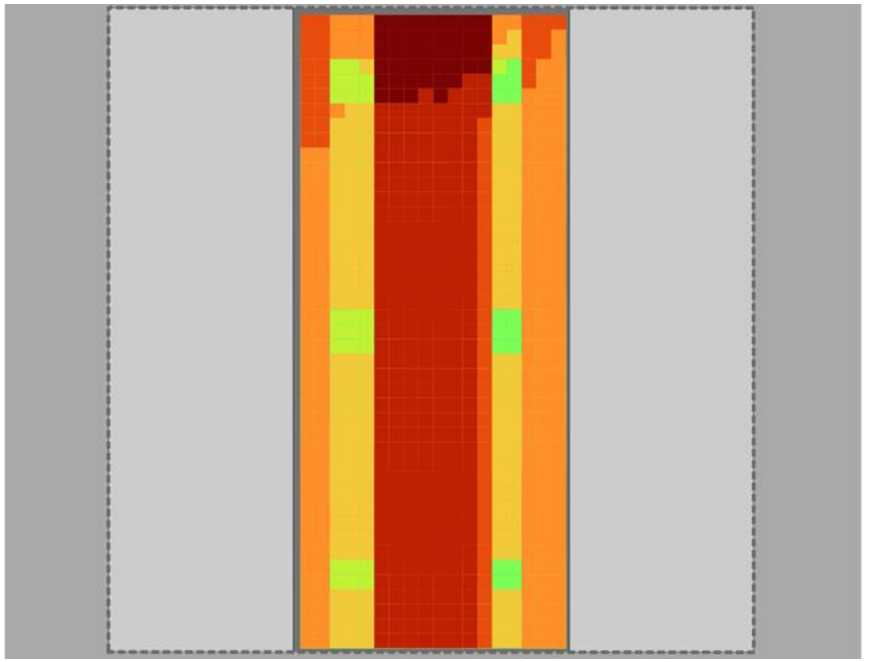
Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

STEP 4 – Strategy & Action plan



Partial vegetalization & grass tiles



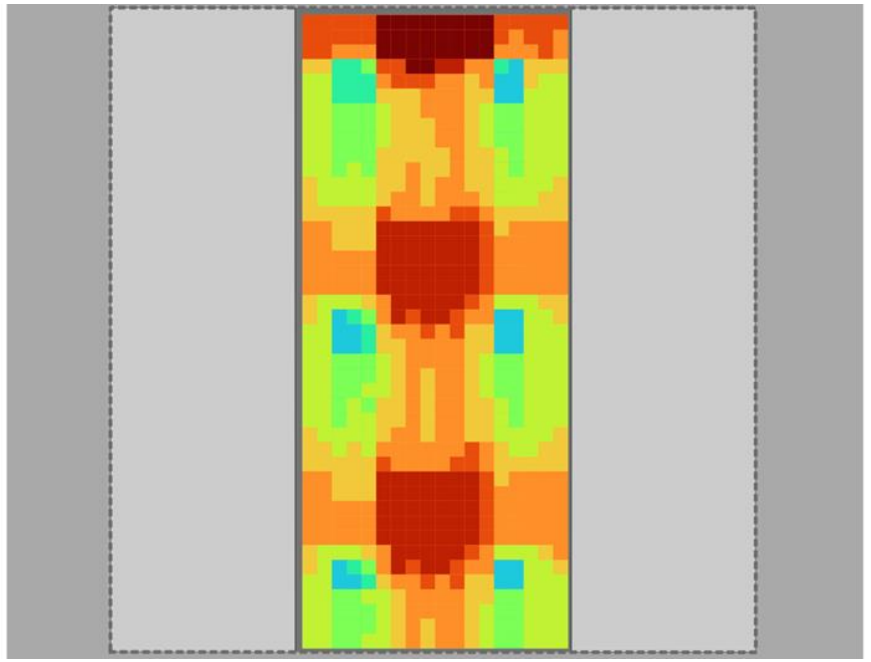
Surface temperature simulation

Mons Canopy Plan

Heat stress mapping to guide urban greening solutions

STEP 4 – Strategy & Action plan

Tree plantations

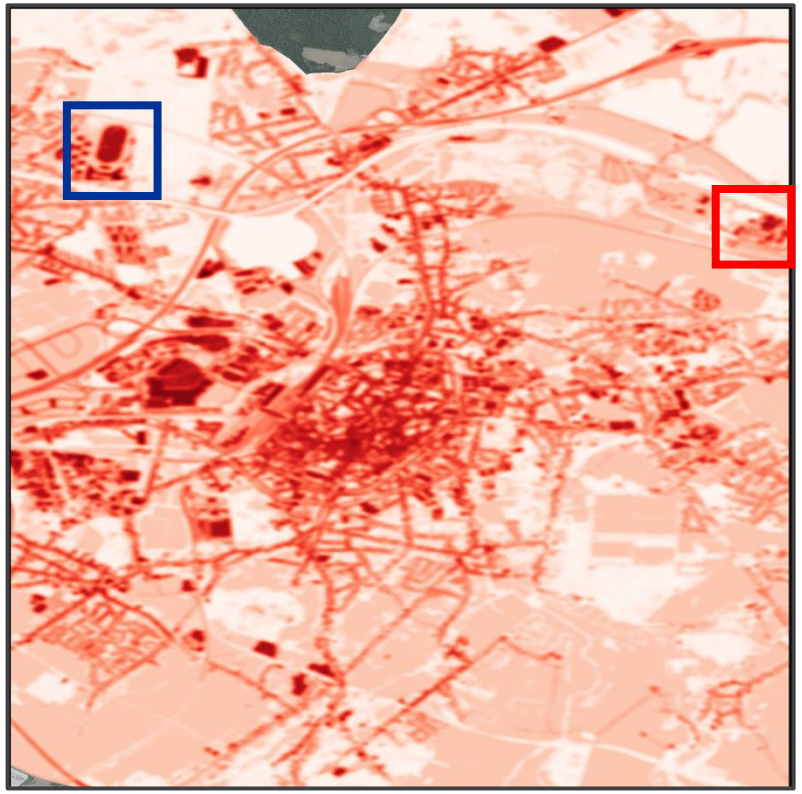


Surface temperature simulation

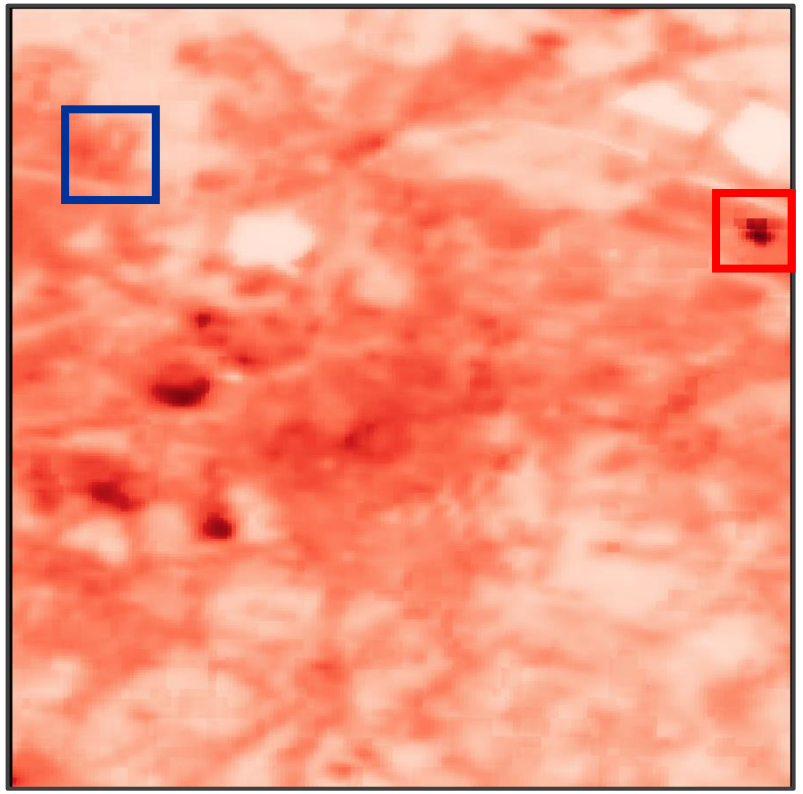
Mons Canopy Plan

Simulation validation with satellite imagery

Landsat 8 – TIRS data



Simulated Physiologically Equivalent Temperature (GSD 1m)



Satellite Land Surface Temperature (GSD 30m)

Mons Canopy Plan

Concretization of intentions

Comprehensive public space redevelopment project

Trees but not only…

Greening of the base of facades

Conversion of mineral surfaces into grassy or shrubby areas

Data limitations & whish list

With those projects

Summary

RGB images / Orthophoto

- Acquisition rate (1x /year)
  - Projects linked to vegetation/crops/… → 1x per season
- NIR band
  - Necessary for most projects
- Pixel size
  - Object detection → The smaller the better

Thermal satellite imagery

- Pixel size
  - Good to validate/calibrate simulations
  - Usually too big for local analysis

LiDAR point cloud (6,8 pt/m²)

- Winter & Summer acquisition

Time for questions

Thank you!

www.interregeurope.eu/SATSDIFACTION