Interreg Danube Region

Co-funded by the European Union

SpongeCity

SpongeCity

Improving urban climate change adaptation capacities by testing and promoting the ‘sponge city’ methodology on transnational level

Progress in the past 11 months

Balázs Borkovits, project coordinator, University of Pécs

EUSDR – National Hearing

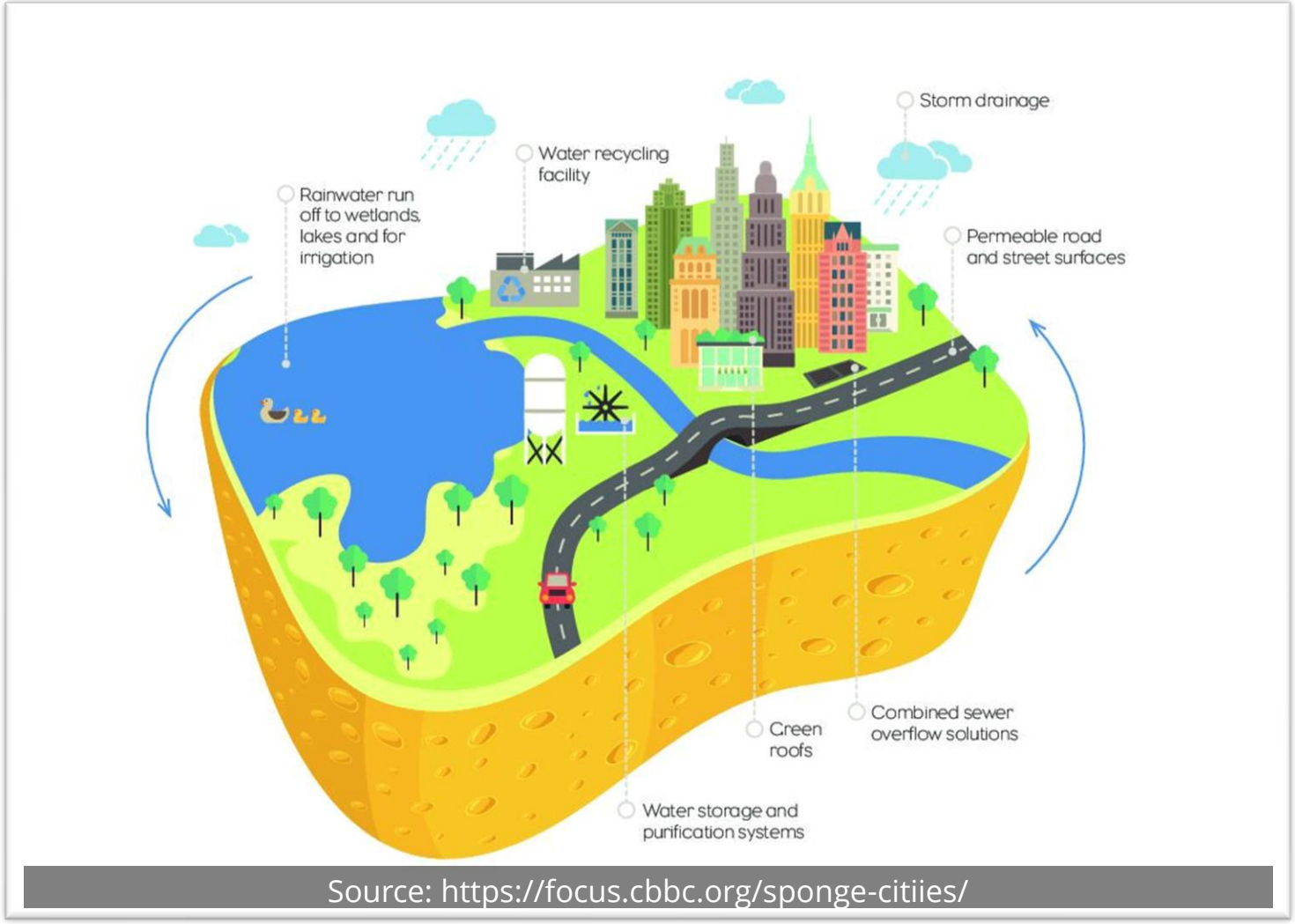
03/12/2024, Budapest

A MISSION

supporting DR settlements with research results, planning capacities and tools, transnational links

The concept

A **sponge city** is an urban area, which has been designed to cope with excess rainfall using a variety of techniques. It mitigates/prevents urban floods by providing the area with the ability to **naturally absorb the water**. It reduces the extent of impermeable surfaces and increases the amount of absorbent land: green surfaces, green walls, bioswales, inner-city lakes, rain gardens, permeable pavements. Supplementing this approach with **channeling and storage** systems also helps to counter water shortages.



Source: https://focus.cbbc.org/sponge-citiies/

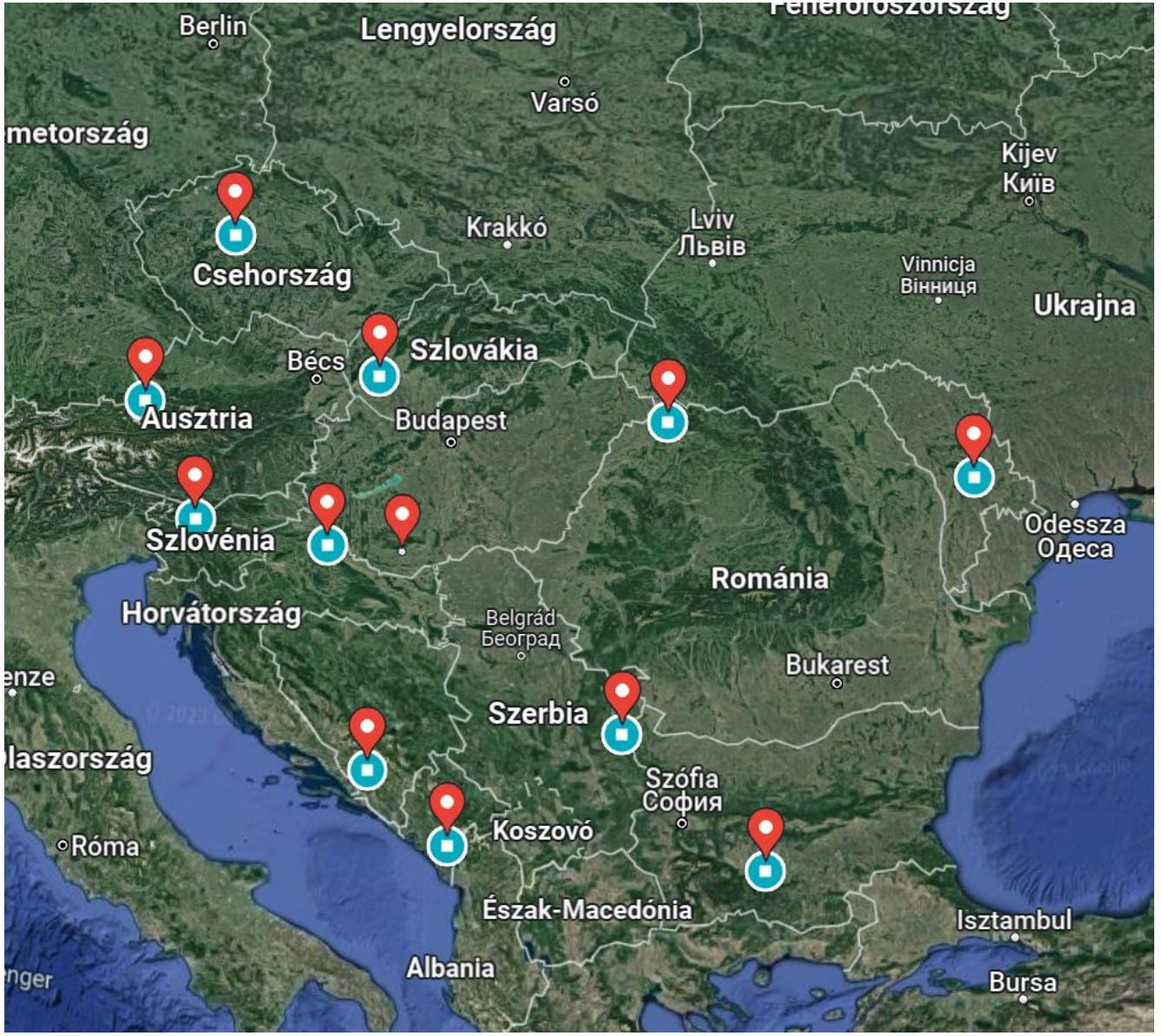
Partner	Country	Type
University of Pécs	HU	Higher Education
Koprivničke vode, Koprivnica	CR	Enterprise
Paris Lodron University, Salzburg	AT	Higher Education
BSC Kranj Regional Development Agency of Gorenjska	SI	Sectoral Agency
Prague 9th District (EUDA)	CZ	Local PA
University of Ss Cyril and Methodius	SK	Higher Education
University of Mostar	BiH	Higher Education
Municipality of Chisinau	MD	Local PA
Regional Development Agency Eastern Serbia	RS	Sectoral Agency
ASPECT-Management and Intercultural Relations	BG	Sectoral Agency
Capital City Podgorica	MNE	Local PA
Satu Mare County Intercommunity Development Association	RO	Sectoral Agency
E-Zavod	SI	Sectoral Agency

Udruženje za tehnologiju vode i sanitarno inženjerstvo	RARIS
Poslovno udruženje komunalnih preduzeća KOMDEL	RARIS
Međunarodni centar za istraživanja i obuku o urbanom odvodnjavanju, Univerziteta u Beogradu	RARIS
Grad Zaječar	RARIS
danube connects das magazin für die donauländer	PTE
Agencija za vodno područje Jadranskog mora	SUM
Orașul Livada	ADISM
Pécsi Városfejlesztési Zrt	PTE
Grad Koprivnica	KC VODE
Община Пловдив	ASPECT
Kék Bolygó Klímavédelmi Alapítvány	PTE
Országos Vízügyi Főigazgatóság	PTE
Salzburg Land	PLUS
City of Trnava	UCM
Trnavský samosprávy kraj	UCM
Obec Tomášikovo	UCM
Občina Tržič	BSC KRANJ
Regionalni razvojni svet Gorenjske	BSC KRANJ
Stadt Salzburg	PLUS
Grad Mostar	SUM

Target settlements

- **<u>Two large cities</u>:** Chisinau (670,000), Plovdiv (343,000)
- **<u>Four medium-sized cities</u>:** Pécs, Salzburg and Podgorica (ca.150,000) and Mostar (113,000)
- **<u>Five smaller cities/districts</u>:** Koprivnica (31,000), Prague 9 (50,000), Trnava (65,000), Zajecar (59,000)

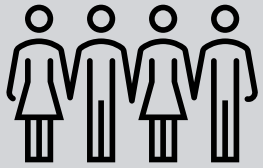
  Livada (5000), Tržič (3670)



The process

1

Building local and transnational communities

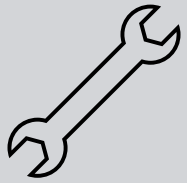


2

Analysing features and current management approaches

3

Providing toolkit for local decision makers



4

Testing the tools, main-streaming results

Results of period 1

DR network: 166 settlements have been involved
Taking part at trainings, feedbacks for toolbox

Regional stakeholder meetings: 19 meetings have been organised

Geographical survey of the involved settlements
Elevation, topography, annual precipitation, heavy rainfall events, flash floods, water scaricity, expectations, soil texture, sealed surfaces

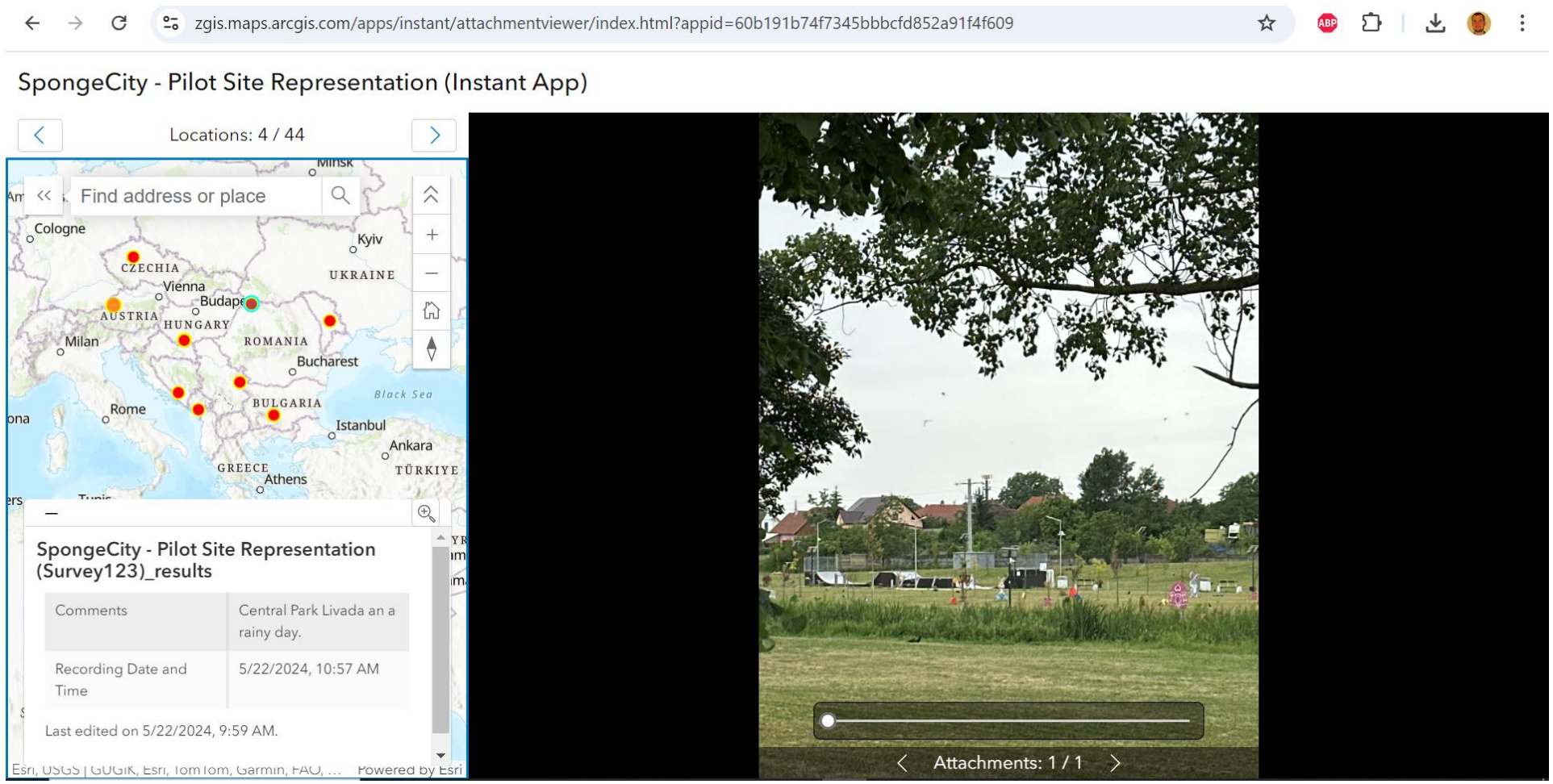
Infrastructural survey of the involved settlements' water management characteristics: sewage system, cleaning infrastructure, pumping stations, inhabitants, stormwater directed to sewage plant – overflows, drinking water network and wells, water level changes, groundwater depletions, rainwater network, water retention

All pilot settlements have been mapped.

Results of period 1

https://zgis.maps.arcgis.com/apps/instant/attachmentviewer/index.html?appid=60b191b74f7345bbbcfd852a91f4f609

Pilot site representation



Toolbox

https://spongecity.sen2cube.at/

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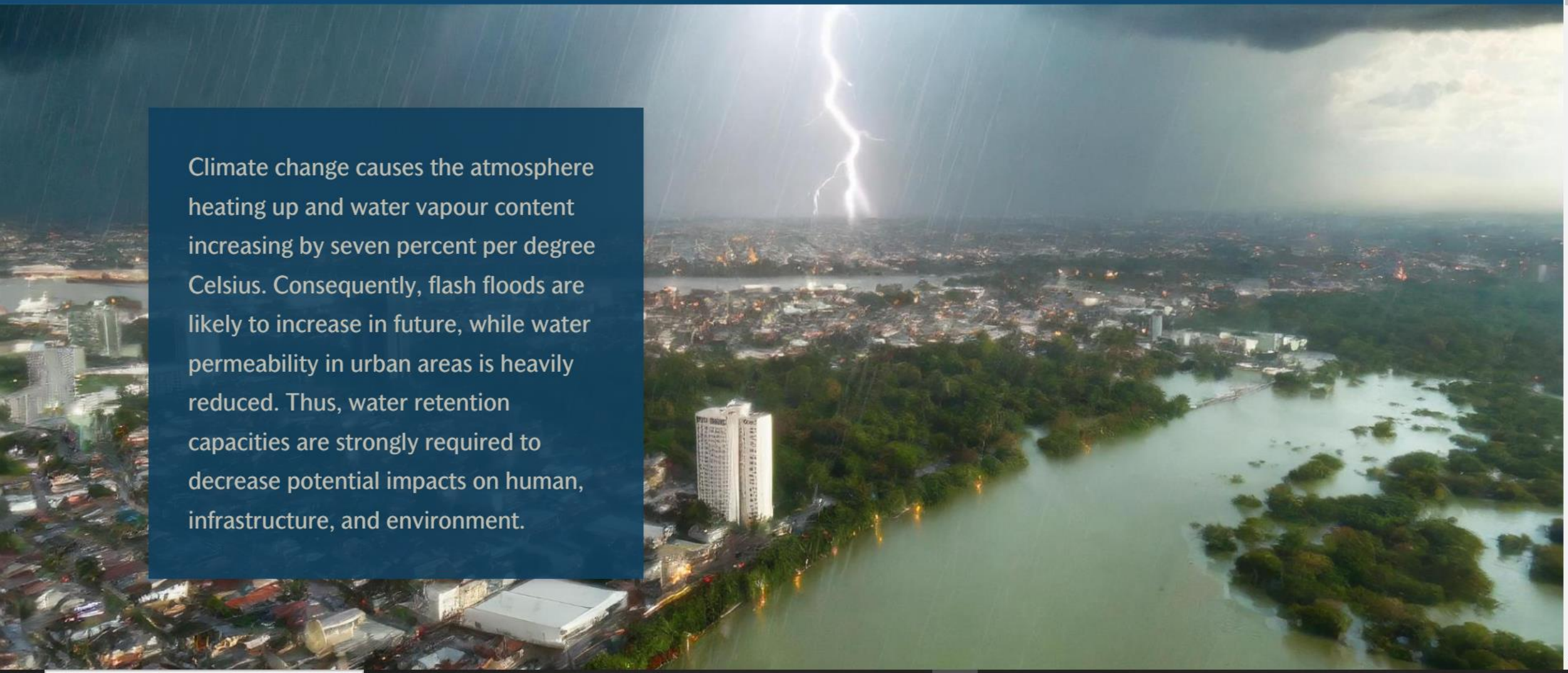
Analysing water retention capabilities in urban areas with Earth Observation tools

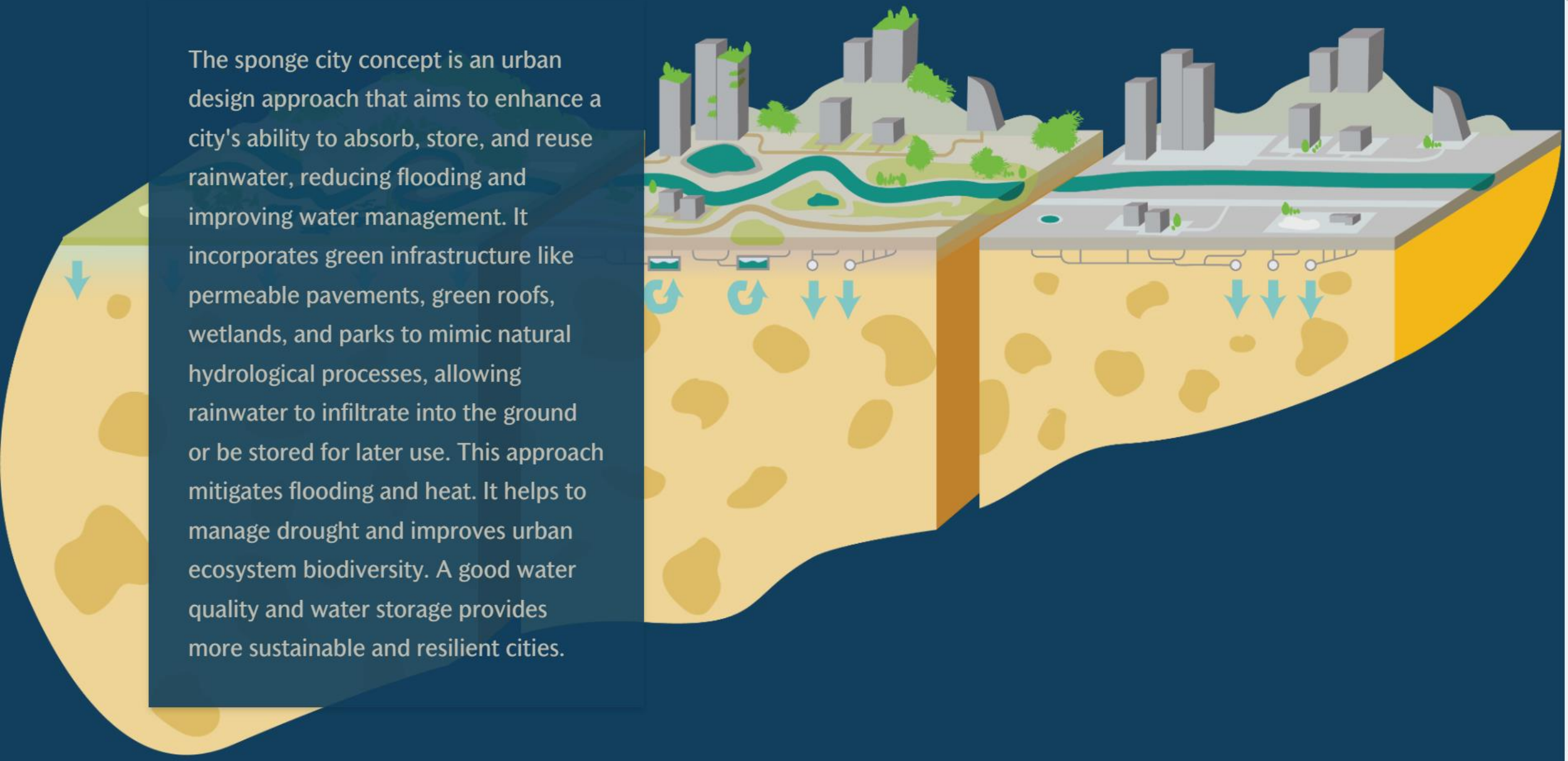
Dirk Tiede, Martin Sudmanns, Thomas Strasser, Nyi Nyi Nyan Lin, Yana Nikolova, Hermann Klug

21 October 2024

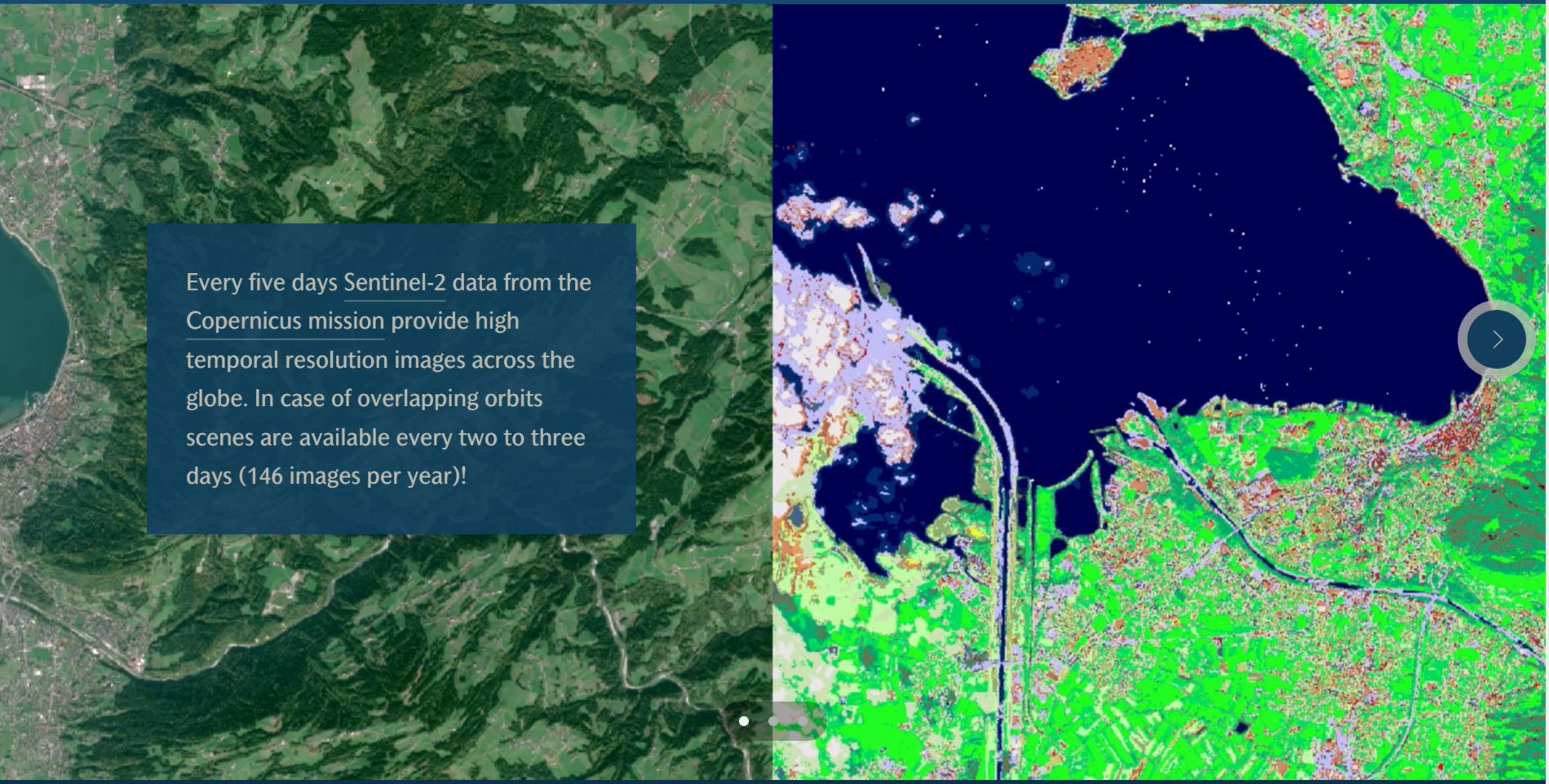


Climate change causes the atmosphere heating up and water vapour content increasing by seven percent per degree Celsius. Consequently, flash floods are likely to increase in future, while water permeability in urban areas is heavily reduced. Thus, water retention capacities are strongly required to decrease potential impacts on human, infrastructure, and environment.

The sponge city concept is an urban design approach that aims to enhance a city's ability to absorb, store, and reuse rainwater, reducing flooding and improving water management. It incorporates green infrastructure like permeable pavements, green roofs, wetlands, and parks to mimic natural hydrological processes, allowing rainwater to infiltrate into the ground or be stored for later use. This approach mitigates flooding and heat. It helps to manage drought and improves urban ecosystem biodiversity. A good water quality and water storage provides more sustainable and resilient cities.



Earth Observation is used to provide continuous and independent data on urban areas to support the management and monitoring of its ability to ensure water retention capacities. Timely changes on surface sealed areas, vegetation, soil, and inland water bodies can be retrieved for defined periods.



Every five days Sentinel-2 data from the Copernicus mission provide high temporal resolution images across the globe. In case of overlapping orbits scenes are available every two to three days (146 images per year)!

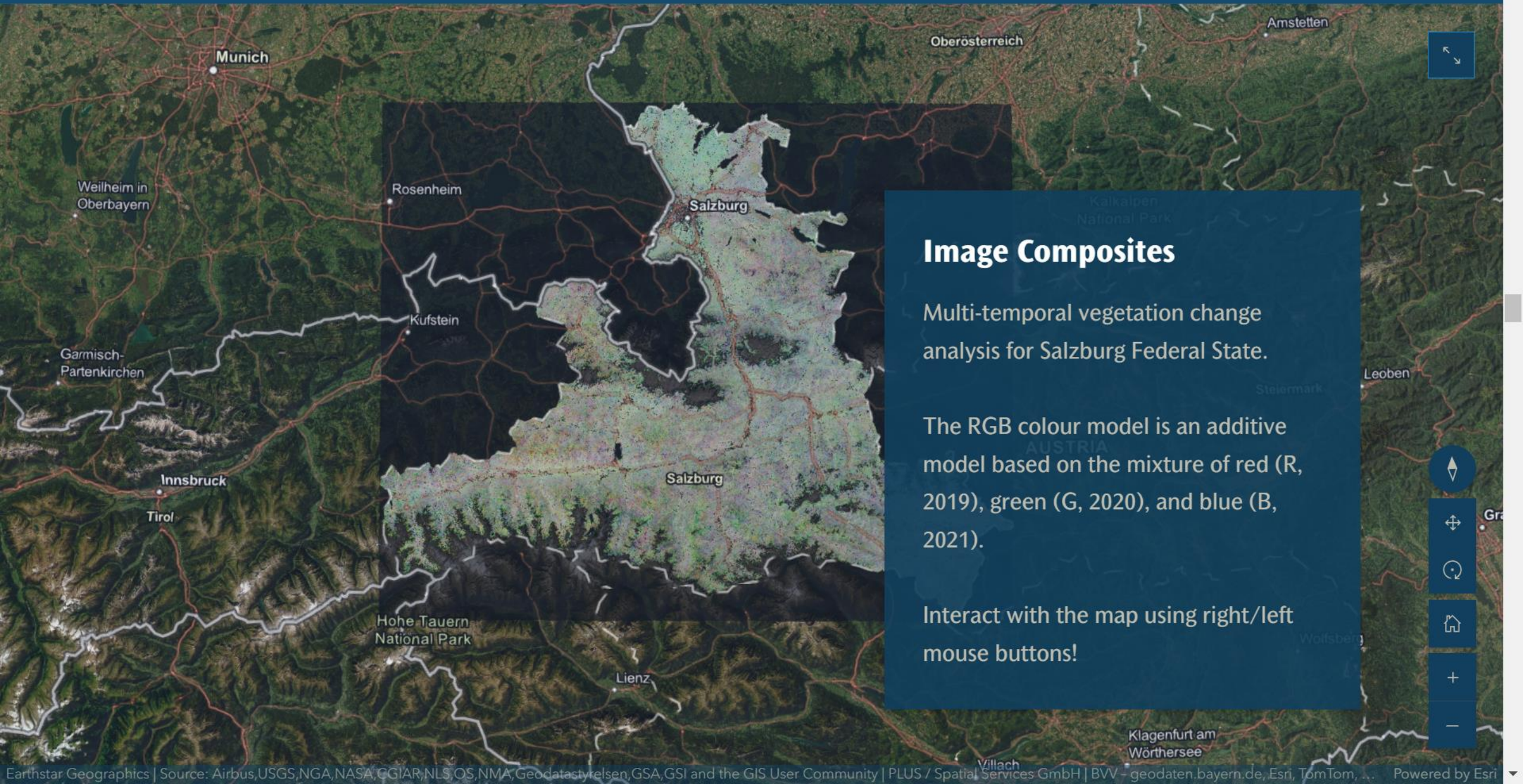


Image Composites

Multi-temporal vegetation change analysis for Salzburg Federal State.

The RGB colour model is an additive model based on the mixture of red (R, 2019), green (G, 2020), and blue (B, 2021).

Interact with the map using right/left mouse buttons!

Colour Coding

White / pastel colours

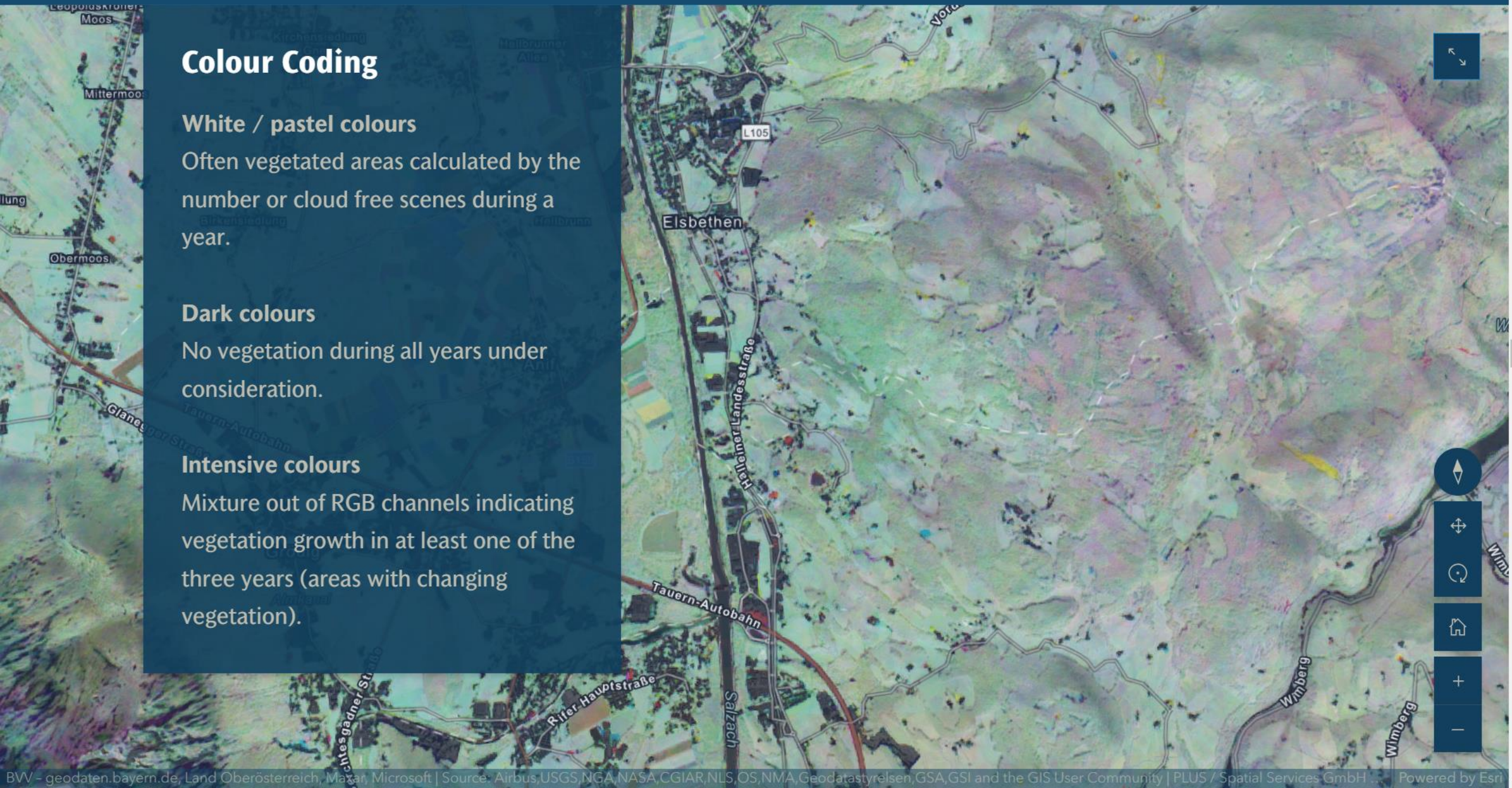
Often vegetated areas calculated by the number or cloud free scenes during a year.

Dark colours

No vegetation during all years under consideration.

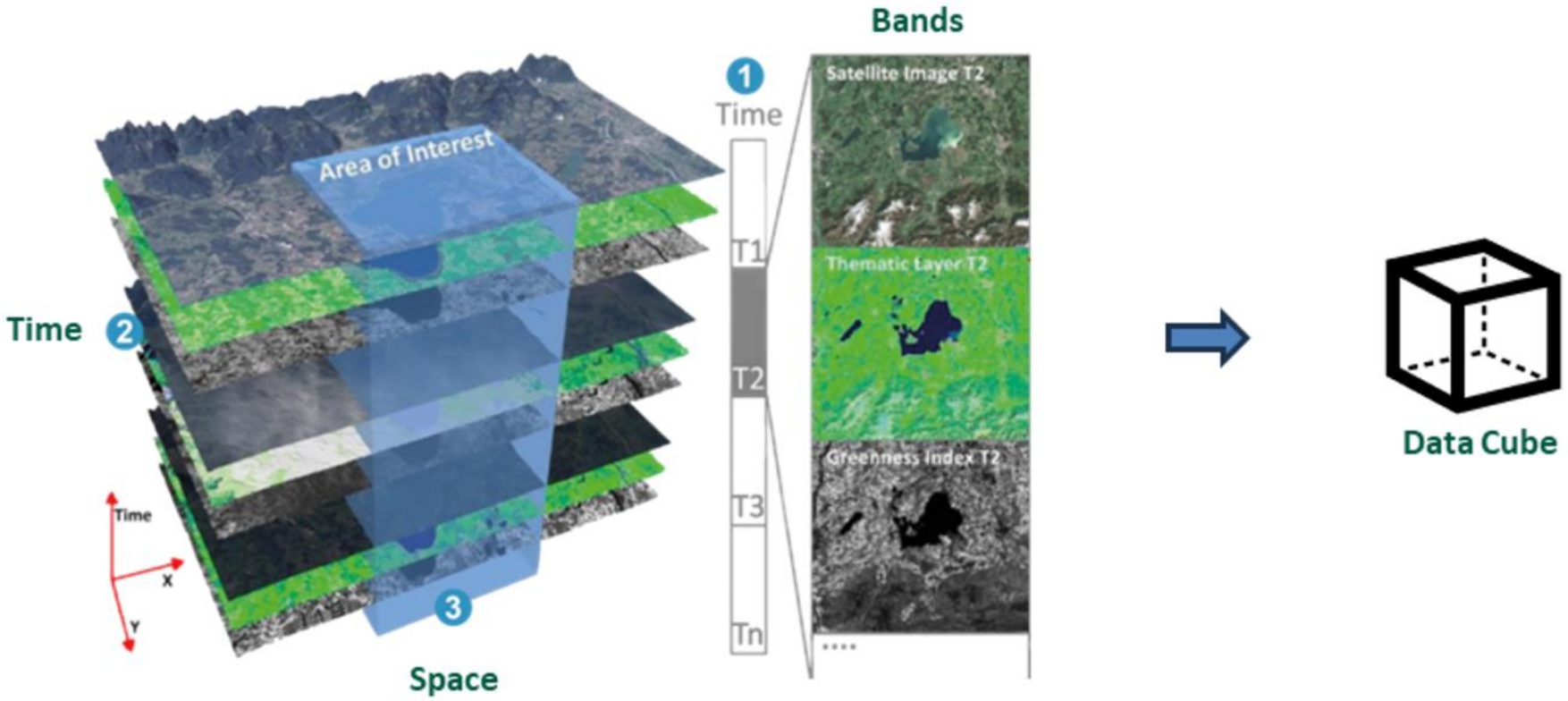
Intensive colours

Mixture out of RGB channels indicating vegetation growth in at least one of the three years (areas with changing vegetation).

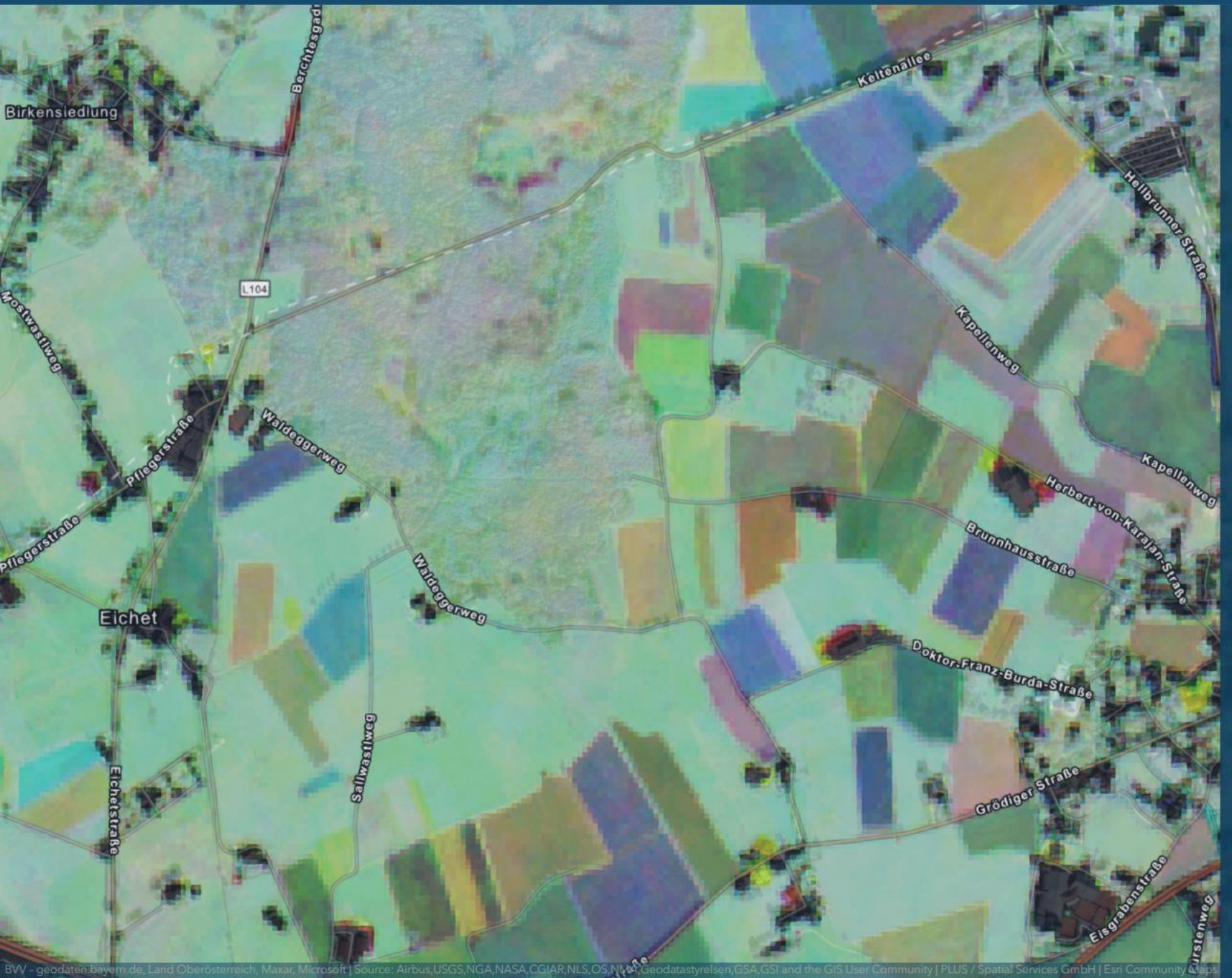


EO Data Management

Data Cube



Source: www.spatial-services.com/en/data-cube-en/



RGB colour definition per year

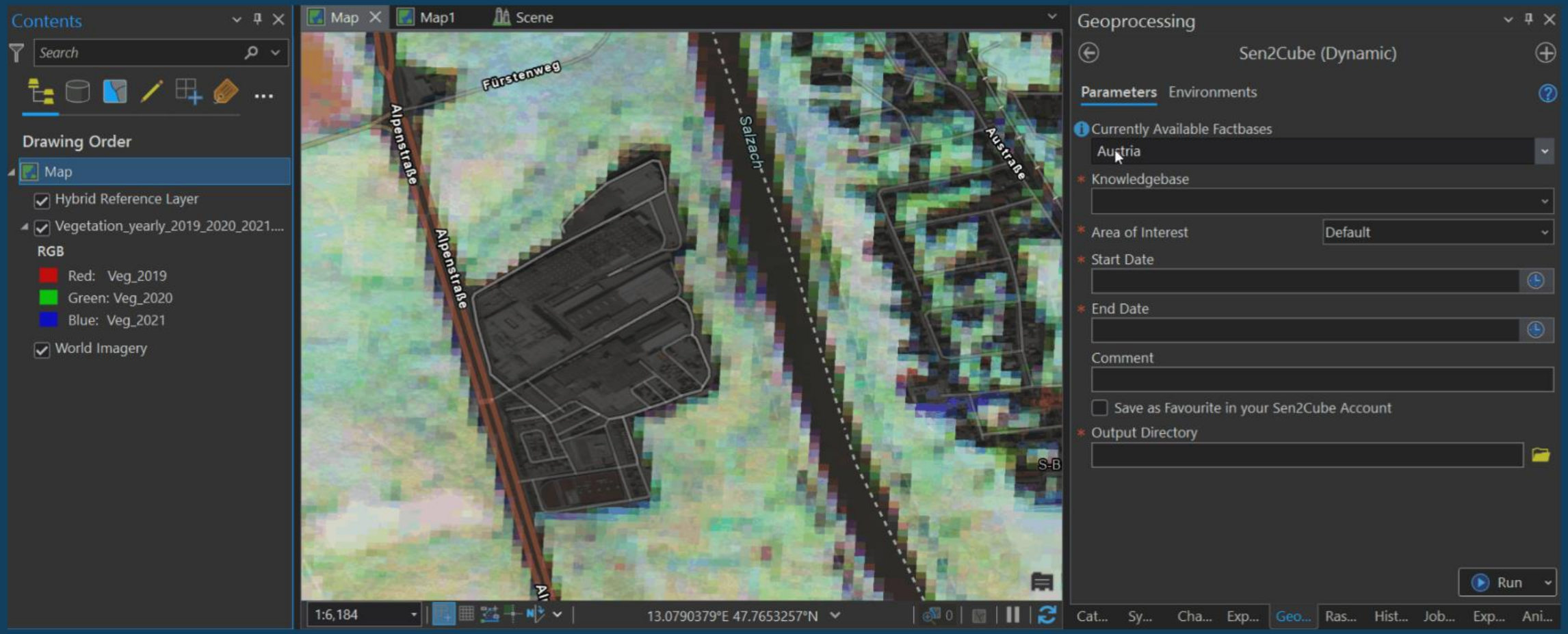
Interpretation

Red: Vegetation in 2019,
limited to no vegetation in 2020 and 2021.

Green: Vegetation in 2020,
limited to no vegetation in 2019 and 2021

Blue: Vegetation in 2021,
limited to no vegetation in 2019 und 2020

Yellow: Colours are in
between 2019 (red) and 2020 (green) and
mean vegetation cover in these years,
but limited to no vegetation in 2021 (blue is missing)



Click to enlarge!

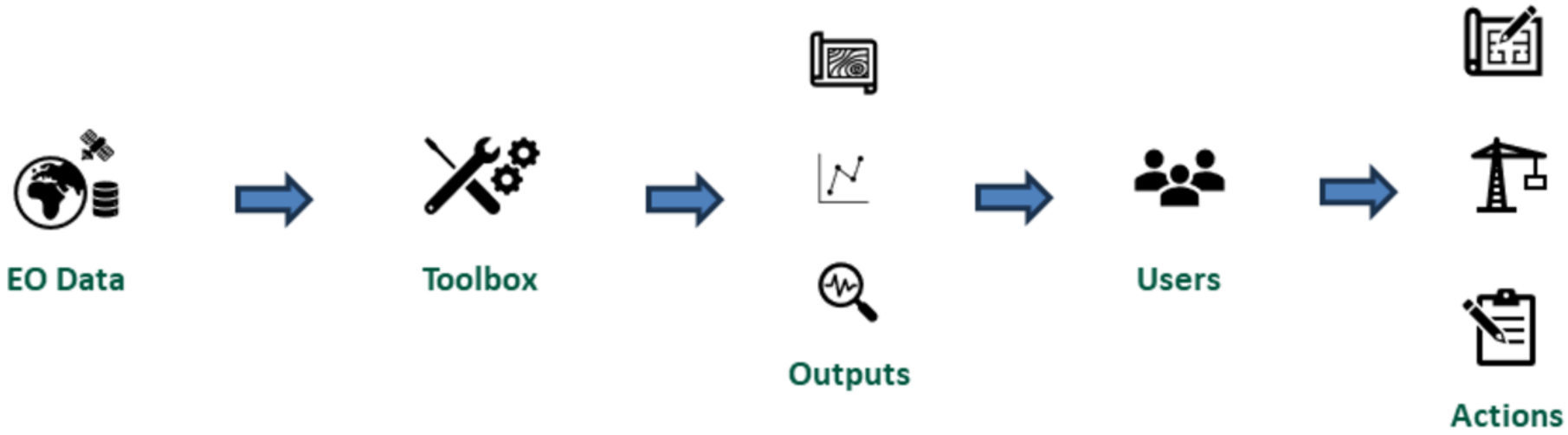
SpongeCity Toolbox

Analysis & Insights

- Land Use and Land Cover Changes
- Urban Sprawl
- Green Spaces
- Surface Sealing
- Vegetation Condition
- Water Body/Surface
- Slope, Drainage & Watershed
- Urban Heat Island
- Urban Surface Temperature
- Heat Hotspots
- Landslide
- Flood Risk

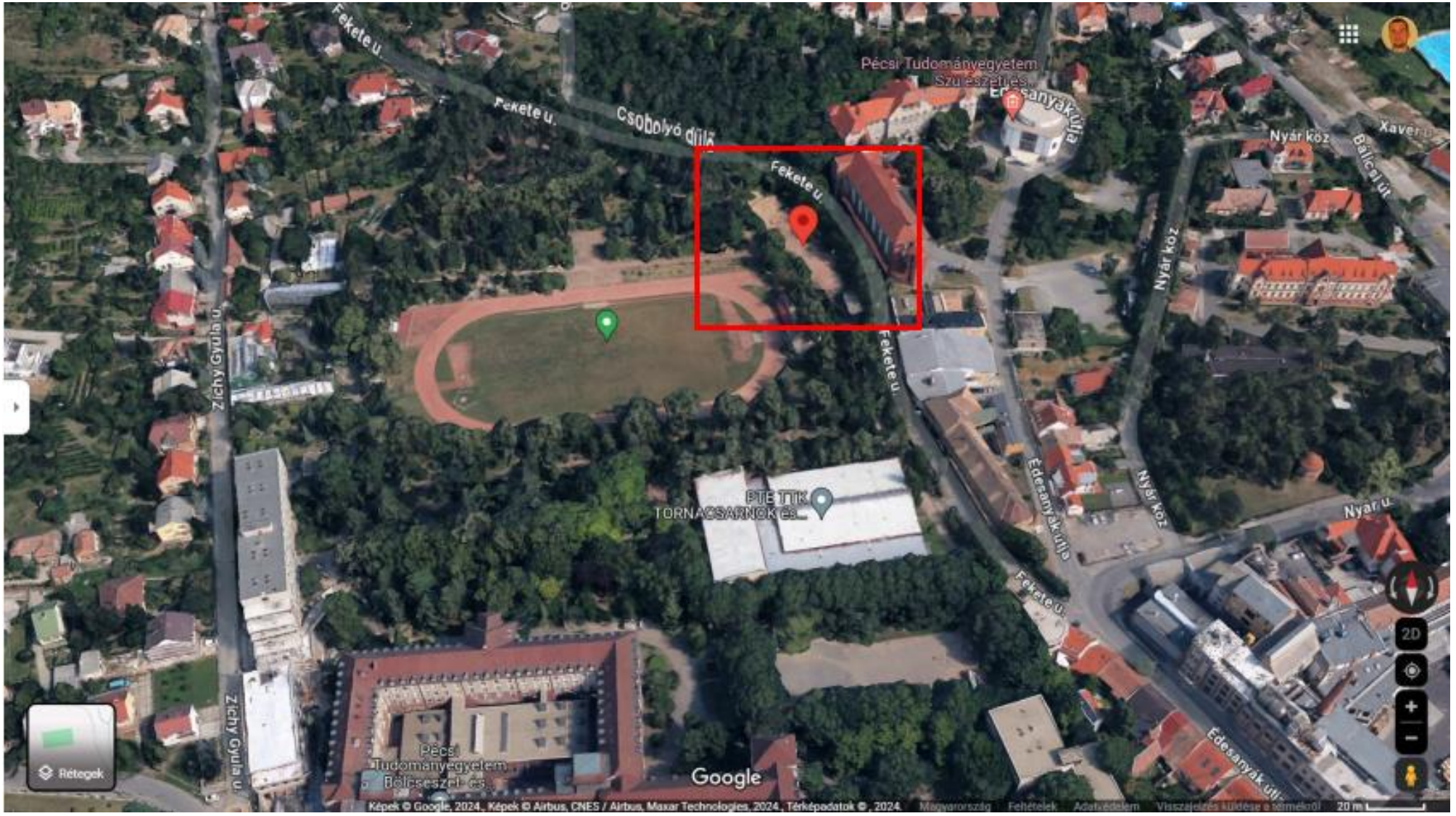
Introduction

Overview

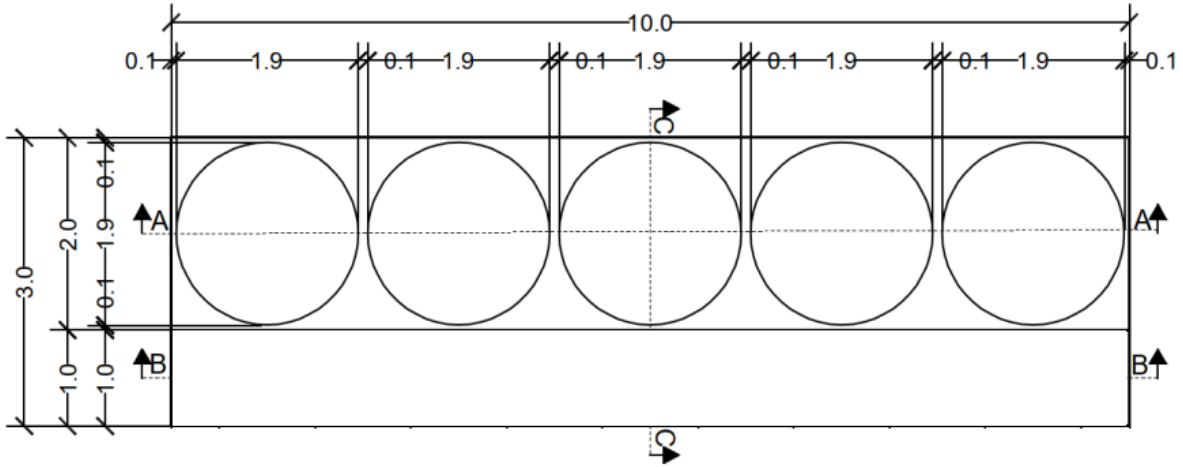


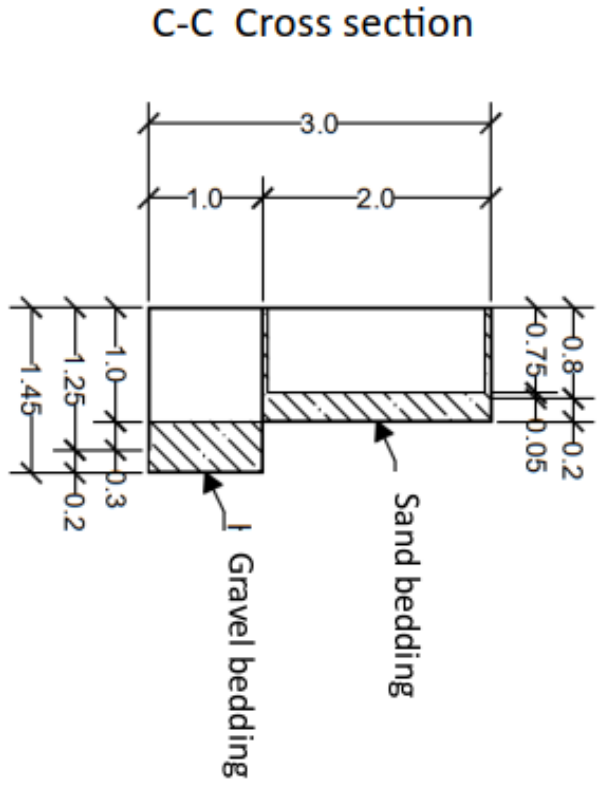
Raingardens

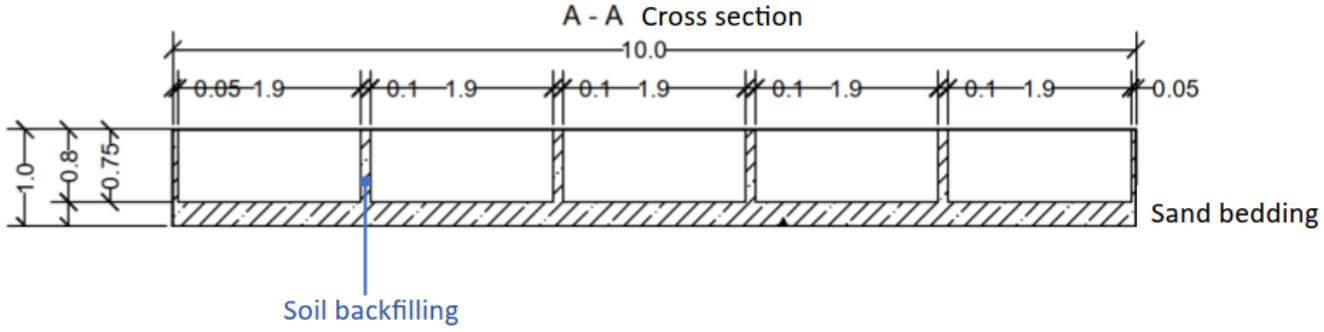
Raingarden – University of Pécs



Site plan


10.0
0.1
1.9
0.1
1.9
0.1
1.9
0.1
1.9
0.1
1.9
0.1
C
A
A
B
B
C
3.0
2.0
1.9
0.1
0.1
1.0
1.0


C-C Cross section
3.0
1.0
2.0
1.45
1.25
1.0
0.3
0.2
0.75
0.05
0.8
0.2
Gravel bedding
Sand bedding

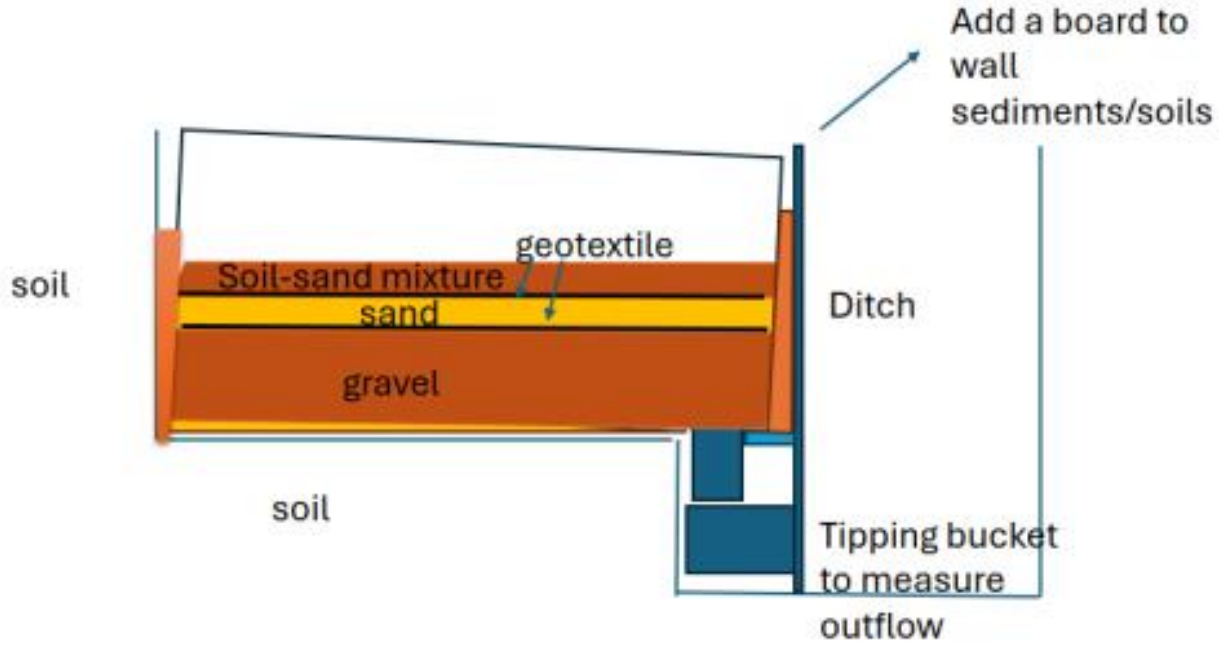

A - A Cross section
10.0
0.05
1.9
0.1
1.9
0.1
1.9
0.1
1.9
0.1
1.9
0.05
1.0
0.8
0.75
Sand bedding
Soil backfilling

Technical description

Raingarden of ca 30 sqm were installed, subdivided into 5 small units:
5 circular plastic tanks with a diameter of 190 cm each.

The tanks are individually drained to measure throughflow and enable the calculation of storage and permeability of the different media.

Compositions:
Cells 1 and 2: 100% potting soil
[Cell 1 does not contain plants, while Cell 2 does]
Cell 3: 10% sand, 90% potting soil
Cell 4: 20% sand, 80% potting soil
Cell 5: 30% sand, 70% potting soil


Add a board to wall sediments/soils
geotextile
soil
Soil-sand mixture
sand
gravel
Ditch
soil
Tipping bucket to measure outflow






Sensors and loggers: Meter Group Inc., Pullman, WA

ZL6 logger

Teros 12 TDR, soil moisture sensor

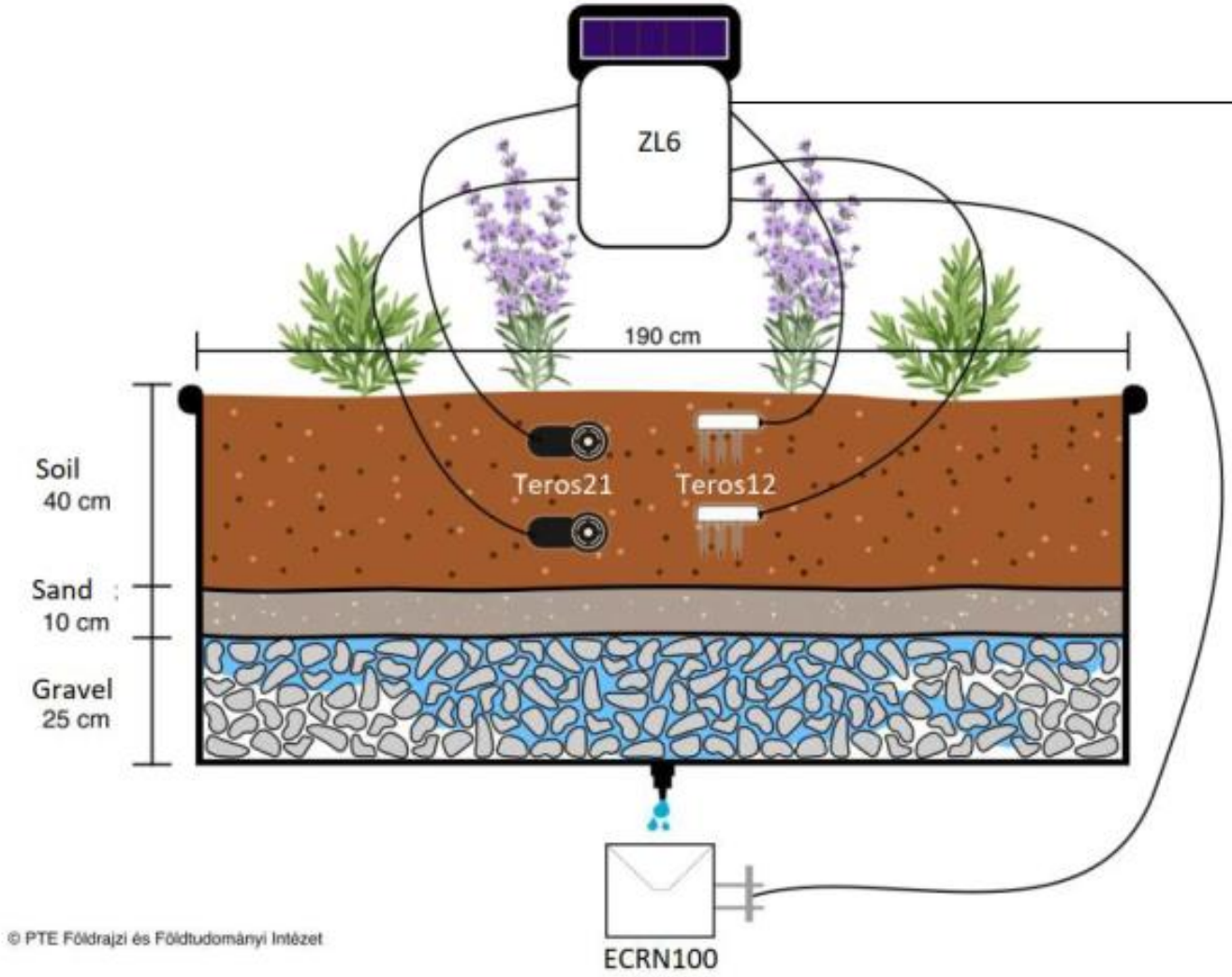
Teros 21 water potential sensor

Atmos-41 all-in-one weather station

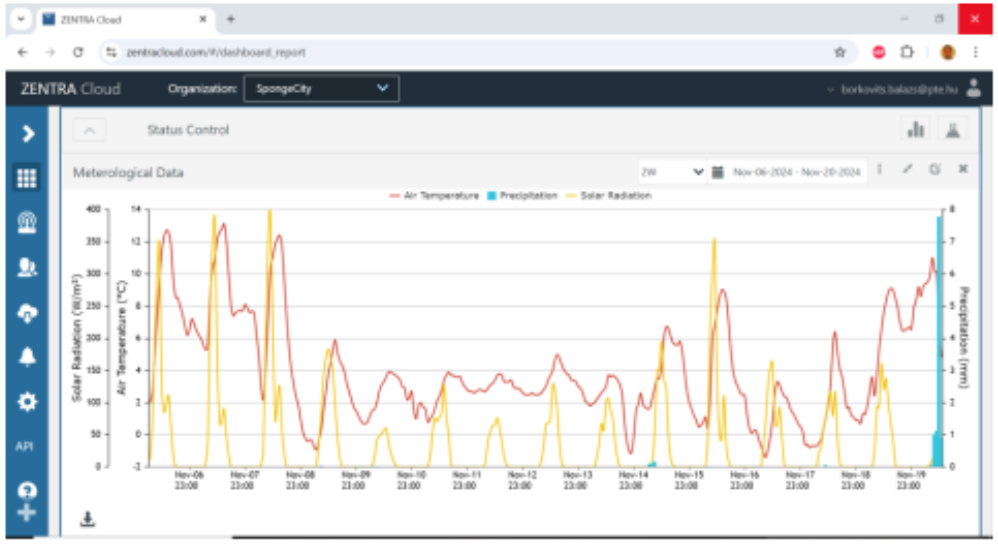
ECRN-100 Rain Gauge

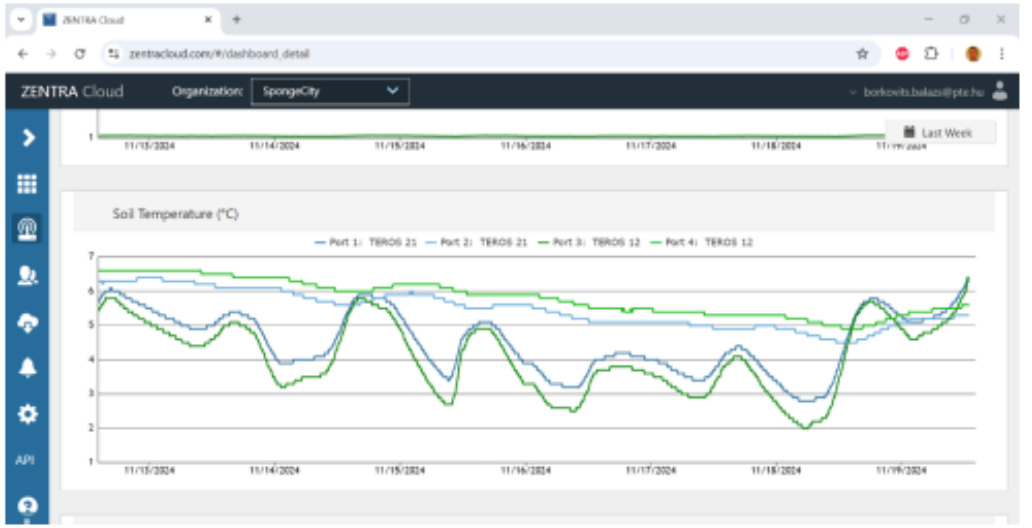
Hydros21

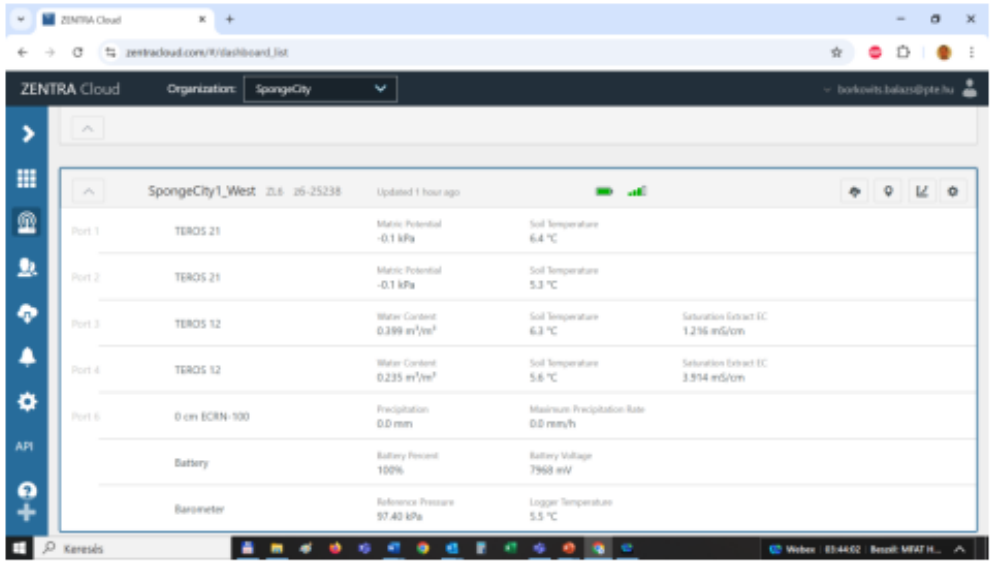
Installing sensors

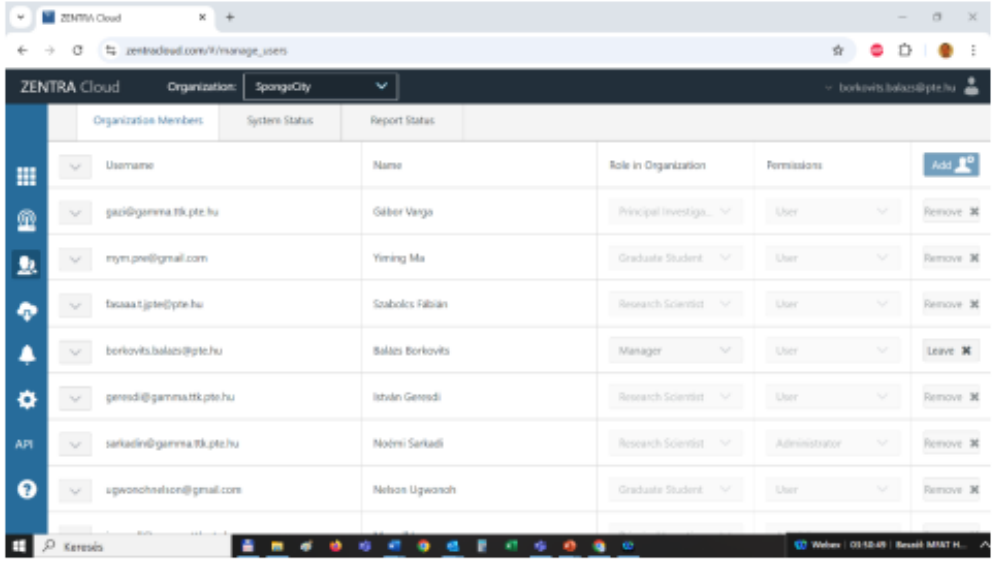


Cloud-based data storage



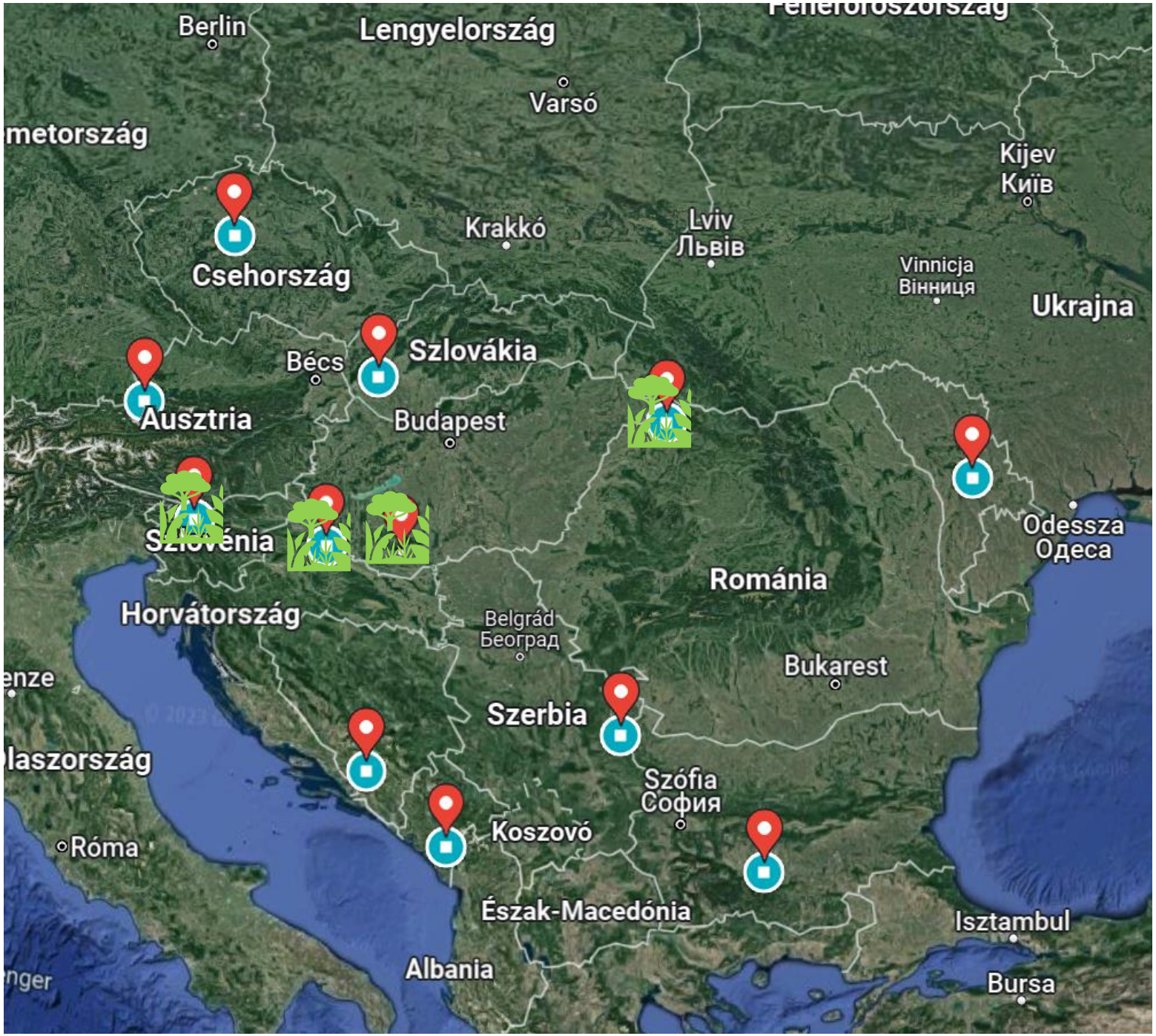






Raingardens

research & demonstration



Next steps

- ✓ Comparing the results of the surveys
- ✓ Collecting best practices to showcase spongecity interventions
- ✓ Defining the content of local action plans (risk analysis)
- ✓ Developing the toolbox
- ✓ Constructing 3 raingardens (CR, SI, RO)
- ✓ Starting to elaborate the training materials

Thank you for your attention!

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SpongeCity project analyses the hydroclimatic characteristics and water management practices of 12 pilot settlements, sets up a toolbox to support the planning of sponge city measures, tests and promotes the tools by participative elaboration of local action plans, feasibility studies and demonstration investments. Partners mainstream the results to national and EU level.